Response to Further Information Request ABP-309770-21

Coole Wind Farm

DOCUMENT DETAILS

Client: **Coole Wind Farm Limited**

Project Title: **Coole Wind Farm**

Project Number: **200445g**

Document Title: **Response to Further Information Request ABP-309770-21**

Document File Name: **Coole RFI-F-2022.10.28-200445g**

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Rev	Status	Date	Author(s)	Approved By
01	Final	31.10.2022	AC/MC	Client

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1. INTRODUCTION

MKO have been instructed by our clients Coole Wind Farm Limited, (the Applicant) to prepare this report in response to the request for Further Information issued by An Bord Pleanála under ABP-309770-21 on the 21st April 2022. The request for Further Information is being made in relation to the proposal for a wind farm development located in the townlands of Coole and others in County Westmeath.

The Proposed Development will comprise the construction and operation of up to 15 No. wind turbines and all associated works. The proposed turbines will have a tip height of up to 175 metres. The full description of the Proposed Development, as per the public planning notices, is as follows:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.
xv. This application is seeking a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

The planning application was lodged with An Bord Pleanála on the 22nd March 2022 where it was assigned the case reference ABP-309770-21. On the 21st April 2022 An Bord Pleanála issued a request in accordance with Section 37(F)(1) of the Planning and Development Act 2000 (as amended) which sought Further Information on 6 items. Section 2 of this report presents our response to the individual further information items, while also takes the opportunity to respond to matters deemed pertinent in third party submissions to the application.

For clarity, those involved in the preparation of this response are as set out in Table 1-1 below.

Table 1-1 Project Team

Company	Name	Qualification	Experience	Contributing Section
AWN Consulting Ltd	Mike Simms	BE, MEngSc, MIOA	Senior Acoustic Consultant with 16 years' experience in the field of environmental acoustics, in particular using computer-based noise modelling for environmental noise assessments.	Noise
Alan Lipscombe Traffic & Transport Consultant	Alan Lipscombe	BEng (hons), MIEI, MIHT	Traffic & Transport Consultant with particular expertise in the assessment of development related traffic and transport modelling, including for numerous wind farm developments,	Traffic & Transport
Fehily Timoney and Company	Ian Higgins	BSc, MSc, MIEI	Geotechnical Engineer with over 20 years consultancy experience in Ireland. Ian has completed numerous peat stability assessments and geological impact assessments for wind farms. In addition, he has significant experience in the geotechnical design of wind energy projects at construction stage.	Geotechnical
Triturus Environmental Limited	Ross Macklin	PhD (candidate), B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM	Ross Macklin PhD (candidate), B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM Ross is an aquatic, fisheries and mammalian ecologist with over 17 years' professional experience in Ireland. He is director of Triturus Environmental Ltd. Ross has a BSc in Applied Ecology and diplomas in integrated Pest Management and GIS. He is currently completing his PhD in fisheries ecology. He has considerable experience in a wide range of ecological and environmental projects including EIAR, EcIA, CEMP and AA/NIS reporting, as well as biodiversity, water quality monitoring, invasive species, mammalian surveys and fisheries management. He also has expert identification skills in fisheries, macrophytes, aqtaic bryophytes, freshwater invertebrates and protected aquatic species. His diverse project experience includes work	Ecology

			on renewable energy developments, flood relief schemes, road schemes, waste management, blueways/greenways, biodiversity projects, non-volant mammal monitoring, fisheries management projects and catchment wide water quality management. He has worked extensively in Ireland completing projects for the NPWS, Waterways Ireland, Pfizer, Irving Oil, Indaver, Transport Infrastructure Ireland, OPW, numerous local authorities and consulting engineering firms.	
Ionic Consulting Ltd*	John Shanahan	BE MSc CEng MIEI	Senior Civil Engineer working as part of an experienced team of civil and structural engineers who have been involved in the design of renewable energy projects in Ireland, the UK and internationally.	Traffic
MKO	Meabhann Crowe	BA, MScURP, MRTPI	Project Planner with MKO, having joined in 2018.	All
	Alan Clancy	BA, M Plan	Project Planner with MKO, having joined in 2022	All
	Pat Roberts	BSc, CIEEM	Principal Ecologist with MKO, having joined in 2005	Ecology
	Jack Workman	MSc, TMLI	Environmental Scientist with MKO, having joined in February 2020.	Landscape & Visual
	Saoirse Fitzsimons	BA, MSc	Environmental Scientist with MKO, having joined in 2021	Landscape & Visual
	Padraig Cregg	MSc, BSc	Senior Ornithologist with MKO, having joined in 2018	Ornithology
	Ellen Costello	MSc., BSc	Project Environmental Scientist with MKO having joined in November 2019.	Shadow Flicker

**Following the acquisition of Ionic Consulting Limited by AFRY, on 1st July 2022, Ionic Consulting will be rebranding under the AFRY name. Future communication and project documentation you receive from us may come under the AFRY brand. In addition the Irish legal entity (Ionic Consulting Limited) will be renamed to AFRY Ireland Limited.*

1.1 Applicant

The applicant for the proposed project is Coole Wind Farm Ltd., which is owned by Statkraft Ireland Ltd. Statkraft Ireland is part of the wider Statkraft group, a global renewable energy company that develops, acquires, builds and operates utility-scale wind and solar power projects. The team at Statkraft Ireland has constructed a portfolio of approx. 299 Megawatts (MW) of wind projects in Ireland, operates approx. 417MW and has an established track record in wind energy in Ireland, with its Irish team based in Tullamore, Co. Offaly and the Cork Airport Business Park, Co. Cork. This team has previously developed wind farms in Counties Clare, Cork, Kerry, Donegal, Limerick, Galway, Waterford, Tipperary, Offaly and Tyrone.

1.2 Westmeath County Development Plan 2021-2027

The Westmeath County Development Plan (WCDP) came into effect on May 3rd 2021 since the lodging of this planning application to An Bord Pleanála under ABP-309770-2 by our clients Coole Wind Farm Limited. The Westmeath County Development Plan 2021-2027 sets out the Council's proposed policies (CPO's) and objectives for the development of the County over the Plan period. The Development Plan seeks to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County.

On the 22nd September 2022, the Minister of State at the Department of Housing, Local Government and Heritage in exercise of the powers conferred on him by Section 31 of the Planning and Development Act 2000 (as amended) ("the Act"), and consequent to a recommendation made to him by the Office of the Planning Regulator under Section 31AN(4) of the Act issued a direction to Westmeath County Council as follows,

1) *This Direction may be cited as the Planning and Development (Westmeath County Development Plan 2021-2027) Direction 2022.*
2) *The Planning Authority is hereby directed to take the following steps:*
    i. *Delete wind energy policy objective CPO 10.143 in its entirety from Section 10.23.2 of the Development Plan as per the Chief Executive's recommendation.*

Policy objective CPO 10.143 sets out the following:

"Provide the following separation distances between wind turbines and residential dwellings:

- *500 metres, where the tip height of the wind turbine blade is greater than 25 metres but does not exceed 50 metres.*
- *1000 metres, where the tip height of the wind turbine blade is greater than 50 metres but does not exceed 100 metres.*
- *1500 metres, where the tip height of the wind turbine blade is greater than 100 metres but does not exceed 150 metres.*
- *More than 2000 metres, where the tip height of the wind turbine blade is greater than 150 metres"*

It is the opinion of the Minister that the WCDP is inconsistent with the policy objectives of the National Planning Framework, specifically NPO 55, which states that it is an objective to *"promote renewable energy use and generation at appropriate locations.....to meet national objectives towards achieving a low carbon economy by 2050'*, and the requirements for the planning authority to comply with, and the development plan to be consistent with, the aforementioned National Policy Objective under Sections 10(1A) and/or 12(11) read in conjunction with Section 12(18);

Furthermore, the Minister considers that the Development Plan contains conflicting objectives on wind energy development such that the Policy objectives supporting wind and renewable energy development in chapters 10 and 11 of the adopted Development Plan cannot be achieved having regard to the separation distances required by wind energy policy objective CPO 10.143 of the WCDP.

2. FURTHER INFORMATION REQUEST

This section of the Response to Further Information (RFI) addresses each individual FI items in detail. It should be read in conjunction with the relevant supporting information enclosed and/or appended to this report.

2.1 Further Information Item No.1

Particulars and Documentation

1.1 It is noted that the development description as set out in the statutory notices refers to a maximum tip height of 175 metres. It noted that within this size envelope various configurations of hub height, rotor diameter and ground to blade tip height may be used and that the make and model of the turbine will be dictated by a competitive tender process. It is noted that a hub height of 100.5m is used as the basis of the noise assessment and that the landscape chapter references a maximum rotor diameter of up to 155m and that there is no similar reference in the biodiversity and ornithology or biodiversity chapters or in the Natura Impact Statement.

1.2 To enable the Board to determine the application please confirm the nature and extent of the development for which permission is sought, by reference to plans and particulars which describe the works to which the application relates, in compliance with the relevant provisions of the Planning and Development Regulations 2001 as amended.

1.3 If the development for which permission is sought incorporates a range of options, please indicate clearly in the application documentation the detail of all such options and confirm that each option has been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement.

1.4 The applicant is requested to verify that all three information formats (the hard copy presented with the application, the USB copy presented with the application and on the website sources) contain the same information and structure. Where necessary please revise the application documentation to ensure consistency in presentation and content.

1.5 You are requested to update the planning history and to include an outline of applications to the EPA for licences relating to peat harvesting at adjoining lands. You are also invited to provide any available information / updates on the future of peat harvesting activities or bog rehabilitation on lands adjacent to the proposed wind farm site and within the blue line.

1.6 Having regard to the Board's decision under ABP-310547-21 you are requested to comment on the validity of the application for CWF as it relates to development within that site boundary. You are invited to consider an amendment to the application and / or to make any revisions to the application documentation which you may consider necessary following the Board's decision.

2.1.1 Response to FI Item No.1.1

It is noted that the development description as set out in the statutory notices refers to a maximum tip height of 175 metres. It noted that within this size envelope various configurations of hub height, rotor diameter and ground to blade tip height may be used and that the make and model of the turbine will be dictated by a competitive tender process. It is noted that a hub height of 100.5m is used as the basis of the noise assessment and that the landscape chapter references a maximum rotor diameter of up to 155m and that there is no similar reference in the biodiversity and ornithology or biodiversity chapters or in the Natura Impact Statement.

For the purposes of the EIAR which accompanied the planning application, various wind turbine parameters all within the 175-metre tip height envelope were considered to assess the likely effects of the proposed development on the environment. Turbine design parameters of blade length, hub height and tip height have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds). In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, turbine design parameters are specified and the chosen parameters have been used to reflect the most relevant parameter for each assessment in the impact assessment.

Within the EIAR the following scenarios were used across the different disciplines:

Table 2-1 Turbine Ranges

Discipline	Turbine Hub Height (metres)	Turbine Rotor (metres)	Blade Length (metres)
Shadow Flicker	97.5m	155m	77.5m
Collision Risk (Ornithology)	97.5m	155m	77.5m
Noise	100.5m	149m	74.5m
ZTV/Photomontages	97.5m	155m	77.5m
Traffic	97.5m	155m	77.5m
Cultural Heritage Viewshed Analysis	97.5m	155m	77.5m
Bat Mitigation (Scenario 1)	97.5m	155m	77.5m
Bat Mitigation (Scenario 2)	100m	150m	75m

Consequently, in responding to the Further Information request and taking into account the Derryadd Judgment (Sweetman v the Board & Ors [2021] IEHC 390 and [2021] IEHC 662), a refined turbine range has now been established for the Proposed Development as follows:

- 15 No. wind turbines with a maximum ground-to-blade tip height of 175 metres, a blade length in the range of 74.5 metres minimum to 77.5 metres maximum and a hub height in the range of 97.5 metres minimum to 100.5m maximum.

Table 2-2 below illustrates these minimum and maximum ranges which could occur within the overall turbine tip height of 175 metres.

Table 2-2 Turbine Ranges (m)

	Minimum (m)	Maximum (m)	Range (m)
Tip Height	175	175	-
Blade Length	74.5	77.5	3
Rotor Diameter	149	155	6
Hub Height	97.5	100.5	3

The assessment of the impacts of the proposed development on biodiversity and on European Sites has taken account of the range of potential turbine sizes and dimensions that may be used. The full range of potential turbine dimensions was considered, with a maximum height of 175m and minimum rotor clearance of 20m above ground level.

In relation to Ornithology, to ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios were as follows:

- Maximum rotor diameter and minimum hub height: 20-175m
- Median rotor diameter and median hub height: 25-175m
- Minimum rotor diameter and maximum hub height: 26-175m

This precautionary approach ensured all scenarios within the Turbine Range were assessed. Please refer to Section 2.1.2 of this FI response and the Collison Risk Assessment included as part of **Appendix 5** for further details.

2.1.2 Response to FI Item No.1.2

To enable the Board to determine the application please confirm the nature and extent of the development for which permission is sought, by reference to plans and particulars which describe the works to which the application relates, in compliance with the relevant provisions of the Planning and Development Regulations 2001 as amended.

The planning application as lodged sought:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;

ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;

iii. 1 no. temporary construction compound;

iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;

v. Excavation of 1 no. borrow pit;

vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;

vii. Laying of approximately 26km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;

viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;

ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;

x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on lands along the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;

xi. Site Drainage;

xii. Forestry Felling;

xiii. Signage, and;

xiv. All associated site development works.

xv. This application is seeking a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

As noted in Section 2.1.1 above, a range of turbine scenarios were used within the EIAR – discipline dependant. Since the planning application was lodged with the Board, the Derryadd Judgment (Sweetman v the Board & Ors [2021] IEHC 390 and [2021] IEHC 662) has been made by the courts and as such a refined turbine range has now been established for the Proposed Development as follows:

- 15 No. wind turbines with a maximum ground-to-blade tip height of 175 metres, a blade length in the range of 74.5 metres minimum to 77.5 metres maximum and a hub height in the range of 97.5 metres minimum to 100.5m maximum.

It is confirmed that all scenarios within the limited range of flexibility set out above (the "Turbine Range") have been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement as lodged.

The initial planning application drawings which accompanied the planning application and illustrated the turbine proposed, have also been refined in light of the Derryadd Judgement. As such the enclosed drawings ref: 200445g – 42A FI, -42B FI, -42C FI and -42D FI illustrate the blade/hub height configurations which may transpire within the overall tip height.

Derryadd Judgment

In the High Court judgment in relation to Derryadd Wind Farm (delivered by Justice Humphreys, 16th June 2021)[1], in relation to a proposed Strategic Infrastructure Wind Farm Development, the High Court found that the "Plans and Particulars" that were submitted with the application documentation were not sufficient in that they allowed too much flexibility, and that the Board erred in including a condition stating:

> *"... the wind turbines will have maximum tip height of 185 metres. Final details of the turbine design, hub height, tip height and blade length complying with the maximum limit and within the range set out in the application documentation, along with details of colouring shall be submitted to and agreed in writing with the planning authority prior to the commencement of development,"*

At the core of the issue considered in the judgement were the following issues:

- The application did not give precise details of the design of the structures but only "typical" arrangements;
- The application did not specify dimensions for the structures, only maximum dimensions; and
- The application did not specify the exact location of all the structures and foundations.

The approach adopted in the Derryadd application is common for wind farm developments, as due to the nature of the applications, application process and permission durations (preparation of an application can take in excess of 2 years for monitoring and surveying, the application process can also in itself take 2 years, and the duration of the consent is normally 10 years) developers must allow and design insofar as practicable for turbines that will be available at the time of construction. The Derryadd judgment acknowledges that there can be some degree of flexibility in relation to plans and particulars of planning applications, (albeit fundamentally in the Derryadd situation the court concluded that there was too much flexibility), at paragraph 56 of the judgement the following is stated:

> *"The regulations require "plans" and "particulars", meaning reasonably (although not necessarily absolutely) precise particulars. I say not necessarily absolutely precise particulars in that ..... in practical terms there may be modest variation between the plans submitted and the structures constructed. Thus we have the concept. Created by the courts for the purpose of s.160*

[1] *2021 IEHC 390 [20202No. 557 JR] P. Sweetman v An Bord Pleanála*

> *of the 2000 Act, of the "material" deviation from the permission, which implies a core of materiality and a periphery of detail; dovetailing with the doctrine permitting points of detail and limited flexibilities to be provided in conditions, and with the doctrine .... that permits 'parameters relating to the construction phase' to be determined later."*

The Judge concludes on this matter as follows:

> *"...there is a fundamental difference in principle between, for example, providing a reasonably modest margin of appreciation (Hamilton C.J.'s 'certain limited degree of flexibility') around details of design, dimensions or location to the millimetre, such that it can be said ...... that no real planning issue is thereby created by reference to which someone could reasonably object, and a situation where as here no specific dimensions are provided other than a maximum, and no specific designs are provided other than what is typical. A scale that is open at one end is not a scale that has a 'certain limited degree of flexibility'."* [emphasis added by author]

The judge also acknowledges the previous judgement of Haughton J. in *Alen-Buckley v. An Bord Pleanála [2017] IEHC 541, [2017] 9 JIC 2602*, which confirmed that it is appropriate for the site notice for a wind farm development to describe only the most important physical feature of the turbines i.e. their overall height.

Turbine Configuration:

In relation to the typical turbine elevation provided it is acknowledged that this is a generic drawing (ref: 200445 – 42) with only the overall tip-height articulated in a dimension. As noted in the EIAR (refer to section 4.3.2 of Chapter 4) and indeed on the drawings (note 2), this was deemed appropriate as the final turbine type to be erected on site has not and cannot be set out at this stage, and instead will be dictated by a competitive tender process. The final turbine type can only be selected once it is known when the Proposed Development is to be brought forward (i.e. post consent) and the available turbine types appropriate for the site are made known by the various manufacturers at that time as part of the competitive tendering process. Notwithstanding this, however, in order to provide further clarity on this issue, and in acknowledgement of the Derryadd judgment please find attached in **Appendix 1** of this report drawings 200445g - 42A-D FI which illustrates the Turbine Range proposed.

Additional drawings, 200445g -42B FI, 200445g -42C FI and 200445g -42D now enclosed, show turbine elevations and plans for individual minimum and maximum configurations (refer to Table 2-2 above), namely 97.5m hub with 77.5m blade, 100m hub with 75m blade, and 100.5m hub with 74.5m blade. The added dimensions clearly articulate the range of turbine parameters assessed within the EIAR and NIS and accordingly specify the range of alternative turbine configurations (hub height, blade length, and tip height) within the Turbine Range. In the interests of clarity and as set out earlier these are set out below:

- Turbine tip height – 175 metres
- Hub Height – Maximum height 100.5metres, Minimum height 97.5metres
- Blade Length: - Maximum length 77.5 metres, Minimum length 74.5metres.

Within the EIAR, the assessments relate to a spectrum of scenarios allowed for relative to each discipline, for example turbine delivery discussed in Chapter 14: Material Assets considers the longest blade as this is the largest component to deliver, similarly the longest blade is used for collision risk monitoring (Chapter 8: Birds) and the shadow flicker assessment (Chapter 6: Shadow Flicker), while the lowest hub height is used for Landscape and Visual Impact Assessment (LVIA) purposes (Chapter 12: Landscape and Visual).

The range of turbine configurations under consideration is quite limited, with the hub height and blade length varying by 3 metres, and all variations remaining within the overall 175m turbine tip height parameter.

Accordingly, within the proposed configuration, the following additional assessments have been carried out as part of this Further Information response:

Table 2-3 EIAR Assessment (Turbine Scenarios)

Discipline	Comment	Turbine Hub Height (Metres)	Turbine Rotor (Metres)
Shadow Flicker	In addition to the shadow flicker assessment undertaken in the EIAR as lodged, two additional shadow flicker models have been run to show the results on receptors for the turbine ranges proposed, all of which are within the 175 metre to tip envelope.	100	150
		100.5	149
Landscape	New photomontage visuals in order to present new turbine scenarios. For consistency and context, these new photomontage visuals are incorporated as additions to the Volume 2 Photomontage Booklet included at Appendix 7 of this FI response that was previously submitted as part of the EIAR.	100.5	149
		100	150
Noise	The noise assessment in the EIAR was based on Nordex N149 turbine technology with a hub height of 100.5 m. In order to address the FI request, two additional models of turbine have been assessed using the same methodology and guidance. These are based on Siemens SG155 model at 97.5 m hub height and Vestas V150 model at 100m hub height.	97.5	155
		100	150
Ornithology	To ensure the full range of possible turbine dimensions were assessed (20-175m) three separate collision risk analyses were undertaken.	97.5	155
		100.5	149
		100	150

Shadow Flicker

In regard to Shadow Flicker, MKO were commissioned to conduct a Shadow Flicker Assessment of 3 no. scenarios for this FI response, this included Scenario 1 as modelled and assessed in Chapter 5 of the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR) and two additional scenarios as indicated in Table 2.3 above. The Shadow Flicker Assessment Results are included at **Appendix 11**.

As detailed in the Shadow Flicker Assessment Results, the variance in results between each of the scenarios is minimal (± 1 no. dwellings) with the greatest number of exceedances of the DoEHLG 2006 wind energy guidelines daily (30 minutes) and annual (30-hours) limits occurring from Turbine Scenario 1. Turbine Scenario 1, which has been assessed within the EIAR using the precautionary principle, has the largest proposed rotor diameter (155m – based on the longest rotor blade) and the minimum hub height (97.5m) (therefore providing a tip height of 175m). Daily and annual shadow flicker exceedances arise at a reduced number of properties for remaining Turbine Scenarios (Scenario 2 and 3) which is to be expected considering their reduced rotor diameter.

It should also be noted that the phenomenon of Shadow Flicker is entirely controllable, and that in the event of favourable consideration it is standard practice for an appropriate planning condition to be imposed. Any future turbine installed on site in the event of favourable consideration must comply with any such condition, and as detailed in Section 5.7.2 of the EIAR, in line with the commitment made for the permitted Coole Wind Farm development and following continuing engagement with the local community requirements Coole Wind Farm Ltd. is committing to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

Landscape

As part of this FI response, the applicant has produced new photomontage visuals in order to present on the range of turbine envelope configurations sought for planning permission. For consistency and context, these new photomontage visuals are incorporated as additions to the Volume 2 Photomontage Booklet that was previously submitted as part of the EIAR. The new photomontage booklet is included as **Appendix 7** of this FI Response. The following text discusses the new additions to the photomontage booklet and how the range of turbine envelope configurations relate to potential landscape and visual impacts.

It is emphasised that irrespective of which turbine model (combination of hub height and rotor diameter) within the range outlined above is installed on site, the significance of residual landscape and visual effects will not be altered. However, for the avoidance of doubt, 2 No. alternative turbine configurations (other than the configuration presented throughout the booklet) are presented for three selected viewpoints included in the **Appendix 7** photomontage booklet accompanying this document under title pages 'Turbine Envelope Range'. These configurations include 'Minimum Rotor Diameter & Maximum Hub Height' and 'Median Rotor Diameter & Median Hub Height'. The 3 No. viewpoints selected are representative of short-range views (Viewpoint 07 - 1.26 km from the Proposed Development), medium-range views (Viewpoint 21 - 5.32 km from the Proposed Development) and long-range views (Viewpoints 14 - 16.5 km from the Proposed Development). The following summarises the 'Minimum Rotor Diameter & Maximum Hub Height' and 'Median Rotor Diameter & Median Hub Height' that is presented:

- **Minimum Rotor Diameter & Maximum Hub Height** – 3 Photomontage Viewpoints (VP07, VP14 and VP21)
  - Maximum Tip Height – 175metres
  - Maximum Hub Height – 100.5 metres
  - MinimumRotor Diameter– 149 metres

- **Median Rotor Diameter & Median Hub Height** – 3 Photomontage Viewpoints
  - Maximum Tip Height – 175metres
  - Median Hub Height – 100 metres
  - Median Rotor Diameter – 150 metres

As is shown by the 'Turbine Envelope Range' visuals within the **Appendix 7** photomontage booklet, it is extremely difficult to determine any difference that would arise from the use of differing turbine configurations within the range of dimensions proposed. Any difference is only identifiable in the wireframe visuals accompanying the photomontages, and these differences are only really distinguishable with the use of magnification. Irrespective of which turbine model is utilised within the proposed range, the residual landscape and visual impacts reported in the EIAR will not be altered.

Noise

AWN Consulting Ltd (AWN) prepared a Technical Note to accompany this document at **Appendix 10**, that provides a response on the range of possible turbine technologies which may be selected if the planning application is granted. The noise assessment in the EIAR was based on the Nordex N149 turbine technology with a hub height of 100.5 m. In order to address this FI request, two additional models of turbine have been assessed using the same methodology and guidance. This technical note summarises the noise assessment in the EIAR and then presents the input data and results for the two additional turbine technologies. The effect of changing the hub height has been examined and in this instance does not result in any change to the noise criteria under the Wind Energy Development Guidelines 2006.

Ornithology

The collision risk assessment is based on vantage point surveys undertaken at the wind farm site from October 2015 up to, and including, September 2017; from April 2018 up to, and including, March 2020; and from March 2021 up to, and including, March 2022. This represents two 24-month survey periods and a 13-month survey period, consisting of five breeding seasons and five non-breeding seasons, which is in full compliance with Scottish Natural Heritage guidance (SNH, 2017). Surveys were undertaken from four fixed Vantage Point (VP) Locations: VP3/VP4 between October 2015 to September 2017, VP3/VP5 between April 2018 to March 2020, VP4/VP6 between March 2021 to March 2022 and VP3/VP4/VP5/VP6 between October 2021 and March 2022.

To ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios were as follows:

- Maximum rotor diameter and minimum hub height: 20-175m
- Median rotor diameter and median hub height: 25-175m
- Minimum rotor diameter and maximum hub height: 26-175m

Please refer to the Collision Risk Assessment included as part of **Appendix 5** which shows the collision risk assessment based on alternative dimension turbines. These three collision risk assessments allow for the full range of possible turbine dimensions to be assessed (20-175m, 25-175m and 26-175m).

Drawing Revisions

Minor changes have been made to the planning application drawings lodged with the planning application, taking into account the Derryadd judgement and to provide further clarity to the Board. These changes are minor in detail and do not change the findings of the impact assessment. The following drawings included at **Appendix 1** have been updated:

- 200445 – 03 FI Site Location Key Plan
- 200445 – FI Site Location Plans 1,2, 5-9
- 200445 – 13 FI Site layout Key Plan B
- 200445 – FI Site Layout Sheets 1-8, 13-24
- 200445 – 38 FI Temporary Construction Compound
- 200445 – 39 FI Substation Layout
- 200445 – 43 FI Turbine Foundation Standard Detail

Following ongoing and regular Project Meetings with EirGrid on the connection method to the existing Mullingar 110kV substation, it has been possible to refine the connection method into the existing substation. This has resulted in the removal of two bay locations and realignment of the grid connection route to Mullingar Substation. These changes are minor in detail and do not change the findings of the impact assessment. The following drawings have been updated:

- Ionic drawings d006.1.1 and d006.1.2 and MKO drawings 200445g - 02 FI, 200445g - 03 FI, 200445g - 12 FI, 200445g - 13 FI, 200445g - 37 FI.

2.1.2.2 Summary Conclusion

Accordingly, the application documentation submitted as detailed above provides the necessary specifications, detailed location of infrastructure as well as the lower and upper range of all the turbine parameters proposed, which provides for the “certain degree of flexibility” permissible as articulated in the Derryadd Judgement.

In the event of favourable consideration of the planning application it is acknowledged that An Bord Pleanála may specify the range and detail the parameters of the tip heights, blade lengths and hub heights as part of an appropriate condition. It is noted that the Board have previously adopted this approach, for example in the case of the Curraglass renewable energy development (ABP ref: PL88.308244), granted by An Bord Pleanála on the 28th of January 2022. Planning Condition no. 6 attached to that permission stated:

The following design requirements shall be complied with:

a) The hub height shall be within the range of 103.5 metres to 120 metres, and the blade length shall be in the range of 58.5 metres to 75 metres. The overall tip height shall be in the range of 175 metres to 178.5 metres and the height of the permanent meteorological mast shall be within the range of 100 metres to 112 metres. Details of the turbine design, hub height, blade length, tip height, and meteorological mast complying with these limits, shall be submitted to, and agreed in writing with, the planning authority prior to commencement of development. The wind turbines, including tower and blades, shall be finished externally in a light grey colour.

2.1.3 Response to FI Item No.1.3

If the development for which permission is sought incorporates a range of options, please indicate clearly in the application documentation the detail of all such options and confirm that each option has been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement.

This point is addressed in full in relation to Items 1.1 and 1.2 in the preceding sections, as well as the enclosed FI drawings at **Appendix 1**. It is confirmed that all scenarios within the limited range of flexibility set out above (the “Turbine Range”) have been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement as lodged.

2.1.4 Response to FI Item No.1.4

The applicant is requested to verify that all three information formats (the hard copy presented with the application, the USB copy presented with the application and on the website sources) contain the same information and structure. Where necessary please revise the application documentation to ensure consistency in presentation and content.

In response to FI Item 1.4 MKO have undertaken a thorough assessment of all three information formats of the application as to whether they contain the same information and structure. In carrying out this assessment the following issues were identified

<u>**Planning Drawings**</u>

- Minor differences, Images have been generated in different quality across formats.

<u>**Volume 2- NIS & Photomontage Booklet**</u>

- Appendix-2-EIAR-Chapter-4-Description - CEMP missing (Appendix 4-8). ESB's standard specification for ESB 38kV page 2 and 3 are in the wrong order (page 415 &416).

<u>**Volume 3a - Appendix 2-1 - 6-4**</u>

- Appendix-4-4-AGEC-Cable-Route-Survey - Differences in the placement of MKO labels on page.
- Appendix-4-11-Decommissioning-Plan – Minor layout difference in table of contents.
- Appendix-5-2-Wind-Farms-Health-Literature-Review-Chapman-2015 – Layout differences in table of contents
- Appendix-6-2-Bat-Impact-Assessment – Layout differences in table of contents, layout slightly different on some pages.

Volume 3b- Appendix 7-1 - 14-3

- Appendix-7-7-Confidential-Appendix-Placeholder – Difference in wording of subheading.

The issues identified above are considered to be minor in nature and do not affect the ability of any person to interrogate or understand the application in full. As such the application documentation has not been revised.

2.1.5 Response to FI Item No.1.5

You are requested to update the planning history and to include an outline of applications to the EPA for licences relating to peat harvesting at adjoining lands. You are also invited to provide any available information / updates on the future of peat harvesting activities or bog rehabilitation on lands adjacent to the proposed wind farm site and within the blue line.

2.1.5.1 Planning History

The planning history section of Chapter 2 of the EIAR sets out the relevant planning history of the proposed wind farm site, planning applications in the vicinity of the site and other wind energy applications within the wider area. These have been updated per the FI request and are set out in tabular format below.

2.1.5.1.1 *Applications in the Vicinity of the Proposed Wind Farm Site*

A substitute consent application for peat extraction at Mountdillon, Duil na Gun, Co. Westmeath, Milkernagh, Co. Westmeath and Co. Longford and Coolcraff, Co. Longford under ABP Ref No. 307281-20 has been withdrawn and an application for an extension of time to apply for substitute consent by Westland Horticulture Limited near Coole and Fineagh, Co. Westmeath was granted permission by An Bord Pleanála , with an application required to be submitted by the 14th December 2021. Both of these applications were included in Section 2.5.2 of the EIAR with their status now updated in table 2.4 below.

Table 2-4 Applications in the vicinity of the proposed wind farm site.

Pl.Ref	Description	Decision
Peat Operations		
ABP 307281-20	Substitute Consent Application for Peat Extraction Mountdillon, Duil na Gun, Co. Westmeath, Milkernagh, Co. Westmeath and Co. Longford and Coolcraff, Co. Longford.	Application withdrawn
ABP-310473	Application for an Extension of Time to Apply for Substitute Consent by Westland Horticulture Limited	Granted by An Bord Pleanála 22/06/2021 up until 14th Dec 2021
ABP 305835	Leave to Apply Substitute Consent by Westland Horticulture for peat harvesting on lands at Lower Coole, Mayne, Ballinealoe and Clonsura County Westmeath	Granted by An Bord Pleanála 01/05/2020

ABP-307853-20	Application for an Extension of Time to Apply for Substitute Consent by Westland Horticulture Limited	Granted by An Bord Pleanála 25/08/2020 up until 23rd November 2020.
Pl Ref. 88/313	Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard.	Granted by Westmeath County Council (WCC) 10/02/1989
Other Applications		
Pl Ref. 11/2043	Alterations to the existing return wing and associated south - east elevation as well as removal of later internal partition and the provision of a reversible enclosure of the basement stairwell to main house pantry including ancillary associated works to a building listed as a protected structure no. 261.	Granted by Westmeath County Council (WCC) 26/10/2011
Pl Ref. 81/699	Erection of a 38kV sub-station	Granted by Westmeath County Council (WCC) 29/10/1981

2.1.5.1.2 Applications in the Vicinity of the Proposed Grid Connection Route

As outlined in Section 2.5.3 of the original EIAR, the proposed underground grid connection route is in the general vicinity of over 100 no. valid planning applications made to Westmeath County Council. The majority of these applications are for residential development and were lodged since the early 1980s. The proposed grid connection route is also immediately adjacent to and/or within the general vicinity of a range of consented commercial developments, particularly within Multyfarnham, and ancillary agricultural infrastructure. Table 2-5 below has been updated below to include recent planning applications made to Westmeath County Council, in proximity of the proposed grid connection route. This includes a residential development (PL Ref No. 21/568) and applications for Community Facilities (PL Ref No's 21/675, 21/301, 21/295).

Table 2-5 Applications in the vicinity of the proposed grid connection route

Pl.Ref	Description	Decision
Energy Infrastructure		
Pl Ref. 18/6063 ABP 303812-19	10 year permission for the construction of an energy storage facility within a total site area up to 0.63 ha, to include one single storey electrical substation building, electrical transformer/invertor station modules, containerised battery storage modules on concrete support structures, access tracks, associated electrical ducting, cable racking and cabling, security fencing and CCTV security monitoring system, lightning protection poles, communications equipment and ancillary infrastructure.	Granted by Westmeath County Council (WCC) 05/02/2019. Granted by An Bord Pleanála 01/07/2019
81/699	Erection of a 38kV sub-station	Granted by Westmeath County Council

		(WCC) 29/10/1981
Peat Operations		
88/313	Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard.	Granted by Westmeath County Council (WCC) 10/02/1989
Residential		
21/568	EOD: 16/6001: planning reference no. 11/5121 for the construction of a new housing development, consisting of 28 No. houses to be constructed in 3 phases made up of a combination of 26 No. Detached 2 Storey Houses (as per Condition no.5 of outline permission planning ref no. 11/5121) with associated services	Granted by Westmeath County Council (WCC) 14/12/2021
16/6001	Planning Application for the development of 28 no. houses to be constructed in three phases.	Granted by Westmeath County Council (WCC) 25/01/2017
Community Facilities		
21/675	to construct a cricket pitch with practice net area and clubhouse to include a changing room with shower room and w.c. visitor changing room with shower room and w.c. and main area, office, kitchen area, storage, lobby with disabled w.c and 2 w.c.'s and umpire changing room with shower and to install a treatment system with percolation area with all ancillary site works.	Granted by Westmeath County Council 05/10/2022
21/301	The development which will consist of a single storey extension to the north of the existing nursing home and comprising of 12 single en-suite bedrooms, ancillary staff and resident facilities and connection to existing on-site sewage water and storm water services. Permission is also sought for all ancillary site development works. The proposed development is located within the curtilage of a protected structures Ref: 006-013 and 006-014 as identified within Volume 8 "Record of Protected Structures" of the Westmeath County Development Plan 2021-2027	Granted by Westmeath County Council 22/02/2022
21/295	The development consists of the proposed partial change of use of a horticultural based sessional training centre for people with intellectual disabilities and publicly accessible therapy garden and café, the latter of which involves change of use of the permitted portacabin structure to a café serving refreshments for consumption on site. Retention permission is also sought for landscaping and engineering works including paving and lighting, the erection of 3 no Gazebos and 1 no. Geodome, fencing around the boundary and associated works	Granted by Westmeath County Council 01/09/2021
18/6233	A proposed sports and recreational development adjacent to the existing Community Centre and playing filed. Permission is also sought to upgrade the existing car parking area and to construct a new car parking area with a total number of 224 spaces and 2 no. bus parking bays.	Granted by Westmeath County Council (WCC) 13/12/2018
18/6174	The installation of a multi-purpose playground unit suitable for under 5 year olds within the confines of the existing playground in Gaine Park.	Granted by Westmeath County Council

		(WCC) 24/08/2018
17/6112	New single storey side extension (42.65 sqm) to the existing building comprising of a new classroom/toilet, disabled toilet and lobby, car-parking and all ancillary site works.	Granted by Westmeath County Council (WCC) 24/07/2017
17/6116	Change of use of a former agricultural yard to a horticultural based sessional training centre for people with intellectual disabilities. Retention permission is also sought for the demolition of two sheds, construction of two polytunnels, erection of one portacabin, two chicken coops, connection to the group water and wastewater schemes, provision of a soakpit, new fencing around the boundary and associated site work	Granted by Westmeath County Council (WCC) 22/11/2017
13/6091	New single storey classroom extension (45sqm) to the rear of the existing building and the provision of a staff carparking area with ancillary site works	Granted by Westmeath County Council (WCC) 03/02/2014
10/2021	To alter & extend part of the existing agricultural training collage buildings (Protected Structure no. B151 of the Westmeath County Council Development Plan 2002-2008) to provide a Cancer counselling and retreat centre and a suicide and training centre. The alteration shall consist of renovating exisiting rooms to provide the following, Administration Counselling Offices, Meeting Rooms, Bedrooms with ensuites, Common Rooms, Therapy Rooms, New Stairwell and Fire Escapes, Toilet Facilities, Kitchen & Dining Areas. The extensions is to include one no. sunroom (23.7m2) to service the visitors, residents, clients and staff of both facilities. Permission is also sought to demolish the discussed derelict building and the gymnasium on the north west side of Franciscan Abbey and to reconstruct one boiler house and bin storage facility to house the plant room for the entire development on site. Permission is also sought to upgrade existing foul and storm water sewage infrastructure and to install new pipeline and infrastructure on site and to install new Telecom, ESB and water main supply to the Friary to cater for the increase in demand. Permission is also sought to alter the existing entrance on the Coole Road R152 to provide safe access and exiting from the facility and to upgrade existing farm entrance to the new facilities and to provide layby, parking bay, refuse turning areas and car & bicycle parking facilities all to cater for all the new facilities being provided on site. Also LARCC has previously recieved planning permission 07/5510 and it is intended to make small alterations to the exterior of this development and redesign internally as submitted in this application	Granted by Westmeath County Council (WCC) 20/08/2010
06/2334	To remove existing prefabricated classroom and to extend existing school to provide a replacement classroom with toilets, staff room, resource room, wheelchair toilet facilities and a P.E. room. The development will also provide for the organising of parking and entrance arrangements, an off road	Granted by Westmeath County Council (WCC) 15/01/2007

	set down and collection area for pupils and all necessary associated site development works	

2.1.5.1.3 Other Wind Farm Sites

The relevant planning history of wind farm applications within the wider area has been updated in Table 2.6 below.

The proposed Bracklyn Wind Farm for the development of 9 turbines and all associated works was granted permission by An Bord Pleanála on the 7th July 2022 under Ref No. ABP 307471-20. The proposed Ballivor Wind Farm Development is a Strategic Infrastructure Development under Ref No. ABP 307471-20. Both of these applications were included in Section 2.5.2 of the EIAR with their status now updated.

County Westmeath

Table 2-6 Other wind farm sites within 20km

Pl.Ref	Description	Decision	Distance	Status
Dryderstown Wind Turbine				
12/2054	Application by Reforce Energy Ltd. for a single electricity generating wind turbine of hub height up to 64m and rotor diameter up to 48m, a hardstanding, Control Building, Associated site roads, drainage & site works	Granted by Westmeath County Council (WCC) 24/05/2013	21km	Operational
Crowinstown Wind Farm				
03/2064	3 No. Wind Turbine Generators, 1 No Control Building, 1 No. Control Building Compound, Associated Access Roads and 1 No. Meteorological tower	Refused by Westmeath County Council(WCC) Granted by An Bord Pleanála (ref:PL25C.205586) 22/06/2004	24.9km	Not Commenced
08/2174	Application by Gaelectric Developments Ltd.seeking to amend planning ref 03/2064 (An Bord Pleanála Ref 25C.205586) relating to the development of a wind farm comprising of 3 wind turbine generators, 1 control building, 1 control building compound, associated access roads and 1 meteorological tower. This amendment seeks to increase the height of the wind turbine generators from a hub height of 78m to 85m and the rotor diameter from 72m to 80m. This will result in a maximum rotor blade tip height of 125m	Granted by Westmeath County Council (WCC) 14/08/2008	24.9km	Operational

Pl.Ref	Description	Decision	Distance	Status
	previously 114m. In addition, this application seeks to amend condition 2 to allow the 20-year permission period to commence from the commissioning date of the wind farm rather than from the date of the grant which was 22nd of June 2004.			
Ballivor Wind Farm				
ABP 307471-20.	Pre-application consultation with An Bord Pleanála for Proposed wind energy development with between 29 no. and 35 no. wind turbines with total output of 116MW to 140MW and all associated site works located in Counties Meath and Westmeath.	Is a Strategic Infrastructure Development	25.6km	N/a
Bracklyn Wind Farm				
ABP 307471-20	Wind Farm Development including 9 turbines and all associated works	Granted by An Bord Pleanála (ref: PA25M.311565) 07/07/2022	24.9km	Not Constructed

County Cavan

Pl.Ref	Description	Decision	Distance	Status
Ballyjamesduff Wind Turbine				
14/103/ ABP 02.243776	Application by Liffey Energy for a development consisting of the erection of a single turbine with a hub height of 100m and rotor diameter of 103m, overall height not exceeding 152m and all associated site development works, including foundations, crane hardstanding, access track and underground cabling. Also, the construction of 20kV switchroom building with a floor area 50sqm, and temporary alteration of existing factory entrance of the L30130.	Granted by Cavan County Council (CCC) 01/08/2014. Granted by An Bord Pleanála (ref: PL 02.243776)	16.4km	Operational
19/447/ ABP Ref. PL 02.309478	Erection of a single wind turbine, access and reinstatement works, temporary site entrance and underground electrical cabling at Kilquilly and Cloggagh, Ballyjamesduff, temporary upgrade works at the	Refused by Cavan County Council (CCC) 22/01/2021. Refused An Bord Pleanála (ref: PL02.309478) 23/06/2021	16km	n/a

Pl.Ref	Description	Decision	Distance	Status
	R935/L6503 junction at Moynehall and along the L2502.			

2.1.6.2 EPA Licencing

The information below sets out the licenced peat extraction facilities available via the EPA GIS mapping website - https://gis.epa.ie/EPAMaps/. The licenced peat extraction installation boundaries of Bord na Móna sites as shown on the EPA mapping relative to wind farm location are shown in Figure 2-1 below.

Figure 2-1 Overall Peat Extraction Boundaries

There are 4 no. bogs which are in close proximity to the wind farm site, which are under the control of Bord na Móna and are all licenced under the single licence registration P0504-01:

Table 2-7 Bogs in close proximity under control of Bord na Móna

Name	Hectares	ITM Easting	ITM Northing
Coolcraff	0.8556432	639218.24	778661.88
Coolcraff	412.2730824	639735.15	777782.36
Milkernagh	629.60802983	638527.27	774574.25
Coolnagun	669.52781286	637534.11	769824.52

The EPA determination of the licence application ultimately concluded:

"the extraction of peat in the course of business which involves an area exceeding 50 hectares at lands labelled as Mountdillon Group on Location Map Drawings 2.1 and 2.2 (Attachment 2) of the IPC

Application subject to the following fourteen Conditions, with the reasons therefor and associated schedules attached thereto."

In addition to the Bord na Móna peat bogs, the following unlicenced peat bogs have been identified. In these instances, the licence application has not been granted by the EPA. The information provided below has been extracted from the public EPA files.

<u>**Westland Horticulture Ltd**</u>

There are two peat harvesting land parcels which are in proximity to the Coole Wind Farm Site which are of note. The first is Clonsura Harvesting Area (shown in purple), the second Coole Harvesting Area (shown in pink).

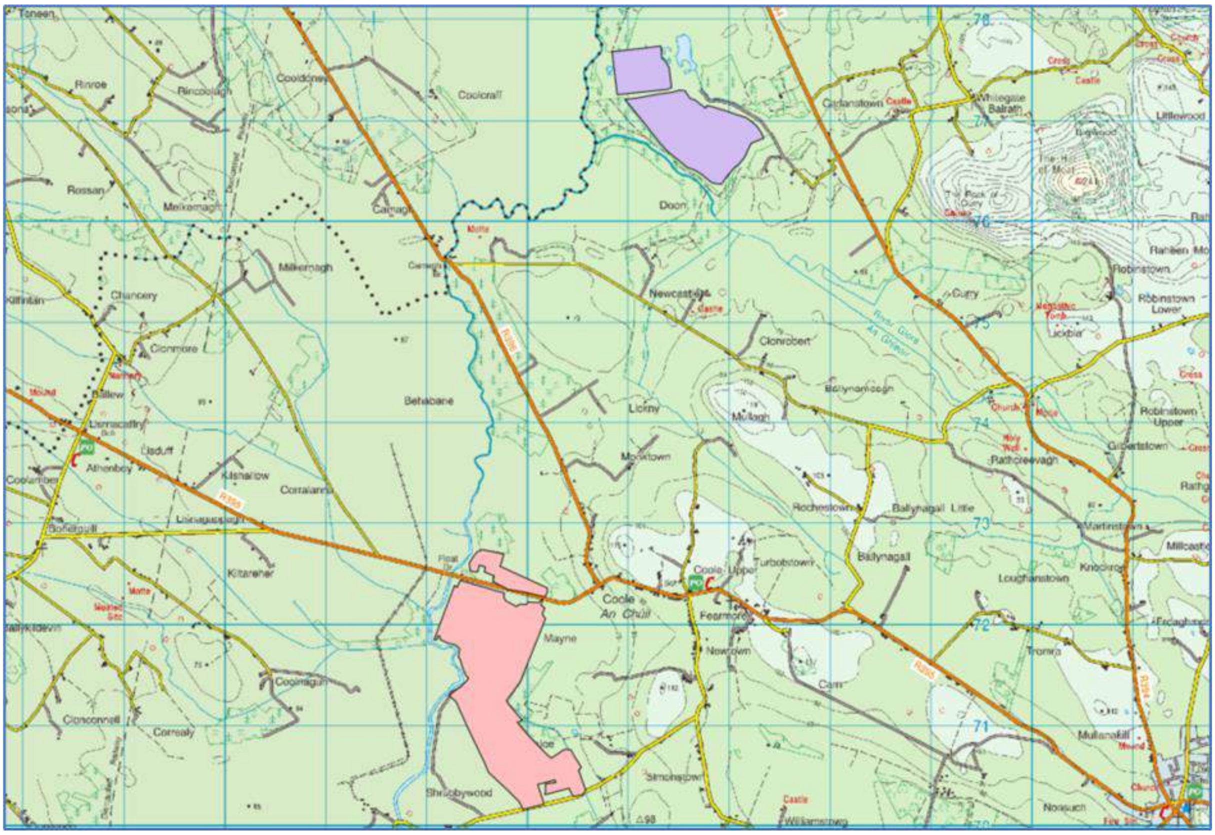

Figure 2-2 Westland Horticulture Ltd – Clonsura and Coole Boundaries

In March 2010 Westland Horticulture Ltd applied for an Integrated Pollution Prevention and Control Licence under Class 1.4: the extraction of peat in the course of business which involves an area exceeding 50 hectares. It was assigned the reference number P0914-01. The details associated with this licence are:

Table 2-8 Westland Horticulture Ltd Licence Ref: P0914-01

Reg No.	P0914-01
Applicant Name:	Westland Horticulture Limited
Location of Facility:	Lower Coole, Mayne, Ballinealoe & Clonsura, Near Coole & Fineagh, Westmeath.
Main Class of Activity:	1.4: Minerals and Other Materials
Other Classes of Activity (more about classes of activity)	n/a
Application Date:	31/07/2013
Licence Status:	Refused
Latest licence for this facility:	Reg No. P0914-01

In October 2020 the applicant wrote to the EPA noted that leave to apply for substitute consent had been granted. That correspondence noted a deadline of the 23rd of November 2020 to lodge the substitute consent application. Within that correspondence the applicant also confirmed that commercial peat extraction had not been carried out on the site since before July 22nd, 2019.

In November 2020 the EPA decided that, following the assessment of the application in relation to compliance with Section 87(1B) of the Environmental Protection Agency Act 1992 as amended and to Section 87(1C) of the EPA Act 1992, as amended, to refuse to consider the application. A letter was subsequently issued to the applicant setting out the rationale for the refusal, namely:

> *"We note that the activity in respect of which a licence is sought by you is one that prima facie involves development in respect of which a grant of planning permission is required. You have failed to provide either confirmation from the planning authority that an application has been made or a copy of a grant of permission, as required by Section 87(1B) of the EPA Act 1992. We note that while leave to apply for substitute consent has been granted by An Bord Pleanála, no such substitute consent has been granted nor has an application for substitute consent been made.*
>
> *Therefore, as the Agency considers that the activity for which you seek a licence is one which involves development for which a grant of planning permission is required, and you have failed to provide either confirmation from the planning authority that an application has been made or a copy of a grant of permission, the Agency refuses to consider your application, as it is obliged to do in accordance with Section 87(1C) of the EPA Act 1992 (as amended)."*

Harte Peat Ltd

The Harte Peat site at Finnea is located on the northern boundary of the Coole Wind Farm site. The application details are set out below.

Figure 2-3 Harte Peat Ltd- Finnea Boundary

Table 2-9 Harte Peat Ltd Licence Ref: P1119-01

Reg No.	P1119-01 RSS Feed About Licence RSS Feeds
Applicant Name:	Harte Peat Limited

Location of Facility:	Lands located within the townland of Derrycrave, Finnea, Westmeath.
Main Class of Activity:	1.4: Minerals and Other Materials
Other Classes of Activity (more about classes of activity)	n/a
Application Date:	7/10/2019
Licence Status:	Refused
Latest licence for this facility:	Reg No. P1119-01

The licence application was lodged with the EPA in October 2019. The lands had been used for peat extraction well before any planning legislation regarding substitute consent came into force.

In November 2020 the EPA wrote to the applicant noting that

"As stated in our letter of the 21 October last, the Agency considers that the activity for which a licence is sought is one that prima facie involves development in respect of which a grant of planning permission may be required, for the reasons already set out in our correspondence.

Further, for the reasons already set out, the Agency considers that there are factors set out in the application which indicate that the activity is one which will require an Environmental Impact Assessment, and therefore, cannot benefit from any claim to exempted development that would otherwise apply by virtue of S.4(4) of the Planning and Development Act 2000 as amended."

The EPA considered that the activity for which a licence was sought is one which involves development for which a grant of planning permission is required – no evidence was provided by Harte Peat during their consideration of the licence confirming an application/grant of permission was in place. Consequently the EPA refused to consider the application and in November 2020 notified the applicant and all associated parties of such.

2.1.6.3 Future Peat Harvesting

Whilst the future of peat harvesting on the areas surrounding the wind farm remains to be determined, the precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation. As detailed in Chapter 1, Section 1.4.1 of the EIAR, the establishment of an 'Interactions Management Group' made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities will be set up. This Group will be set up regardless of whether or not peat harvesting is taking place. All parties within this group will collaborate to ensure that any peat harvesting activities, proposed repurposing of the site or rehabilitation will be considered and carried out appropriately in conjunction with the wind farm. Should the peat cutting operations permanently cease, any rehabilitation or repurposing of the site will be the subject of ecological assessment, Screening for Appropriate Assessment or full Appropriate Assessment and any such assessment would take account of the potential cumulative effects of any permitted or proposed wind farm. It is likely that the ecological impacts of any rehabilitation would be of a lower significance than those associated with the ongoing peat cutting. This is set out in Section 7 of the revised NIS.

2.1.7 Response to FI Item No.1.6

Having regard to the Board's decision under ABP-310547-21 you are requested to comment on the validity of the application for CWF as it relates to development within that site boundary. You are invited to consider an amendment to the application and / or to make any revisions to the application documentation which you may consider necessary following the Board's decision.

Case RLM25.310547 as noted in the FI request relates to a Section 5 Referral, not a planning application as stated. The question asked was '*Whether the harvesting of peat is or is not development or is or is not* *exempted development."* Westmeath County Council made no declaration in respect of the Section 5 request but referred the question to An Bord Pleanála. The conclusion of the Board was that the works comprised the industrial extraction of peat and the works are not exempted development.

The Boards decision to ABP 310547-21 is noted. This decision relates to a Section 5 query and does not relate to a valid planning application.

2.2 Further Information Item No.2

Nature Impact Statement

2.1 Clarification is required in relation to the appendices associated with the NIS as there is a lack of consistency between the information submitted under the different formats. In addition, the applicant is requested to consider whether all application documents relevant to the assessment of special conservation interests and related mitigation and monitoring should be attached as appendices to the NIS.

2.2 Observations made by the Department of Housing, Local Government and Heritage on nature conservation identify gaps in the survey information and assessments presented in the Screening for appropriate assessment and the NIS. You are requested to address all points made by the Department in their submission as part of a revised screening report and NIS.

2.3. In particular, the Board seeks clarity on the extent of coverage of the site during bird surveys conducted between 2015 and 2020 noting also the gap in viewshed of the vantage points utilised. Further scientific justification is required in relation to the absence of bird migratory routes over the site or the crossing of the site by birds moving between SPA sites as outlined by the Department. In line with the Department's submission, you are requested to re-consider the screening exercise and the exclusion of Special Conservation Interest (SCI) species including Greenland White-fronted geese.

2.4. The scientific information provided as part of an NIS to inform Appropriate Assessment and as part of the EIAR should be based on up-to-date ecological reports and data. You are requested to give careful consideration to which, if any surveys need to be updated based on CIEEM (2019) advice note on the lifespan of ecological reports and surveys and taking account of the concerns raised by the Department. Survey data and analysis should be updated with any ongoing survey data that may have been collected since 2020.

2.5. The assessment should include consideration of in combination effects with ongoing peat harvesting and any future rehabilitation plans during the operation lifespan of the proposed development. The potential for any peatland habitat rehabilitation to provide enhanced habitats for wintering and breeding birds within the sites should be considered. Updated aquatic survey for some parameters at least may be required to address the request for a detailed assessment of the water quality parameters required for the River Inny and Lough Derravarragh SPA in order to assess in combination effects of peat harvesting with the proposed development.

2.2.1 Response to FI Item 2.1

Clarification is required in relation to the appendices associated with the NIS as there is a lack of consistency between the information submitted under the different formats. In addition, the applicant is requested to consider whether all application documents relevant to the assessment of special conservation interests and related mitigation and monitoring should be attached as appendices to the NIS

The NIS and AA Screening Document have been revised and are provided in **Appendix 4**. The following approach has been taken to address the points raised in the Further Information request:

The NIS has been revised and amended to ensure consistency. For clarity, the document provides a clear description of all elements of the proposed development but references (rather than appending) the description chapter from the EIAR. It also makes reference to the Hydrology Chapter of the EIAR where appropriate, rather than appending it. It continues to append the Construction and Environmental Management Plan as a definitive list of mitigation/best practice and monitoring to be employed. In addition, the NIS and associated appendices provide full details of the updated surveys that have been undertaken including the aquatic surveys undertaken in 2022 and the bird survey report (and all associated data) that provides results from surveys that were undertaken in 2021 and 2022.

The information provided is sufficient to allow the Competent Authority to undertake their Appropriate Assessment of this proposed development.

2.2.2 Response to FI Item 2.2

Observations made by the Department of Housing, Local Government and Heritage on nature conservation identify gaps in the survey information and assessments presented in the Screening for appropriate assessment and the NIS. You are requested to address all points made by the Department in their submission as part of a revised screening report and NIS.

The NIS and AA Screening have been revised and are included as **Appendix 4**. A description of how each of the points raised by the Department of Housing, Local Government and Heritage is provided below:

2.2.2.1 Matters Relating to AA

2.2.2.1.1 *1.1 Data and Surveys*

The Department acknowledges the surveys that have been carried out in preparing the NIS. However, the Department notes that the proposed development site was divided into two sections for the purposes of field surveys. The Northern section was surveyed from 2015 to 2017 and the South and East sections were surveyed from 2018 to 2020. The Department notes that the Ornithological Vantage Point (VP) 4 that covers the northern section of the proposed development site was not surveyed between 2018 and 2020. In addition, the aquatic survey carried out in 2016 has not been updated.

The data and surveys that were used to inform the AA Screening and NIS have been updated where appropriate. Details of the additional surveys undertaken are listed below:

- Aquatic surveys undertaken in 2016 were used to provide the baseline for the application. Following receipt of the submission from the Department, and adopting a precautionary approach, these surveys were updated in 2022. Thus, updated information has been provided on the baseline aquatic environment. Details of these surveys including the methodology followed, dates of survey and names of surveyors are provided in Appendix 3 of the revised NIS. The information collected in the 2022 surveys does not alter the findings of the assessment in either the NIS or EcIA.
- Further bird surveys were undertaken between March 2021 and March 2022 and these included full coverage of the northern section of the site, which includes VP4. Any issues relating to the age of the data used to inform the impact assessment, and the coverage of the site are discussed in Section 2.5.2 below. The 2021 – 2022 bird survey report is provided as Appendix 4 to the revised NIS and provide full details of the surveys undertaken.
- Additional Ecological Multi- Disciplinary Walkover Surveys of the proposed development including the cable route were undertaken in November 2021 and August 2022 to ensure the ecological information on the site baseline is up to date and remains accurate. The survey work was conducted by suitably qualified ecologists, Laoise Kelly (B. Sc. Env, MCIEEM) and Aran

Von der Geest Moroney (BSc.) on the 17th and 25th of November 2021and on the 3rd, 23rd and 24th of August 2022 by Kevin McElduff (BSc. Env.).

2.2.2.1.2 *1.2 Screening for AA*

The Department is concerned about the rationale and procedure used in screening for AA, on Page 9 which states, "Where there is no potential for significant effects on individual Qualifying Interests or Special Conservation Interests (QI or SCI), this is identified in the table and these features are not considered further in the AA Screening Report (AASR) or Natura Impact Statement (NIS)." The approach taken in screening out certain Qualifying Interest (QI) habitats and species and Special Conservation Interest (SCI) species and habitats is not recommended. Once a conclusion has been reached that certain sites screen-in for AA, all the Ql and SCI habitats and species for these sites should be taken forward to stage 2 and an assessment carried out.

Whilst the original approach was valid and facilitated a comprehensive and robust assessment of the potential for any effects on European Sites as a result of the proposed development, in order to address the Departments submission, the AA Screening has been revised to address this concern. The revised document that is provided in **Appendix 4** now screens in an entire site rather than the individual QIs/SCIs of a particular site. All QI/SCI species on those sites that are Screened In are considered in the Stage 2 assessment that is provided in the revised NIS as requested by the Department.

The Department is also concerned about the scientific rationale used for excluding SPAs in the screening for AA. The screening for AA references, McGuinness et al., 2015 and Scottish Natural Heritage (SNH) guidance. While the Department acknowledges there is limited guidance available on connectivity between SPA sites, the limitations of the SNH guidance in assessing connectivity between SPAs, in terms of species foraging ranges during breeding and wintering seasons, should be acknowledged. The SNH guidance covers selected species only, in a Scottish context and may need to be adapted for use in the Irish context. Furthermore, this guidance does not include information on migratory routes which should be included in any assessment of impacts. Mc Guinness et al., 2015 uses data which relates to selected species only. The limitations of this guidance with respect to the age of the data and the selected species should be acknowledged. The Screening for AA should be reassessed with respect to the SCIs for the European sites in proximity to the proposed development. And while the SNH provides guidance on Whooper Swan (Cyngus Cygnus) and Greenland White-fronted goose (Anser albifrons flavirostris), it does not provide foraging and core breeding ranges for all of the listed SCIs within the SPAs, in the vicinity of the proposed development.

The AA Screening that is provided as **Appendix 4** has been revised to address the concerns of the Department and no longer relies on McGuinness et.al. but on the source pathway receptor method for establishing connections with European sites and the results of the dedicated and extensive bird surveys that were undertaken between 2015 and 2022 to support this (and previous) applications on this site. The rationale for Screening each site is set out in Section 3.1 and Table 3.1. of the revised AA Screening.

The assessment with respect to the Lough Iron SPA relies on the core foraging range as set out in the SNH guidance and McGuinness et at. (2015) to exclude Greenland White-fronted Goose from the zone of sensitivity for this proposed development. While the zone of sensitivity for this species is 600m, this does not allow for an assessment of the movements between wintering sites in the Irish context.

As described above, the revised AA Screening is informed by the extensive bird surveys that were undertaken between 2015 and 2022. The results of the most recent surveys are provided in the Bird report that is provided in **Appendix 5** to this document. Greenland white fronted goose was not regularly recorded at the site of the proposed development during the surveys that were carried out between 2015 and 2022 and no potential for significant effects on the species are identified. Therefore, it was possible to conclude that there is no potential for the proposed development to result in significant effects on any European Site in respect of this species, whether considered individually or in combination with other plans or projects. No evidence from surveys of the site of the proposed development indicate that the site is on a migratory route or regularly used commuting route for Greenland white fronted goose.

Notwithstanding the above, and following an extremely precautionary principle, the potential for effects on the species have been considered in the NIS in respect of Lough Iron SPA and Garriskil Bog SPA.

The Department notes the screening for AA has stated that the proposed development is not within an identifiable migration route. Detailed scientific evidence should be provided with regard to this statement.

The extensive bird surveys that were undertaken between 2015 and 2022 provide the detailed scientific evidence to demonstrate that the site of the proposed wind farm is not on any migration route for any species. The bird surveys were undertaken between 2015 and 2022 and included comprehensive coverage of the main periods of bird migration (September to November and March to April) along with surveys at all times of day including at dawn and dusk. No evidence of a migration route for any species was recorded during these surveys. This is discussed in greater detail in the ornithological data below in Section 2.2.2.2.6 below.

2.2.2.1.3 *NIS*

As already outlined, the Department does not recommend the approach taken in screening out certain QI/SCI species and habitats. As a result of the screening for AA process undertaken in screening out certain SCI species, for example, for Lough Iron SPA (Site Code 004046); Whooper Swan (Cygnus cygnus) [A038], Wigeon (Anas penelope) [A050], Teal (Anas crecca) [A052), Shoveler (Anas clypeata) [A056], Coot (Fulica atra) [A125],Golden Plover (Pluvialis apricaria) [A 140] and Greenland White-fronted Goose (Answer albifrons flavlrostrls) [A395) have been excluded from stage 2 AA. The Department is also concerned about the impacts that may potentially arise with respect to Lough Kinale and Derragh Lough SPA (Site Code 004061), Lough Sheelin SPA (Site Code 004065), Glen Lough SPA (Site Code 004045) and Garrlskil Bog SPA (Site Code 004102).The Department is therefore of the view that the NIS Is deficient in not assessing all the QI/SCI for sites which have been screened in for AA.

As described in relation to Point 1.2 above, whilst the original approach is considered valid the AA Screening assessment has been revised to Screen in or out European Sites with no assessment of individual SCI/QI Species associated with those sites at the Screening stage. Similarly, the NIS has been revised to assess each of the SCI/QI for the Screened In European Sites. The revised AA Screening and NIS are provided in **Appendix 4**.

In addition, a rationale for the Screening Out of sites is provided in Section 3.1 and Table 3.1 of the revised AA Screening Report and described in relation to Point 1.2 above. The Screening process relies on a source, pathway receptor model and the results of the detailed bird survey work that was undertaken between 2015 and 2022. Therefore, it was possible to conclude that there was no potential for the proposed development to result in significant effects on any of the European Sites that were Screened Out.

The Department would also like to highlight that SCI species cannot be excluded from assessment if the Wetland and Waterbirds [A999]' habitat has been screened in for AA. The Department notes on page 3 of the NIS that incorrect Qls have been listed for Lough Ennell Special Area of Conservation (SAC) (Site code 000685).

The NIS that was submitted in support of this planning application considered all SCI species where a pathway for potential effect on downstream water quality was identified. However, in order to provide a concise assessment, the potential effect on all species via this pathway was considered under the heading 'Wetlands and Waterbirds (A999)'.

To respond to the concerns raised by the Department, the revised NIS that is provided in **Appendix 4** to this document, considers and lists all SCI species, which are potentially affected by deterioration of ground and surface waters.

The revised NIS considers the correct QI Habitat for Lough Ennell - Alkaline fens [7230]. Whilst the NIS as previously submitted listed the incorrect QI habitats for Lough Ennell, the potential for effects on Alkaline Fen at the site was assessed and the finding of the NIS was valid and correct.

1.3.1 Site Description

The Department notes that the proposed development site is located mainly on an area of cutaway peat and conifer plantation. The Department notes that the NIS states that the proposed development has been designed to be "as far from watercourses as possible." The Department notes that a number of turbines are proposed to be located in close proximity to a number of prominent watercourses i.e. the River Glore and River Inny which in turn flow downstream to Lough Derravarragh. The Department also notes that a number of watercourse crossings are proposed in the site itself and along the grid connection with the potential to significantly affect European Sites.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development.The NIS clearly describes the interaction between the proposed development and any watercourses. Section 3.3.1 of the NIS describes exactly how the proposed development has been designed to avoid significant effects on watercourses by ensuring that all major infrastructure such as turbines, substations and site compounds will be over 50m from any main watercourse (identified on EPA watercourse mapper) and 10m from any large drainage channels on the site. It then goes on to describe the elements of work that will be located within these buffers such as access tracks, clearspan bridges and watercourse crossings along the grid connection route. It describes how there will be no in-stream works required in respect of the proposed development. The NIS also provides reference to the Construction and Environmental Management Plan and Hydrology chapter of the EIAR (Chapter 9), which are appended to the original NIS. In addition, Section 5.4 of the revised NIS contains full details of all measures that will be in place to protect water quality. All potential impacts on water quality are fully assessed in the NIS and there is no potential for adverse effects on any European Site as a result of water pollution.

It is unclear from the EIAR and NIS if peat harvesting will continue or whether the commercial peat area will be rehabilitated during the operational lifespan of this proposed development. Clarification is required in this respect.

Whilst the future of peat harvesting on the areas surrounding the wind farm remains to be determined, the precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation. As detailed in Chapter 1, Section 1.4.1 of the EIAR, the establishment of an 'Interactions Management Group' made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities will be set up. This Group will be set up regardless of whether or not peat harvesting is taking place. All parties within this group will collaborate to ensure that any peat harvesting activities, proposed repurposing of the site or rehabilitation will be considered and carried out appropriately in conjunction with the wind farm. Should the peat cutting operations permanently cease, any rehabilitation or repurposing of the site will be the subject of ecological assessment, Screening for Appropriate Assessment or full Appropriate Assessment and any such assessment would take account of the potential cumulative effects of any permitted or proposed wind farm. It is likely that the ecological impacts of any rehabilitation would be of a lower significance than those associated with the ongoing peat cutting. This is set out in Section Seven of the revised NIS.

1.3.2 Surveys

As outlined already, the Department would like to highlight the need for ecological survey data to describe the current situation in relation to the environmental baseline. In particular, the Department is of the view that the aquatic surveys undertaken in June 2016 are not fit for purpose and need to be updated.

This point is addressed in relation to Point 1.1 above. Aquatic surveys were undertaken in 2022. Details of these surveys including the methodology followed, dates of survey and names of surveyors are provided in Appendix 3 of the revised NIS at **Appendix 4**.

With respect to flight activity, reliance has been placed on vantage point (VP) surveys. The Department notes that data provided should be up to date for each VP location. The Department notes there is a gap in the view shed of the three VP locations (VP3, 4 & 5) and that nocturnal bird surveys were not conducted to assess movements between SPAs to assess migratory routes.

The Department notes the breeding raptor survey duration of effort is not standardised with respect to vantage point watches. The duration of VP watches should be consistent and in accordance with the methodology and guidelines used.

The Department acknowledges the waterfowl surveys which were undertaken which were above the requirements of the SNH 2017 guidance[3]. In relation to Lough Iron, the monthly surveys, focused on Greenland White-fronted goose. The Department is concerned that the conclusion of the screening for AA has excluded this species from further assessment in the NIS given the recorded observations of flights through the proposed development site.

Responses to these points are provided in Section 2.2.2.2.6 below, which provides details of the ornithological surveys and analysis that was undertaken between 2015 and 2022. Details of the most recent survey information is provided in the Bird Survey Report in **Appendix 5.** The revised NIS fully assesses the potential for effects on this species.

1.3.3 Desktop Study Results

The Department notes the 'Desktop Study Results' for each of the Identified European Sites. Deterioration in surface water quality, collision and bird disturbance is identified as a potential impact from the proposed development. The Department would like to highlight the requirement to assess all the identified impacts on each QI and SCI, in view of the conservation objectives, of the European sites. The Department recommends where Site Specific Conservation Objectives (SSCOs) are available that these are detailed in the desktop study assessment with links to the relevant SSCOs provided.

Whilst each individual QI/SCI species was assessed in either in the submitted AA Screening Document or NIS, as described above, the NIS have now been revised to include an assessment of all QIs/SCIs within the NIS rather than to Screen Out some individual species. The revised NIS also now includes links to the Site Specific Conservation Objective Documents where they are available. The revised NIS is provided in **Appendix 4**.

The Department is concerned about potential impacts on bird species that utilise the SPAs in the vicinity of the proposed development. Sufficient scientific survey information is required to adequately assess the movements of species between SPA sites and also on migratory routes. Barrier effects can only be assessed following detailed surveys across all day and night periods.

The potential for the proposed development to impact on bird species was fully considered in the EIAR, NIS and AA Screening Report as submitted. However, in light of the submission received from the Department, further responses to these points are provided in Section 2.2.2.2.6 below, which provides details of the ornithological surveys and analysis that was undertaken between 2015 and 2022. Details of the most recent survey information are provided in the Bird Survey Report in **Appendix 5**.

The Department would like to highlight that Rivers Inny and Glore are listed as "At Risk" by the Environmental Protection Agency (EPA) in the immediate vicinity of the proposed development. The Department recommends an assessment of data from water source sampling locations, in view of the conservation objectives, to determine if the existing mitigation used by the peat harvesting operation and the proposed mitigation for the proposed development will be effective in avoiding or reducing impacts to European Sites. Lough Derravarragh SPA has seen a decline in the SCI species using this lake,

therefore a detailed assessment of the water quality parameters is required in the River Inny and Lough Derravarragh SPA in order to assess the in-combination effects.

The point made by the Department is acknowledged. The potential for the proposed development to impact on downstream waterbodies including the River Inny and Lough Derravarragh has been fully considered in the NIS as submitted. Comprehensive details of water quality parameters in both the River Inny and in Lough Derravarragh are provided in Section 9.3 of the Hydrology Chapter of the of the EIAR, which is appended to the NIS as submitted. This information was used to undertake a thorough assessment in Section 5.4 of the NIS, of the potential impacts of the proposed development on water quality and to reach the conclusion that the proposed development either individually or when considered cumulatively and in combination with other plans and projects, will not have any adverse effect on any downstream European Sites in respect of water quality. The hydrological impact assessment focusses on the minimisation and avoidance of impacts on water quality rather than the tolerances of the receiving waters to receive pollutants.

1.3.5 Ecological Survey Results

The Department acknowledges the detailed habitat survey information provided, however clarification is requested about the habitat identified as PB1 on page 34 of the NIS and whether this habitat equates to Annex I habitat.

Whilst not strictly relevant to the NIS as this habitat is not located within any European Site, it has been fully assessed in the EIAR and is described as follows:

> "*Degraded raised bog (non-Annex I) is present in scattered locations surrounding the EIAR study area boundary. The largest extent of this habitat occurs to the north west of the development site. The degraded peatland does not conform to any of the Annex I raised bog habitat classifications. Areas of the habitat are dried out and drained on all sides. Such areas are not capable of natural regeneration to active raised bog habitat. It is noted that the, structure, function and viability of the habitat make it susceptible to peat extraction and scrub/woodland encroachment. The remnant degraded Raised Bog is assigned* ***Local Importance (Higher Value)*** *on the basis of containing semi-natural habitat types with high biodiversity in a local context."*

Impacts on this habitat have been avoided in the design of the scheme and the assessment is fully described in the Section6.6.3 of the EIAR Biodiversity Chapter.

The Department would also like to highlight recent research on Ground Water Dependent Terrestrial Ecosystems (GWDTE) {Regan et al., 2019} which indicates that raised bogs are not 'isolated hydrological entities' but rather ambient hydrogeological conditions can result in significant, direct hydrological connections between the peatland and the groundwater. This means that the effects of marginal drainage works around raised bogs can extend to 900 metres into the bog and impact significantly on the surface acrotelm. The impacts on Garriskil Bog and Scragh Bog from the proposed grid connection should also be assessed in this context.

This point is addressed in relation to hydrology in Section 4.4 below. The hydrological assessment that was prepared by Hydro-Environmental Services Ltd. concludes that there are no direct/indirect hydrological pathways between the Grid Connection Route and Gariskil Bog SAC or Scragh Bog SAC

1.3.6 SCI Species

A response to the point 1.3.6.1 in relation to Whooper Swan are provided in Section 2.5.2 below, in relation to ornithology. It should be noted that Greenland White Fronted Goose is considered in respect of Lough Iron SPA and Garriskil Bog SPA in the revised NIS, which is provided in **Appendix 4**. It is however, concluded that, in the absence of mitigation, any impact on this species would not be significant and therefore, it can be concluded that when considered individually or in combination with other plans and projects, there is no potential for the proposed development to result in adverse effects on this species.

Similarly Point 1.3.6.2 relates to the bird survey methodology undertaken and a response is provided in Section 2.5.2 below in relation to ornithology.

The Department notes that 'Mitigation by Design, Mitigation during Construction, Operation and Decommissioning' is outlined generally for whooper swan and for deterioration of water quality. Mitigation measures should be clear and specific for each identified impact on each Ql and SCI. They must be based on a sound scientific understanding of the habitats or species within the affected European sites and designed to ensure they can be effectively implemented.

The Department recommends that mitigation is clearly outlined for each of the identified Ql habitats and species identified under 'Deterioration of Water Quality' i.e. Section 5.2.3. Furthermore, construction phase mitigation presented e.g. Section 5.2.2.3 relates to EIAR mitigation and not specifically how it will avoid impacts on Ql or SCI species and habitats.

Section Five of the revised NIS has been reformatted to address the concerns raised by the DAU in ensuring that the impact assessment is clearly set out in relation to the relevant QIs/SCIs and provides clear, specific and definite mitigation where appropriate, for all identified impacts.

The Department recommends in 'Construction Phase Drainage Management' that all mitigation measures, for example, vegetation filters and locations of silt fences should be specified on maps. With respect to 'Hydrocarbons and Waste Material' and 'Concrete Pouring'. the use of terms e.g. 'Wherever possible' or 'It Is anticipated' should be removed. Specific detail and certainty underpins the NIS, the AA process, there should be no uncertainty surrounding the implementation of a mitigation measure in an NIS. Furthermore, the Department highlights that piled foundations are indicated as 'likely' to be required for all turbines with exception of T5 and T15. This should be clarified.

It should be noted that the drainage drawings for the site that are provided in Appendix 9.3 of the Hydrology Chapter, which is appended to the NIS as submitted. These show the locations of all the mitigation to protect water quality such as silt fences, level spreaders, buffers etc. It should be noted that all drainage measures are subject to micro siting and optimisation should that be necessary during construction.

The mitigation described in the NIS, and associated appendices follows tried and tested methodologies and is highly prescriptive. It follows the precautionary principle and where there is unavoidable uncertainty in the details of the scheme, all options are assessed and the mitigation is designed accordingly to cover all options. Nonetheless, the revised NIS seeks to avoid any such ambiguity or uncertainty through revision of the language used in Section 5.4 of the revised NIS.

The NIS provides a list of water quality monitoring parameters as 'likely' to be used in section 5.2.3.5, all of which should be included in the monitoring programme.

The list of water quality monitoring parameters prescribed in Section 5.4.1.5 of the revised NIS will all be included in the monitoring programme. This aligns with the water quality monitoring parameters as set out in HES report, refer to **Appendix 2**.

Mitigation for the Decommissioning phase, Section 5.2.4.1 is limited to describing the turbine decommissioning. Rehabilitation of the development site following decommissioning has not been described.

Full details of the rehabilitation of the development site are provided in the decommissioning plan that is provided in Appendix 4-11 to the EIAR, which was appended to the NIS as submitted. The revised NIS provides additional detail in relation to the rehabilitation proposals within the body of the report.

1.3.6.4 Assessment of Residual Adverse Effects:

The Department notes the assessment of the 'Targets' and 'Attributes' for the QI habitats presented in Table 6-1 page 71 of the NIS, however as outlined already, an analysis of data from water source sampling locations within and downstream of the proposed development site is recommended in the NIS, in view of the SSCOs, to determine if the mitigation measures will be effective in avoiding or reducing impacts to European sites. For example, the SSCO documents for QI habitat [3140] states the following:

> ***"Attribute: Water quality nutrients, Target- Maintain the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species. Notes: For Lake Habitat 3140 is typically associated with high water quality, as demonstrated by naturally low dissolved nutrients ...... , annual average TP concentration should be ≤ 10μTP, average annual total ammonia concentration should be ≤ 0.04mgA N and annual 95^{th} percentile for total ammonia should be ≤ 09mg/l N."***

The mitigation measures presented in the NIS should be designed so that the targets for the SSCO for each Q/SCI will not be exceeded during the construction and operational phases of the proposed development.

The wind farm drainage measures that will be in operation during construction, operation and decommissioning have been specifically designed to avoid any significant effects on water quality, either adjacent to the site of the proposed development or in the wider catchment. The thorough assessment of potential impacts on water quality that is provided in Section 9.4 of the Hydrology Chapter of the EIAR (as appended to the NIS) does not find that there will be any significant effect on water quality as a result of the proposed development. It can therefore be concluded that there will be no significant effect on the water quality within downstream designated sites and thus, no adverse effects on the water quality parameters that are a measure of the integrity of any European Site. The residual impact section of the revised NIS provides clarity on this issue.

> ***With respect to Lough Derravarragh SPA which is hydrologically connected to the proposed development site within the foraging and commuting range of Whooper swan, further assessment is recommended in terms of the movement of species and associated flightpaths. The Department notes the assessment for Lough Iron SPA has only considered the SCI habitat [A999] in the NIS and has not assessed the potential for likely significant impacts on Greenland white-fronted goose. It is noted that Greenland white-fronted geese were observed on two occasions flying through the proposed development site. The observed data shows that Greenland white–fronted geese do move outside of the core foraging range stated in the SNH guidance, in the context of the Irish landscape. Any potential loss of Greenland white·fronted geese can be considered significant given the long term decreasing trend for this wintering species Burke et al. (2018)[9] and impacts on family groups from mortalities. The Department is concerned with regard to the lacunae in the assessment of the nocturnal migratory routes for this species, specifically.***

Further survey and assessment on both whooper swan and Greenland white fronted goose are provided in greater detail in Section 2.5.2 below in relation to ornithology. However, it is noted that in the impact assessments in both the EIAR ornithology Chapter as submitted and the 2021 – 2022 bird survey report, no significant effect on either species is predicted and therefore it can be concluded that there is no potential for adverse effects on the integrity of any European Site in respect of these species.

1.3.6.5 Invasive Species:

> ***A linear infrastructure project such as the grid connection of the proposed project provides an opportunity for invasive species to spread over long distances. Any control or management of invasive species required should be undertaken in accordance with the two recent Transport Infrastructure Ireland (TII) publications 'The Management of Invasive Alien Plant Species on National Roads- Standard' and 'The Management of Invasive Alien Plant Species on National***

Roads- Technical Guidance'. Removal of Knotweed species off site should adhere to the strict licensing requirements under Regulation 49 of the European Communities (Birds and Natural Habitats Regulations 2011, as amended. The disposal facility should also be specified in the NIS.

Section 6-7 of the submitted NIS describes the intended procedure for management of invasive species. However, the revised NIS has referenced the above guidance and a commitment is made to adhere to it.

1.3.6.6 In combination Effects:

The Department would like to highlight the Westmeath County Development Plan 2021-2027 Natura 2000 sites' policy objective CPO 12.6, "Ensure that any plan or project that could have a significant adverse impact (either by themselves or in combination with other plans and projects} upon the conservation objectives of any Natura 2000 Site or would result in the deterioration of any habitat or any species reliant on that habitat will not be permitted. Footnote: Except as provided for in Article 6(4) of the Habitats Directive, viz. There must be a) no alternative solution available, b) imperative reasons of overriding public interest for the project to proceed; and c) Adequate compensatory measures in place."

This point is noted and it is recognised that the NIS has concluded that:

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Sites, either alone or in combination with other plans or projects.

The project is therefore in accordance with the above objective.

The Department notes the inclusion of the Further Information request relating to the planning application for the grid connection, planning reference 20/6121, which has been included in the in-combination effects assessment. The Department issued detailed observations with regard to the proposed grid connection at the time of the application.

This point is noted, and it is confirmed that the submitted NIS has taken cognisance of the observations of the Department with regard to that project.

The Department recommends the inclusion of a map highlighting the location of all other projects which have been included in the in-combination assessment. An assessment of the potential barrier effects to SCI species, in combination with all the other projects, should also be carried out. In addition an assessment of the existing peat harvesting at the development site should be included in the in-combination assessment, in view of the conservation objectives of the European sites.

The submitted NIS considered numerous projects, plans and land uses in Section 7. The projects considered included wind farm sites in the wider area, forestry, residential and community facilities, energy infrastructure, live planning applications in the vicinity of the site of the proposed development and developments that are on the site of the proposed development. Whilst no peat harvesting is currently being carried out on the site and has not been carried out on the site for a number of years, peat harvesting is considered, not only in the cumulative assessment but also as the baseline environment into which the development is proposed with all assessments having taken it into full account. An assessment of potential barrier effects is provided in Section 2.5.2 in relation to ornithology. It should be noted that the provision of a map to show all projects that were considered in the cumulative assessment was considered. However, the number of projects that were assessed and the geographical area over which they were spread, limited the value and use of any such map.

2.2.2.2 2.0 Matters Relating to Environmental Impact Assessment Report

2.2.2.2.1 *2.1 Project Description*

The Department notes that the EIAR states that it assesses the potential for peat extraction on the site to continue and indicates in the event that peat extraction ceases that a site rehabilitation plan will be required to encourage re-vegetation of bare peat areas and creation of small wetland areas. The Department recommends that the rehabilitation plan should be assessed in conjunction with the EIAR for this proposed development. The peat harvesting activities, in the Department's view, have not been sufficiently addressed in the NIS and EIAR in the context of the interactions with the proposed development.

As described in the preceding sections, the ecological assessment of the proposed development has been undertaken with the existing peat harvesting activities being part of the baseline environment as well as an activity within the cumulative assessment. The interactions between the wind farm and the peat extractions have been fully and thoroughly assessed. Proposed in the EIAR (Chapter 1, Section 1.4.1) as submitted is the establishment of an 'Interactions Management Group' which will be made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities. This Group will be set up regardless of whether or not peat harvesting is taking place. All parties within this group will collaborate to ensure that any peat harvesting activities, proposed repurposing of the site or rehabilitation will be considered and carried out appropriately in conjunction with the wind farm. Should peat harvesting permanently cease on the site, it will be the responsibility of that business, which is separate from the proposed wind farm, to design and implement a restoration plan. That plan would be required to take account of any other relevant developments in its cumulative assessment. Should it be granted permission, the wind farm that is the subject of this application, would be among those considered.

2.2.2.2.2 *2.2 Surveys*

In addition, to the observations with respect to surveys and data already outlined in the NIS, the Department recommends that the methodologies and timings used in the bird surveys for the grid connection route should be clarified. The Department acknowledges that a car based bat survey was conducted along the grid connection route however the rationale should be provided for using a single survey visit methodology.

As described above in relation to Appropriate Assessment, a number of ecological surveys have been updated since the submission of the EIAR and are listed below:

- Aquatic surveys undertaken in 2016 were used to provide the baseline for the application. Following receipt of the submission from the Department, and adopting a precautionary approach, these surveys were updated in 2022. Thus, updated information has been provided on the baseline aquatic environment. Details of these surveys including the methodology followed, dates of survey and names of surveyors are provided in Appendix 3 of the revised NIS. The information collected in the 2022 surveys does not alter the findings of the assessment in either the NIS or EcIA.
- Further bird surveys were undertaken between March 2021 and March 2022 and these included full coverage of the northern section of the site, which includes VP4. Any issues relating to the age of the data used to inform the impact assessment, and the coverage of the site are discussed in Section 2.5.2 below. The 2021 – 2022 bird survey report is provided as Appendix 4 to the revised NIS and provide full details of the surveys undertaken.
- Additional Ecological Multi- Disciplinary Walkover Surveys of the proposed development including the cable route were undertaken in November 2021 and August 2022 to ensure the

ecological information on the site baseline is up to date and remains accurate. The survey work was conducted by suitably qualified ecologists, Laoise Kelly (B. Sc. Env, MCIEEM) and Aran Von der Geest Moroney (BSc.) on the 17th and 25th of November 2021and on the 3rd, 23rd and 24th of August 2022 by Kevin McElduff (BSc. Env.).

With reference to the bat surveys of the grid connection route, they are fully described in Section 6.5.2.5.1 of the submitted EIAR. They were not the subject of a single visit methodology. A survey of the entire length of the grid connection route was undertaken on the 15th September 2020 for potential bat roost features. Any features recorded were of low or negligible suitability and would remain undisturbed by the proposed works, which involve the laying of a cable in the road infrastructure, with no requirement for vegetation loss or works proposed that have the potential to disturb any potential roost features. Given these findings, the undertaking of a night time detector survey was not required. However, in order to gather information about bat species composition and activity within the area, a driven transect survey was undertaken. The result of this survey did not alter the previous finding that there was no potential for significant effect on bat species as a result of the proposed grid connection cable. The grid connection route was revisited in November 2021 and August 2022 and was once again assessed for potential roost features. The results of these surveys did not alter the previous findings that there was no potential for significant effect on bat species as a result of the proposed grid connection cable.

2.2.2.2.3 Peat Stability

The Department notes that peat depths varied between 0 and 7.8m with an average of 3.2m, with angle of slope varying between 1-3°. The "Geotechnical and Peat Stability" report states that T1, T3, T4, T10, T11, T12 & T13 are located in areas which have a higher construction risk. The Department notes these correspond to areas where significant peat depths are recorded, i.e. between 5m-8m in depth. In addition T1, T3 & T4 are close to the River Glore and Inny and associated features including Loch Bane proposed National Heritage Area (pNHA)(Site Code 001721). The Department is concerned about the potential impacts from the siting of a turbine with regard to the drainage impacts on this pNHA.

The Department notes that the geotechnical report states on page21 that "Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-analysis, was estimated at 2.5kPa. The recorded undrained strength at Coole is significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Coole site." The Department is concerned about this statement in view of the peat depths and slope angles at the following turbine locations: T1, T2, T3, T9, T10, T12 and T13 where peat depths vary from 4m to 6.6m. The slope angles at each of these proposed locations are 2° except for T9 and T13 which are greater, i.e. 3°. the geotechnical report should be updated in light of information from recent landslide events in Leitrim and Donegal. The factors that have been used to determine that the proposed development has an acceptable margin of safety and 'low risk' may need to be revised, as the recent landslides occurred on very low slopes between 1-4 degrees. While the existing drainage within the proposed development site may reduce instability of the peat, pathways exist where rapid increase in water pore pressure can cause the peat to become unstable, therefore the Department is concerned that there is a potential high risk of failure at the Coole Wind farm site.

This point is addressed by Ian Higgins of Fehily Timony and Company (FT) herein.

The higher construction risk refers to the depth of peat at these locations, which will likely require some form of temporary works, either to stabilise excavations or to provide temporary working platforms for piling equipment in order to construct the turbines and hardstands.

The failure referenced in County Leitrim (Shass Mountain/Dawn of Hope) is primarily attributed to an intense rainfall event and the concentration of runoff from forestry drainage into an area of saturated, relatively deep, peat, which was also the headwater of a small stream. This stream provided a pathway for failed material to be transported a large distance. Slope angles were typically 4-6 degrees across the failure area. Such intense rainfall events cannot be avoided; however, the impact can be mitigated by ensuring that all existing drainage is maintained during the proposed construction works to avoid blockages and water build-up, especially in deeper peat areas. Concentrated discharge of water onto peat slopes should be avoided. Refer to the SWMP for details.

The failure referenced in Donegal occurred on the Meenbog Wind Farm during the construction of a floating road. This road was constructed adjacent to an area of very weak peat, with shear strengths of <5kPa recorded in this area, and along a break in slope between a flat area and a slope of 5-6 degrees. While floating roads are proposed for the Coole Wind Farm site, there are no such breaks in slope present on the Coole site where loading could lead to a similar failure. In addition, the peat strengths recorded are all >10kPa, well in excess of those recorded at the Meenbog site, where peat strengths were around 5kPa.

It should be noted that both of these failures occurred on upland blanket bogs adjacent to or within forestry plantations, at elevations of above 200mOD, with nearby streams providing a path for failed material to be transported significant distances. The Coole site is a raised bog deposit characterised by flat terrain at an elevation of approximately 70mOD. There is not considered to be a high likelihood of a similar failure occurring on the Coole site as the site conditions are very different to those at the referenced sites in Donegal and Leitrim.

FT undertook the peat stability assessment following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2nd Edition, 2017). The Peat Hazard and Risk Assessment Guide (PHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

With reference to the slope angles at turbine locations: Slope angle is one part of the stability assessment, which also takes into account peat depth and strength. In addition, FT do not solely rely on the factor of safety (FoS) measurement; a risk assessment using qualitative factors is also used to determine the relative risk of peat instability on a site (Appendix D of the Peat Stability Assessment (PSA), Appendix 8.1 of the EIAR). The qualitative factors used in the risk assessment have been compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK. The risk assessment includes a number of factors (detailed in Appendix G of the PSA Report), as follows:

- Combination of factors (shear strength, slope angle, peat depth with 10kPa applied load)
- Evidence of sub peat water flow
- Surface water flow
- Evidence of previous slips
- Evidence of bog pools
- Evidence of mechanically cut peat
- Evidence of quaking/buoyant peat
- Type of vegetation
- Slope characteristics,
- Others

In total 10 factors, including the FoS results, are used to assess peat stability. In the risk assessment (FT's PSA report Section 8 and Appendix B) the likelihood of a hazard (peat failure) occurring is determined based on the results of the stability calculation FoS and the qualitative factors given above. This is considered by FT to be a robust approach to assessing peat stability and following this assessment showed that the proposed Coole wind farm site has an acceptable margin of safety and is suitable for wind farm development.

2.2.2.2.4 Carbon Benefit Analysis

The Department notes that the total estimated volume of peat and overburden to be excavated is 97,980m³. The calculation on CO_2 from the proposed development, Table 10-10, estimates an expected loss of 156,138 tonnes of CO_2 equivalent, over the 30 year lifespan. The calculation model allows for two choices with respect to the habitat type, 'Acid Bog' or 'Fan'. Cutover peat areas will emit increased carbon air and water compared to intact peat lands. The model calculations are based on the development footprint and not on the whole development site. Calculations should include scenarios where peat harvesting continues in combination with the proposed development and where rehabilitation is undertaken in combination with the proposed development. Noting the peat depths within the proposed development site which vary between 0-7.8m, the model should include an assessment of the carbon savings from rehabilitating the whole development site in conjunction with the carbon savings from rehabilitating the whole development site in conjunction with the carbon savings, which are acknowledged over the lifetime of the development

As detailed within Section 10.3.3.3.1 of the EIAR, the main carbon losses associated with the development footprint have been modelled based on the following assumptions relative to habitat: that the habitat type is 'Acid Bog' (within the confines of the model used, this is one of two choices, the other being 'Fen'), and the full development footprint is assumed to be located on Acid Bog. This is a precautionary approach and in reality leads to an overestimation of impacts as the predominant habitat onsite is cutover peatland with certain development components located within forestry and agricultural land.

Within the model, the CO_2 losses from the removal of intact peatland and loss of carbon fixing potential is calculated from the area affected by wind farm development, both directly by removal of peat, and indirectly by drainage, the annual gains due to the C fixing potential of the peat land, and the time required for habitat restoration, restore[3]. The carbon losses associated from a removal of Acid Bog (i.e intact peatland) is greater than that of cutover/drained peatland, as intact peatland has a higher carbon fixing potential and acts as a carbon sink. This is in agreement with the statement made by the Department above *"Cutover peat areas will emit increased carbon via air and water compared to intact peatlands"* where cutover peatlands act as a carbon emitter rather than that of a sink.

For clarity, the carbon emissions are developed based on the development proposals and the development footprint as this is the extent of the development for which consent is sought and which has the potential for effects. The Department states that the calculations do not include for the whole development site. This is not the case. Peatland areas outside the planning permission may be used for continued peat extraction or may be rehabilitated. A separate consenting process is required to determine this and so both options have been considered in the context of the cumulative assessment.

As detailed in Section 10.3.3.3.2 of the EIAR, a simple formula was used to calculate carbon dioxide emissions reductions resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil. The results of the carbon losses calculations associated with the construction, operation and decommissioning of proposed development are then subtracted from this value to ascertain the carbon savings associated with the proposed development. As detailed in Section 10.3.4.3.1 there will be a **long-term moderate positive impact** on climate as a result of reduced greenhouse gas emissions.

As detailed in Section 3.2 in Chapter 3 of the EIAR "*This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site in conjunction with any peat extraction activities. Should peat extraction cease, a site rehabilitation plan will be required which would be likely to encourage revegetation of bare peat areas, with targeted active management being used to enhance re-vegetation and the creation of small wetland*

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[3] *Scottish Government (2008) Calculating carbon savings from wind farms on Scottish peat lands: a new approach* https://www.gov.scot/publications/calculating-carbon-savings-wind-farms-scottish-peat-lands-new-approach/pages/6/

areas. Due to the small footprint of the Proposed Development in the context of the entirety of the commercial peat extraction area, a rehabilitation plan where required would take account of the wind farm infrastructure. In doing so, the environmental effects in terms of emissions are likely to be neutral."

The McCauley Institute formula, used in the EIAR and presented in Appendix 10-1 includes for calculations of carbon losses from drained land if the site is not restored of if it is restored after decommissioning, the results of which are presented below: :

CO_2 loss due to drainage

Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been derived directly from experimental data for acid bogs and fens (see Nayak et al, 2008 - Final report).

5d. CO2 loss from drained peat

	Exp.	Min.	Max.
Calculations of C Loss from Drained Land if Site is NOT Restored after Decommissioning			
Total GHG emissions from Drained Land (t CO2 equiv.)	71369.95	12148.93	269867.02
Total GHG emissions from Undrained Land (t CO2 equiv.)	59856.03	12148.93	179101.3
Calculations of C Loss from Drained Land if Site IS Restored after Decommissioning			
Losses if Land is Drained			
CH4 emissions from drained land (t CO2 equiv.)	-393.47	-623.3	2301.13
CO2 emissions from drained land (t CO2)	55462.27	14878.67	138017.81
Total GHG emissions from Drained Land (t CO2 equiv.)	71369.45	12148.93	269867.03
Losses if Land is Undrained			
CH4 emissions from undrained land (t CO2 equiv.)	184.87	-523.3	12343.29
CO2 emissions from undrained land (t CO2)	46184.31	14878.67	60087.31
Total GHG emissions from Undrained Land (t CO2 equiv.)	59856.03	12148.93	175101.3
RESULTS			
Total GHG emissions due to drainage (t CO2 equiv.)	11413.92	0	73865.71

Figure 2-4 Excerpt from Appendix 10-1 Carbon Calculations of the EIAR

2.2.2.2.5 *Fauna*

2.5.1 Mammals

With respect to the map presented on page 6-56, clarification is required with regard to the location of the Otter (*Lutra lutra*) spraint, the legend colours are similar and it appears data is missing for the 2013 survey.

This figure has been updated and has been included at **Appendix 13**

Badger (*Meles meles*) activity has been Identified within the proposed development site. The Department recommends clarification with regard to identifying the main sett location.

Full details of the results of all badger surveys are provided in Section 6.5.2.5.2 of the EIAR. Very few signs of the species were recorded and no setts were recorded within the study area during any of the ecological walkover surveys that were undertaken to inform the EIAR or the Further Information Response. Badger were included as a Key Ecological Receptor on a highly precautionary basis and the potential for impacts thereon is fully considered in Section 6.6.3.2.2 of the EIAR. This concluded that there was no potential for significant effects on badger in the absence of any mitigation. This conclusion is reached based on the lack of activity recorded on the site and the lack of any sett being recorded within the study area. If the location of a main sett were identified at some other location outside the study area, it would not alter these findings. It is recommended in the EIAR that a pre-commencement badger survey be undertaken to ensure that, should badger migrate into the site, they are adequately protected.

In relation to assessment of potential effects on Otter and Badger, it is noted that pre-commencement surveys are proposed as mitigation. The Department notes that these additional surveys for Otter are proposed prior to commencement of works in the context of the requirements of Regulation 51 of the

EC (Birds and Natural Habitats) Regulations, 2011 (as amended). The Department underlines the need to ensure that the requirements of Regulation 51 are met in full so that the strict regime of protection afforded this species is ensured.

This point is noted and it is confirmed that these surveys will be undertaken should a grant of planning permission be issued by An Bord Pleanála.

The Department acknowledges the detailed bat survey and impact assessment prepared by Woodrow Sustainable Solutions Ltd. The Department notes that 31,065 bat passes were recorded during the surveys and notes that the bat impact assessment identifies Common and Soprano pipistrelle and Leisler's bat at highest risk of collision and/or barotrauma. Three turbine locations are identified as having the potential to cause significant impacts on Common and Soprano pipistrelle at a local level. Similarly, Nathusius' pipistrelle are listed as medium risk and significant impacts at a local level.

The Department notes that Leister's bat is at higher risk around turbines T5 and T7. The Department acknowledges the mitigation proposed in the bat survey report and impact assessment report and recommends implementing these in full. The Department acknowledges that recent published guidance has been used to determine the survey design however new survey research on patterns of bat activity in upland wind farms indicates it is more appropriate to use 30 day survey periods with static automated detectors, in each season, and in different weather conditions to reduce sampling bias and to accurately determine when the curtailment mitigation is required during the operational phase of the proposed development. Curtailment mitigation should be based on the peak activity times within each season at each turbine location.

The bat surveys were undertaken in full accordance with the most relevant guidance available at the time of surveying in 2020:

1. *Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.*

2. *Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London.*

3. *Hundt, L. (2012). Bat Surveys: Good Practice Guidelines. 2nd Edition. BCT – Bat Conservation Trust, London.*

4. *Bat Conservation Ireland (2012) Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland*

5. *Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) Landscape conservation for Irish bats & species specific roosting characteristics. Bat Conservation Ireland*

A thorough and comprehensive survey and assessment of the potential effects on bat species is provided in Appendix 6-2 of the EIAR. Mitigation to avoid any significant effects is prescribed in Section 6 of that report with a detailed scope of post construction monitoring set out to allow smart curtailment to be employed as necessary.

With regard to the query over whether it 'is more appropriate to use 30 day survey periods with static automated detectors'; this information is based on an online webinar 'Patterns of Bat Activity at Upland Windfarms: Implications for Sampling and Mitigation' (CIEEM, 2020). The presenter stated during the 'Summary & Questions' that their Scottish company undertake surveys for '30 days' although they 'haven't derived 30 days in any scientific way'. and concludes that they 'have not looked to see what is the optimum efficiency'. The information presented has not been published the speaker states that 'there have been meetings to review the guidance' (i.e. SNH, 2019). However, it is stated that it is likely the

SNH (2019) guidelines will not change and that there may only be clarification issued on the existing guidelines, 'rather than necessarily changing it'. It should also be noted that Coole Wind Farm is not at an upland site. Therefore, the surveys undertaken at the site of the proposed development are fully in line with the industry best practice and a comprehensive assessment was achieved.

> **The Department recommends the following measures are put in place to mitigate impacts to all bat species in the proposed development site and along the proposed grid connection route:**
>
> > ***1. Bat surveys in the proposed development site should be carried out over a number of additional dates prior to the commencement of the development, potential bat roosts should be reassessed over a number of dates, recorded, marked and examined at height for bat presence, under licence from the National Parks and Wildlife Service section of this Department. The survey should be carried out in accordance with the Bat Tree Habitat Key and companion volume, BTHK 2020, available for free download at http://battreehabitatkey.eo.uk/?page id=43. A report on this survey, including details of potential roost features found to be submitted to the planning authority and the National Parks and Wildlife Service prior to the commencement of the development.***
> >
> > ***2. Any roosts identified, are protected under the provisions of Regulation 51 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015. Therefore, damage/disturbance to any such roosts must be avoided in the first instance. While the Minister may grant a derogation licence under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015, a licence can only be granted once a number of strict criteria have been met (see Regulation 54). Applications for derogation licences can be made in writing, including survey results and proposed mitigation measures, to the Wildlife Licensing Unit of the National Parks and Wildlife Service.***
> >
> > ***3. Replacement planting of trees and hedgerows should include a mix of age classes of trees of native species to ensure a similar structure to the removed hedgerows is replaced. A specific condition, as stated in the EIAR, should be included prohibiting any removal of any trees or vegetation including conifer trees in the plantation; between the 1st March to 31st August of any year for the duration of the construction phase for the purposes of protecting nesting bird species and bat species recorded during the surveys.***

The above recommendations are acknowledged and it is confirmed that they will be undertaken should planning permission be granted by An Bord Pleanála.

2.2.2.2.6 *Ornithology*

2.5.2 Birds

The Further Information Request issued by An Bord Pleanála (ABP) states the following concerning birds:

> *"Observations made by the Department Housing, Local Government and Heritage on nature conservation identify gaps in the survey information and assessment presented in the Biodiversity chapter of the EIAR. You are requested to address all points made by the Department in their submission as part of the request for further information.*
>
> *In particular the Board seeks further information on the impacts on bird species in terms of the concerns raised by the Department. As outlined, this may require consideration of additional survey and analysis"*

This section of the response to the further information (FI) request relates solely to ornithology and herein sets out the response to the matters raised in the FI and by DAU submission on the 17th of May 2021. The concerns outlined in the FI and DAU submission are addressed by topic below. The response to these issues has been prepared by the MKO Ornithology team who undertook the bird surveys and contributed to the Ornithology Sections of the EIAR.

It is noted that the DAU raised concerns in relation to water quality impacts on key receptors including birds, a response to this issue is provided in Section 4.4 of this report.

Data and Surveys

An Bord Pleanála (ABP) requested careful consideration of the sufficiency of the survey data stating:

> ***You are requested to give careful consideration to which, if any surveys need to be updated based on CIEEM (2019) advice note on the lifespan of ecological reports and surveys and taking account of the concerns raised by the Department. Survey data and analysis should be updated with any ongoing survey data that may have been collected since 2020.***

The Department hereafter referred to as the DAU raised concerns relating to the age of the data, questioned whether sufficient coverage of the study area was achieved and suggested that nocturnal surveys were required. The wording was as follows (DAU submission Section 1.3.2):

> ***With respect to flight activity, reliance has been placed on vantage point (VP) surveys. The Department notes that data provided should be up to date for each VP location. The Department notes there is a gap in the view shed of the three VP locations (VP3, 4 & 5) and that nocturnal bird surveys were not conducted to assess movement between SPAs to assess migratory routes.***

It is further stated by the DAU in relation to nocturnal surveying that "*radar and other research techniques which can include satellite tracking*" could have been used to survey target species including Greenland white-fronted goose and whooper swan.

Age of the Data

Since lodging, the Coole Wind Farm planning application surveying has been ongoing at the subject site. As provided in **Appendix 5** of this report, 13 additional months of surveying have been undertaken at the wind farm site. As outlined in Section 3.1 of **Appendix 5** to this report, additional field surveys were undertaken from March 2021 to March 2022 inclusive.

In summary, surveying of the wind farm site has taken place throughout the following periods:

- Between October 2015 and September 2017 (included in the EIAR as lodged),
- Between April 2018 and March 2020 (included in the EIAR as lodged),
- Between March 2021 and March 2022 inclusive (provided in **Appendix 5** of this report[4]).
- Between April and September 2022 (the key observations from this period are provided in Appendix 5 of this report) and can be made available on request,
- Surveys are ongoing this winter 2022/23, this data can be made available on request.

Please refer to Section 7.2.4 of the EIAR for further information on the surveys undertaken through the two survey periods: April 2015 – March 2017 and April 2018 – March 2020 and **Appendix 5** of this report for the surveys undertaken between March 2021 and March 2022.

[4] This report includes discussion of the key observations from the 2022 breeding season.

In the wind farm industry, it is typically accepted that data up to five years old can be used at the assessment stage, as per SNH (2017). While not mentioning birds specifically CIEEM (2019) recommends using data no greater than three years old unless justifications can be provided. Such justifications can include no significant change to the habitat present onsite. This is the case at the proposed wind farm site. The dominant habitat types throughout the bird survey period between October 2015 and March 2022 remain peatland, grassland and forestry.

In the present case, given the onsite habitats haven't significantly changed and SNH (2017) remains the foremost guidance document concerning bird surveying for the wind farm sector it is reasonable to follow its recommendations of using data up to five years old at the assessment stage.

Throughout the above initial four years (between 2015 and 2020), a comprehensive suite of bird surveys has been undertaken at the Proposed Development site (as per SNH, 2017). This is now supplemented by a fifth year of surveying to industry-best standards (SNH, 2017). It is further noted that surveys have been ongoing in 2022 and will continue this winter 2022/23, this data was not available at the time of writing this response but can be collated and made available on request. Please refer to Section 3 of **Appendix 5** of this report for further details.

The data collected at the proposed wind farm site exceeds the requirement of SNH (2017)[5] (min. two years < 5 years old) and in addition provides useful information on how the site usage and the rate of occurrence of birds have changed over time, i.e. between October 2015 and March 2022. As was requested by ABP and to incorporate this most recently collected data (March 2021 to March 2022) into the assessment of significant effects a revised impact assessment has been completed and is provided in **Appendix 5** of this report. This impact assessment considers potentially significant impacts including habitat loss, disturbance, displacement, barrier effect and collision risk. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 and key observations from the 2022 breeding season will inform any change to the impact assessment provided in the EIAR as lodged.

As outlined in Section 4.4 of **Appendix 5** of this report, no effect significance level greater than a *Low effect significance* (as per Percival, 2003 criteria) or *Long-term slight negative effect* (as per EPA, 2022 criteria) has been identified. Please note that this impact assessment includes an updated collision risk analysis. Please refer to **Appendix 5** for further details.

This further corroborates the impact assessment provided in the EIAR as lodged.

Gaps in the View Shed

As outlined in Section 7.2.4.2.1 of the EIAR, flight activity data was collected from the view sheds[6] of three vantage point locations (VPs 3, 4 and 5) to inform a collision risk analysis and identify areas of ornithological importance within the wind farm site.

It is noted in Section 7.2.4.2.1 of the EIAR that although there is a small gap in the view shed, as detailed in EIAR Figure 7-2, the coverage of the site, in general, is considered adequate to inform the collision risk analysis (the majority of the site is visible), i.e. the Band Model (2007) presumes random movement of target species within the view shed, therefore given sufficient coverage of the site, the Band Model can account for gaps in the view shed. In the Random Band Model, activity time data gathered from the entire survey area is used to predict activity time within the smaller area containing the turbines. Put another way, the Band Model uses an estimate of the amount of flight activity recorded per unit area of the site to calculate the likelihood of a bird colliding with a turbine given the area occupied by the rotating

[5] *Three and half years of the five years of surveying at the proposed wind farm site is less than five years old. These three and a half years of surveying alone greatly exceed the two year minimum of surveying recommended by SNH (2017).*
[6] *The view shed is the area visible at a given height from a vantage point.*

turbine blades[7]. The estimate of the amount of flight activity per unit area does not require complete view shed coverage of the site as the model makes predictions using a representative sample of the local flight activity.

An overall prediction of activity across the entire wind farm is calculated as the average number of transits per turbine multiplied by the total number of turbines. Thus, if the activity in the gap is the same as the activity at the viewsheds, then the averaging method can account for a gap.

In the present case, the three VP locations (VP3, 4 & 5) provided views of a significant area of peatland, grassland and forestry habitats within the study area as per EIAR figure 7-2. It is reasonable to conclude that the flight activity recorded from this considerable area of onsite habitats is sufficient to provide a representative sample of local flight activity. This being the case, the Band Model can account for gaps in the view shed.

Notwithstanding the above, as part of the ongoing surveying at the subject site an additional vantage point (VP6) was included, to provide views of the identified gap in the view shed. This vantage point was added out of an abundance of caution. The survey approach adopted is in line with best practices and follows the recommendation of SNH guidance (2017). Please refer to **Appendix 5** of this report for details on the view shed coverage of the site and bird activity that was recorded at this location (VP6). Please note that a revised view shed analysis is also provided in **Appendix 5**. As outlined in **Appendix 5** the flight activity recorded at VP6 is not significantly different from what was recorded at the other three VP locations (VP3, 4 & 5). It then follows that the original three VP locations (VP3, 4 & 5) provided a representative sample of local flight activity.

In summary, the view shed coverage of the site is entirely adequate given sufficient coverage of the site was achieved to provide a representative sample of the local flight activity. Furthermore, the additional vantage point that was added confirmed that there was nothing unusual about the flight activity within the identified view shed gap, which corroborated the assertion that the original three VP locations (VP3, 4 & 5) provided a representative sample of local flight activity.

Nocturnal Bird Surveys

It is acknowledged that some waterbirds commute between feeding and roosting locations during periods of low light, typically before sunrise or after sunset. The DAU in particular highlights whooper swan and Greenland white-fronted goose as two species that habitually undertake such low light flights. As a consequence of this behaviour, a diurnal schedule of surveys could miss these low light and nocturnal flights and hence under-represent the amount of flight activity for these species and consequently predict a lower rate of collision risk. However, the survey scope that was undertaken at the proposed wind farm site included the low light periods before sunrise or after sunset.

It is noted in Appendix 7-2 of the EIAR, that winter vantage point surveys finished/started the hour after/before sunset/sunrise. These surveys were specifically designed to overlap with these previously mentioned periods of low light to ensure that commuting flights of waterbirds including whooper swan and Greenland white-fronted goose would be recorded. This survey approach is in line with best practices and follows the recommendation of SNH (2017). SNH (2017) states in Table 1.3 that vantage point surveys targeting swans and geese should be undertaken "*between and including dawn and dusk*." Throughout these surveys, no regularly used commuting corridor or migratory route was identified that crossed the wind farm site.

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[7] *It is noted that there are other elements to the analysis, however, this is the key step that can account for gaps in the view shed.*

Furthermore, nocturnal flights have been taken into account and included in the calculation of collision risk[8], notwithstanding this, the analysis did not predict significant levels of collision risk for either species. Please refer to Section 7.8.2 of the EIAR for further detailed discussion and **Appendix 5** which includes an updated collision risk analysis.

In summary, significant collision risk is not predicted for either whooper swan or Greenland white-fronted goose. This assessment is based on a robust survey approach and after allowing for the propensity of these species to undertake nocturnal flights in the collision risk analysis.

Migratory Route and Barrier Effect

The DAU raised concerns relating to migratory routes (DAU submission Section 1.2), stating:

> ***The Department notes the screening for AA has stated that the proposed development is not within an identifiable migratory route. Detailed scientific evidence should be provided with regard to this statement.***

The robust suite of surveys undertaken on the subject site is the scientific evidence for the statement that no migratory route was identified. As previously outlined since lodging, the Coole Wind Farm planning application surveying has been ongoing at the subject site. Throughout the above initial four years (between 2015 and 2020), a comprehensive suite of bird surveys has been undertaken at the Proposed Development site (as per SNH, 2017). This is now supplemented by a fifth year of surveying to industry-best standards (SNH, 2017). It is further noted that surveys have been ongoing in 2022 and will continue this winter 2022/23, this data was not available at the time of writing this response but can be collated and made available on request.

In summary, surveying of the wind farm site has taken place throughout the following periods:

- Between October 2015 and September 2017 (included in the EIAR as lodged),
- Between April 2018 and March 2020 (included in the EIAR as lodged), and
- Between March 2021 and March 2022 inclusive (provided in **Appendix 5** of this report).

As outlined in Section 7.5 of the EIAR no regular commuting/migratory flights for any species were recorded throughout the comprehensive suite of surveys undertaken.

The DAU raised concerns relating to barrier effects (DAU submission Section 1.3.3), stating:

> ***Barrier effects can only be assessed following detailed surveys across all day and night periods.***

It is noted in Appendix 7-2 of the EIAR, that winter vantage point surveys finished/started the hour after/before sunset/sunrise. These surveys were specifically designed to overlap with these previously mentioned periods of low light to ensure that commuting flights of waterbirds would be recorded. This survey approach is in line with best practices and follows the recommendation of SNH (2017). Throughout these surveys, no regularly used commuting corridor or migratory route was identified that crossed the wind farm site.

As outlined in the updated impact assessment provided in **Appendix 5** of this document no significant barrier effects have been identified for any species.

Breeding Raptor Surveys

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[8] *As is noted in Table 3-3 of Appendix 7-5 of the EIAR, it is assumed that whooper swan and Greenland white-fronted goose were active for 25% of the night as well as the daylight hours as per SNH guidance on accounting for swan/goose and wader flight activity. This 25% of the night is calculated as a portion of the length of the night for the survey period (provided by www.timeanddate.com) and is added to available hours of activity for these species per year.*

The DAU raised concerns relating to the adequacy of breeding raptor surveys. The wording was as follows (DAU submission Section 1.3.2):

> ***The Department notes the breeding raptor survey duration of effort is not standardised with respect to vantage point watches. The duration of VP watches should be consistent and in accordance with the methodology and guidelines used.***

It is noted in Table of Appendix 7-2 of the EIAR that the breeding raptor vantage point watches were all three hours in duration throughout 2017, 2018 and 2019 breeding seasons. Furthermore, this consistency of duration was repeated throughout the 2021 breeding season (as detailed in **Appendix 5**). Breeding raptor surveys were also undertaken during the 2022 breeding season. This data was not available at the time of writing this response but can be collated and made available on request.

As is noted in Section 7.2.4.2.3 of the EIAR, breeding raptor surveys (i.e. birds of prey and owls) were undertaken within the study area and its immediate surroundings. These surveys aimed to identify occupied territories and monitor their breeding success within the study area.

The survey methodology was *in accordance with* Hardey et al. (2013), as per SNH (2017) recommendations and was consistent in their duration.

Grid Connection Route

The DAU requested further information in relation to the timing and methodology used in surveying the grid connection route.

It is noted in Section 7.2.4.2.7 of the EIAR, that ornithological surveys were conducted as part of the multidisciplinary surveys along the proposed grid connection route carried out by MKO in 2017, 2019 and 2020. These surveys were undertaken in addition to the dedicated bird surveys carried out between 2015 and 2017 as part of the Coole Wind Farm. The grid connection works will be confined to the existing road corridor, conifer plantation and Mullingar substation.

Greenland White-fronted Goose

While acknowledging the adequacy of the waterfowl surveys, the DAU questioned the exclusion of Greenland white-fronted goose from further assessment in the NIS. The wording was as follows (DAU submission Section 1.3.2):

> ***In relation to Lough Iron, the monthly surveys, focused on Greenland white-fronted goose. The Department is concerned that the conclusion of the screening for AA has excluded this species from further assessment in the NIS given the recorded observations of flights through the proposed development site.***

It should be noted that Greenland White Fronted Goose is considered in respect of Lough Iron in the revised NIS. Further concerns were raised in relation to the Greenland white-fronted goose collision risk, the following was stated:

> ***Any potential loss of Greenland white-fronted goose can be considered significant given the long term decreasing trend for this wintering species Burke et al (2018) and impacts on family groups from mortality.***

It is noted in Section 4.3.1 of **Appendix 5** that the predicted Greenland white-fronted goose collision risk is negligible (<1% increase in background mortality) in the context of the county population. Please refer to **Appendix 5** for further details. No significant effects are predicted. The magnitude of the predicted collision risk is sufficiently low that even if the loss of an adult within a family group were to lead to additive mortality it is highly unlikely that there would be a sufficient increase to result in a significant effect. Rationale: the collision risk has been calculated at a ratio of 0.04 collisions per year, this would have to be increased by a multiple of approx. 17 before the classification of the magnitude of the effect would be increased from negligible to low (as per Percival 2003 criteria).

Such an additive increase in mortality is not likely. Therefore, significant effects are not predicted.

Further concerns were raised in relation to the Greenland white-fronted goose migratory routes crossing the wind farm site, the following was stated:

> ***The Department notes the screening for AA has stated that the proposed development is not within an Identifiable migration route. Detailed scientific evidence should be provided with regard to this statement.***

Specifically, in relation to Greenland white-fronted goose throughout surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind farm site.

Please refer to Section 4.4 of **Appendix 5** for further discussion.

Whooper Swan

The DAU raised concerns relating to the impact of the proposed development on whooper swan (DAU submission Section 1.3.6). The wording is as follows:

> ***The Department recommends clarification regarding the scientific evidence for the statement on page 58 of the NIS that the development site does not lie on a migratory corridor for whooper swan.***

It is noted in Section 7.8.2.1 of the EIAR that whooper swan were rarely recorded flying over the Proposed Development area. As provided in Appendix 7-4 of the EIAR of all the whooper swan vantage point flights that were recorded, there was one flight recorded during the migratory period of the first winter surveyed (2015/16), one further flight during the 2018/19 migratory season and a further three during the 2019/20 migratory season. Such an infrequency of observations could not be said to be evidence of a significant migratory corridor for whooper swans.

During the most recent surveys (2021/22) there were 16 flights recorded during the migratory period (in this case October 2021), however, the majority of these flights (Map ref: WS01-WS016 in **Appendix 5**) are associated with the Inny River along the western margin of the site and the peatland offsite and still further west of the wind farm site. It is noted that many of the flights were short and some of these flights are noted to be descending presumably to local foraging grounds. If the wind farm were present in the landscape the swans could continue to follow the river along the western margins of the site without the development acting as a barrier.

These survey results do not indicate that the development site lies on any significant migratory corridor for whooper swans.

Further concerns were raised in relation to the whooper swan collision risk, the following was stated

> ***The assessment should also include impacts on family groups. While a single mortality may be considered insignificant, mortality of the adults within a family group, may be significant. Mitigation is not presented with respect to disturbance to whooper swan or in the event of increased mortality being observed during the monitoring period of the operational phase.***

It is noted in Section 4.3.5 of **Appendix 5** that the predicted whooper swan collision risk is of low significance in the context of the county population[9]. Please refer to **Appendix 5** for further details. No significant effects are predicted. The magnitude of the predicted collision risk is sufficiently low that even if the loss of an adult within a family group were to lead to additive mortality it is highly unlikely that there would be a sufficient increase to result in a significant effect. Rationale: the collision risk has been calculated at a ratio of 0.79 collisions per year, this would have to be increased by a multiple of 2.5 before the classification of the magnitude of the effect would be increased from negligible to low (as per Percival 2003 criteria).

Such an additive increase in mortality is not likely. Therefore significant effects are not predicted.

Woodcock

The DAU raised concerns in relation to the age of woodcock surveys (DAU submission Section 2.5.2), stating:

> ***The Department notes that breeding woodcock surveys took place in 2016 and 2017. These surveys are considered now to be out of date.***

As previously outlined, since lodging the Coole Wind Farm planning application surveying has been ongoing at the subject site. During May and June 2021, breeding season surveys for woodcock were undertaken in accordance with Gilbert et. al (1998). The survey area extended 500m beyond the wind farm site in areas of suitable breeding habitat. Surveys commenced one hour before sunset and continue for an hour after sunset/ until it was too dark to see. The survey aimed to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area.

The survey effort undertaken is presented in **Appendix 5**, including details of survey duration and weather conditions. Figure 4 in **Appendix 5** shows the survey area.

Since the 2016 and 2017 surveys were undertaken, there has been an increase in the number of identified woodcock territories. Please refer to **Appendix 5** for further details. To incorporate this most recently collected data into the assessment of significant effects a revised impact assessment has been completed and is provided in Section 4.4.9 of **Appendix 5** of this report.

As outlined in Section 4.4.9 of **Appendix 5** of this report, no significant effects were predicted for woodcock. Please refer to **Appendix 5** for further details.

This, therefore, corroborates the results of the impact assessment provided in Section 7.4.22 of the EIAR as lodged.

Buzzard

The DAU raised concerns in relation to buzzard collision risk (DAU submission Section 2.5.2), stating:

> ***The Department notes the collision risk analysis for buzzard has assessed the risk across all seasons. The collision risk assessment should include an assessment during the breeding season specifically.***

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[9] In 2021, the 2020 International Swan Census data was published (Burke et al., 2021) which estimated the Westmeath whooper swan population to be 982 birds.

The collision risk has been calculated at a ratio of 3.7 collisions per year and 2.4 for the breeding season alone. The favourable conservation status of this species (Green-listed BoCCI) limits the potential for ecologically significant effects to result. The predicted collision risk is insignificant in the context of the county, national and international population.

Lapwing

The DAU raised concerns in relation to lapwing collision risk (DAU submission Section 2.5.2), stating:

> ***The collision risk analysis should be undertaken with respect to the breeding population as well as the wintering season.***

As outlined in Section 7.6 of the EIAR and **Appendix 5** of this response document, no breeding season flights were recorded at potential collision height during vantage point surveys throughout 2016, 2017, 2018, 2019 and 2021. This is likely due to where the birds were breeding, i.e. predominantly offsite. As the species was not recorded flying at potential collision height during vantage point surveys, collision-related mortality is not likely to significantly impact this species.

Passerines

The DAU raised concerns in relation to the sufficiency of the data collected and impacts on passerines (DAU submission Section 2.5.2), stating:

> ***Survey data is insufficient with regard to red listed BoCCI, for example, meadow pipit but also including other species such as amber listed skylark. Loss of habitat surrounding T15 will result in the loss of habitat for meadow pipit and skylark. Impacts associated with meadow pipit will also impact on cuckoo.***

It is noted in Section 7.6 of the EIAR as per SNH guidance, it is generally considered that passerine species (primarily due to their large populations) are not significantly impacted by wind farms. Furthermore, the habitat at T15 (grassland) is not rare locally or unique to the wind farm site.

Golden Plover

The DAU raised concerns in relation to golden plover collision risk (DAU submission Section 2.5.2), stating:

> ***The predicted collision risk for golden plover was 34 collisions per year which equates to approximately 1,020 over the lifetime of the operational phase, which is half of the estimated County population of this Annex I listed species.***

Whilst the number of likely collisions is an important part of predicting the magnitude of any impacts, it is not the only part (Percival 2003). As populations remain viable despite ongoing sources of mortality the significance of the predicted collision rate should be determined in the context of the background mortality rate for that species. The aim is to establish if there is a significant change to the background mortality rate as a result of the likely collisions. No significant effect was identified. This industry best practice is the approach that has been taken in the collision risk analysis as provided in **Appendix 5**.

The DAU further stated (DAU submission Section 2.5.2):

> ***Declines of >20% are evident in golden plover in recent years, Burke et al., (2018). The Department advises that the large and rapid decline in the golden plover numbers as well as the cumulative collision risk in combination with other wind farms should be taken into account when assessing the significance of collision impacts on local populations.***

As previously outlined, since lodging the Coole Wind Farm planning application surveying has been ongoing at the subject site. When this additional data was added to the analysis, the collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (Please see EIAR Appendix 7-5 for further details). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. Please see **Appendix 5** for further discussion.

It is noted that a cumulative impact assessment is provided in full in Section 7.12 of the EIAR as lodged. As outlined in Section 7.12.1 of the EIAR, no potentially significant cumulative habitat loss, disturbance, displacement or collision risk effects on any of the KORs, including golden plover collision risk, have been identified with regard to the development proposal.

In the specific case of cumulative collision risk, there are two turbines total within a 20km radius of the proposed development only one of which is existing. These turbines are located approximately 10.2km (proposed turbine) and 16.2km (existing turbine) from the wind farm Site. This low density of turbines is shown in EIAR Chapter 2 Figure 2-10. Owing to the scale of these developments (one-off turbines) and the considerable separation distance from the wind farm Site, significant cumulative effects (including collision risk) are not predicted for golden plover.

Peregrine falcon

The DAU raised concerns in relation to peregrine collision risk (DAU submission Section 2.5.2), stating:

> ***The collision risk is estimated as 0.127 collisions per year which equates to four individuals over the 30 year span of the proposed project which is considered a significant impact on the local breeding population in the Department's view.***

As previously outlined, since lodging the Coole Wind Farm planning application surveying has been ongoing at the subject site. When this additional data was added to the analysis, the collision risk was calculated at 0.196 collisions per year or one bird every 6 years. The results of this analysis are not significantly different from the collision risk report in the EIAR as lodged. This therefore further corroborates the results of the impact assessment of no significant effect as provided in Section 7.8.2.5 of the EIAR as lodged.

Lighting

The DAU raised concerns in relation to the impact of lighting on bird species and in particular reference is made to the following guidance document: Effects of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures. It is stated (DAU submission Section 1.3.6.2) that:

> ***A number of mitigation options exist and these are listed in this guidance and must be considered in relation to the proposed development.***

As some bird species are known to be attracted to artificial lighting (phototaxis), there is potential for some bird species to be put at increased risk of colliding with a turbine if attracted to artificial lighting on turbines. However, some taxonomic groups (e.g. some burrow nesting seabirds) and nocturnally migratory species (especially passerines) are more attracted to lights than others. It is noted that there were no key ornithological receptors (KOR) from either of these groups identified at the Site. Please see Section 7.6 of the EIAR for further details of KOR identification. As detailed in the guidance document referred in the DAU submission: Effects of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures. It is stated that:

> *"It is likely that collision risk at lit turbines for non-passerine taxa are likely to be relatively low in general."*

This is of note as all of the KORs identified at the wind farm Site were non-passerines. No significant effects are therefore predicted.

In-combination Barrier Effects

The DAU raised concerns in relation to in-combination barrier effects (DAU submission Section 1.3.6.6), stating:

> ***An assessment of the potential barrier effects to SCI species, in combination with all the other projects, should also be carried out.***

It is noted that a cumulative impact assessment is provided in full in Section 7.12 of the EIAR as lodged. As outlined in Section 7.12.1 of the EIAR, no potentially significant cumulative habitat loss, disturbance, displacement or collision risk effects on any of the KORs have been identified with regard to the development proposal.

In the specific case of cumulative barrier effect, there are two turbines total within a 20km radius of the proposed development only one of which is existing. These turbines are located approximately 10.2km (proposed turbine) and 16.2km (existing turbine) from the wind farm Site. This low density of turbines is shown in EIAR Chapter 2 Figure 2-10. Owing to the scale of these developments (one-off turbines) and the considerable separation distance from the wind farm Site, significant cumulative effects (including barrier effects) are not predicted.

Summary Conclusion

Following the clarification and explanation provided above, it is clearly demonstrated that the issues raised have been comprehensively addressed and that the information before the Planning Authority is adequate and no deficiencies in information remain. Furthermore, it has been demonstrated that the proposed development will not significantly impact avian populations of importance in the area.

2.2.2.2.7 *3.0 Biodiversity Net Loss:*

> ***The National Biodiversity Action Plan 2017- 2021 aims to conserve and restore Ireland's biodiversity. A key objective of this Plan is to achieve no net contribution to biodiversity loss arising from development projects occurring within the lifetime of the plan. Accordingly, the application should outline how this project will avoid a net loss of biodiversity noting the potential impacts on local and migratory bird species from the operational phase of the proposed development.***

The proposed development has been specifically designed to avoid net loss and the provisions of the National Biodiversity Plan has been considered in the ecological and environmental assessment of the proposed development. This is set out in Section 6.2 of the EIAR. The information provided in the submitted EIAR and in response to this further information request clearly demonstrates that the proposed development will not result in any significant effects on biodiversity, including local and migratory birds and has been developed in accordance with the National Biodiversity Action Plan 2017 – 2022 .

2.2.3 Response to Item 2.3

In particular, the Board seeks clarity on the extent of coverage of the site during bird surveys conducted between 2015 and 2020 noting also the gap in viewshed of the vantage points utilised. Further scientific justification is required in relation to the absence of bird migratory routes over the site or the crossing of the site by birds moving between SPA sites as outlined by the Department. In line with the Department's submission, you are requested to re-consider the screening exercise and the exclusion of Special Conservation Interest (SCI) species including Greenland White-fronted geese.

This item has been fully addressed in Section 2.2.2.2.6 of this response document.

2.2.4 Response to FI Item 2.4

The scientific information provided as part of an NIS to inform Appropriate Assessment and as part of the EIAR should be based on up-to-date ecological reports and data. You are requested to give careful consideration to which, if any surveys need to be updated based on CIEEM (2019) advice note on the lifespan of ecological reports and surveys and taking account of the concerns raised by the Department. Survey data and analysis should be updated with any ongoing survey data that may have been collected since 2020.

This item has been fully addressed in Section 2.2 of this response document.

2.2.5 Response to FI Item No.2.5

The assessment should include consideration of in combination effects with ongoing peat harvesting and any future rehabilitation plans during the operation lifespan of the proposed development. The potential for any peatland habitat rehabilitation to provide enhanced habitats for wintering and breeding birds within the sites should be considered. Updated aquatic survey for some parameters at least may be required to address the request for a detailed assessment of the water quality parameters required for the River Inny and Lough Derravarragh SPA in order to assess in combination effects of peat harvesting with the proposed development.

Whilst the future of peat harvesting on the areas surrounding the wind farm remains to be determined, the precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation. As detailed in Chapter 1, Section 1.4.1 of the EIAR, the establishment of an 'Interactions Management Group' made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities will be set up. This Group will be set up regardless of whether or not peat harvesting is taking place. All parties within this group will collaborate to ensure that any peat harvesting activities, proposed repurposing of the site or rehabilitation will be considered and carried out appropriately in conjunction with the wind farm. Should the peat cutting operations permanently cease, any rehabilitation or repurposing of the site will be the subject of ecological assessment, Screening for Appropriate Assessment or full Appropriate Assessment and any such assessment would take account of the potential cumulative effects of any permitted or proposed wind farm. It is likely that the ecological impacts of any rehabilitation would be of a lower significance than those associated with the ongoing peat cutting. This is set out in Section 7 of the revised NIS at **Appendix 4**.

As stated in section 2.2 of this FI response Aquatic surveys undertaken in 2016 were used to provide the baseline for the application. Following receipt of the submission from the Department, and adopting a precautionary approach, these surveys were updated in 2022. Thus, updated information has been provided on the baseline aquatic environment. Details of these surveys including the methodology followed, dates of survey and names of surveyors are in Appendix 3 to the revised NIS at **Appendix 4**. The information collected in the 2022 surveys does not alter the findings of the assessment in either the NIS or EcIA.

The potential for the proposed development to impact on downstream waterbodies including the River Inny and Lough Derravarragh has been fully considered in the NIS as submitted. Comprehensive details of water quality parameters in both the River Inny and in Lough Derravarragh are provided in Section 9.3 of the Hydrology Chapter of the of the EIAR, which is appended to the NIS as submitted. This information was used to undertake a thorough assessment in Section 5.4 of the NIS, of the potential impacts of the proposed development on water quality and to reach the conclusion that the proposed development either individually or when considered cumulatively and in combination with other plans and projects, will not have any adverse effect on any downstream European Sites in respect of water quality. The hydrological impact assessment focusses on the minimisation and avoidance of impacts on water quality rather than the tolerances of the receiving waters to receive pollutants.

2.3 Further Information Item No.3

Biodiversity (EIAR)

3.1. Observations made by the Department Housing, Local Government and Heritage on nature conservation identify gaps in the survey information and assessments presented in the Biodiversity chapter of the EIAR. You are requested to address all points made by the Department in their submission as part of the request for further information.

3.2. In particular the Board seeks further information on the impacts on bird species in terms of the concerns raised by the Department. As outlined, this may require consideration of additional survey and analysis.

2.3.1 Response to FI Item No.3.1

Observations made by the Department Housing, Local Government and Heritage on nature conservation identify gaps in the survey information and assessments presented in the Biodiversity chapter of the EIAR. You are requested to address all points made by the Department in their submission as part of the request for further information.

This item has been fully addressed in Section 2.2.2.2.6 of this response document.

2.3.2 Response to FI Item No.3.2

In particular the Board seeks further information on the impacts on bird species in terms of the concerns raised by the Department. As outlined, this may require consideration of additional survey and analysis.

This item has been fully addressed in Section 2.2.2.2.6 of this response document.

2.4 Further Information Item No.4

Soils and Geology and Interactions with Peat Harvesting

4.1. In section 8.3.2.1 of the EIAR it is stated that the recorded peat depth at T12 is given as 12.5mfrom the 2020 rotary core boreholes while the peat depth within 50m is 4.5m based on table 8-4. You are requested to justify the location of the turbine in very deep peat and at a location where the slope angle is 3 degrees and to consider whether there is a more suitable alternative.

4.2. The comments of the Department Housing, Local Government and Heritage on nature conservation raise a number of issues including the following which are considered of particular relevance to soils and geology and hydrology:

- *The effectiveness of the existing mitigation measures used by peat harvesting operation and proposed for CWF in terms of the protection of European sites.*
- *The potential for impacts on Garriskil Bog and Scragh Bog as a result of the effects of drainage works.*
- *The need to identify the location of all mitigation measures involved in the construction phase drainage management.*
- *Clarification relating to the nature of foundations.*
- *The need to avoid uncertainty relating to the mitigation measures including in the context of the NIS.*

- *The nature of the site rehabilitation and the effects of decommissioning.*
- *Recent cases of peat slippage which are stated to have occurred on lands with very low slopes and the need to revise the peat stability assessment.*

You are requested to address these observations.

4.3. The EIAR is stated to set out the coordination between the peat harvesting activities should they continue and the proposed development in terms of the drainage system. The detailed drawings provided in appendix 9- 3 of the proposed drainage system are noted. You are requested to demonstrate sufficient control over the existing drainage associated with the peat harvesting activities and to clarify that the proposed drainage plan can be effectively implemented, regardless of whether or not peat harvesting is taking place and the associated drainage system being maintained.

4.4. It is considered that more detailed information should be provided relating to water quality monitoring proposals specified in section 9.4.1.1 of the EIAR. In particular the suite of parameters to be monitored and the limits to be met should be specified.

4.5. You are requested to clarify the layout and management arrangements for the operational phase

4.6 It is noted that the heading of section 8.5.1.2 of the EIAR includes reference to the alteration of peat/soil geochemistry. Please clarify how this topic is assessed under that heading or if it is addressed elsewhere in the submitted documentation.

2.4.1 Response to FI Item No.4.1

In section 8.3.2.1 of the EIAR it is stated that the recorded peat depth at T12 is given as 12.5m from the 2020 rotary core boreholes while the peat depth within 50m is 4.5m based on table 8-4. You are requested to justify the location of the turbine in very deep peat and at a location where the slope angle is 3 degrees and to consider whether there is a more suitable alternative.

The peat probing investigation that informed the EIAR were undertaken by HES & AGEC/FTCO 2016-2020 with peat depths ranging from 0 to 7.8m with an average depth of 3.2m. Peat depths recorded during the drilling of the 13 no. rotary core boreholes at proposed turbine locations ranged from 2 to 12.5m. The rotary core borehole peat depth measurement of 12.5m occurred at T12.

As part of this FI response Malachy Walsh and Partners (MWP) undertook further peat probing at T12, which identified the peat depth at T12 to be 8.7m. MWP also assessed LiDAR data for the T12 location which shows the max slope is 1.5 degrees and on average 0.24 degrees. The results of these investigations are included in MWP's response document at **Appendix 12** and is summarised in the following section.

The peat stability assessment for T12 has been revised by MWP with the updated peat depth (maximum of 9m) and maximum slope angle from LiDAR at T12 (1.510).

A Factor of Safety (FOS) of 1.3 is the minimum required by "BS 6031:2009 Code of practice for earthworks". All of the calculated FOS values in Table 3-1 are greater than 1.3.

In light of the updated slope data in MWP's report for T12, Fehily Timony and Company (FT) undertook a review of the LiDAR data for the other turbine locations and have determined that the slope angles are not significantly different to those recorded on site and has concluded that the peat stability assessment at all other turbine locations provides an adequate factor of safety.

It is concluded by MWP in their response that

"the location of T12 is justified as the peat stability assessment provides an adequate factor of safety."

In summary, following a review of available ground investigation information and peat probes, MWP noted that the Rotary Core Borehole at T12 overestimates the depth of peat at this location. The peat probes which were undertaken to inform this response confirm the peat depth to be 8.7m at the centre of T12 and a maximum peat depth of 9m in the vicinity of the turbine and hardstand. MWP consider that the depths provided by the peat probes provide the most accurate peat depths and should be used for assessment purposes. Further investigations of the slope at T12 were also undertaken which included a review of LiDAR information. The steepest slope angle derived from the LiDAR is 1.51 degrees while the average angle is 0.24 degrees. The LiDAR is considered more accurate than the methodologies used which originally yielded a slope angle of 3 degrees. Taking all this into consideration, the location of T12 is considered to be justified as the update slope is considered to be a very shallow slope with minimal risk of peat failure, as illustrated by the factor of safety results in the Peat Stability Assessment and in the MWP technical note included at **Appendix 12.**

2.4.2 Response to FI Item No.4.2

The comments of the Department Housing, Local Government and Heritage on nature conservation raise a number of issues including the following which are considered of particular relevance to soils and geology and hydrology:

- ***The effectiveness of the existing mitigation measures used by peat harvesting operation and proposed for CWF in terms of the protection of European sites.***
- ***The potential for impacts on Garriskil Bog and Scragh Bog as a result of the effects of drainage works.***
- ***The need to identify the location of all mitigation measures involved in the construction phase drainage management.***
- ***Clarification relating to the nature of foundations.***
- ***The need to avoid uncertainty relating to the mitigation measures including in the context of the NIS.***
- ***The nature of the site rehabilitation and the effects of decommissioning.***
- ***Recent cases of peat slippage which are stated to have occurred on lands with very low slopes and the need to revise the peat stability assessment.***

You are requested to address these observations.

A full and comprehensive response to the comments of the Department of Housing, Local Government and Heritage is provided by the MKO Ecology team in Section 2.2 of this response document. In the interest of clarity, an individual response is provided to each of these items numbered (a) to (g) below.

(a) The effectiveness of the existing mitigation measures used by peat harvesting operation and proposed for CWF in terms of the protection of European sites.

Issues raised by the department in relation to mitigation measures have been addressed in Section 2.2 of this FI response. The precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation.

The potential for the proposed development to impact on downstream waterbodies including the River Inny and Lough Derravarragh has been fully considered in the NIS as submitted. Comprehensive details of water quality parameters in both the River Inny and in Lough Derravarragh are provided in Section

9.3 of the Hydrology Chapter of the of the EIAR, which is appended to the NIS as submitted. This information was used to undertake a thorough assessment in Section 5.4 of the NIS, of the potential impacts of the proposed development on water quality and to reach the conclusion that the proposed development either individually or when considered cumulatively and in combination with other plans and projects, will not have any adverse effect on any downstream European Sites in respect of water quality. The hydrological impact assessment focusses on the minimisation and avoidance of impacts on water quality rather than the tolerances of the receiving waters to receive pollutants.

(b) The potential for impacts on Garriskil Bog and Scragh Bog as a result of the effects of drainage works.

Please refer to Section 2.1.1 of HES FI response at Appendix 2 of this report for a full response to this item.

(c) The need to identify the location of all mitigation measures involved in the construction phase drainage management.

Please refer to Section 2.1.2 of HES FI response at Appendix 2 of this report for a full response to this item

(d) Clarification relating to the nature of foundations

Chapter 4, Sections 4.3.2, 4.3.10 and 4.8, Chapter 8 and Appendix 8.1 Geotechnical & Peat Stability Report deal with the nature of the turbine foundations and the assessment of impacts. As set out in Section 4.3.2 of the EIAR, each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process.

As detailed in Section 2.1.2 above, minor changes have been made to Drawing 200445-43 FI Turbine Foundation Standard Detail. This updated drawing has been included at **Appendix 1.**

(e) The need to avoid uncertainty relating to the mitigation measures including in the context of the NIS.

As stated in Section 2.2 of this FI response, the mitigation described in the NIS, and associated appendices follows tried and tested methodologies and is highly prescriptive. It follows the precautionary principle and where there is unavoidable uncertainty in the details of the scheme, all options are assessed, and the mitigation is designed accordingly to cover all options. Nonetheless, the revised NIS seeks to avoid any such ambiguity or uncertainty through revision of the language used in Section 5.4 of the revised NIS.

(f) The nature of the site rehabilitation and the effects of decommissioning.

As stated in Section 2.2 of this FI response, full details of the rehabilitation of the development site are provided in the decommissioning plan that is provided in Appendix 4-11 to the EIAR, which was appended to the NIS as submitted. The revised NIS provides additional detail in relation to the rehabilitation proposals within the body of the report.

(g) Recent cases of peat slippage which are stated to have occurred on lands with very low slopes and the need to revise the peat stability assessment.

This item is addressed by Ian Higgins of Fehily Timoney and Company (FT) as follows in Section 2.2.2.2.3 of this Document

2.4.3 Response to FI Item No.4.3

The EIAR is stated to set out the coordination between the peat harvesting activities should they continue and the proposed development in terms of the drainage system. The detailed drawings provided in appendix 9- 3 of the proposed drainage system are noted. You are requested to demonstrate sufficient control over the existing drainage associated with the peat harvesting activities and to clarify that the proposed drainage plan can be effectively implemented, regardless of whether or not peat harvesting is taking place and the associated drainage system being maintained.

Coole Wind Farm Ltd. confirm that the Land Option Agreement incorporating agreed form Leases with all relevant landowners and tenants include contractual rights over lands outside of the Planning Application Boundary (which for the avoidance of doubt extends to include all of the Optioned Lands as shown on Drawing 200445g-59 FI at **Appendix 1**) and would include an obligation on the landowner to not allow drainage issues interfere with the wind farm. Accordingly, there are sufficient legal remedies available to Coole Wind Farm Ltd. to require maintenance of any associated drainage system affecting the proposed Project. As set out in Chapter 1, Section 1.4.1 an Interactions Management Group will be set up to allow a co-ordinated approach between Coole Wind Farm Ltd and the peat companies in the management of site activities and to allow for the environmental management of all activities associated with the proposed wind farm including site drainage, ecology, archaeology, geology etc. This Group will be set up regardless of whether or not peat harvesting is taking place.

2.4.4 Response to FI Item No.4.4

It is considered that more detailed information should be provided relating to water quality monitoring proposals specified in section 9.4.1.1 of the EIAR. In particular the suite of parameters to be monitored and the limits to be met should be specified.

Please refer to Section 2.2.1 of HES FI response at **Appendix 2** of this report for a full response to this item.

2.4.5 Response to FI Item No.4.5

You are requested to clarify the layout and management arrangements for the operational phase

Please refer to Section 2.3.1 of HES FI response at **Appendix 2** of this report for a full response to this item.

2.4.6 Response to FI Item No.4.6

It is noted that the heading of section 8.5.1.2 of the EIAR includes reference to the alteration of peat/soil geochemistry. Please clarify how this topic is assessed under that heading or if it is addressed elsewhere in the submitted documentation.

Please refer to Section 2.4.1 of HES FI response at **Appendix 2** of this report for a full response to this item.

2.5 Further Information Item No.5

Access

5.1. You are requested to clarify whether there would be any restrictions on public access to the wind farm site in the operational period and to describe any proposals to facilitate use of the site by the public including integration with planned and existing recreation routes. The comments in Chapter 5 including section 5.9.5.2 are noted.

2.5.1 Response to FI Item No.5.1

Section 5.9.5.2 of the EIAR as lodged states:

> *"There are no key identified tourist attractions pertaining specifically to the site of the Proposed Development itself. According to the Westmeath County Development Plan 2014-2020, it is an objective of Westmeath County Council to extend public walking and cycling routes. A section of the proposed extension to the Westmeath Way runs adjacent to the site of the proposed wind farm. Should this route be pursued in the future, there are no problems foreseen with its integration with the wind farm. If the Westmeath Way is constructed adjacent to the wind farm there would be a long-term slight positive cumulative impact on local recreation and amenity.*
>
> *Any slight cumulative impact that the Grid Connection Route and other projects listed in Section 2.3.2 may have on tourism will be very temporary in nature and related to traffic impacts during the construction phase. On completion, the road corridor in which the underground cabling works are to be undertaken will be fully reinstated, leaving no visible above-ground evidence of the proposed works that have the potential to give rise to any operational phase impacts or associated effects."*

MKO have reviewed the Westmeath County Development Plan 2021-2027 for any potential update in respect of the above, and have sought to engage with the Council in this regard. There is no information in the County Development Plan which indicates any planned tourist or public access routes through or around the Proposed Development site beyond that already considered. The contents of Policy Objective CPO 6.61 and CPO 8.70 in respect of the Westmeath Way are noted. The applicant will work with the Council should these objectives progress.

2.6 Further Information Item No.6

Submissions and Observations

6.1. Please provide a comprehensive response to the matters raised in the submissions and observations received by the Board from members of the public and prescribed bodies and to the matters raised in the report received from Wicklow County Council including the recommended planning conditions.

6.2. In responding to submissions and observations you are requested to supplement your response with additional photomontage or drawings as required. This may include further details with respect to proposals for cultural heritage mitigation.

2.6.1 Response to FI Item 6.1

2.6.1.1 Local Authority Submission – Westmeath County Council

This FI response includes specific responses by consultants to this planning application engaged by the applicant. Responses to the submission made by Westmeath County Council are detailed below.

Transportation Section

The Transport Section has reviewed the proposed development solely in the context of a bridge structure perspective. The following issues were raised:

1. ***Implications for the safety of both motorised and non-motorised users in the context of the development being proposed along the public roads and bridge structures on the following roads:***

   a) R396 Camagh Road,
   b) R395 Coole village
   c) L1825 Simonstown
   d) L1825 Coole Road – Multyfarnham
   e) L1819 Multyfarnham – Ballinafid
   f) N4-722 Ballinafid , and,
   g) L1773-0 Old Longford Road

Response: Section 14.1 of the EIAR addresses the addresses the likely significant effects of the Proposed Development on transportation infrastructure, including remedial works required on the R395, R396 as noted above.

2. ***Implications of the impact of construction of the proposed cabling on the local roads and bridges and culverts on the N4.***

Response: Please refer to Ionic's FI response at **Appendix 9** of this report for a full response to this item.

District Engineer's Report

In the Westmeath County Council District Engineers response to the proposed development, Section 16.2 sets out the requirement for various items to be provided in relation to roads, cable route, bridges/culverts, surface water, sewage treatment, bonds and general requirements are requested. These requirements will be provided where conditioned in a grant of planning permission.

A response to specific conditions requested by the District Engineer is provided by Alan Lipscombe Traffic and Transport Consultants as follows;

Provision of 3.0m x 90m sightlines at junctions serving the proposed development on the L-5755-16.

Design team response – It is noted that 2.4m x 90m visibility splays were proposed at the proposed junctions on the L5755 in accordance with Geometric Design of Junctions DN-GEO-0306, TII, April 2017, as shown in Figures 14-25 and 14-28 of the EIAR. These may be increased to a setback of 3m as requested by WMCC.

Figures 14-25 and 14-28 and Figure 14-33 have been revised accordingly and are included at **Appendix 3.**

Provision of 3.0m x 150m sightlines shall be achieved and maintained on R395 and R396 from proposed link road between the R395 and the R396.

Design team response – It is agreed that the visibility splays shown in Figures 14-16 and 14-19 of the EIAR may be increased from 2.4m to 3.0m as requested by WMCC.

Figures 14-16 and 14-19 and Figure 14-22a have been revised accordingly and are included at **Appendix 3.**

Archaeology and Cultural Heritage

Please refer to Section 3.1 of Tobar's FI response of this report for a full response to this item response at **Appendix 8.**

Visual Amenity

Section 18.2 of Westmeath County Council's submission states that

> *"It is considered that in order to protect the residential amenity of neighbouring dwellings, compliance with mitigation measures as proposed is a fundamental requirement"*

Response - The applicant agrees with this statement. The Proposed Development will be constructed in compliance with the mitigation measures as outlined in Chapter 12 Landscape and Visual of the EIAR.

Property Values

Section 18.4 of Westmeath County Council's requests evidence of the potential impact of Wind Farms on property valuations within the immediate vicinity.

Response - Section 5.6 the EIAR details the results of research into effects of wind farms on property prices and provides an overview of studies undertaken. Although there have been no empirical studies carried out in Ireland on the impacts of wind farms on property prices, the literature described in Section 5.6 demonstrates that at an international level, wind farms have not impacted property values in the local areas. It is a reasonable assumption based on the available international literature, that the provision of a wind farm at the proposed location would not impact on the property values in the area.

Turbine Design

Section 18.5 of Westmeath County Council's submission requests that the Board considers the ratio of rotor diameter to hub height. The Planning Authority considers that no livery, stripes etc. whatsoever should be painted or attached to the turbines in order to keep them as visually clean as possible.

Response – These points are addressed in Section 2.1.1 of this FI response.

Amenity Potential

Section 18.6 of Westmeath County Council's reports requests the Board to consider the development of amenity improvements consisting of the development of amenity pathways and links to the public roadways.

2.6.1.2 Response - These points are addressed on Section 5.1 of this FI response. Statutory/Prescribed Bodies

2.6.1.2.1 *Department of Tourism, Culture, Arts, Gaeltacht, Sports and Media*

A full and comprehensive response to each point raised by the department is provide by the MKO Ecology and Ornithology team at Section 2.2 of this FI response document. It is highlighted to the Board that the NIS and AA Screening submitted with the have been revised and are included at **Appendix 4**.

2.6.1.2.2 *Geological Survey Ireland*

In their submission, the Geological Survey Ireland noted two CGS's located within the vicinity of the proposed development, which they acknowledge the proposed development will have no envisaged impacts. The GSI response also refers to data sources in relation to groundwater quality, quantity, and distribution, geohazard, minerals and aggregates and geotechnical information.

2.6.1.2.3 *Irish Aviation Authority*

The Irish Aviation Authority requested that conditions related to aeronautical Obstacle warning light scheme and as-constructed coordinates are provided to them under planning condition, should planning permission be granted. It is also requested that the IAA are notified of intentions to commence crane operations with at least 30 days prior notification of their erection. The applicant confirms its agreement to such conditions.

2.6.1.2.4 *Transport Infrastructure Ireland*

Transport Infrastructure Ireland (TII) have provided a number of observations for the Board's consideration which have been addressed below.

Future National Road Scheme Planning

The proposed works are included within the Constraints Study Area for the N4 Mullingar to Longford Scheme which is a national road investment objective of the National Development Plan.

TII is of the opinion that *"a grant of permission for grid connection cable routing to the extents proposed in the subject application is at variance with the provisions of official policy and is premature pending the determination of a road layout for the area to give effect to National Strategic Outcome No. 2 of the National Planning Framework and Government investment objectives included in the National Development Plan relating to the N4 Mullingar to Longford Scheme"*

Response: The applicant acknowledges the submissions and concerns raised by TII, the N4 Mullingar to Longford Scheme is at an early stage and in the absence of any preferred route which is yet to be confirmed, the applicant's position is that outright refusal on the grounds is unwarranted. The latest update on the Project Website was in November 2021 which indicated that a preferred route would be selected and published at a third public consultation in early 2022, the current status of the preferred route is entirely unknown.

For the purposes of examination, Ionic Consulting Limited in their TII Submission included as part of **Appendix 9** have outlined 2 potential scenarios to examine the impact caused by the presence of the HV cable on future upgrade works to the N4.

The Existing National Road Network

In their response TII outlined what they consider to be a number of significant implications for road authorities in the management and maintenance of the strategic national road network resulting from the laying of high voltage electricity cabling in the national road reservation.

Response: Please refer to Section 5 of Ionic's FI response at **Appendix 9** of this report for a full response to this item

National Road Network Maintenance & Safety

Haul Route

In their submission, TII stipulated a number of requirements of the developer with regards to the haul route.

Response: Please refer to Section 5 of Ionic's FI response at **Appendix 9** of this report for a full response to this item

2.6.1.3 Third-Party Submissions

This section deals with non-statutory third-party submissions. Due to large number of third-party submissions, which generally have recurring themes, the responses outlined below are grouped by matter of topic

2.6.1.3.1 *Alternative Renewable Technology*

A number of submissions questioned the appropriateness of a wind energy development compared to other forms of renewable technology, most notably solar energy. Section 3.4 of Chapter 3 'Consideration of Reasonable Alternatives' provides an assessment considering the use of solar energy at the proposed site. A comparison of the potential environmental effects of the development of a solar PV array when compared against the Proposed Development of a wind farm at this site is presented in Table 3-2 of the EIAR. To achieve the same electricity output, as is expected from the proposed wind energy development, from solar energy would require a significantly larger development footprint. In this instance the proposed wind farm will occupy 5% of the primary site area of 530 ha. A solar PV array of the scale necessary to provide the same electricity output would require a significantly larger area. In addition, a solar development would have a higher potential environmental effect on Hydrology & Hydrogeology, Traffic & Transport (construction phase) and Biodiversity (habitat loss) at the site.

2.6.1.3.2 *Biodiversity*

A number of submissions raised concerns over the perceived effect of the proposed development on ecology and biodiversity in the area including habitats, birds and mammals. Extensive ecological field studies and desktop studies were undertaken over the period 2016 - 2022. Chapter 6 'Biodiversity' of the EIAR details the range of surveys undertaken (Section 6.4), the results (Section 6.5) and an assessment of the impacts on biodiversity (Section 6.6). Chapter 16 'Schedule of Mitigation and Monitoring Proposals' also sets out a suite of mitigation measures to reduce or eliminate any potential impacts during both the construction and operational phases.

It is also noted that matters raised in relation to ecology and biodiversity have been addressed in Section 2.2 of this report.

2.6.1.3.3 Noise

A number of submissions related to perceived impacts on human health as a result of potential noise impacts from the proposed development. Chapter 11 'Noise and Vibration' of the EIAR describes the assessment undertaken of the potential noise and vibration related impacts associated with the proposed development. The assessment was carried out by AWN Consulting Ltd. in accordance with current guidance and best practice. Sections 11.5.2 and 11.5.4 provide the noise assessment carried out for the construction phase of the project and the associated mitigation measures, respectively. Sections 11.5.3 and 11.5.5 provide the noise assessment carried out for the operational phase of the project and the associated mitigation measures, respectively. Chapter 5 'Population and Human Health' Section 5.5.4 addresses perceived health impacts from the wind farm including those claimed to be noise related.

In addition, AWN Consulting Ltd (AWN) prepared a Technical Note to accompany this document at **Appendix 10**, that provides a response on the range of possible turbine technologies which may be selected if the planning application is granted. This technical note summarises the noise assessment in the EIAR and then presents the input data and results for the two additional turbine technologies. The effect of changing the hub height has been examined and in this instance does not result in any change to the noise criteria under the Wind Energy Development Guidelines 2006.

2.6.1.3.4 Air & Climate

A number of submissions related to perceived impacts on air quality with regards to dust as a result of construction activities for the proposed development. Chapter 10 'Air & Climate' of the EIAR provides the assessment of potential effects on air quality in the local area as a result of activities during the construction phase of the project. The potential dust-related effects on local air quality and the relevant associated mitigation measures are presented in Sections 10.2.4.2.2 and 10.2.4.3.3.

It is noted in Section 10.4 of the EIAR that during the construction phase of the Proposed Development and other developments within 20 kilometres of the Proposed Development site that are yet to be constructed, there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, once the mitigation proposals, as outlined in Sections 10.2.4 and 10.3.4 are implemented during the construction phase of the proposed development, there will be no cumulative negative effect on air and climate.

It is further noted in this section that Emissions of carbon dioxide (CO2), oxides of nitrogen (NOx), sulphur dioxide (SO2) or dust emissions during the operational phase of the Proposed Development will be minimal, relating to the use of operation and maintenance vehicles onsite, and therefore there will be no measurable cumulative effect with other developments on air quality and climate.

2.6.1.3.5 Landscape and Visual

A number of submissions related to the perceived landscape and visual impacts arising from the Proposed Development. Chapter 12 'Landscape and Visual' provides an assessment of the likely significant effects of the Proposed Development with regards to landscape and visual. It includes a description of the assessment methodology, a description of the Proposed Development, and the existing landscape based on relevant guidance.

In addition, the FI LVIA response provided by the MKO Landscape team at **Appendix 6** addresses specific concerns raised in the third party submissions in relation to the perceived landscape and visual impacts. The discussion within the FI LVIA Report concludes that that the lengthy and comprehensive discussion within the sections of the EIAR clearly demonstrate that the landscape of the site is suitable for the Proposed Development and that Significant landscape effects will not arise in relation to the Proposed Development.

2.6.1.3.6 Shadow Flicker

A number of submissions raised concerns over perceived impacts from shadow flicker. The shadow flicker assessment is detailed in Section 5.7 of Chapter 5 'Population & Human Health'. Coole Wind Farm Ltd. have committed to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development, therefore eliminating this as a potential issue.

In addition, MKO were commissioned to conduct a Shadow Flicker Assessment of 3 no. scenarios for this FI response, this included Scenario 1 as modelled and assessed in Chapter 5 of the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR) and two additional scenarios as indicated in Table 2.3 above. The Shadow Flicker Assessment Results are included at **Appendix 10**.

2.6.1.3.7 Human Health

A number of submissions related to perceived impacts on human health as a result of the proposed development. Chapter 5 'Population & Human Health', Section 5.5 addresses perceived health impacts from wind farms, While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research largely does not support these statements. There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised in Section 5.5.

Section 5.10 of the EIAR concludes that *"provided that the Proposed Development is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant effects on population and human health, associated with health and safety, noise, dust, traffic and shadow flicker, are not anticipated at international, national or county scale."*

2.6.1.3.8 Traffic

A response to issues raised by third parties in relation to traffic concerns has been addressed.

While the grid connection is being constructed on the road from Coole to Multyfarnham, the road will be closed on 2 occasions while works are carried out at the crossings of the River Inny. There is no time limit indicated for these closures. This will add 9 miles twice a day to all those using this road.

Design team response - As part of the assessment of the traffic impacts of the construction of the proposed Grid Connection presented in Appendix 14.1 of the EIAR, it is identified that there are 2 water crossings that will require road closures of 9 days each (resulting in a total of 18 days) when the L-1826 between Coole to Multyfarnham will require to be closed. On the days that the road is closed the length of the detour will depend on the origin and destination of each trip.

The L1826 road from Coole to Multyfarnham is not a proper 2 lane road – there are no white lines down the middle of it and if a lorry is passing a car, one of them has to pull over to the verge. These verges are soft as the road is sited on the bog. In many places the grid connection trench will be dug in the middle of the road. The viable joint pots at 2.5m wide x 6m long will be situated in the middle of the road every 500m. Additionally approximately 15 truck movements per day to each works are to both remove excavated material and deliver appropriate infill material. A small number of truck movements will be required to deliver cable route components to site. The applicant states that the road will stay open during most of the grid connection construction work. However, in the main the road is simply not wide enough to sustain a 2.5 metre hole in the middle, plus diggers, tipper lorries and construction traffic to be able to keep the road open. For over 6 months this will cause huge disruption and expense to those that travel to and from Coole every day.

Design team response – The L-1826 between Coole and Multyfarnham has an existing variable width generally between 5.0m and 5.5m (with some sections wider), and provides for 2-way traffic flow over its full length between the 2 villages. It is noted that along most of the route there are verge on either side of the road which also may be used for local widening. While a detailed survey of the cable grid route will be required undertaken at detailed design stage to determine the actual method of construction for each section, it is considered at the preliminary design stage that with the use of modest sized excavators, maintaining a one-way operation at the point of construction will be possible for most of the majority of the route. (This is based on a minimum c-way width of 2.5m, safety zone of 1.2m and excavator width of 1.6m = total 5.3m).

The road on which the supposed borrow pit is only 8 – 10ft wide and is not going to be able to withstand the constant barrage of 60-80 tonne dump trucks

Design team response – The surface of the 1.5km section of the local L5755 road that will be used to transport material between the proposed site and the borrow pit will be up-graded where required by the local authority for the construction stage. It is noted that standard sized tipper trucks will be used, and not 60-80 tonnes trucks as stated.

The borrow pit entrance is on a bend. This leaves an unsafe road for local access whether this be traffic or pedestrians.

Design team response – The proposed access to the borrow pit is located on a straight section of the L5755 situated between 2 existing bends, as shown in Figure 14-31 of the EIAR. The required visibility splays (2.4m (now increased to 3.0 at the request of the District Engineer) x 90m) required to permit safe access and egress to and from the site, which will be provided on site, are shown also shown in Figure 14-31.

2.6.1.3.9 Property Value

A number of submissions raised concerns in relation to perceived impacts to property devaluation in the vicinity of the proposed development. Chapter 5 ‘Population & Human Health’, Section 5.6 of the EIAR details the results of research into effects of wind farms on property prices and provides an overview of studies undertaken. Although there have been no empirical studies carried out in Ireland on the impacts of wind farms on property prices, the literature described in Section 5.6 demonstrates that at an international level, wind farms have not impacted property values in the local areas. It is a reasonable assumption based on the available international literature, that the provision of a wind farm at the proposed location would not impact on the property values in the area.

2.6.1.3.10 Telecommunications

A number of submissions raised concern regarding perceived impacts to telecommunications services in relation to TV, broadband and mobile phone reception. Chapter 14 ‘Material Assets’, Section 14.2 of the EIAR assesses the likely significant effects of the Proposed Development on telecommunications. Section 14.2.4 presents details on how any potential interference with telecommunications signals will be avoided and Section 14.2.5 presents the mitigation measures proposed. The potential for interference to domestic television receptors and/or broadcast radio receivers was identified by RTE/2rn during the consultation process. It is standard practice of RTE/2rn to produce a Protocol Document for wind farm developments, which will be signed by the developer. The Protocol Document ensures that in the event of any interference occurring to RTÉ television or radio reception due to operation of a wind farm, the required measures as set out in the document, will be carried out by the developer to rectify this. A standard Protocol Document has been prepared by RTE/2rn for the proposed development, which has been signed by Coole Wind Farm Ltd. A copy of the Protocol Document is presented in Appendix 14-2 of the EIAR.

2.6.1.3.11 *Public Consultation*

A number of submissions related to public consultation and perceived inadequacies associated with the public consultation conducted. Chapter 2 'Background to the Proposed Development', Section 2.6.4 of the EIAR sets out in detail the public consultation conducted. Public consultation on the project began at a very early stage in the development process, with engagement with the local community beginning during the initial feasibility and scoping stages in 2013. At this time, a nominated Community Liaison Officer (CLO) was appointed to the area and since then the CLO responsible for the area has been the main point of contact to the local community. As the development process progressed for the development, a Community Liaison Strategy and Community Liaison Team was established and set into motion in late 2016. Consultation with the local community has taken the form of house-to-house calls, meetings, dissemination of information including leaflets and brochures, a dedicated project specific website with a Virtual Consultation Room and a public consultation event held in February 2017. Section 2.6.4 of the EIAR provides details of the engagement undertaken with the local community since 2013 including details of ongoing engagement since the grant of planning permission for the original Coole Project in 2017 and ongoing consultation during 2020 and 2021. The CLO and Community Liaison Team have and continue to engage with the local community in ongoing consultations and meetings to understand their views and provide clear and understandable information on the project.

2.6.1.3.12 *Hydrology*

The third-party submissions relating to relating to Soils & Geology or Hydrology/Hydrogeology are addressed by Hydrological Environmental Services under the following headings;

1) Due to the emplacement of the turbine hardstands, a large volume of groundwater will be displaced, which will create a rise in the groundwater level, that will in turn flow to the River Glore/Inny and could cause flooding.

2) All surface water from the site flows towards the Inny/Glore River, which are headwaters of Lough Derravaragh. The proposed works will have a negative impact on water quality in these river and thus the downstream lake.

3) The proposed development will have a negative effect on the hydrology/hydrogeology of Lough Bane, Gariskil Bog, Scragh Bog and other designated sites.

The response to these issues is detailed in Section 3 of HES Response which is enclosed at **Appendix 2.**

2.6.1.3.13 *Archaeology*

The third-party submissions relating to relating to Archaeology are addressed by Tobar Archaeological Services Ltd under the following headings;

- Concerns regarding effect on setting of archaeological monuments
- UNESCO World Heritage Sites, National Monuments and Recorded Monuments
- Concern regarding Mitigation Measures
- Concern regarding Protected Structures

The response to these issues is detailed in Section 4 of Tobar's Response which is enclosed at **Appendix 8**.

2.6.1.3.14 *Tourism*

A number of submissions raised concern with the perceived impacts of Proposed Development on tourism within the surrounding area. Chapter 5 'Population and Human Health', Section 5.3 of the EIAR provides a baseline assessment of the existing tourism numbers, revenue and attractions and discusses surveys conducted on tourist attitudes to wind farms.

It is noted in Section 5.3.3 of the EIAR that BiGGAR Economics undertook an independent study in 2016, entitled 'Wind Farms and Tourism Trends in Scotland', to understand the relationship, if any, that exists between the development of onshore wind energy and the sustainable tourism sector in Scotland.

Overall, the conclusion of this study is that published national statistics on employment in sustainable tourism, demonstrate that there is no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level, nor in the areas immediately surrounding wind farm development. However the report also concluded that *'Although this study does not suggest that there is any direct relationship between tourism sector growth and wind farm development, it does show that wind farms do not cause a decrease in tourism employment either at a local or a national level.'*

In 2007, Fáilte Ireland in association with the Northern Ireland Tourist Board carried out a survey of domestic and overseas holidaymakers to Ireland in order to determine their attitudes to wind farms. The purpose of the survey was to assess whether the development of wind farms impacts on the enjoyment of the Irish scenery by holidaymakers. The survey involved face-to-face interviews with 1,300 tourists (25% domestic and 75% overseas). The results of the survey are presented in the Fáilte Ireland Newsletter 2008/No.3 entitled 'Visitor Attitudes on the Environment: Wind Farms'.

The Fáilte Ireland survey results indicate that most visitors are broadly positive towards the idea of building wind farms in Ireland. There exists a sizeable minority (one in seven) however who are negative towards wind farms in any context. In terms of awareness of wind farms, the findings of the survey include the following:

- Almost half of those surveyed had seen at least one wind farm on their holiday to Ireland. Of these, two thirds had seen up to two wind farms during their holiday.
- Typically, wind farms are encountered in the landscape while driving or being driven (74%), while few have experienced a wind farm up close.
- Of the wind farms viewed, most contained less than ten turbines and 15% had less than five turbines.

The report goes on to state that while there is a generally positive disposition among tourists towards wind development in Ireland, it is important also to take account of the views of the one in seven tourists who are negatively disposed towards wind farms. This requires good planning on the part of the wind farm developer as well as the Local Authority. Good planning has been an integral component of the Proposed Development throughout the site design and assessment processes. Reference has been made to the 'Planning Guidelines on Wind Energy Development 2006' and cognisance of the 'Draft Revised Wind Energy Development Guidelines December 2019' in addition to IWEA best practice guidance, throughout all stages, including pre-planning consultation and scoping.

2.6.1.3.15 *Electric & Magnetic Fields*

Issues relating to Electric & Magnetic Fields have been addressed by Ionic Consulting Limited in their Grid Route Connection Response included at **Appendix 9**.

It is noted within this response that EirGrid are the state owned company that manages and operates the transmission grid across the island of Ireland, and the proposed Coole Wind Farm 110kV grid connection will be designed and constructed to their specifications.

2.6.2 Response to FI Item No.6.2

In responding to submissions and observations you are requested to supplement your response with additional photomontage or drawings as required. This may include further details with respect to proposals for cultural heritage mitigation.

As outlined throughout this document, this FI response is accompanied by a suite of documents and drawings to supplement responses to submissions and observations, which are outlined as follows

- Further Information Drawings Pack
- Further Information Response by Hydro Environmental Services (HES)
- Updated Figures 14-16, 14-19, 14-22a, 14-25, 14-28 and 14-33
- Further Information Ecology Reports including,
    - Revised Natura Impact Assessment
    - Revised Appropriate Assessment Screening
- Bird Survey Report: March 2021- March 2022
- Further Information Landscape and Visual Impact (LVIA) Response
- Volume 2 Photomontage Booklet
- Tobar Archaeology Services Further Information and Third Party Responses.
- Ionic Further Information Response including,
    - TII Submission, N4 National Road, Co. Westmeath
    - 110kV Grid Route Connection RFI Response
    - Westmeath County Council Submission – Bridge Crossings
- AWN Technical Note
- Shadow Flicker Assesment Results by MKO
- Malachy Walsh and Partners Limited (MWP) Further Information Response
- Updated Figure 6-7 Mammal Survey and Habitat Significance

In relation to concerns regarding cultural heritage mitigation, this has been responded to by Tobar Archaeological Services Ltd within their Further Information Response included at **Appendix 8** of this document. It is considered that all concerns regarding the assessment process and the results of same as reached in Chapter 13 of the EIAR are addressed here and that the mitigation measures outlined in the Chapter are appropriate for the amelioration of any potential impacts identified.

3. OVERALL CONCLUSIONS

This document and appendices constitute a full and robust response to the further information request issued by An Bord Pleanála in respect of planning application reference ABP-309770–21 regarding the proposed Coole Wind Farm.

Items raised within the request have been addressed in full. In addition, third party submissions to the planning application have been considered as part of this response.

It is therefore concluded that the FI request has been responded to in full. We trust that the information provided within this submission satisfactorily addresses each of the items raised within the request for Further Information and respectfully request the Board now finalise their consideration of the planning application.

APPENDIX 1

FI DRAWING PACK (ENCLOSED SEPERATELY)

Coole Wind Farm FI,

Co. Westmeath

Planning Permission Application Drawings

Schedule of Drawings

Drawing No.	Drawing Title	Scale	Page Size
200445g – 01 FI	Location Context Map	1: 60,000	A3
200445g – 02 FI	Site Location Map	1: 60,000	A1
200445g – 03 FI	Site Location Key Plan	1: 30,000	A1
200445g – 04 FI	Site Location Plan 1 of 9	1: 5,000	A1
200445g – 05 FI	Site Location Plan 2 of 9	1: 5,000	A1
200445g – 08 FI	Site Location Plan 5 of 9	1: 5,000	A1
200445g – 09 FI	Site Location Plan 6 of 9	1: 5,000	A1
200445g – 10 FI	Site Location Plan 7 of 9	1: 5,000	A1
200445g – 11 FI	Site Location Plan 8 of 9	1: 5,000	A1
200445g – 12 FI	Site Location Plan 9 of 9	1: 5,000	A1
200445g – 13 FI	Site layout Key Plan B	1: 30,000	A1
200445g – 14 FI	Site Layout Sheet 1 of 24	1: 2,500	A1
200445g – 15 FI	Site Layout Sheet 2 of 24	1: 2,500	A1
200445g – 16 FI	Site Layout Sheet 3 of 24	1: 2,500	A1
200445g – 17 FI	Site Layout Sheet 4 of 24	1: 2,500	A1
200445g – 18 FI	Site Layout Sheet 5 of 24	1: 2,500	A1
200445g – 19 FI	Site Layout Sheet 6 of 24	1: 2,500	A1
200445g – 20 FI	Site Layout Sheet 7 of 24	1: 2,500	A1
200445g – 21 FI	Site Layout Sheet 8 of 24	1: 2,500	A1
200445g – 26 FI	Site Layout Sheet 13 of 24	1: 2,500	A1
200445g – 27 FI	Site Layout Sheet 14 of 24	1: 2,500	A1
200445g – 28 FI	Site Layout Sheet 15 of 24	1: 2,500	A1
200445g – 29 FI	Site Layout Sheet 16 of 24	1: 2,500	A1
200445g – 30 FI	Site Layout Sheet 17 of 24	1: 2,500	A1
200445g – 31 FI	Site Layout Sheet 18 of 24	1: 2,500	A1
200445g – 32 FI	Site Layout Sheet 19 of 24	1: 2,500	A1
200445g – 33 FI	Site Layout Sheet 20 of 24	1: 2,500	A1
200445g – 34 FI	Site Layout Sheet 21 of 24	1: 2,500	A1
200445g – 35 FI	Site Layout Sheet 22 of 24	1: 2,500	A1
200445g – 36 FI	Site Layout Sheet 23 of 24	1: 2,500	A1
200445g – 37 FI	Site Layout Sheet 24 of 24	1: 2,500	A1
200445g – 38 FI	Temporary Construction Compound	1: 500	A3
200445g – 39 FI	Substation Layout	1: 500	A3
200445g – 42A FI	Wind Turbine Range Elevations & Plan	1: 500	A1
200445g – 42B FI	97.5m hub and 77.5m blade Wind Turbine Elevations & Plan	1: 500	A1
200445g – 42C FI	100m hub and 75m blade Wind Turbine Elevations & Plan	1: 500	A1
200445g – 42D FI	100.5m hub and 74.5m blade Wind Turbine Elevations & Plan	1: 500	A1
200445g – 43 FI	Turbine Foundation Standard Detail	1: 200	A3
200445g – 59 FI	Peatland Optioned Lands	1: 10,000	A1
COLE d005.3.3	CLONAVA BRIDGE CROSSING PROPOSED OPTION C	1:25/ 1:125	A1
COLE d005.3.4	SHRUBBYWOOD BRIDGE CROSSING WH-L1825-002.00 PROPOSED OPTION B	1:100 / 1:25	A1
COLE d005.3.5	SHRUBBYWOOD BRIDGE CROSSING WH-L1825-002.00 PROPOSED OPTION C	1:100 / 1:25	A1
COLE d005.3.6	CLONAVA BRIDGE CROSSING WH-L1825-001.00 PROPOSED OPTION D	1:25 / 1:125	A1
COLE d005.3.7	CLONAVA BRIDGE CROSSING WH-L1825-001.00 PROPOSED OPTION E	1:25 / 1:125	A1
COLE d005.3.8	SHRUBBYWOOD BRIDGE CROSSING WH-L1825-002.00 PROPOSED OPTION D	1:100 / 1:25	A1
COLE d006.1.1	MULLINGAR SUBSTATION ILLUSTRATIVE PLAN	1: 100	A1
COLE d006.1.2	MULLINGAR SUBSTATION EXTENSION EQUIPMENT DETAILS	1: 100	A1

Drawing Legend

Planning Application Boundary

DRAWING TITLE:

Location Context Map

PROJECT TITLE: Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 01 FI
SCALE: 1:60,000 @A3	DATE: 27.10.2022
OS SHEET No.: OS2226, OS2426	

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

Planning Application Boundary

Landowners Boundary

Site Notice

N

DRAWING TITLE:

Site Location Map

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 02 FI**
SCALE: **1:30,000 @ A1**	DATE: **27.10.2022**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Temporary Construction Compound
- Internal Electrical Cabling
- Grid Connection Route
- Proposed Cable Alteration
- Wind Farm Substation
- Existing Mullingar Substation

N

DRAWING TITLE:

Site Location Key Plan

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 03 FI**
SCALE: **1:30,000 @ A1**	DATE: **27.10.2022**

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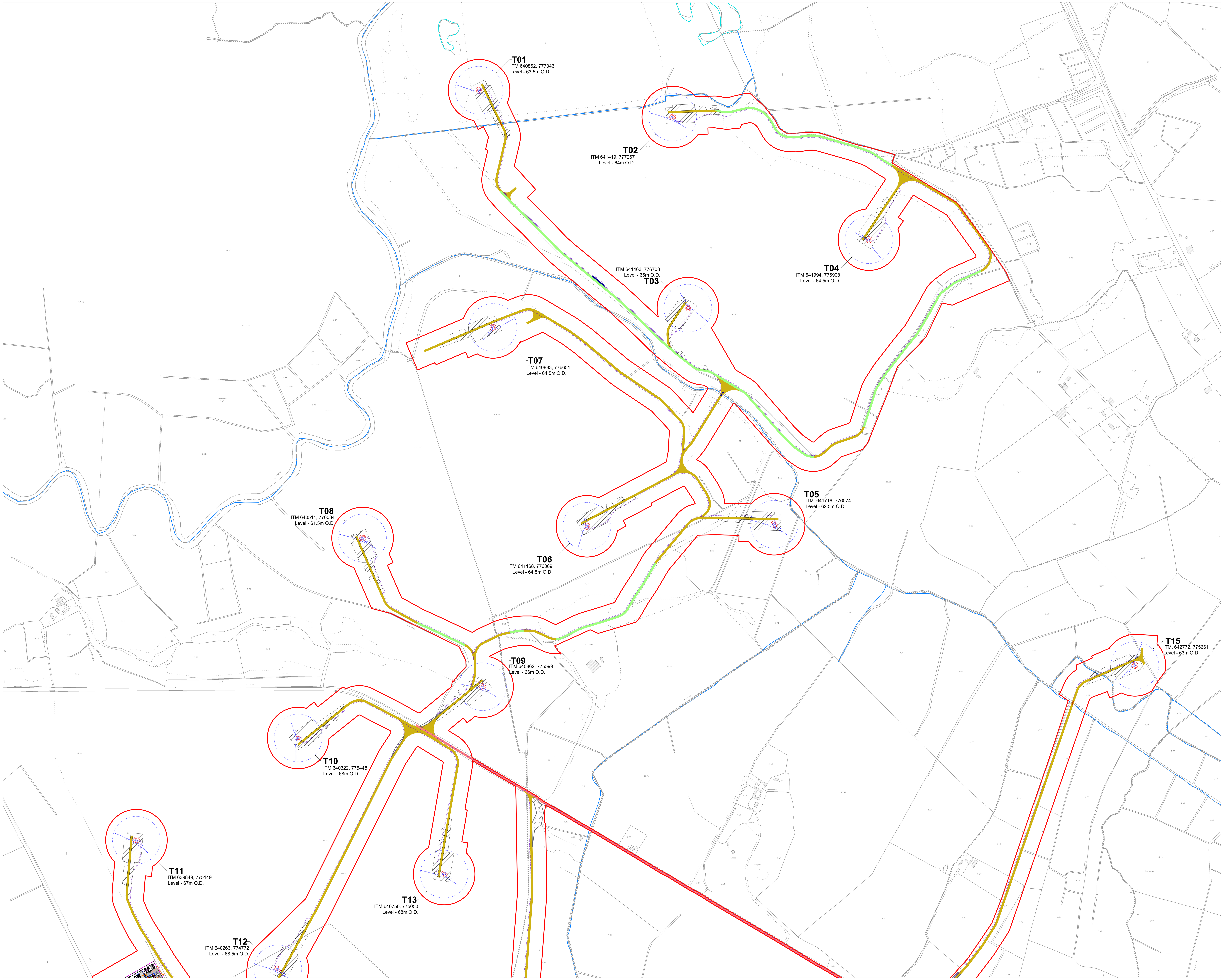

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Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Existing Crossing for Upgrade
- Passing Bays
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Temporary Construction Compound
- Internal Electrical Cabling
- Wind Farm Substation
- River/Stream
- Lakes

N

DRAWING TITLE:

Site Location Plan Sheet 1 of 9

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 04 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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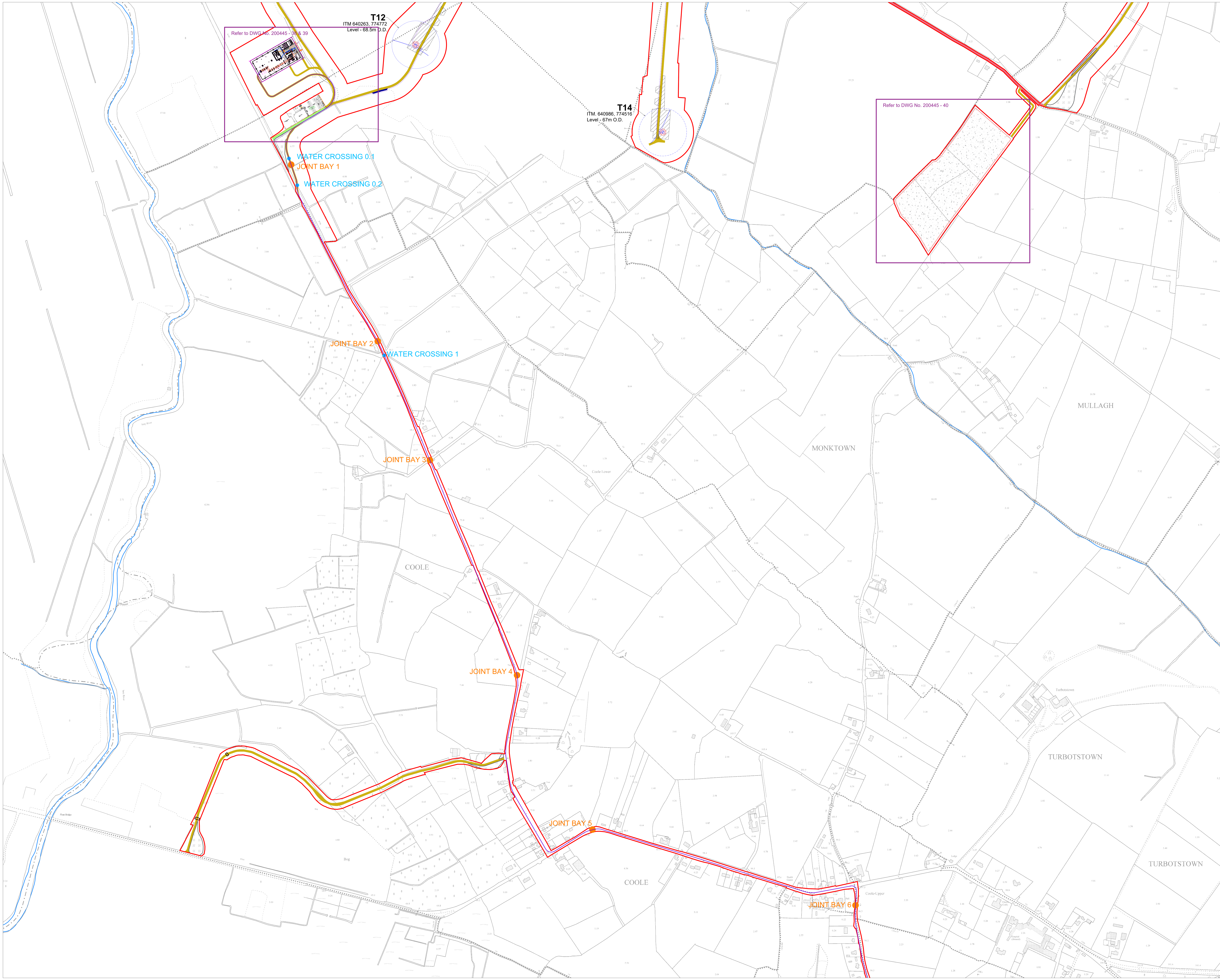

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Passing Bays
- Unbound Hardcore Surface
- Crossing Point for Landowners
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Internal Electrical Cabling
- Grid Connection Route
- Wind Farm Substation
- Joint Bay
- Watercrossing
- River/Stream

DRAWING TITLE:

Site Location Plan Sheet 2 of 9

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 05 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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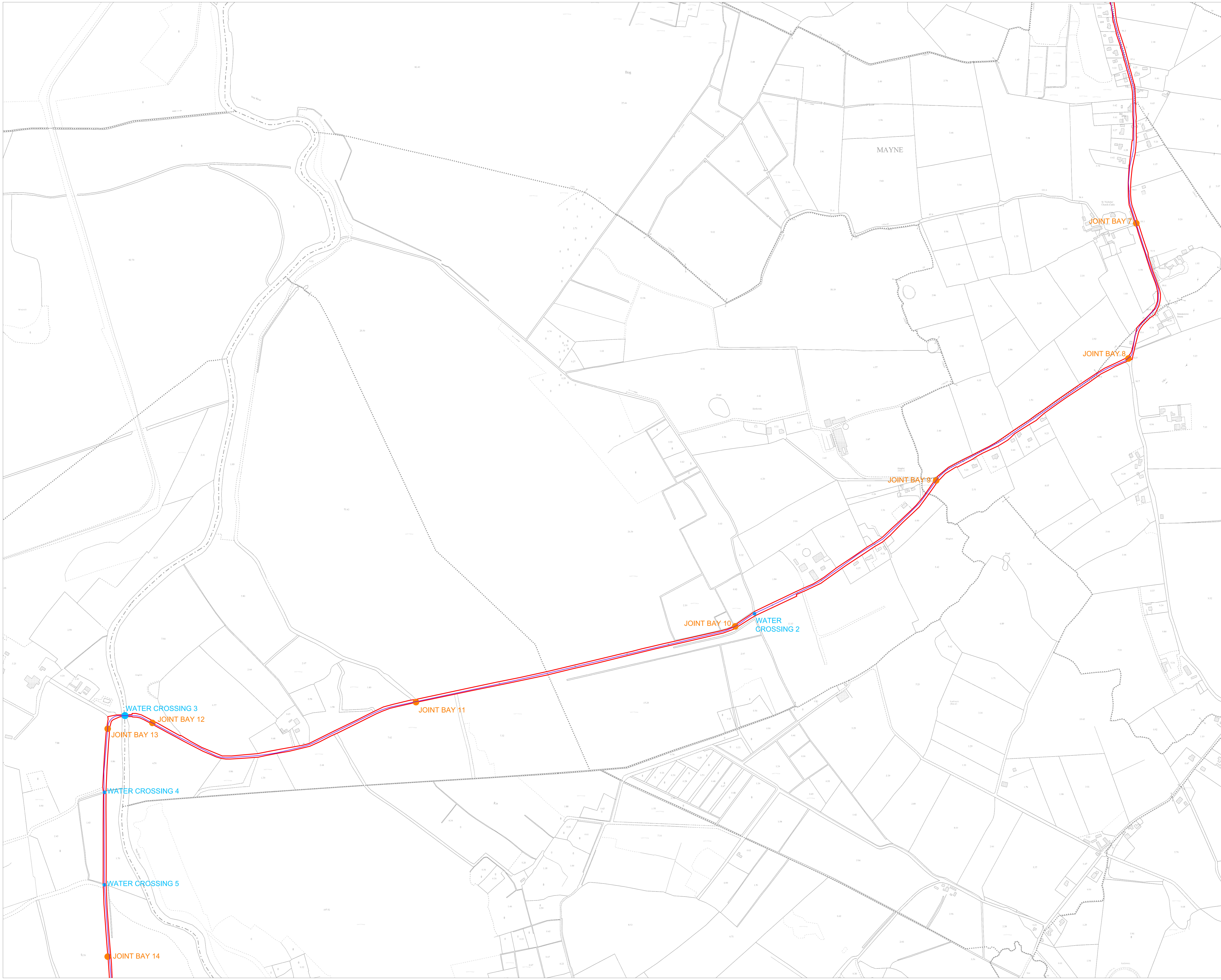

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Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Location Plan Sheet 5 of 9

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 08 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Location Plan Sheet 6 of 9

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 09 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

DRAWING TITLE:
Site Location Plan Sheet 7 of 9

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 10 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301, 2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702, 2768, 2769, 2770, 2771

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Website: www.mkoireland.ie

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

DRAWING TITLE:
Site Location Plan Sheet 8 of 9

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 11 FI**
SCALE: **1:5,000 @ A1**	DATE: **27.10.2022**

OS SHEET No.:
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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend
- Planning Application Boundary
- Site Notice
- Grid Connection Route
- Proposed Cable Alteration
- Joint Bay
- Watercrossing
- Existing Mullingar Substation

N

DRAWING TITLE:
Site Location Plan Sheet 9 of 9

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 12 FI
SCALE: 1:5,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301, 2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702, 2768, 2769, 2770, 2771

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Temporary Construction Compound
- Internal Electrical Cabling
- Grid Connection Route
- Proposed Cable Alteration
- Wind Farm Substation
- Existing Mullingar Substation

N

DRAWING TITLE:
Site Location Key Plan B

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 13 FI**
SCALE: **1:30,000 @ A1**	DATE: **27.10.2022**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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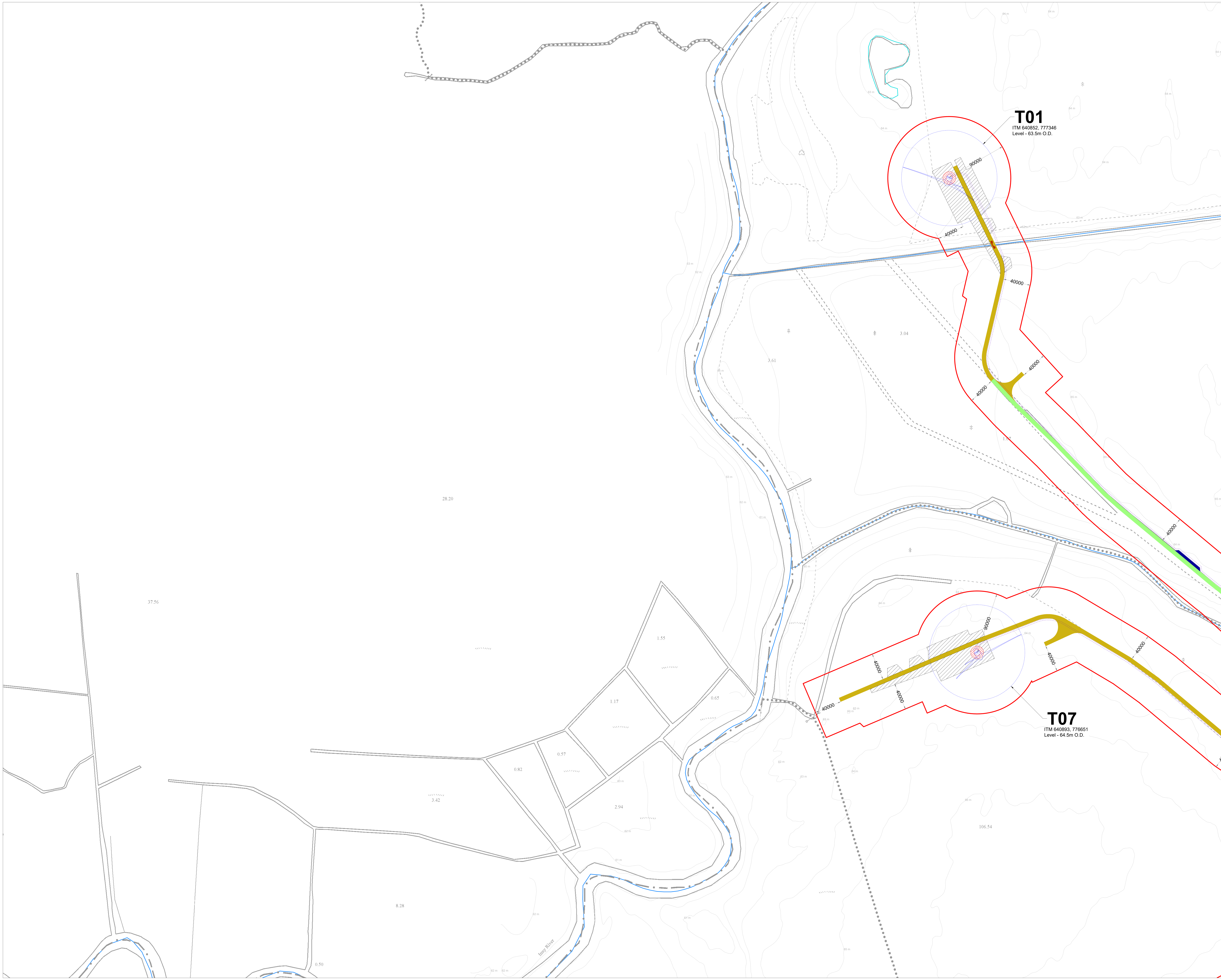

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Passing Bays
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Internal Electrical Cabling
- River/Stream

DRAWING TITLE:

Site Layout Plan Sheet 1 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 14 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

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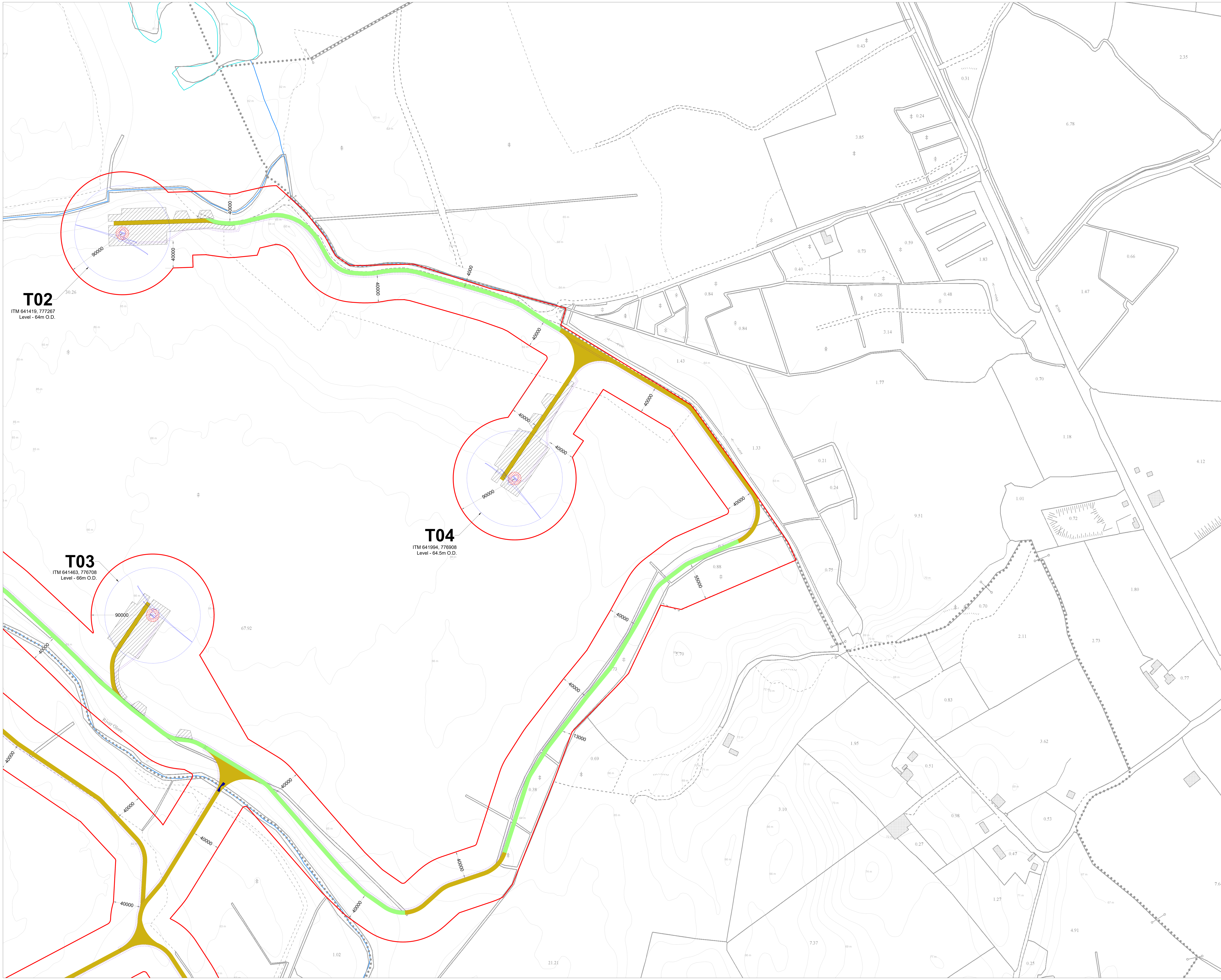

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Existing Crossing for Upgrade
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Internal Electrical Cabling
- River/Stream
- Lakes

N

DRAWING TITLE:

Site Layout Plan Sheet 2 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 15 FI**
SCALE: **1:2,500 @ A1**	DATE: **27.10.2022**

OS SHEET No.:
2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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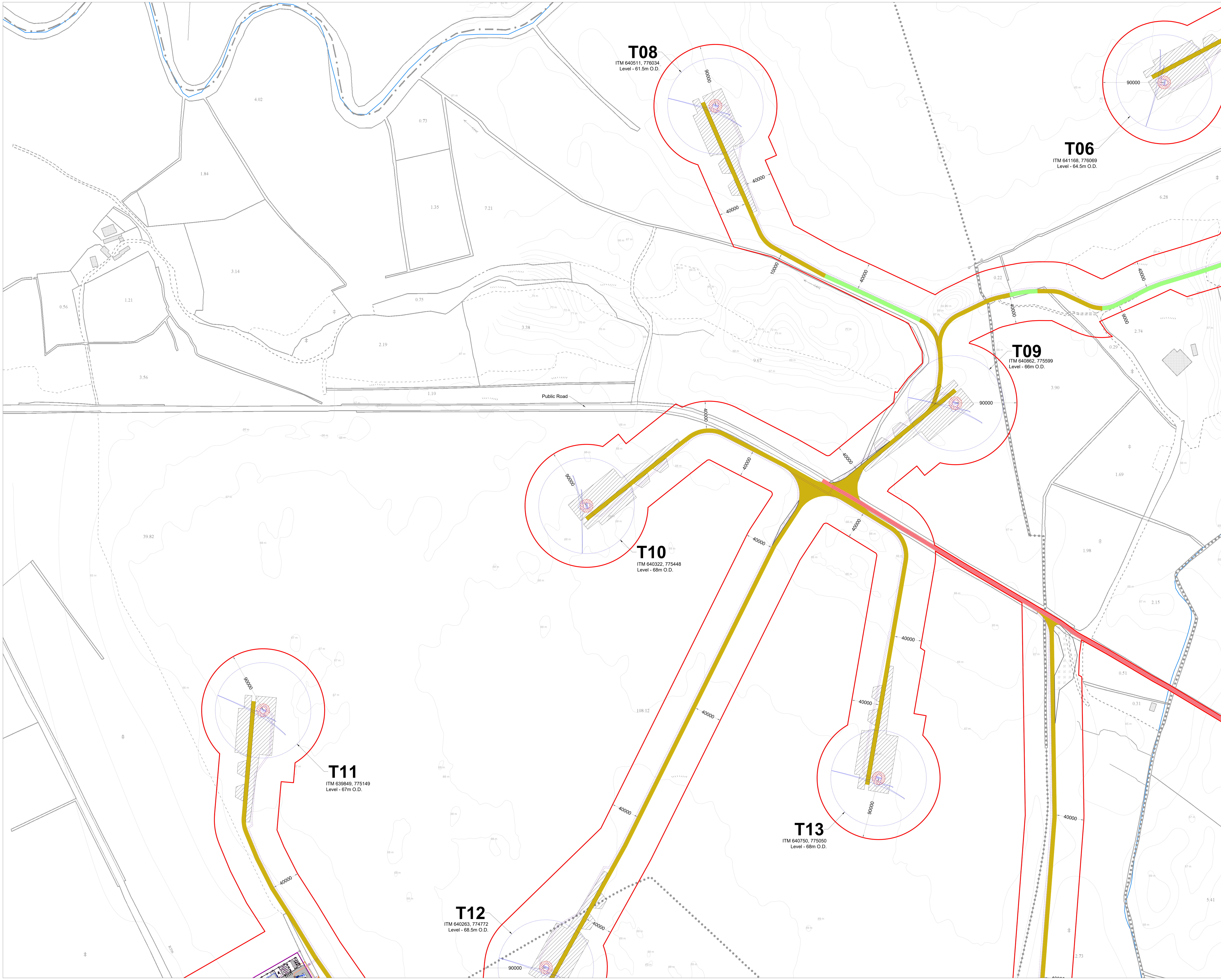

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Existing Crossing for Upgrade
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Internal Electrical Cabling
- Wind Farm Substation
- River/Stream

DRAWING TITLE:

Site Layout Plan
Sheet 3 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 16 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.:

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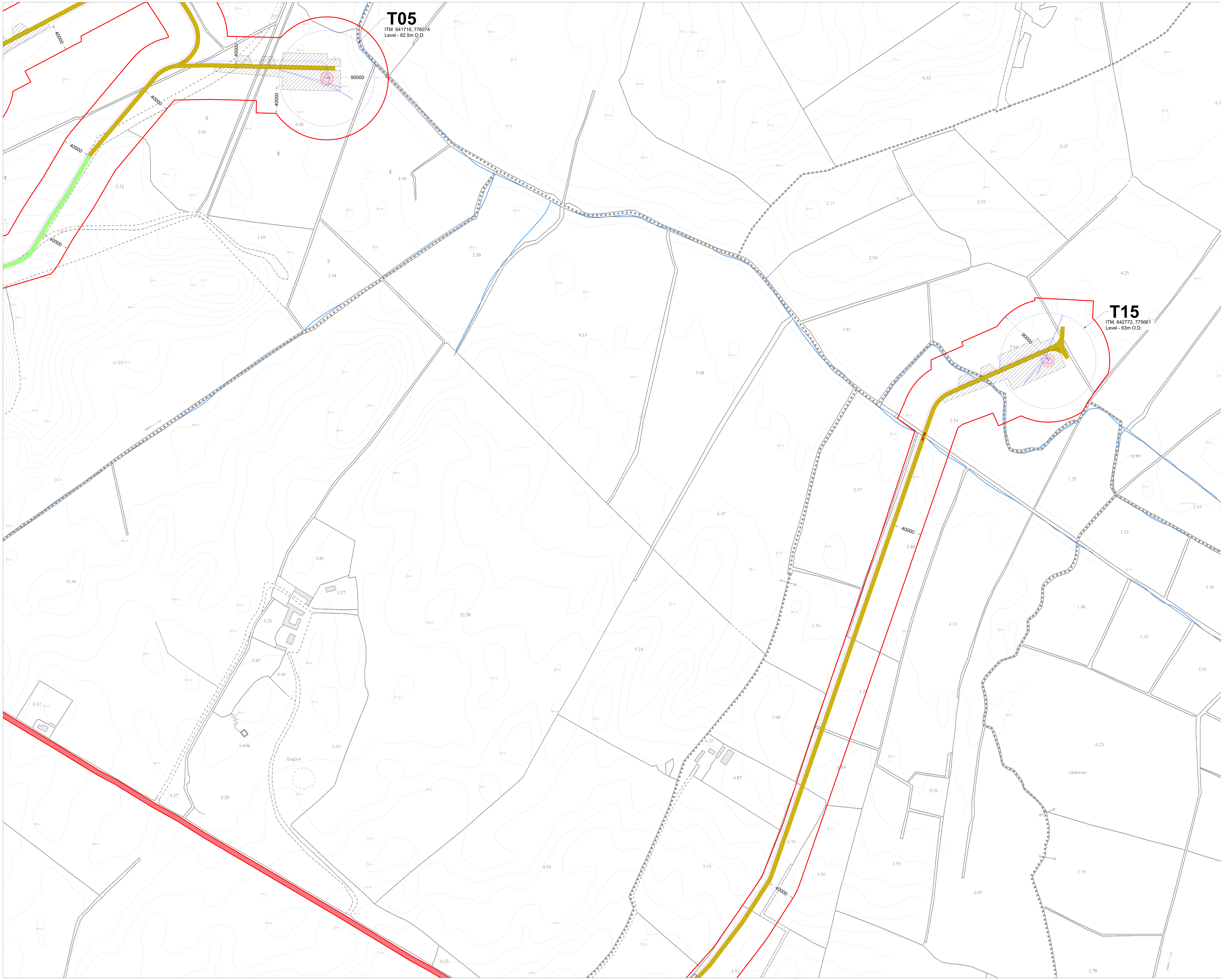

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Internal Electrical Cabling
- Wind Farm Substation
- River/Stream

N

DRAWING TITLE:
Site Layout Plan Sheet 4 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 17 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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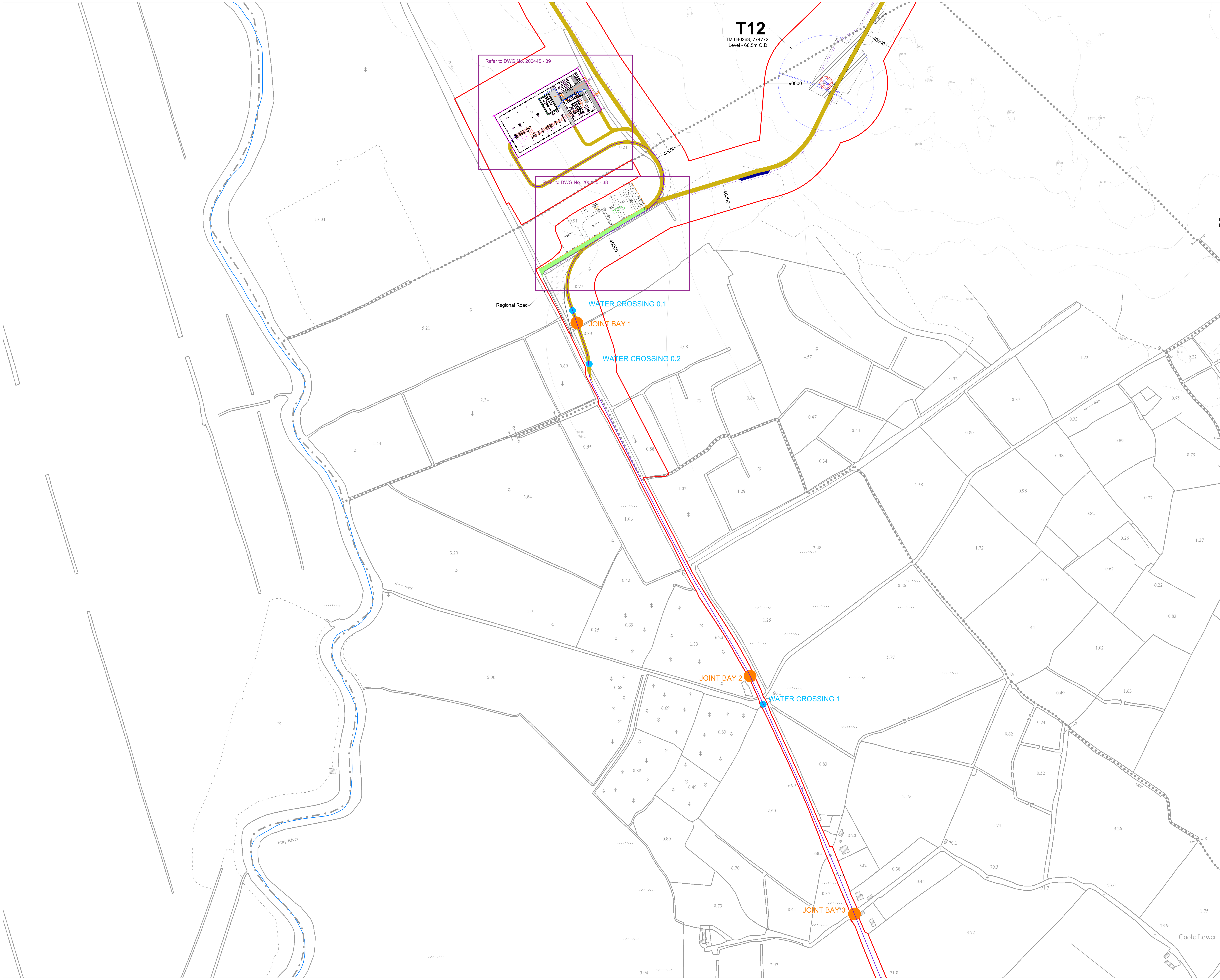

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Temporary Construction Compound
- Internal Electrical Cabling
- Grid Connection Route
- Wind Farm Substation
- X Spot Height
- Joint Bay
- Watercrossing
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 5 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 18 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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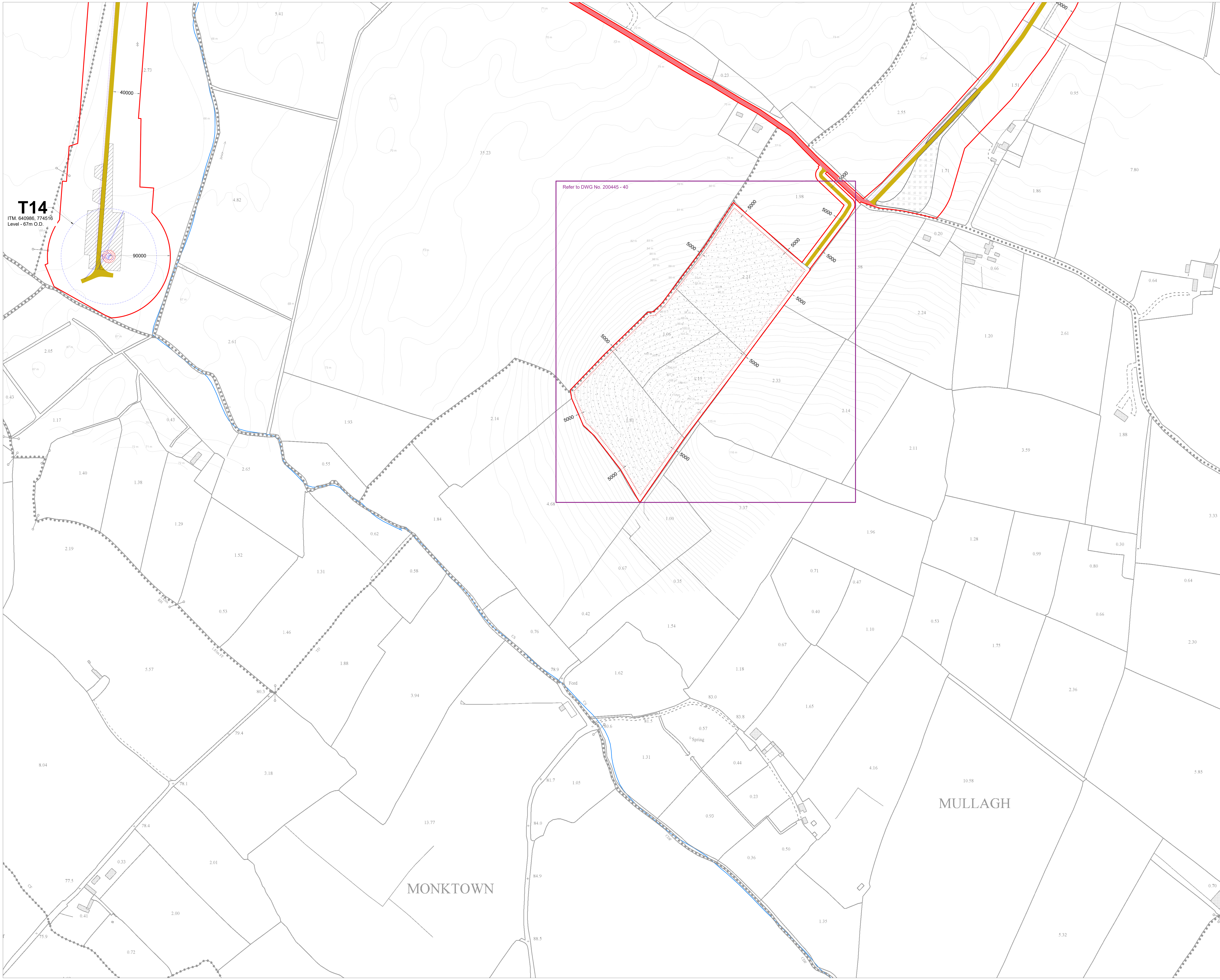

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing External Road to be Upgraded
- Proposed Road
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Internal Electrical Cabling
- River/Stream

N

DRAWING TITLE:
Site Layout Plan Sheet 6 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 19 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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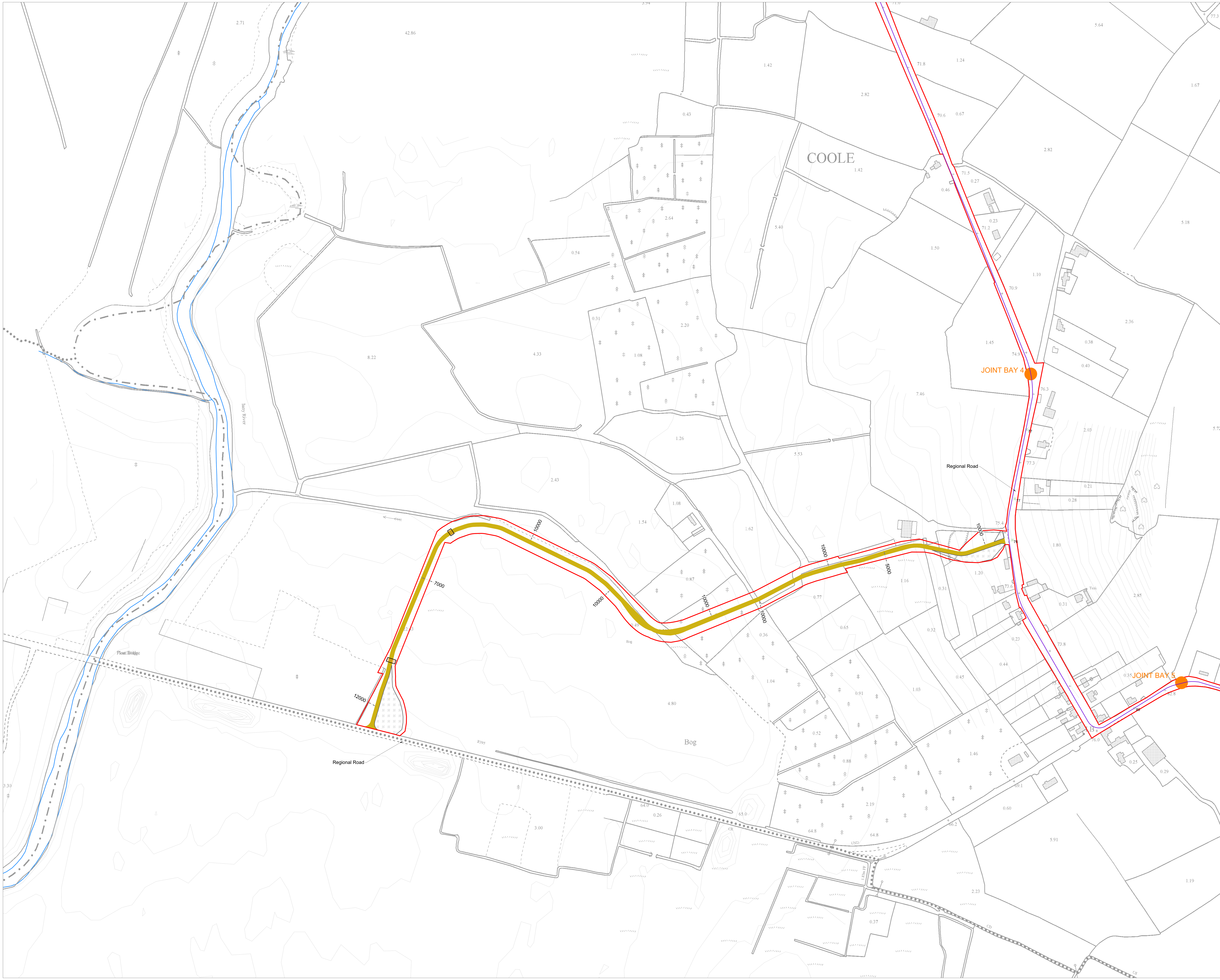

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Unbound Hardcore Surface
- Crossing Point for Landowners
- Grid Connection Route
- X Spot Height
- Joint Bay
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 7 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 20 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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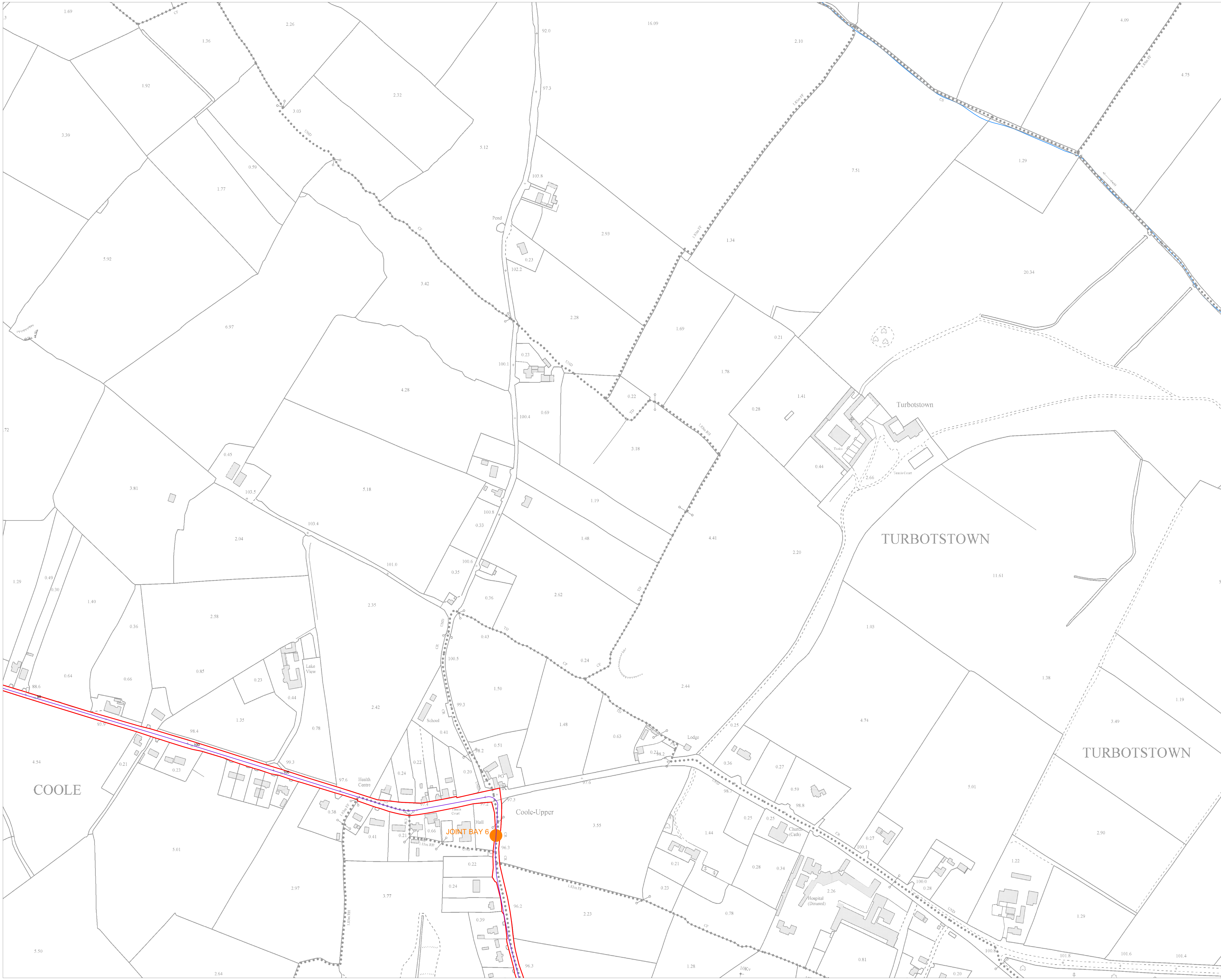

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay

N

DRAWING TITLE: **Site Layout Plan Sheet 8 of 24**	
PROJECT TITLE: **Coole Wind Farm FI, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 21 FI**
SCALE: **1:2,500 @ A1**	DATE: **27.10.2022**
OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771	

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay

N

DRAWING TITLE:
Site Layout Plan Sheet 13 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 26 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.:
2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 14 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 27 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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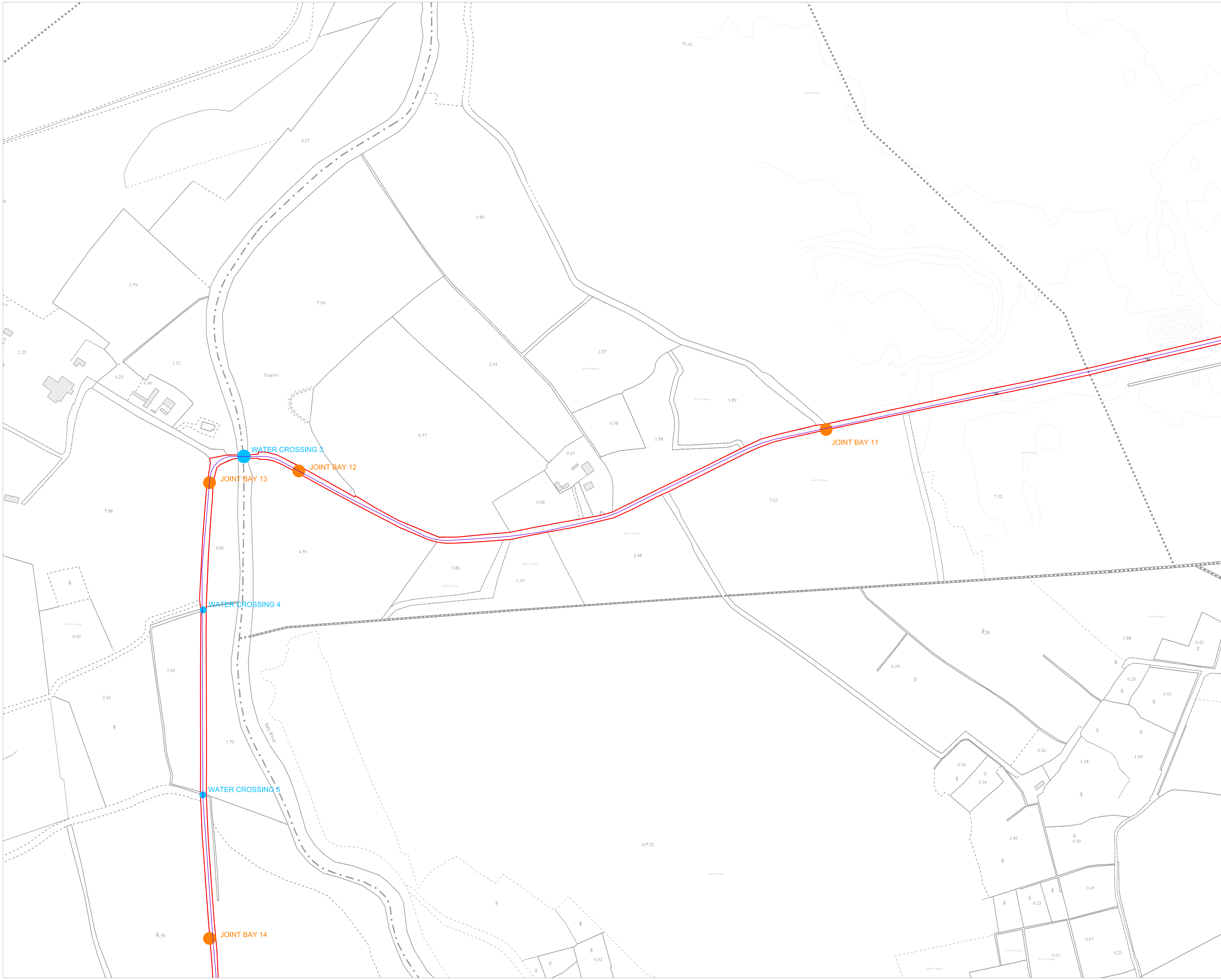

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 15 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 28 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan
Sheet 16 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 29 FI**
SCALE: **1:2,500 @ A1**	DATE: **27.10.2022**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 17 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 30 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay
- Watercrossing

N

DRAWING TITLE:
Site Layout Plan
Sheet 18 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 31 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

Red line	Planning Application Boundary
Purple line	Grid Connection Route
X	Spot Height
Orange dot	Joint Bay

DRAWING TITLE:
Site Layout Plan Sheet 19 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 32 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301, 2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702, 2768, 2769, 2770, 2771

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 20 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 33 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan
Sheet 21 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 34 FI**
SCALE: **1:2,500 @ A1**	DATE: **27.10.2022**

OS SHEET No.:
2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay

N

DRAWING TITLE:

Site Layout Plan
Sheet 22 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 35 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- X Spot Height
- Joint Bay

N

DRAWING TITLE:

Site Layout Plan Sheet 23 of 24

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 36 FI**
SCALE: **1:2,500 @ A1**	DATE: **27.10.2022**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Proposed Cable Alteration
- Existing Mullingar Substation
- X Spot Height
- Joint Bay
- Watercrossing

N

DRAWING TITLE:
Site Layout Plan Sheet 24 of 24

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 37 FI
SCALE: 1:2,500 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301, 2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702, 2768, 2769, 2770, 2771

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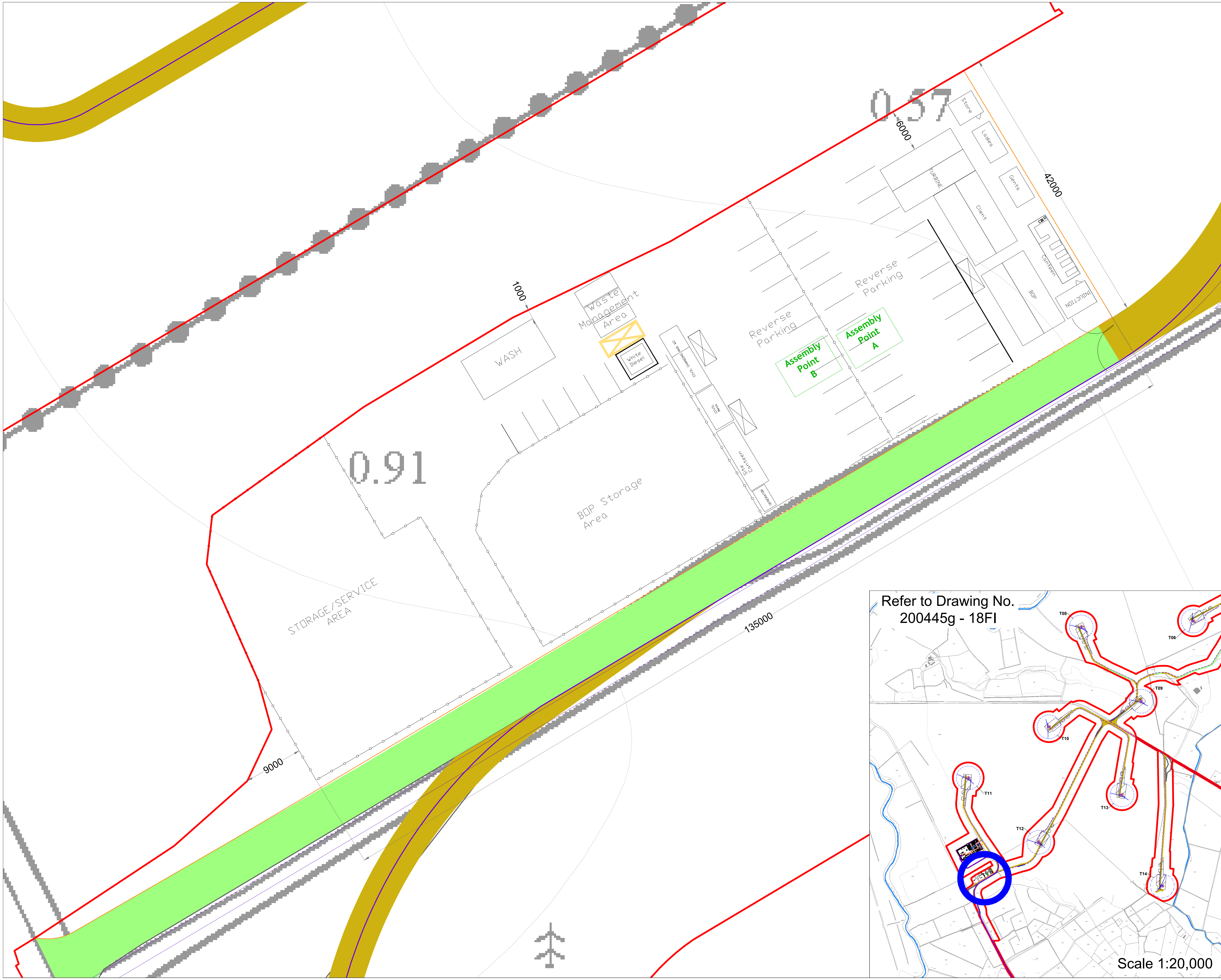

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Internal Electrical Cabling
- Temporary Construction Compound
- Grid Connection Route

N

DRAWING TITLE:
Temporary Construction Compound

PROJECT TITLE: Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 38 FI
SCALE: 1:500 @A3	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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Drawing Notes

1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Internal Electrical Cabling
- Grid Connection Route

N

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DRAWING TITLE:

Substation Layout

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 39 FI
SCALE: 1:500 @A3	DATE: 27.10.2022

OS SHEET No.:
2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of 175m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine foundation diameter may vary.
5. Ground level represents the top of turbine foundation.

DRAWING TITLE:
Wind Turbine Range Elevations & Plan

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 42A FI
SCALE: 1:500 @A1	DATE: 27.10.2022

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Drawing Notes

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2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine foundation diameter may vary.
5. Ground level represents the top of turbine foundation.

DRAWING TITLE:
97.5m hub and 77.5m blade Wind Turbine Elevations & Plan

PROJECT TITLE:
Coole Wind Farm FI, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g -42B FI**
SCALE: **1:500 @A1**	DATE: **27.10.2022**

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Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of 175m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine foundation diameter may vary.
5. Ground level represents the top of turbine foundation.

DRAWING TITLE: **100m hub and 75m blade Wind Turbine Elevations & Plan**	
PROJECT TITLE: **Coole Wind Farm FI, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g -42C FI**
SCALE: **1:500 @A1**	DATE: **27.10.2022**

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Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of 175m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine foundation diameter may vary.
5. Ground level represents the top of turbine foundation.

DRAWING TITLE: **100.5m hub and 74.5m blade Wind Turbine Elevations & Plan**	
PROJECT TITLE: **Coole Wind Farm FI, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g -42D FI**
SCALE: **1:500 @A1**	DATE: **27.10.2022**

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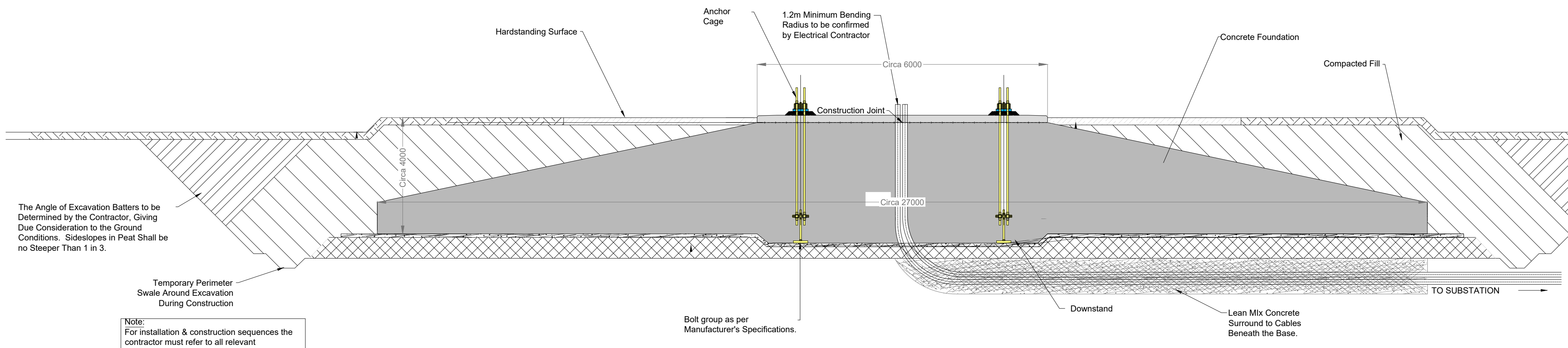
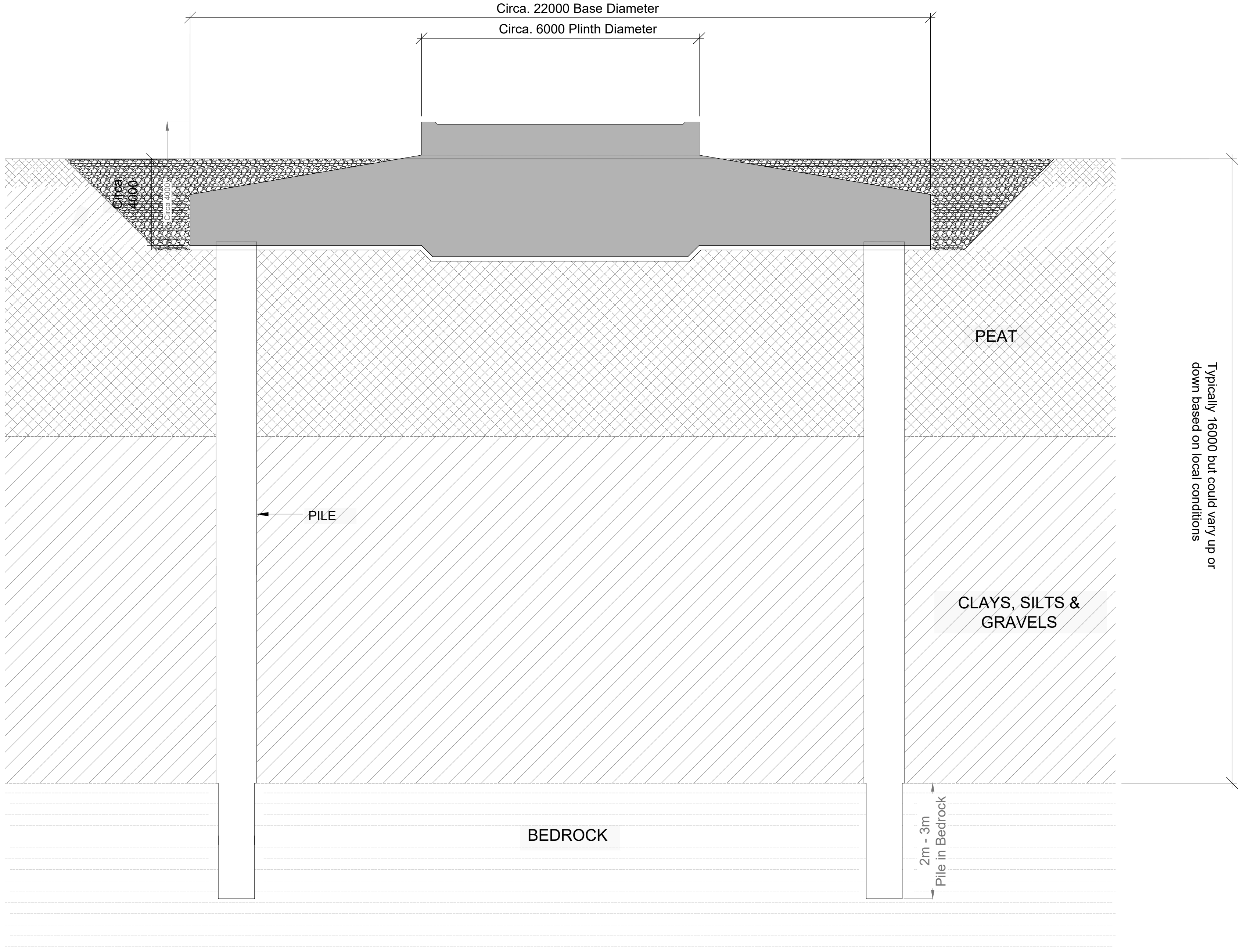
Website: www.mkoireland.ie



Note:
For installation & construction sequences the contractor must refer to all relevant Instructions, drawings & details.

Section of an Excavated Foundation Scale
1:200



Section of a Piled a Foundation
Scale 1:200

Drawing Notes

- Bedrock depth ranges from 8.7m to 16.9m
- Details/dimensions are provided for indicative purposes and will be subject to detailed design by the appointed contractor
- Piles are typically 900 to 1200mm diameter, reinforced concrete installed by bored or continuous flight auger methods and are typically socketed 2 to 3m into competent bedrock
- Excavated material will be placed/spread locally alongside the excavations of the infrastructure elements or where required removed to an appropriately licensed facility

DRAWING TITLE: **Turbine Foundation Standard Detail**	
PROJECT TITLE: Coole Wind Farm FI, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Meabhann Crowe**
PROJECT No.: **200445g**	DRAWING No.: **200445g - 43 FI**
SCALE: **1:200@A3**	DATE: **27.10.2022**

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Project Design Drawing Notes

1. Drawings issued are for planning application purposes only.
2. Drawings not to be used for construction/contract conditions.
3. Copyright, all rights reserved. No part herewith may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner McCarthy Keville O'Sullivan.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Turbine Sweep Area
- Optioned Lands

DRAWING TITLE:

Peatland Optioned Lands

PROJECT TITLE:

Coole Wind Farm FI, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Meabhann Crowe
PROJECT No.: 200445g	DRAWING No.: 200445g - 59 FI
SCALE: 1:10,000 @ A1	DATE: 27.10.2022

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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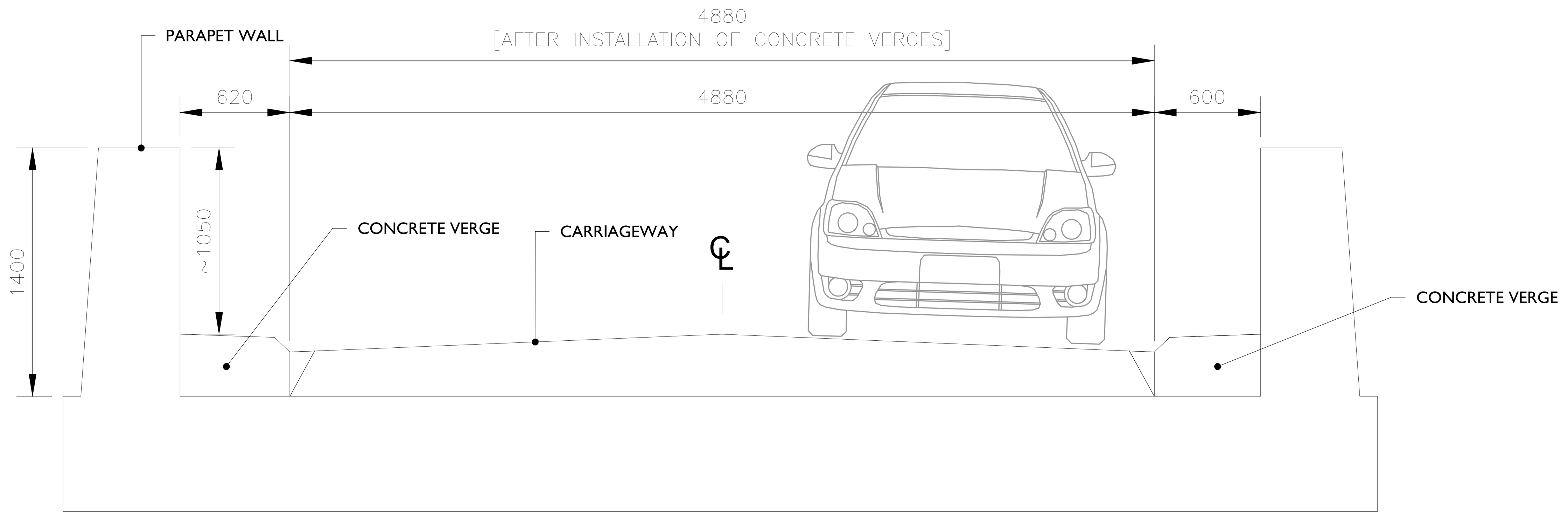
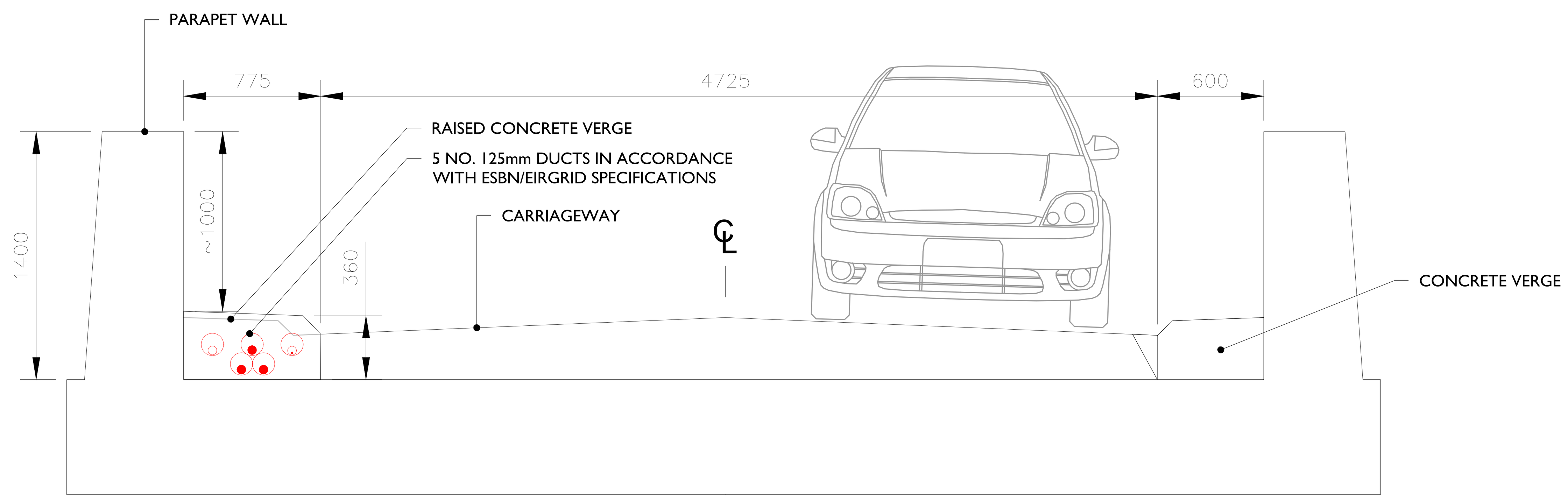
PLAN - PROPOSED OPTION DUCTS PLACED IN ROAD
SCALE 1:125



SECTION: EXISTING BRIDGE
SCALE 1:25



SECTION A-A - PROPOSED OPTION C DUCTS IN CONCRETE VERGE
SCALE 1:25

WH-1825-002.00 BRIDGE LOCATION

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
B	25/10/2022	M.B.	C.ÓD.	GENERAL REVISION - REVISED TO "OPTION C"
A	26.09.2022	E.A.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: CLONAVA BRIDGE CROSSING WH-L1825-001.00 PROPOSED OPTION C

REVISION: B

DRAWN BY	DATE	PAPER SIZE	SCALE
E. ANDRADE	07/10/2022	A1	1:25 / 1:125

CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
J. SHANAHAN	07/10/2022	DRAFT	COLE d005.3.3

Plotted - 26/10/2022 16:47:21
Z:\Projects\Ireland\Coole COLE\Drawings\d005 Grid Route\COLE D05.3 Bridge Details

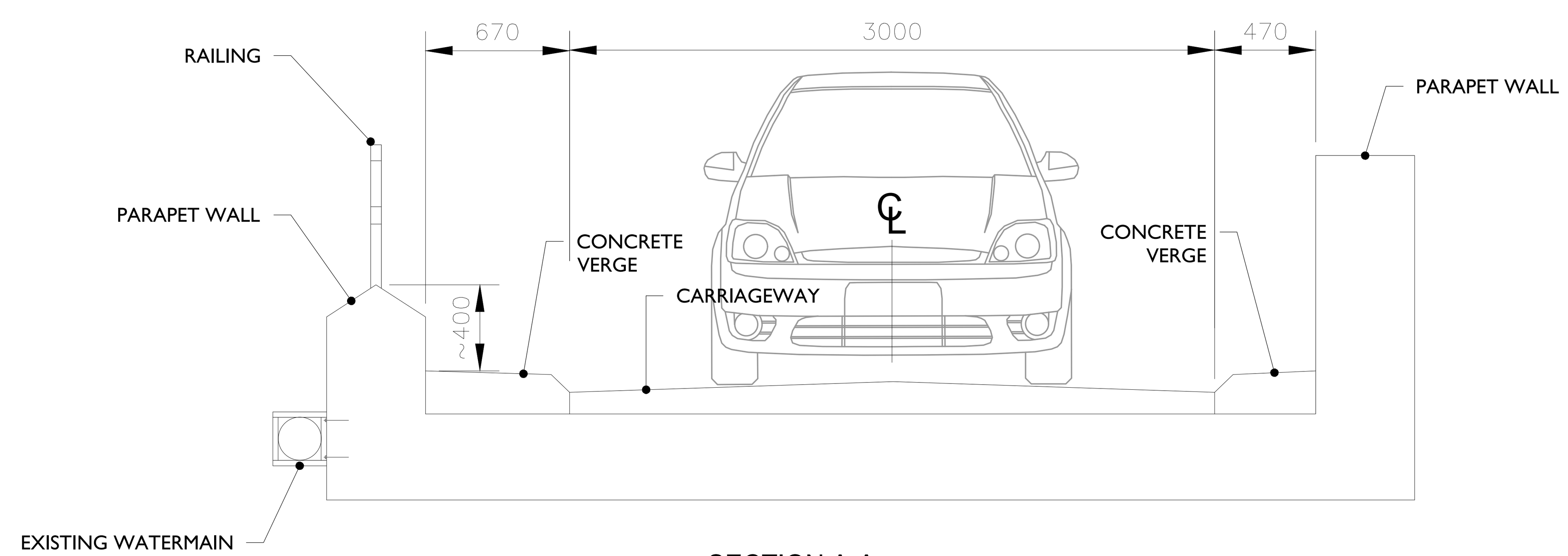
PLAN - PROPOSED OPTION B DIRECTIONAL DRILL

SCALE 1:100

SECTIONAL ELEVATION - PROPOSED OPTION B DIRECTIONAL DRILL

SCALE 1:100

WH-1825-002.00 BRIDGE LOCATION



SECTION A-A

SCALE 1:25

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
C	27/10/2022	E.A.	J.S.	WATERMAIN ADDED
B	26/10/2022	M.B.	J.S.	"OPTION A" RENAMED TO "OPTION B"
A	07/10/2022	E.A.	J.S.	FIRST ISSUE

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DRAWN BY: E. ANDRADE | DATE: 07/10/2022

CHECKED AND APPROVED: J. SHANAHAN | DATE: 07/10/2022

PAPER SIZE: A1 | SCALE: 1:100 / 1:25

STATUS: DRAFT

PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: SHRUBBYWOOD BRIDGE CROSSING WH-L1825-002.00 PROPOSED OPTION B

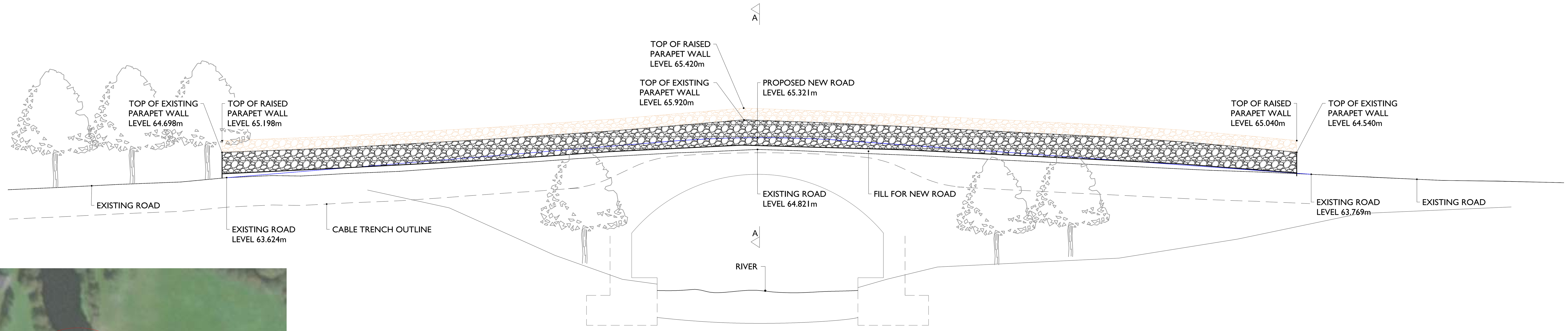
REVISION: C

DRAWING NUMBER: COLE d005.3.4

Plotted - 27/10/2022 16:23:34
Z:\Projects\Ireland\Coole COLE\Drawings\d005 Grid Route\COLE D05.3 Bridge Details

PLAN - PROPOSED OPTION C DUCTS PLACED IN ROAD

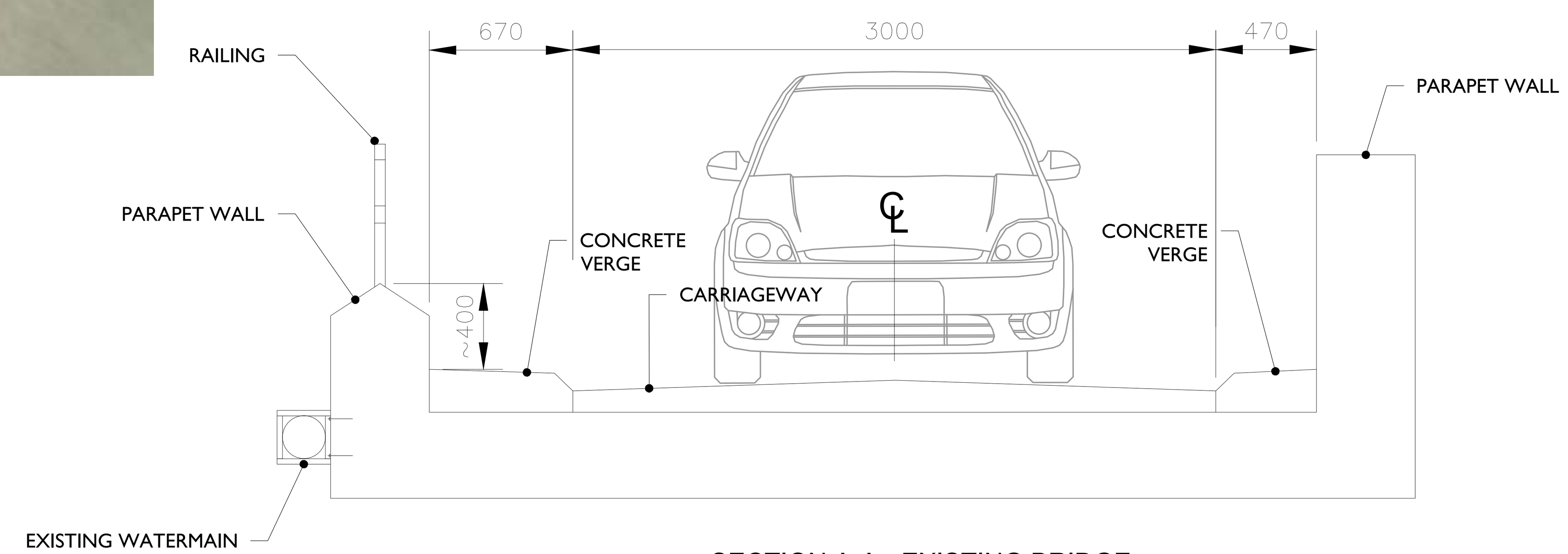
SCALE 1:100



SECTIONAL ELEVATION - PROPOSED OPTION C DUCTS IN ROAD

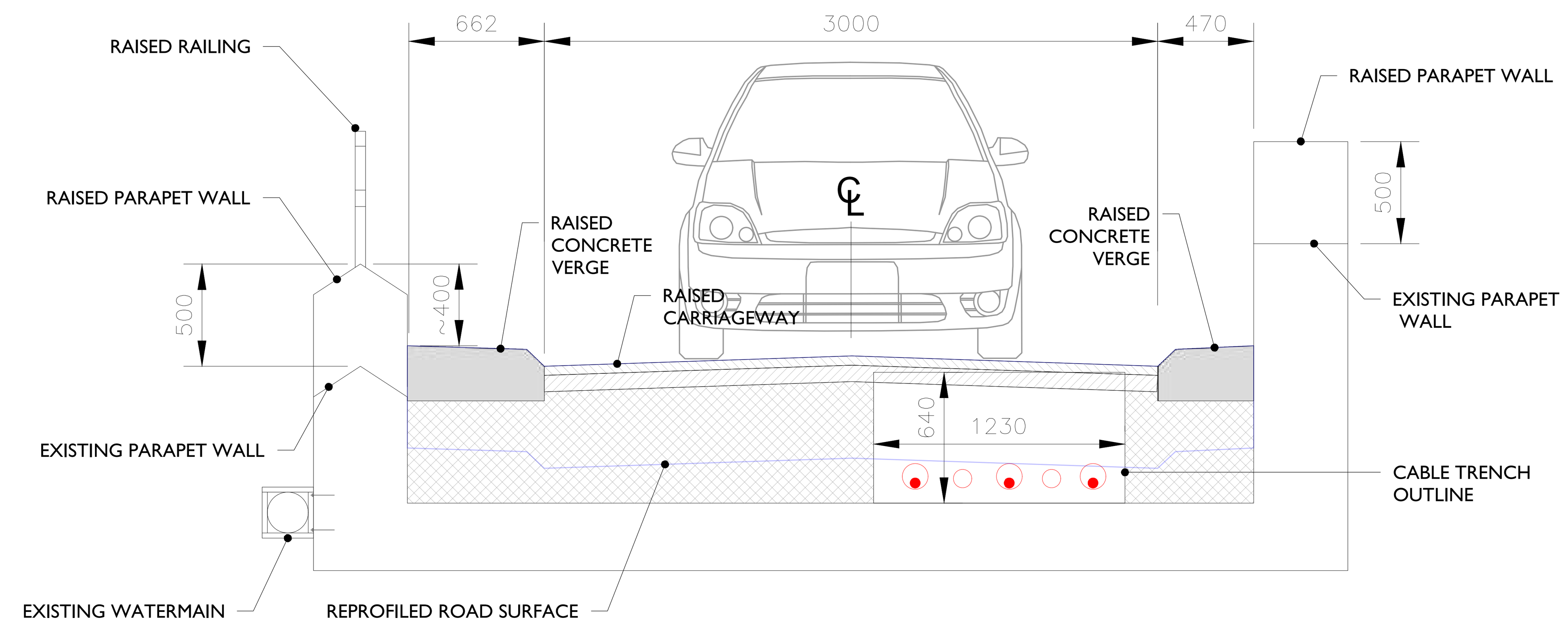
SCALE 1:100

WH-1825-002.00 BRIDGE LOCATION



SECTION A-A - EXISTING BRIDGE

SCALE 1:25



SECTION A-A - PROPOSED OPTION C

SCALE 1:25

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
C	27/10/2022	E.A.	J.S.	WATERMAIN ADDED
B	26/10/2022	M.B.	J.S.	"OPTION B" RENAMED TO "OPTION C"
A	07/10/2022	E.A.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

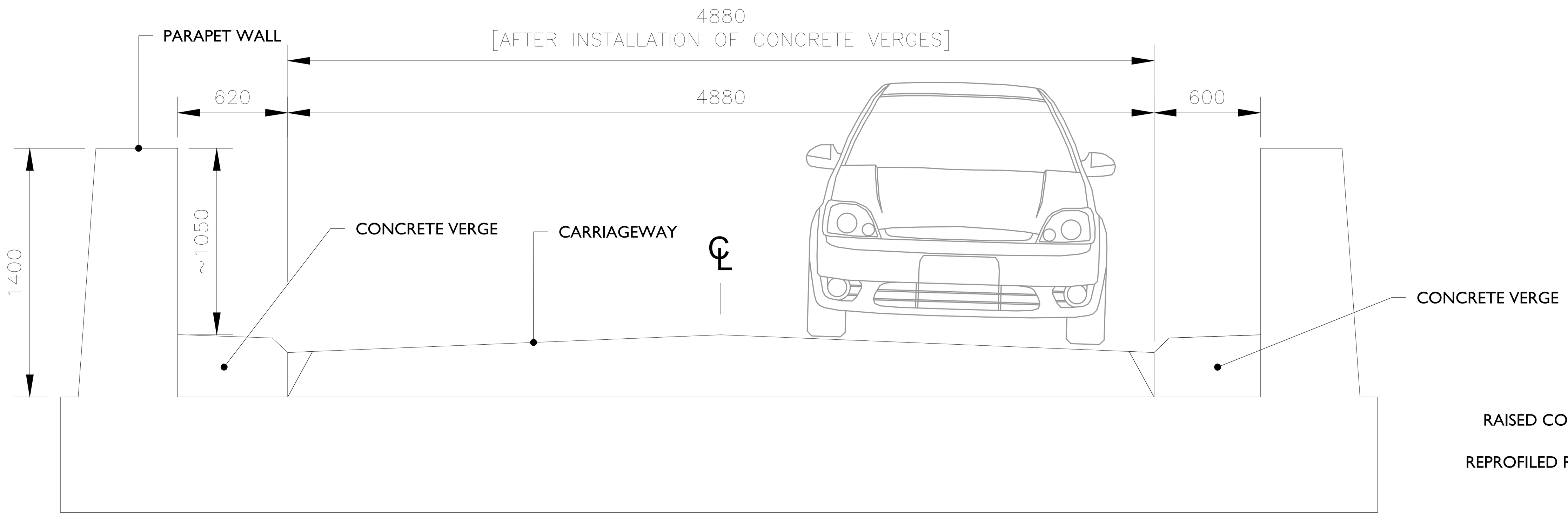
TITLE: SHRUBBYWOOD BRIDGE CROSSING WH-L1825-002.00 PROPOSED OPTION C

REVISION: C

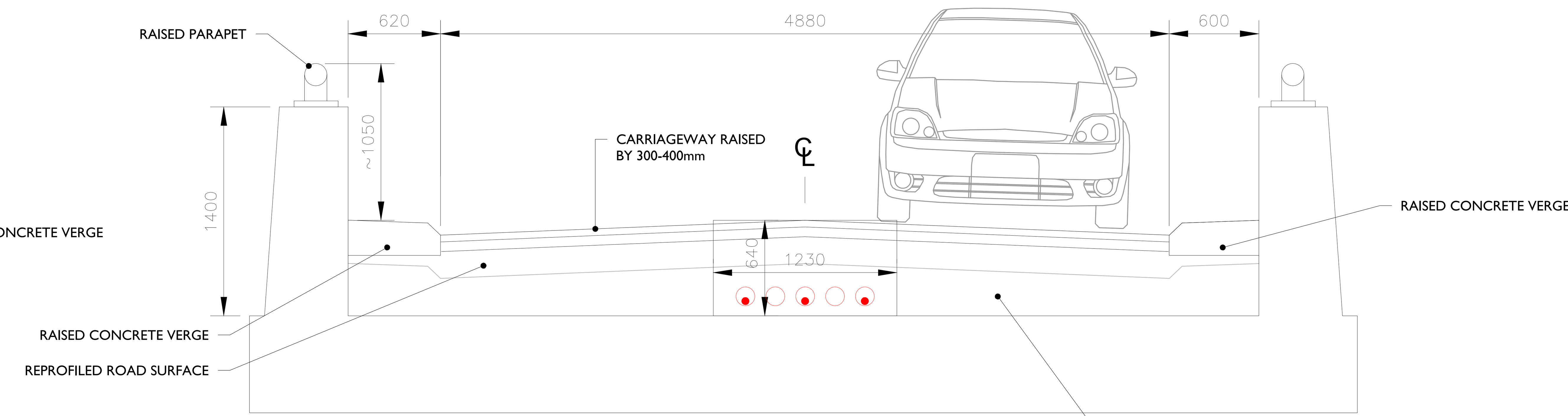
DRAWN BY	DATE	PAPER SIZE	SCALE
E. ANDRADE	07/10/2022	A1	1:100 / 1:25

CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
J. SHANAHAN	07/10/2022	DRAFT	COLE d005.3.5

PLAN - PROPOSED OPTION DUCTS PLACED IN ROAD
SCALE 1:125



SECTION: EXISTING BRIDGE
SCALE 1:25



SECTION A-A - PROPOSED OPTION D DUCTS IN ROAD
SCALE 1:25

WH-1825-002.00 BRIDGE LOCATION

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
A	25/10/2022	E.A.	J.S.	FIRST ISSUE

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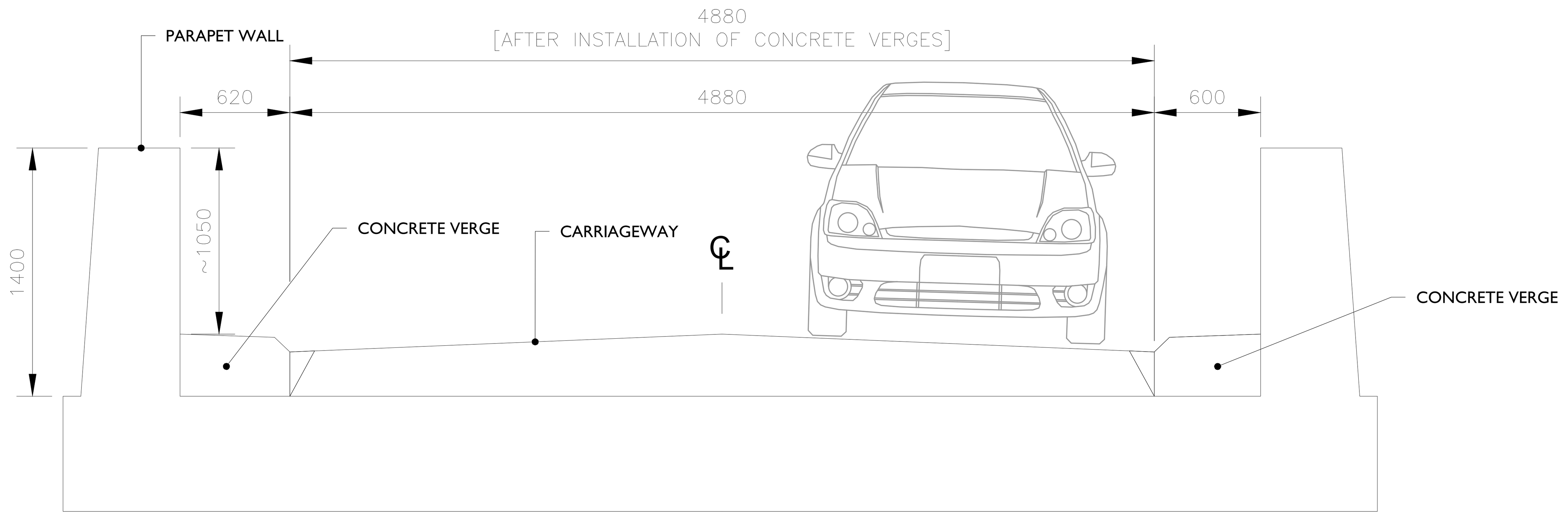
PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
CLONAVA BRIDGE CROSSING
WH-L1825-001.00 PROPOSED OPTION D

REVISION
A

DRAWN BY: M. BROWNE
DATE: 25/10/2022
PAPER SIZE: A1
SCALE: 1:25 / 1:125
CHECKED AND APPROVED: J. SHANAHAN
DATE: 25/10/2022
STATUS: DRAFT
DRAWING NUMBER: COLE d005.3.6

PLAN - PROPOSED OPTION DUCTS PLACED IN ROAD
SCALE 1:125



SECTION: EXISTING BRIDGE
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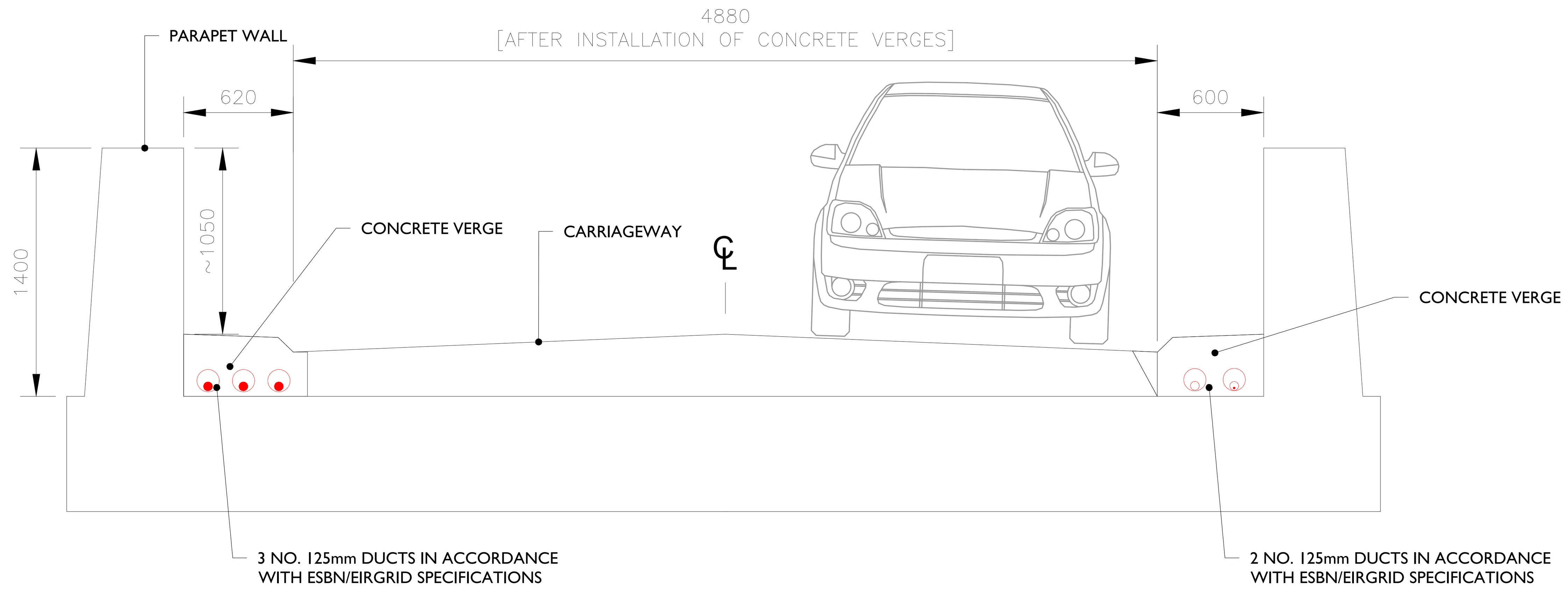

SECTION A-A - PROPOSED OPTION E DUCTS IN ROAD
SCALE 1:25

WH-1825-002.00 BRIDGE LOCATION

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
A	25/102022	M.B.	J.S.	FIRST ISSUE

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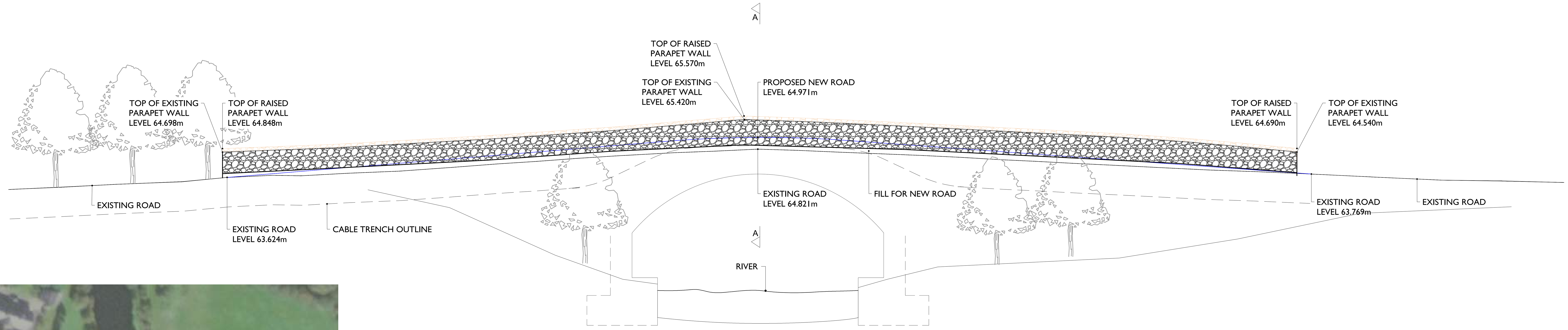
PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
CLONAVA BRIDGE CROSSING
WH-L1825-001.00 PROPOSED OPTION E

DRAWN BY	DATE	PAPER SIZE	SCALE
E. ANDRADE	25/10/2022	A1	1:25 / 1:125

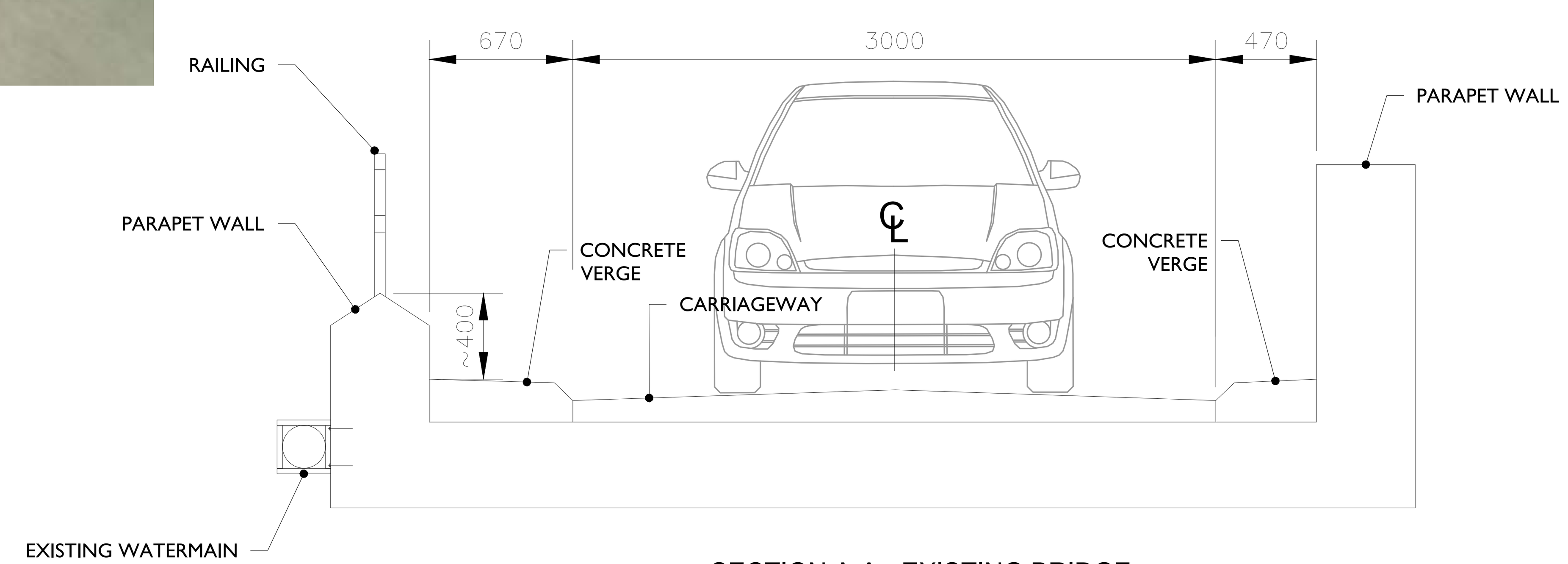
CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER	REVISION
J. SHANAHAN	25/10/2022	DRAFT	COLE d005.3.7	A

PLAN - PROPOSED OPTION D DUCTS PLACED IN ROAD
SCALE 1:100

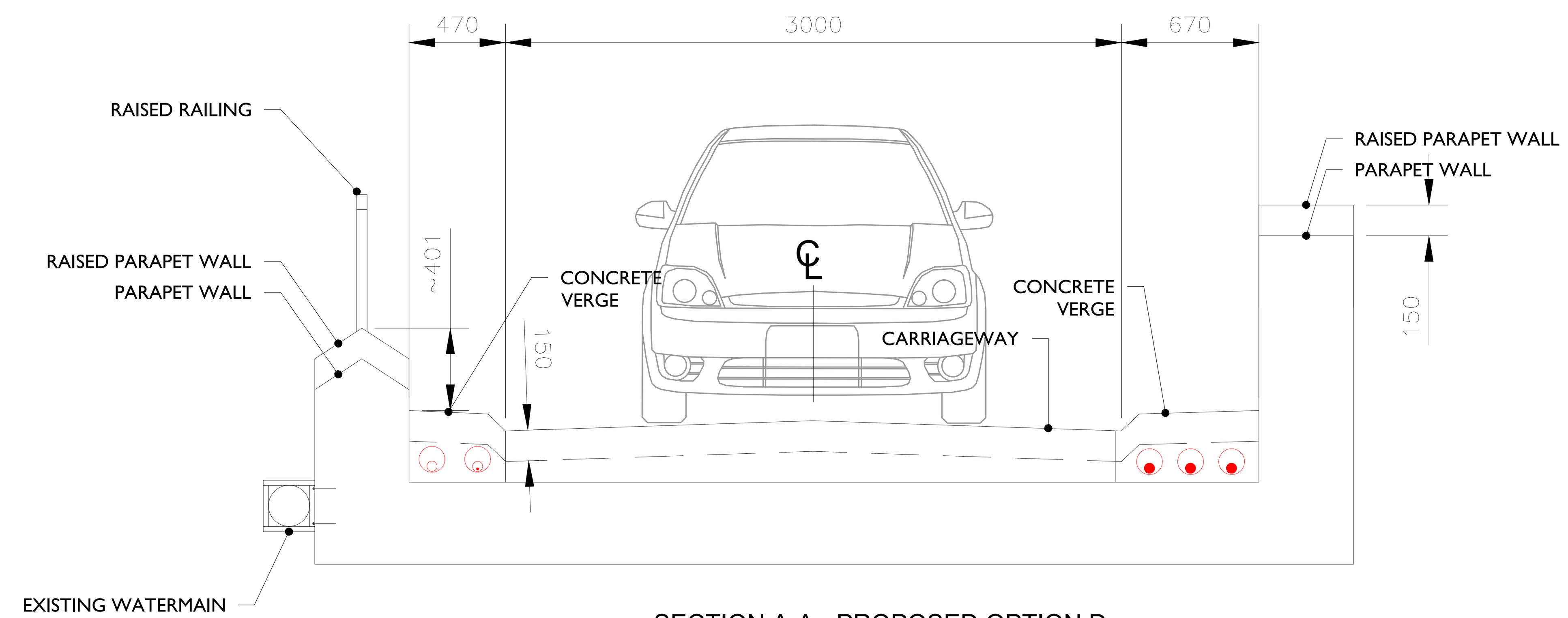


SECTIONAL ELEVATION - PROPOSED OPTION D DUCTS IN ROAD
SCALE 1:100

WH-1825-002.00 BRIDGE LOCATION



SECTION A-A - EXISTING BRIDGE
SCALE 1:25



SECTION A-A - PROPOSED OPTION D
SCALE 1:25

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
B	27/10/2022	E.A.	J.S.	TRENCH OUTLINE REALIGNED
A	07/10/2022	E.A.	J.S.	FIRST ISSUE

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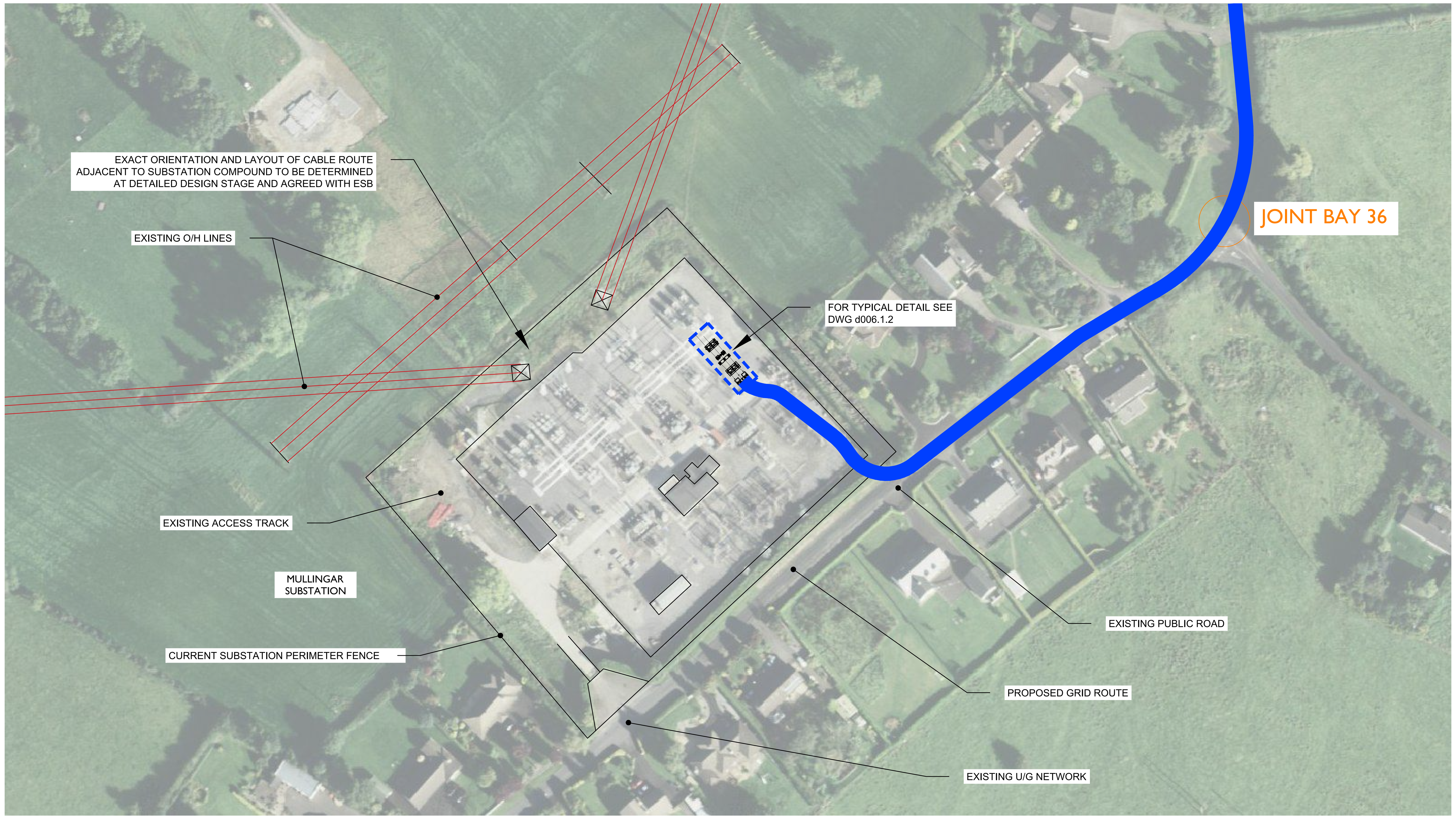
DRAWN BY: E. ANDRADE — DATE: 07/10/2022
CHECKED AND APPROVED: J. SHANAHAN — DATE: 07/10/2022
PAPER SIZE: A1 — SCALE: 1:100 / 1:25
STATUS: DRAFT

PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
SHRUBBYWOOD BRIDGE CROSSING
WH-L1825-002.00 PROPOSED OPTION D

REVISION
B

DRAWING NUMBER
COLE d005.3.8



MULLINGAR SUBSTATION - ILLUSTRATIVE PLAN
Scale 1:50

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
E	13/10/2022	E.A.	J.S.	ALTERNATIVE CONNECTION BAY LOCATIONS REMOVED
D	16.03.2022	JS	PK	ELECTRICAL EQUIPMENT UPDATED
C	11.03.2022	JS	PK	ELECTRICAL EQUIPMENT UPDATED
B	20.03.2020	MS	JS	BAY LOCATIONS MOVED
A	16.01.2020	M.B.	J.S.	FIRST ISSUE

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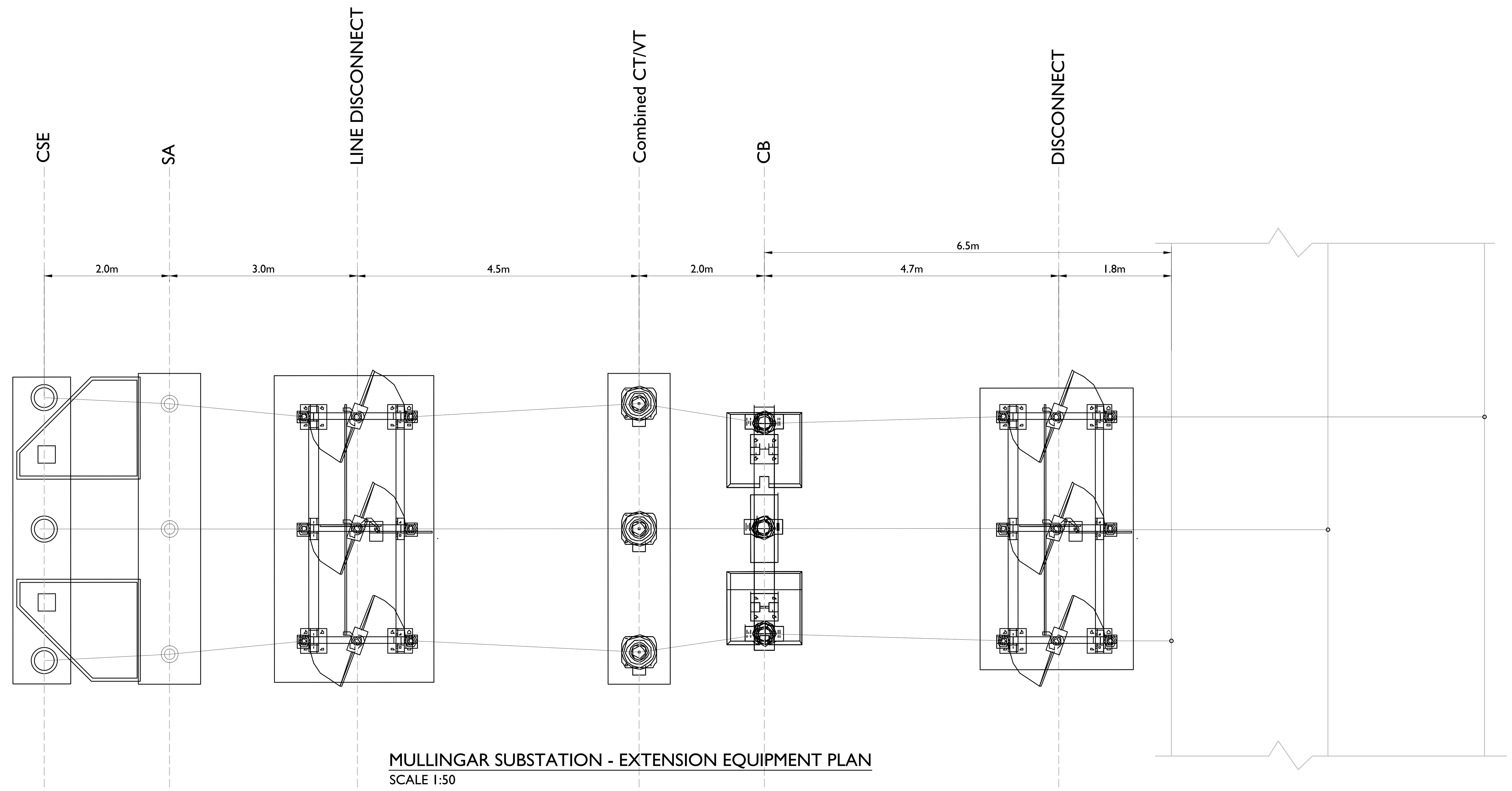
PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
MULLINGAR SUBSTATION
ILLUSTRATIVE PLAN

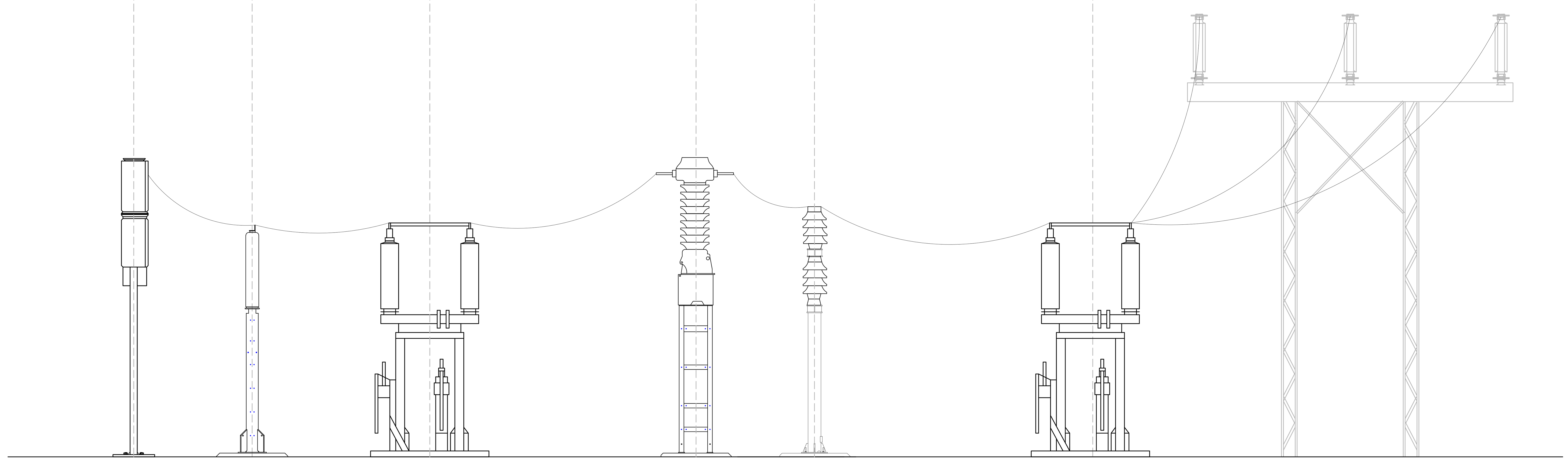
REVISION
E

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	16/01/2020	A1	1:1000

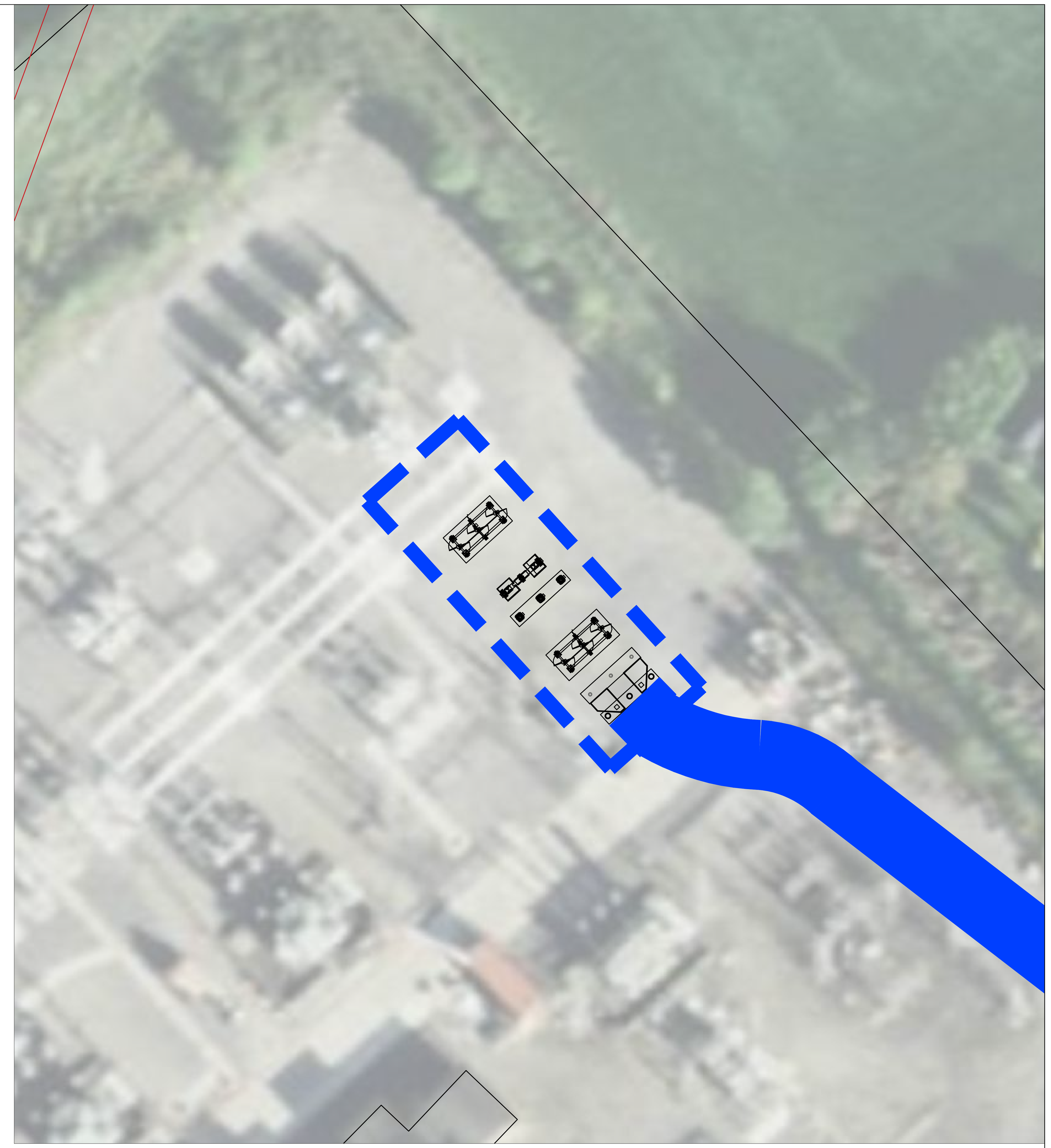
CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
J. SHANAHAN	16/01/2020	DRAFT	COLE d006.1.1



MULLINGAR SUBSTATION - EXTENSION EQUIPMENT PLAN
SCALE 1:50



MULLINGAR SUBSTATION - EXTENSION EQUIPMENT ELEVATIONS
SCALE 1:50



MULLINGAR SUBSTATION - EXTENSION EQUIPMENT LOCATION
SCALE 1:250

NOTES
1. Confirmation of overall bay length is subject to an as-built survey within the substation area.

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
E	13/10/2022	E.A.	J.S.	ALTERNATIVE CONNECTION BAY LOCATIONS REMOVED
D	16.03.2022	JS	PK	ELECTRICAL EQUIPMENT UPDATED
C	11.03.2022	JS	PK	ELECTRICAL EQUIPMENT UPDATED
B	20.03.2020	MS	JS	PLAN UPDATED
A	16.01.2020	M.B.	J.S.	FIRST ISSUE

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
MULLINGAR SUBSTATION
EXTENSION EQUIPMENT DETAILS

REVISION
E

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	16/01/2020	A1	As shown
CHECKED AND APPROVED	DATE	STATUS	
J. SHANAHAN	16/01/2020	DRAFT	

DRAWING NUMBER
COLE d006.1.2

Plotted - 13/10/2022 12:11:07
Z:\Projects\Ireland\Coole COLE\Drawings\d006 Substation\COLE D006 Mullingar Sub

APPENDIX 2

FI HES RESPONSE

HYDRO ENVIRONMENTAL SERVICES

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fax: +353 (0)58 44244
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web: www.hydroenvironmental.ie

Date: 27th October 2022
Our Ref: P1320-2-0010

MKO Ireland
Planning & Environmental Consultants
Tuam Road,
Galway.
H91 VW84.

Attn: Ms. Meabhann Crowe

Dear Meabhann,

Re: Hydrological & Hydrogeological Responses to An Bord Pleanála Further Information Request and Third-Party Submission in relation to the proposed Coole Wind Farm, Co. Westmeath (ABP Ref: 309770-21)

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO) to respond to a further information request from An Bord Pleanála (ABP) with respect to geological, hydrological, and hydrogeological matters raised in relation to the proposed Coole Wind Farm SID application, Co. Westmeath.

1 STATEMENT OF EXPERIENCE – WIND FARM DRAINAGE

Hydro-Environmental Services (HES) has extensive wind farm drainage and hydrogeological experience relevant to this project. Wind farm environmental impact assessment in respect of geology, hydrology, and hydrogeology has and is a core business area for HES presently and also over the past 18 years. Wind farm drainage design/management requires experience both as a civil/drainage engineer, a hydrologist, and as a hydrogeological specialist. HES have these combined experiences and expertise. HES has worked on over 100 wind farm projects in Ireland and Northern Ireland. Many of these required assessments of existing drainage features and streams and water quality data. HES work at all stages of wind farm developments including feasibility stage, layout design & preliminary drainage design/planning stage, and also at construction management stage.

HES's experience also covers the key area of water quality and drainage controls and mitigation during the construction phase of wind farm developments. HES work at EIAR/planning stage to assist with the development of the optimal site layout which involves the development of hydrological constraints maps and interaction with geotechnical and ecological specialists and with site designers. HES also provide a follow-on consultancy service (if planning is granted and the development proceeds to construction) of detailed drainage design and construction management for drainage during wind farm development/construction stage. This practical on-site experience is invaluable as it has led to development of improved preliminary and detailed drainage layouts and also many improvements/optimisations to standard peatland drainage mitigation measures.

HES specialises in wetland and peatland eco-hydrology. We also complete flood risk assessments for all types of developments across the country.

All these experiences are particularly relevant to this project, and they have been applied through the project development phase, the constraints mapping phase, and EIAR preparation work, including the cumulative impact assessment.

This response submission has been prepared by Adam Keegan and Michael Gill. Adam and Michael prepared the Land Soil and Geology and Water Chapters of the submitted EIAR, and their qualifications, competencies, and experience are already presented in the EIAR.

2 RESPONSE TO ABP ITEM 4 "SOILS AND GEOLOGY AND INTERACTIONS WITH PEAT HARVESTING"

Further peat depth probing and investigations have been completed by MWP in the area of T12. As a result of those investigations, which are outlined in the report entitled "Response to RFI Item 4.1, Coole Wind Farm" (MWP, September 2022), the upper end of peat depths referenced in the EIAR should now be 8.7m. As such peat thicknesses from peat probing, window sampling, and drilling ranged from 0 to 8.7m.

2.1 "Soils & Geology interaction with Peat Harvesting" Item 4.2

Item 4.2 is divided into 7 bullet points (for ease of reference we have numbered those as a) to g)). HES is responding below to items pertinent to the EIAR (Land, Soils & Geology and Water Chapters), namely items (**b**) and (**c**). Item 4.2 is written as follows:

> *"The comments of the Department of Housing, Local Government and Heritage on nature conservation raise a number of issues including the following which are considered of particular relevance to soil and geology and hydrology.*
>
> *b) The potential for impacts on Gariskil Bog and Scragh Bog as a result of the effects of drainage works.*
>
> *c) The need to identify the location of all mitigation measures involved in the construction phase drainage management.*

2.1.1 HES Response to Item 4.2 (b)

As outlined in Section 9.4.1.9 of the EIAR, the potential effects of the proposed development on the Gariskil Bog SAC and Scragh Bog SAC have been carefully considered.

These designated sites are >5km from the Coole Wind Farm, thus the proposed drainage measures incorporated into the Wind Farm design will not impact on them. However, the SAC's are located near the associated grid route.

As set out in Section 9.4.19 of the EIAR, and on Cross-Section X1 and Cross-Section X2 (refer to EIAR Appendix 9.4), Gariskil Bog SAC is situated ~60m from the Grid Connection Route along the L1826. The road (and Grid Connection Route) is ~ 2.5m lower than the raised bog that forms the SAC. The River Inny exists between the edge of the bog and the public road and acts as a hydraulic boundary to groundwater flow. A small stream (a tributary of the River Inny) exists, ~ 230m south of the bridge to the north of the SAC boundary. This stream is culverted under the L1826. The stream flows east, while drainage from the bog will flow west towards the River Inny.

In summary, the potential for hydrological impacts from the Grid Connection Route to Gariskil Bog SAC are limited by:

- The River Inny acting as a hydraulic boundary between the Gariskil Bog;
- The separation distance between the Grid Connection Route and the SAC;
- Local drainage patterns are towards the River Inny and away from the grid connection trench;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench; and,
- The base of the temporary trench is above the invert of the River Inny which is located between the SAC and the Grid Connection Route.

As set out in Section 9.4.1.9 of the EIAR, Scragh Bog SAC/pNHA is situated ~320m from the Grid Connection Route at its closest point. Land-use between the Grid Connection Route and the

Scragh bog is typically agricultural with some residential dwellings along the N4 road. There is a considerable amount of grass verge/shrubbery along the N4 roadside. Given the distance relative to the ~1.2m deep trench and the intervening land use, there is no direct or indirect hydrological pathway to the Scragh Bog SAC/pNHA, any excess surface water would infiltrate to ground within several metres of the road, based on permeability/groundwater recharge values mapped by the GSI.

In summary, the potential for hydrological impacts from the Grid Connection Route to Scragh Bog SAC/pNHA are limited by:

- The separation distance between the Grid Connection Route and the SAC;
- There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench; and,
- The shallow nature of the temporary trench along Grid Connection Route.

The proposed mitigation measures to eliminate any potential impacts on these SAC's are given in Section 9.4.1.9, and are summarised briefly as follows:

- Drainage control measures will be put in place during the excavation and construction of the grid route;
- Sediment control measures used during the construction such as silt bags, the covering of exposed soils and the avoidance of works during heavy rainfall;
- Mitigation measures related to spills/chemical releases, *i.e* petroleum products will be put in place during the construction;
- No groundwater dewatering is required during grid route construction;
- All trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed; and,
- No deep foundations are proposed near the SAC's or along the grid route in general.

Section 9.4.1.9 of the EIAR concludes, and we, HES, continue to assert, that with the implementation of the mitigation measures (as outlined in the EIAR and as summarised above), no significant hydrological or hydrogeological impacts on designated sites are anticipated from the proposed development.

In addition to the above, and in response to paragraph 1.3.5 of the Departments (DAU) submission, the type of drainage impact encountered by Regan et al (2019)[1] at Clara Bog SAC cannot occur at Gariskil Bog SAC nor at Scragh Bog SAC/pNHA, as in this instance the proposed grid connection trench will be 1.2m deep, it will be a transient and temporary excavation, and it will not intercept or drain the local groundwater system.

2.1.2 HES Response to Item 4.2 (c)

The locations of proposed mitigation measures to be implemented within the Coole Wind Farm site during the construction phase including check dams, attenuation ponds, settlement ponds, silt fences, and collector and interceptor drains are shown in Drawings D101 to D107 (EIAR Appendix 4.9).

The implementation of these mitigation measures is listed in detail in Section 9.4.1.1 of the EIAR. The concluding paragraph of Section 9.4.1.1 states:

[1] *Regan, S., Flynn, R., Gill, L., Naughton, O., & Johnston, P. (2019). Impacts of groundwater drainage on peatland subsidence and its ecological implications on an Atlantic raised bog. Water Resources Research.*

"The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route and near other ancillary works (River Inny, Glore River, River Deel, Monkstown stream, Lough Derravaragh).

For the reasons outlined above, no significant effects on the surface water quality are anticipated."

Mitigation measures proposed along the grid route are also described in the EIAR (Section 9.4.1), and include the temporary use of appropriate interceptor drainage, which will be continuously implemented along the grid route during construction, as the route progresses. The mitigation measures implemented will be specific to the ground conditions/slope and related to the antecedent weather (*i.e* during periods of low/no rainfall, management of surface water will not be required). The EIAR includes the following requirements:

- The majority of the Grid Connection Route is >50m from any nearby watercourse, apart from a section of the N4 alongside Lough Owel and at bridges along the Grid Connection Route. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils
- A constraint/buffer zone will be maintained for all crossing locations where possible, whereby all watercourses will be fenced off.
- Source controls such as silt bags, silt fences, filter fabrics and interceptor drains will be installed where required.
- No batching of wet-cement products will occur along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site (along grid route) will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded.
- Mitigation measures relating to the use of biodegradable drilling fluids such as Clear Bore are included in Section 9.4.1.10 if directional drilling is deemed necessary.
- The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected.
- No groundwater dewatering is proposed during grid route construction. Any rainwater removal will be temporary and at a very shallow depth above the groundwater table.
- All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.
- No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site (grid route).

The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. These mitigation measures are included in the submitted CEMP, and during the construction phase works will be supervised and overseen by an ECoW. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route.

2.2 "Soils & Geology interaction with Peat Harvesting" Item 4.4

Item 4.4 is written as follows:

> *"It is considered that more detailed information should be provided relating to water quality monitoring proposals specified in Section 9.4.1.1 of the EIAR. In particular, a suite of parameters to be monitored and the limits to be met should be specified."*

2.2.1 HES Response to Item 4.4

The paragraphs relating to water quality monitoring in Section 9.4.1.1 of the EIAR states:

> *"During the construction phase, field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly, and event based)."*

To supplement this, the following suite of parameters will be monitored:

Parameter	EQS	Event	Methodology
Visual Inspection	No abnormal change	Daily	Field Inspection and photographic record.
pH	4.5<pH>9.0	Weekly	Field Measurement (Handheld probe)
Dissolved Oxygen	No abnormal change	Weekly	Field Measurement (Handheld probe)
Conductivity	No abnormal change	Weekly	Field Measurement (Handheld probe)
Temperature	No abnormal change	Weekly	Field Measurement (Handheld probe)
Ammonia	High Status ≤0.04mg/L Good Status ≤0.065mg/L	Monthly	Accredited Laboratory Analysis
Nitrate	-	Monthly	Accredited Laboratory Analysis
BOD	High Status ≤1.3 mg/L Good Status ≤1.5 mg/L	Monthly	Accredited Laboratory Analysis
Total Petroleum Hydrocarbons	Below Detection Limit	Monthly/ Following potential hydrocarbon spill	Accredited Laboratory Analysis
Orthophosphate	High Status ≤0.025 Good Status ≤0.035		
Alkalinity	No abnormal change	Monthly/ Following potential cement leaching	

The inspections, monitoring, and sampling will be undertaken at the locations WF_SW1 – WF_SW5 show in Figure 9-9 of the EIAR. These sampling points are located along both the Glore River and River Inny.

2.3 Soils & Geology interaction with Peat Harvesting" Item 4.5

Item 4.5 is written as follows:

> *"You are requested to clarify the layout and management arrangements for the operational drainage structure."*

2.3.1 HES Response to Item 4.5

The drainage system as outlined in drawings D101-D107 (Refer to Appendix 4-9 and 9-3 of the EIAR) will be utilised and maintained during the operational phase of the proposed Wind Farm. The maintenance and management of the drainage system will be included within the overall maintenance regime of the Wind Farm.

Coole Wind Farm Ltd will have the responsibility for maintaining the drainage system at the operational wind farm. The maintenance of the wind farm will incorporate the activities associated with keeping the drainage system operating effectively.

The drainage maintenance regime will include:

- The inspection and maintenance of swales and settlement ponds;
- Inspecting cross-drains for any blockages, and removal of any blockages identified;
- Inspecting and maintaining outfalls to existing field drains;
- Inspecting the existing roadside drains for any obstructions, and removal of any obstructions identified;
- Inspecting the progress of the re-establishment of vegetation and where required testing the water quality at the outfalls periodically; and,
- Inspection and regular cleaning of drainage channels and settlement ponds. Drainage inspections and maintenance will be in completed accordance with CIRIA C697 SuDS and Maintenance Manual.

Note, weekly inspections will be required during the construction period. Monthly inspections will be completed for one year following construction, and then on a quarterly basis thereafter during the operational lifetime of the Wind Farm.

2.4 Soils & Geology interaction with Peat Harvesting" Item 4.6

Item 4.6 is written as follows:

> *"It is noted that the heading of Section 8.5.1.2 of the EIAR includes reference to the alteration of peat/soil geochemistry. Please clarify how this topic is assessed under that heading or if it is addressed elsewhere in the submitted documentation"*

2.4.1 HES Response to Item 4.6

The alteration of peat/soil geochemistry is included under Section 8.5.1.2 as "Contamination of soil by leakages and spillages and alteration of Peat/Soil Geochemistry".

It is understood that this may have been misinterpreted as being separate items and should be renamed "Contamination of soil by leakages and spillages and ***resulting*** alteration of Peat/Soil Geochemistry".

This section considers the possibility of hydrocarbon spills from the use of on-site fuel/oil and the potential impact on the Peat/Soil geochemistry as a receptor. A potential fuel/oil spill could alter the peat/soil geochemistry by lowering or raising the pH (depending on the specific type of hydrocarbon), by potentially reducing dissolved oxygen via the creation of an oil film and in a more general sense from introducing a range of hydrocarbon molecules which would not otherwise be present.

With the implementation of the mitigation measures outlined in the EIAR (Section 8.5.1.2), the assessed impact of this potential source is "*Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock*".

3 RESPONSE TO 3RD PARTY SUBMISSIONS

3.1 DAU Submission Point 2.3

T1, T3 and T4 are close to the River Gore and Inny and associated features including Lough Bane pNHA. The Department is concerned about the potential impacts from the siting of a turbine with regard to the drainage impacts on this pNHA.

3.1.1 HES Response to DAU Submission Point 2.3

Potential impacts on Lough Bane pNHA have been assessed within Section 9.4.1.9 of the EIAR. Lough Bane pNHA is upgradient of the wind farm site therefore it is hydraulically disconnected from the Wind Farm site in terms of surface water. There is also a high bank and a number of deep drains separating the Wind Farm Site from the pNHA and the groundwater gradient at the Wind Farm Site is not in the direction of Lough Bane.

Please note Lough Bane was specifically targeted for investigation and monitoring during the EIAR process. Piezometers were installed to the south and southeast of the Lough, and seasonal monitoring was undertaken (refer to Sections 9.3.7.1 and 9.4.1.9). Hydrochemical monitoring was also completed in Lough Bane.

Impact assessment with respect to T2 was also undertaken at Section 9.4.1.9 of the EIAR. This concluded:

> *"The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected as:*
>
> - *No groundwater dewatering is proposed during construction. Any rainwater/surface water removal will be temporary and at a very shallow depth.*
> - *All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.*
> - *No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site."*

Therefore there will be no hydrological or hydrogeological impacts on designated sites.

3.2 Other 3rd Party Submissions

A total of 41 no. 3rd party submissions were received in relation to ABP Ref: 309770-21. Of these, 10 no. submissions contained comments relating to Soils & Geology or Hydrology/Hydrogeology.

The main hydrological/hydrogeological issues raised in those 10. no. submissions can be distilled down to the following themes:

1) Due to the emplacement of the turbine hardstands, a large volume of groundwater will be displaced, which will create a rise in the groundwater level, which will in turn flow to the River Glore/Inny and could cause flooding.
2) All surface water from the site flows towards the Inny/Glore River, which are headwaters of Lough Derravaragh. The proposed works will have a negative impact on water quality in these rivers, and thus the downstream lake.
3) The proposed development will have a negative effect on the hydrology/hydrogeology of Lough Bane, Gariskil Bog, Scragh Bog, and other designated sites.

3.2.1 HES Response to 3rd Party theme 1) issue:

- The installation of the turbine hardstands and its potential impacts on the water environment has been assessed in Section 9.4.1.1 (Construction) and 9.4.2.1 (Operation).
- The primary mechanisms for alteration of the water environment is considered to be excavation during the construction phase which has been carefully assessed in Section 9.4.1.1 and the emplacement of relatively impermeable concrete hardstands which has been carefully assessed within Section 9.4.2.1.
- The emplacement of the turbine hardstands will not displace a large volume of water, in the context of the overall bog basins. Any displacement of water caused by turbine installation will be a singular, localised occurrence, before the groundwater table recedes back to its static level, controlled by the surrounding drainage channels.
- The emplacement of a 600m3 turbine hardstand will displace ~450 m3 of water.

- Over a 523 hectare site, assuming each of the 15 no. turbines require the same approximate volume of concrete/lean mix, this will displace a volume of water leading to an average initial rise of 0.0012m, just over 1 millimetre.
- The groundwater will then recede back to its initial conditions with no further change in groundwater levels.
- For context, there is a ~ 20cm annual range in groundwater levels across the bogs.

On this basis, it is considered that implying the hardstands will displace a volume of water which could have any potential impacts on downstream hydrology/hydrogeology is shown to have a negligible impact on groundwater levels. This issue will not create or generate a potential significant impact.

3.2.2 HES Response to 3rd Party theme 2) issue:

- The potential effects on downstream receptors such as the River Inny, River Glore and Lough Derravaragh has been assessed in detail in Sections 9.4.1.1 to 9.4.1.10 of the EIAR. Robust and effective mitigation measures have been included within the EIAR which will break the pathway between source and receptor. These mitigation measures are outlined briefly in Section **Error! Reference source not found.** above.
- Through the implementation of these mitigation measures. there will be no significant effects on surface water quality as a result of the proposed development, including the River Inny, River Glore, and Lough Derravaragh.

3.2.3 HES Response to 3rd Party theme 3):

- Refer to Section **Error! Reference source not found.** above, i.e. response to Item 4.2 (b)

4 RESPONSE SUBMISSION SUMMARY:

- A robust and detailed EIAR for the proposed wind farm development was submitted with the SID application.
- A detailed drainage plan outlining the location of drainage mitigation measures has been submitted (Appendix 4-9 and 9-3 of EIAR).
- We have comprehensively responded to and addressed all matters raised by the Board, and by Statutory and non-statutory submissions.
- There is significant water related mitigation outlined in the EIAR to ensure that water quality protection is upheld.
- All (water-related) mitigation as outlined in the EIAR will be included in the CEMP and implemented on-site.
- We have comprehensively addressed the matters raised in the DAU submission relating to Lough Bane; and,
- The submitted EIAR concludes, and HES continue to assert, that through the implementation of the proposed groundwater and surface water protection related mitigation measures, this proposed development will not have significant impacts on the hydrology/hydrogeology of the Wind Farm Site, nor the Grid Connection Route, nor any downstream receptors such as the River Inny, River Glore and all nearby designated sites.

5 CLOSURE

We trust the above response meets your requirements. Please contact the undersigned if you have any questions regarding the above.

Yours sincerely,

Adam Keegan
Hydrogeologist
B.Sc., MSc.

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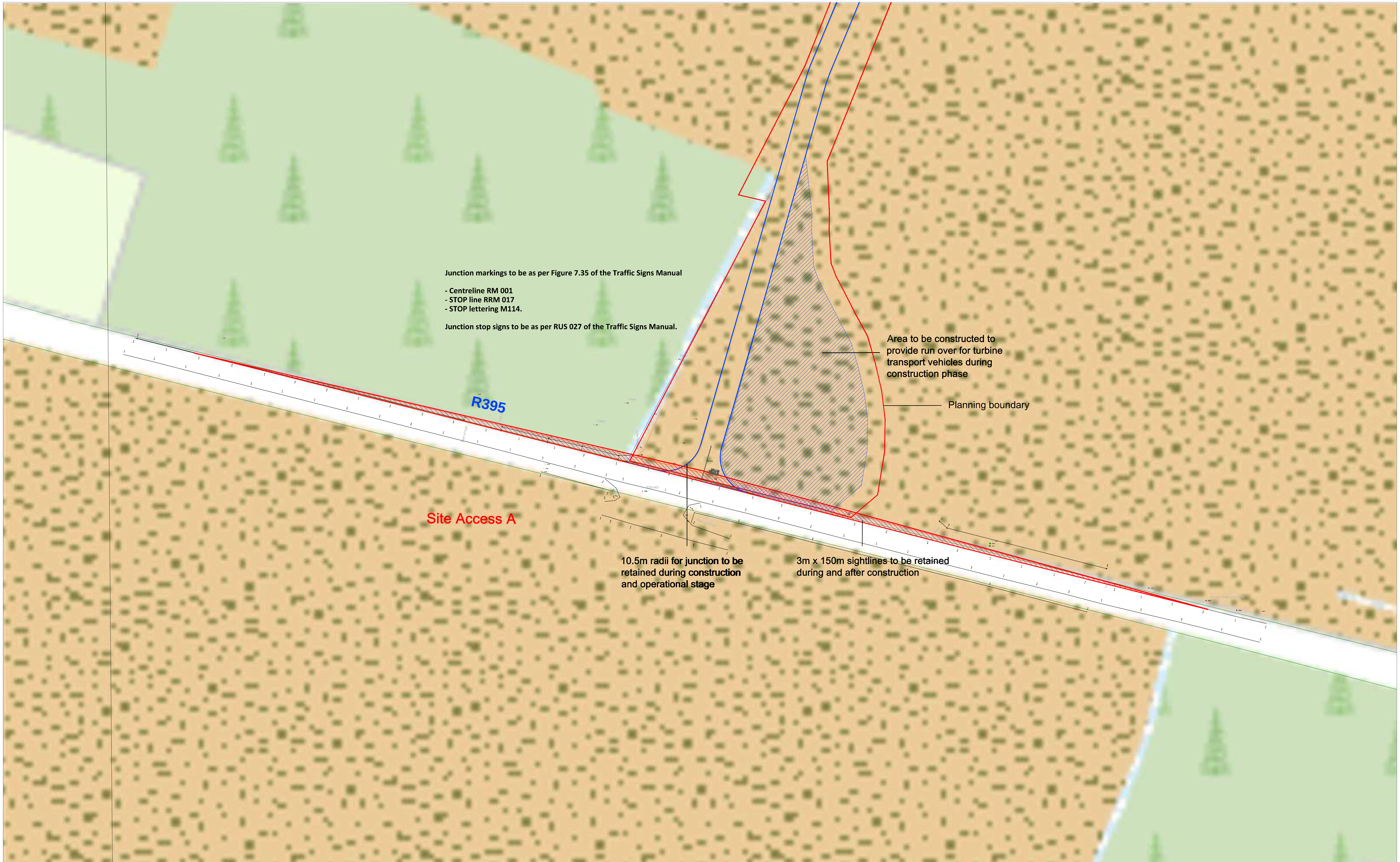
APPENDIX 3

UPDATED FIGURES 14-16, 14-19, 14-22A, 14-25, 14-28 AND 14-33



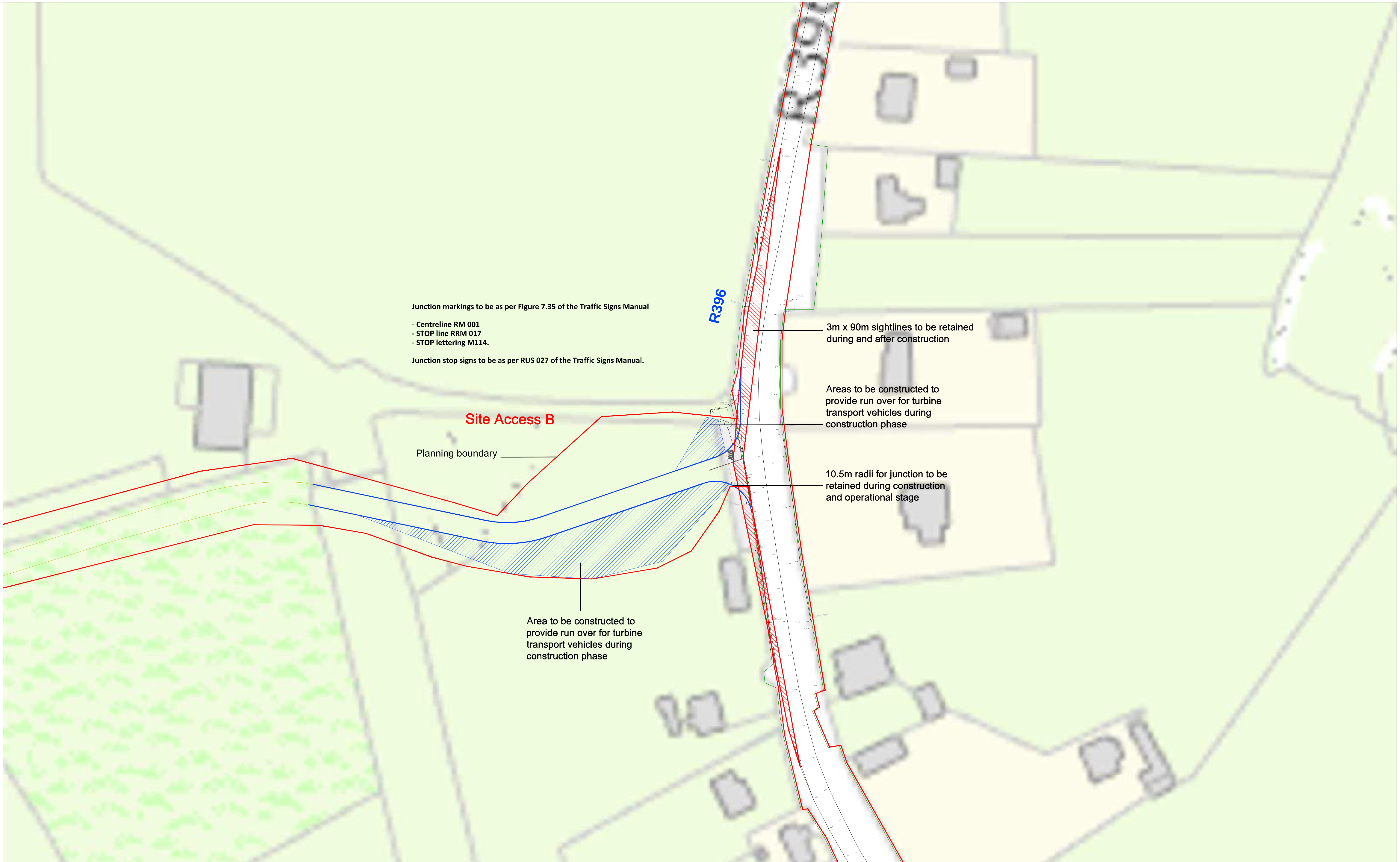
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-16 Location 5 - Site access Junction A off R395 (3m x 150m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



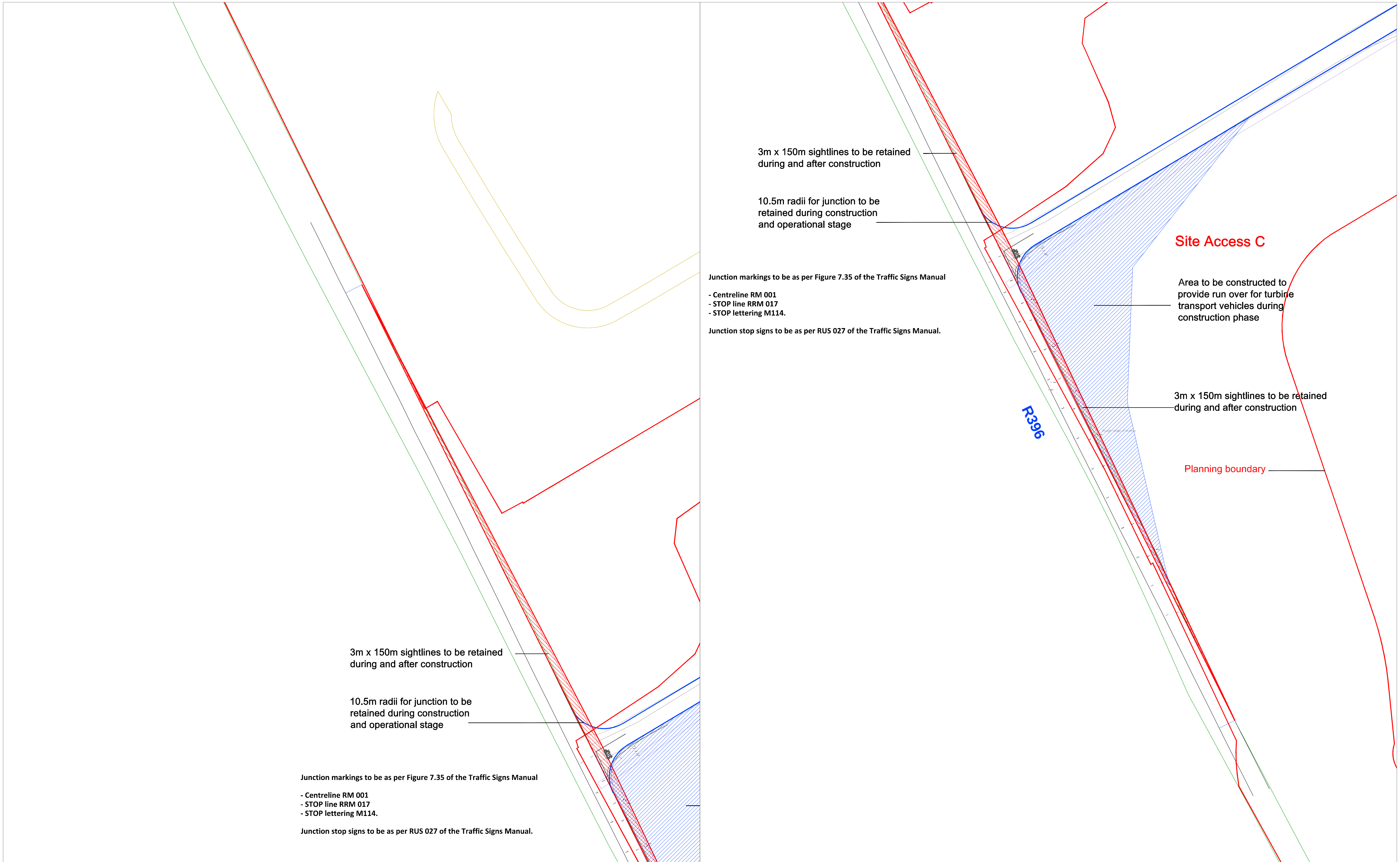
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-19 Location 6 - Site access Junction B onto R396 (3m x 90m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



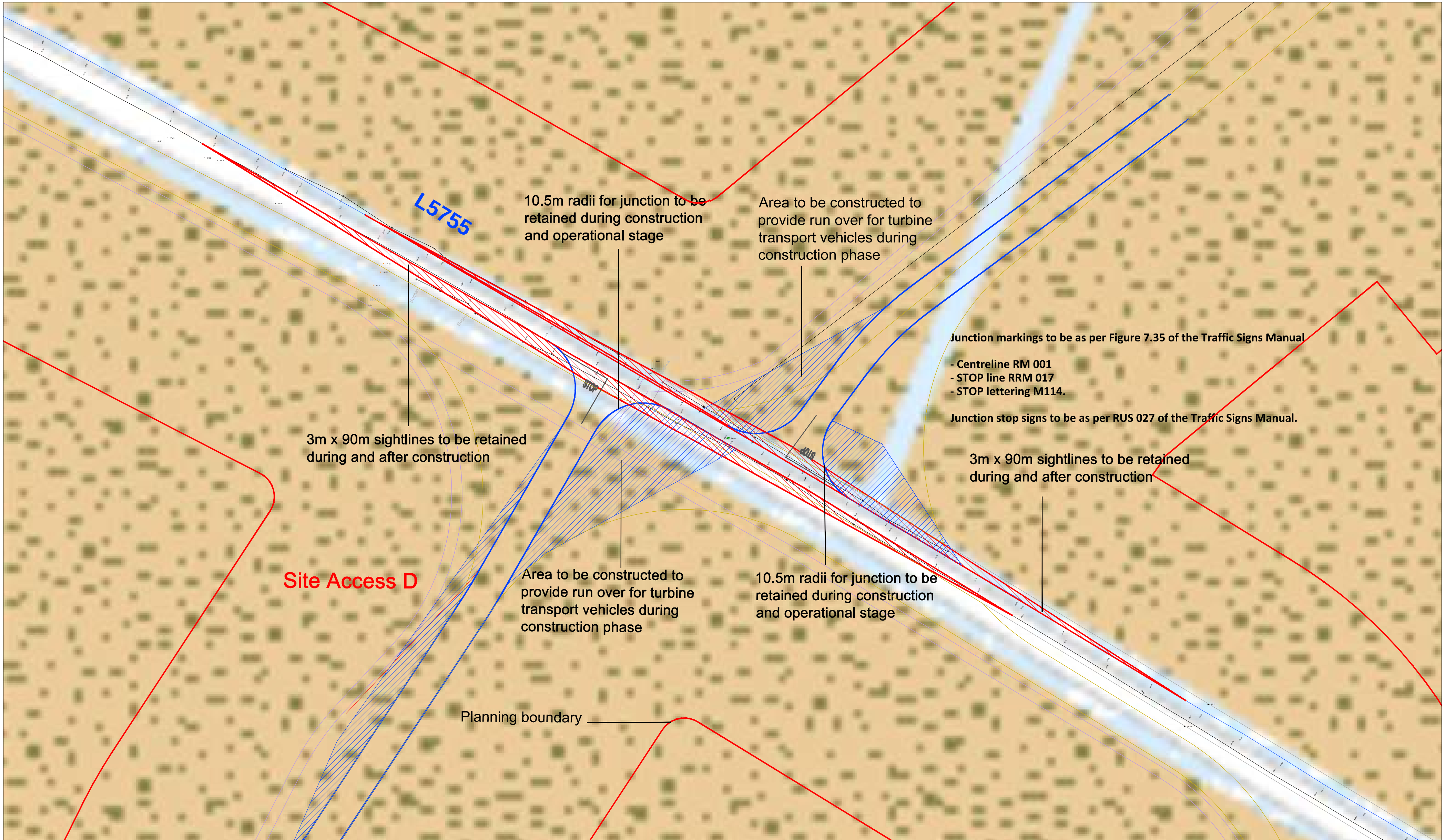
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-22a Location 7 - Site access Junction C off R396 (3m x 150m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



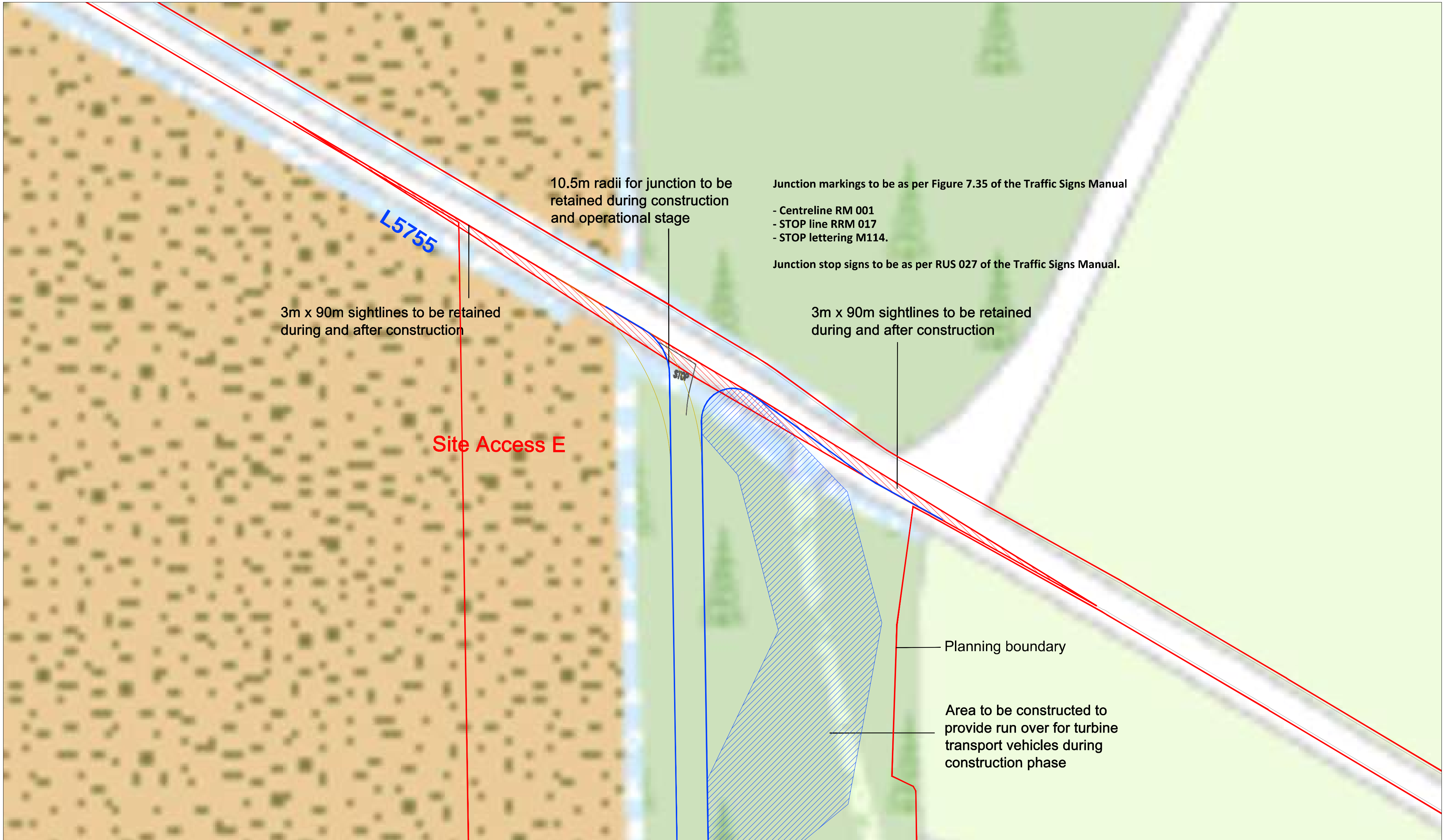
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-25 Location 8 - Site access Junction D across L5755 (3m x 90m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



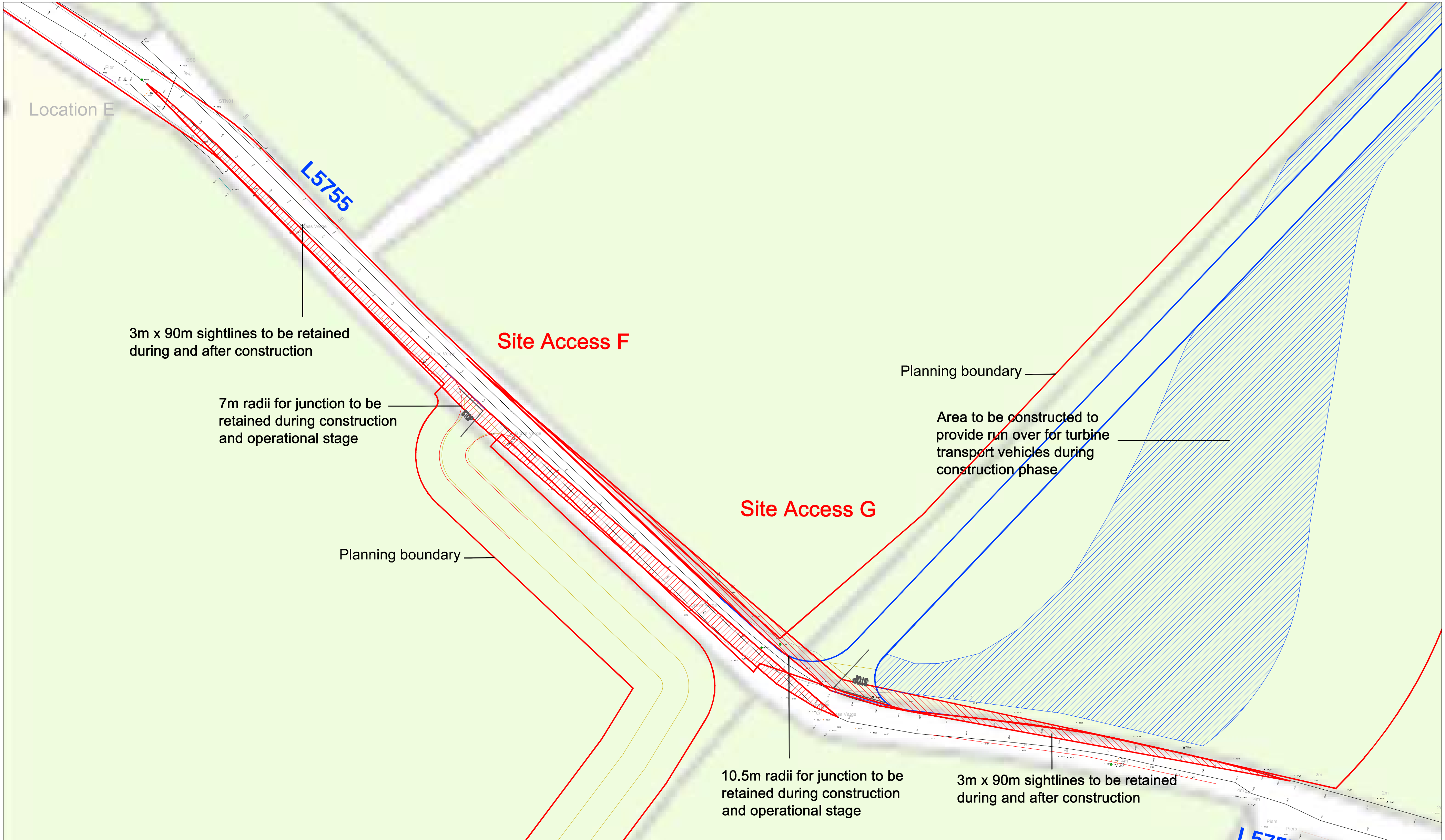
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-28 Location 9 - Site access Junction E off L5755 (3m x 90m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-33 Location 11 - Site access Junction G off L5755 (3m x 90m visibility splays)

PROJECT:	Coole Wind Farm		
CLIENT:	Coole Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 4860	DATE: 25.10.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

APPENDIX 4

FI ECOLOGY REPORTS

-REVISED NATURA IMPACT ASSESSMENT (ENCLOSED SEPERATELY)

- REVISED APPROPRIATE ASSESSMENT SCREENING REPORT

Revised Appropriate Assessment Screening Report

Coole Wind Farm, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm Optimisation**
Project Number:	**200445**
Document Title:	**Appropriate Assessment Screening Report**
Document File N	**RAASR -F – 2022.09.09 – 200445g**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	09/09/2022	LK	PR

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1. INTRODUCTION

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Screening for Appropriate Assessment of the proposed construction of a 15 No. turbine wind energy development including the grid connection, near Coole, in north Co. Westmeath. This Screening Assessment report has been revised to take account of the request for further information issued by An Bord Pleanála in relation to the project on the 21st April 2022 and the submissions from the Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage on the 17th May 2021. This document supersedes the Appropriate Assessment Screening Report that was submitted with the Planning Application.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Part XAB of the Planning and Development Act 2000, as amended. Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The current project is not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

The data underpinning this revised AA Screening Report was obtained through a desk study and field surveys undertaken between 2015 and 2020. In addition, further surveys were undertaken in 2021 and 2022 to ensure that all baseline information was up to date and relevant. Using this data, MKO has assessed the potential for the Proposed Development to result in significant effects on European sites in the absence of any best practice, mitigation or preventative measures.

This revised Appropriate Assessment Screening Report has been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
3. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*
4. *EC (2020) Guidance document on wind energy developments and nature legislation*

1.1 Appropriate Assessment

1.1.1 Screening for Appropriate Assessment

Screening is the process of determining whether an Appropriate Assessment is required for a plan or project. Under Part XAB of the Planning and Development Act, 2000, as amended, screening must be carried out by the Competent Authority. As per Section 177U of the Planning and Development Act, 2000, as amended '*A screening for appropriate assessment shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or Proposed Development, individually or in combination with another plan or project is likely to have a significant effect on the European site*'. The Competent Authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and should be recorded. The Competent Authority may request information to be supplied to enable it to carry out screening.

Consultants or project proponents may provide for the competent authority, the information necessary for them to determine whether an Appropriate Assessment is required and provide advice to assist them in the Article 6(3) Appropriate Assessment Screening decision.

Where it cannot be excluded beyond reasonable scientific doubt at the Screening stage, that a proposed plan or project, individually or in combination with other plans and projects, would have a significant effect on the conservation objectives of a European site, an Appropriate Assessment is required.

Where an Appropriate Assessment is required, the Competent Authority may require the applicant to prepare a Natura Impact Statement.

The term Natura Impact Statement (NIS) is defined in legislation[1]. An NIS, where required, should present the data, information and analysis necessary to reach a definitive determination as to 1) the implications of the plan or project, alone or in combination with other plans and projects, for a European site in view of its conservation objectives, and 2) whether there will be adverse effects on the integrity of a European site. The NIS should be underpinned by best scientific knowledge, objective information and by the precautionary principle.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provisions of section 177U of the Planning and Development Act 2000 as amended.

1.1.2 Statement of Authority

This report has been prepared by John Hynes (BSc., MSc., MCIEEM) and Laoise Kelly (BSc., MCIEEM) and reviewed by Pat Roberts (B.Sc. Environmental Science, MCIEEM). Pat has over 17 years' experience in ecological management and assessment. John Hynes has over 10 years' professional ecological consultancy experience Laoise Kelly has over 6 years' professional ecological consultancy experience and both are full members of the Chartered Institute of Ecology and Environmental Management. The baseline ecological surveys were undertaken by John Hynes B.Sc. (Env.) M.Sc MCIEEM, Pamela Boyle (PhD), Una Nealon (PhD), Laoise Kelly B.Sc. (Env.), MCIEEM and Susan Doyle B.Sc. (Env.) M.Sc (Eco). All surveyors have relevant academic qualifications and are competent experts in undertaking habitat and ecological assessments to this level. The bird surveys are undertaken by Patrick Manley (B.Sc.) Project

[1] As defined in Section 177T of the Planning and Development Act, 2000 as amended, an NIS means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a Proposed Development, on its own and in combination with other plans and projects, for a European site in view of its conservation objectives. It is required to include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for the European site in view of its conservation objectives

Ornithologist with MKO, Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

1.1.3 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of existing information obtained during the application made in 2017 as part of the permitted Coole Wind Farm.
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Review of NPWS Article 12 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Project is located.
- Review of OS maps and aerial photographs of the site of the Proposed Development
- Review of other plans and projects within the area.
- MKO field assessments and bird surveys carried out between 2015 and 2022 and as provided in full in the EIAR, NIS and associated appendices.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed wind farm site is located approximately 2.4 kilometres north of Coole village (i.e. distance from Coole village centre to the main wind farm site boundary). The town of Castlepollard is located approximately 6.7 kilometres southeast of the wind farm site boundary, at its nearest point. The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. Mullingar Substation is located in the townland of Irishtown approximately 2 kilometres northwest of Mullingar town. The proposed grid connection route measures approximately 26m from the proposed wind farm site to the existing substation near Mullingar.

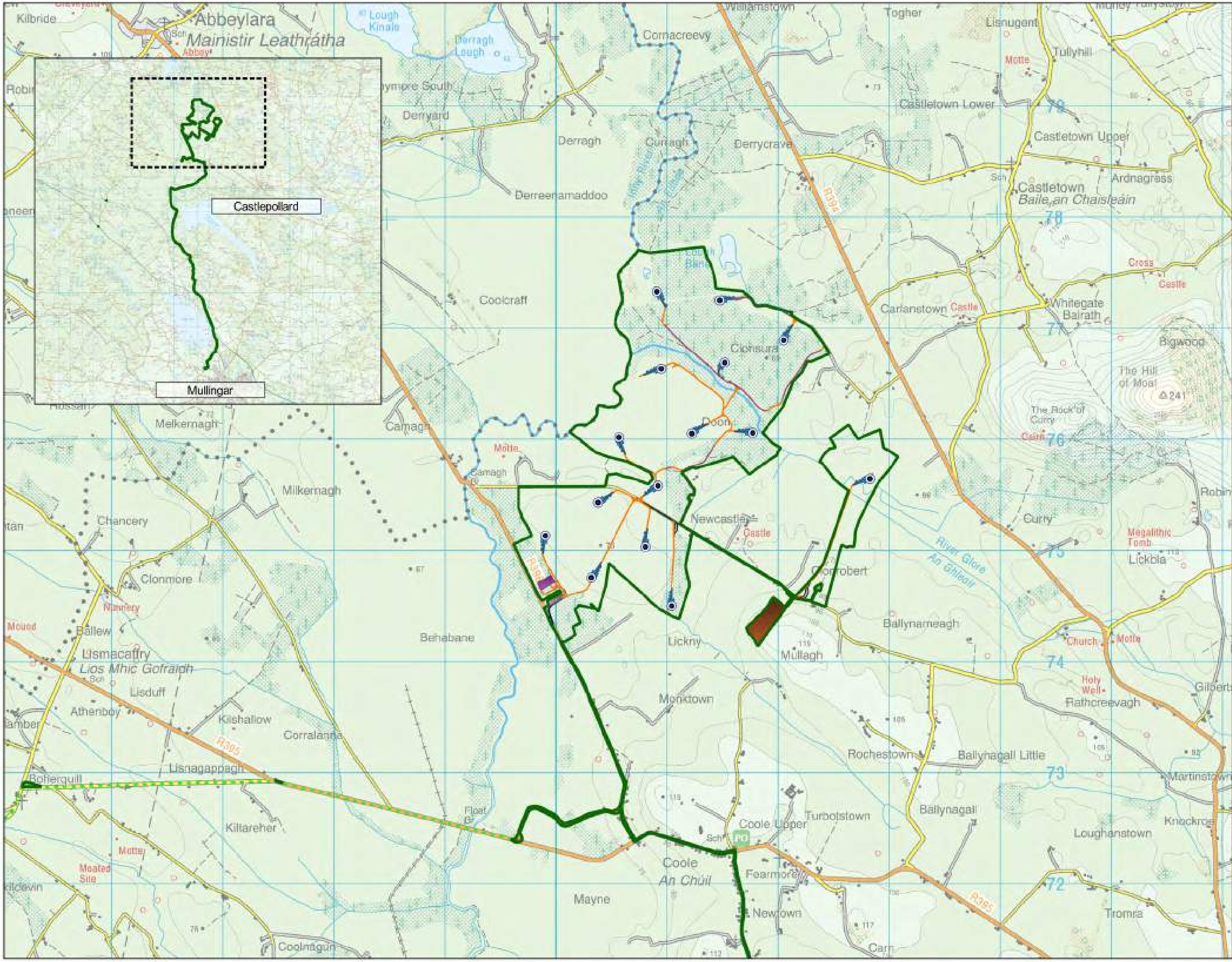
The townlands in which the proposed wind farm site, ancillary works, grid connection route and junction accommodation works are located include; Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle, Mullagh, Boherquill, Coole, Corralanna, Culvin, Joanstown, Mayne, Fearmore (Fore by), Newtown (Fore by), Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava, Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by).

The location of the proposed works is shown in Figure 2-1.

2.2 Characteristics of the Proposed Development

Project Description

A previous application for a wind farm development at this location was submitted by Coole Wind Farm Ltd. to Westmeath County Council on the 19th October 2017 and was considered under Pl. Ref. 17/6292. This application comprised of a wind farm consisting of up to 13 No. wind turbines with a tip-height of up to 175 metres, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Westmeath County Council issued their decision to refuse to grant permission on 12th December 2017 based on 1 no. refusal reason. This decision was appealed to An Bord Pleanála on 14th January 2018 and was considered under ABP-300686-18. An Bord Pleanála issued the decision to grant permission for the wind farm on 27th March 2019.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Proposed Borrow Pit
- Construction Compound
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- External Roads (Upgrades to Existing)
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Turbine Delivery Route
- Temporary Hardcore Surfacing Areas

Drawing Title: Site Location

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
HW	LK
Project No. 200445	Drawing No. Figure 2-1
Scale 1:30000	Date 2021.01.27

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The Proposed Development will comprise the construction and operation of up to 15 No. wind turbines and all associated works. The proposed turbines will have a tip height of up to 175 metres. The full description of the Proposed Development, as per the public planning notices, is as follows:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

The application is seeking a 10-year planning permission, that is that the planning consent would remain valid for 10 years following a final grant of planning permission.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

Project Location & Access

The Proposed Development site measures approximately 498 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072.

Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site.

Grid Connection

The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing 110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres.

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the Proposed Development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 03/03/2021. The datasets were utilised to identify European Sites which could feasibly be affected by the Proposed Development.
- All European Sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European Sites within a distance of 15km surrounding the development site are shown on Figure 3.1. Information on these sites with regard to their conservation objectives is provided in Table 3-1[2]. Sites that were further away from the proposed development were also considered. Given the nature, scale and location of the Proposed Development no potential for significant effect on sites that are located outside the 15km buffer were identified. The nearest downstream site outside the 15km buffer is Lough Ree SAC and SPA located over 40km hydrological distance from the proposed works and buffered by the intervening waterbody of Lough Iron. Consequently, based on distance and the existing intervening waterbodies (e.g. Lough Iron and Lough Ennell) no pathway for significant effect on these or any other European sites outside the 15km buffer was identified.
- In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the Scottish Natural Heritage (SNH) Guidance, '*Assessing Connectivity with Special Protection Areas* (SPA)' (2016) was consulted. This document provides guidance in relation to the identification of connectivity between proposed development and Special Protection Areas. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
- The site of the proposed development was not found to lie on any significant migration route for any species. The results of these surveys (including those submitted in response to the Further Information Request), provide the scientific evidence to support this conclusion.
- In addition, the results of the detailed bird surveys that were undertaken between 2015 and 2022 were taken into account during the assessment.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the Proposed Development and any European Sites. The hydrological catchments are also shown in Figure 3.1.
- The hydrological studies and analysis that was presented in the EIAR that supports the application were also taken into account in this AA Screening assessment, as was the hydrological information that is presented in response to the request for further information.
- Table 3.1 provides details of all relevant European Sites as identified in the preceding steps and assesses which are within the likely Zone of Impact.
- The results of the extensive bird surveys carried out between 2015 and 2022 were consulted in the course of this screening exercise and provided information on whether the birds recorded on the site could potentially be associated with any European Site.

[2] Office of the Planning Regulator (2021) guidance; 'OPR Practice Note PN01 Appropriate Assessment Screening for Development Management', utilises the Source-Pathway-Receptor model. This Appropriate Assessment Screening Report follows this guidance as well as providing information on European sites located within 15km of the proposed development as recommended in guidance provided by DEHLG (2010).

- The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report. Figure 3.1 shows the location of the Proposed Development in relation to all European sites within 15km of the Proposed Development.
- Where potential pathways for Significant Effect such as habitat or hydrological connectivity are identified, the site is included within the Likely Zone of Impact.

3.2 Assessment of Potential for Significant Effects on European Sites

This Appropriate Assessment Screening Report considers any potential for likely direct or indirect impacts of the Proposed Development, both alone and in combination with other plans and projects, on European Sites by virtue of the following criteria: size and scale, land-take, distance from the European Site or key features of the site, resource requirements, emissions, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this screening assessment.

Table 3.1 below identifies which European Sites are located within the Zone of Likely Impact and identifies pathways by which impacts may occur. All European Sites that are within the Zone of Likely Impact are Screened In following the precautionary principle and assessed within the Natura Impact Statement. In addition, the individual pathways by which effects may occur are identified in Table 3-1 below.

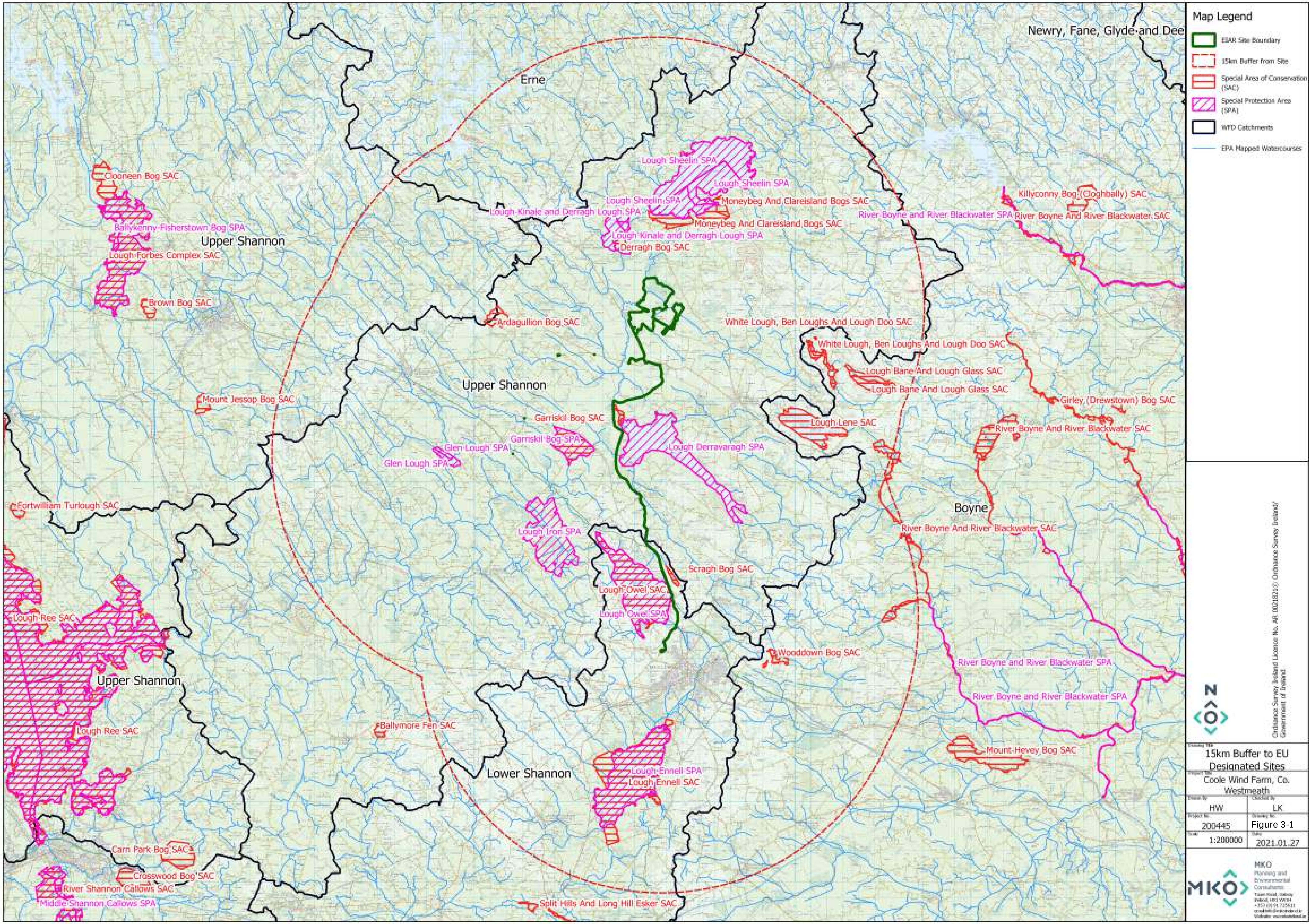
Map Legend
EIAR Site Boundary
15km Buffer from Site
Special Area of Conservation (SAC)
Special Protection Area (SPA)
WFD Catchments
EPA Mapped Watercourses
Newry, Fane, Glyde and Dee
Erne
Upper Shannon
Lower Shannon
Boyne
Cloonen Bog SAC
Ballykenny-Fisherstown Bog SPA
Lough Forbes Complex SAC
Brown Bog SAC
Lough Sheelin SPA
Moneybeg And Clareisland Bogs SAC
Lough Kinale and Derragh Lough SPA
Derragh Bog SAC
Killyconny Bog (Cloghbally) SAC
River Boyne and River Blackwater SPA
River Boyne And River Blackwater SAC
Ardagullion Bog SAC
White Lough, Ben Loughs And Lough Doo SAC
Lough Bane And Lough Glass SAC
Mount Jessop Bog SAC
Garriskil Bog SAC
Garriskil Bog SPA
Glen Lough SPA
Lough Lene SAC
Lough Derravaragh SPA
Girley (Drewstown) Bog SAC
Fortwilliam Turlough SAC
Lough Iron SPA
Scragh Bog SAC
Lough Owel SAC
Lough Owel SPA
Lough Ree SAC
Wooddown Bog SAC
Ballymore Fen SAC
Mount Hevey Bog SAC
Lough Ennell SPA
Lough Ennell SAC
Carn Park Bog SAC
Crosswood Bog SAC
River Shannon Callows SAC
Middle Shannon Callows SPA
Split Hills And Long Hill Esker SAC
N
Ordnance Survey Ireland Licence No. AR 0021821© Ordnance Survey Ireland/ Government of Ireland
15km Buffer to EU Designated Sites
Coole Wind Farm, Co. Westmeath
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Figure 3-1
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Table 3-1 Identification of Designated Sites within the Likely Zone of Impact and assessment of potential for significant effects

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Special Area of Conservation (SAC)			
Lough Owel SAC (000688) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site.	› White-clawed crayfish *Austropotamobius pallipes* [1092] › Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140] › Transition mires and quaking bogs [7140] › Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development Consequently, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate Assessment process. This site is therefore considered to be **within the Likely Zone of Impact**.
Garriskil Bog SAC (000679)	› Active raised bogs* [7110] › Degraded raised bogs still capable of natural regeneration [7120]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.06km east of the proposed grid connection route. 4.5km from windfarm site.	- Depressions on peat substrates of the *Rhynchosporion* [7150]		The SAC is located approximately 60m east of the proposed grid connection route (at its closest point.) and 4.5km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Gariskil Bog SAC There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Scragh Bog SAC (000692) **Distance:** 0.3km east of the proposed grid connection route. 14.4km from windfarm site.	- Slender green feather-moss *Drepanocladus vernicosus* [1393] - Transition mires and quaking bogs [7140] - Alkaline fens [7230] -	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 300m east of the proposed grid connection route and 14.4km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA. There is no connectivity pathway for pollution or drainage related impacts. No

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Derragh Bog SAC (002201) **Distance:** 2.4km north of the windfarm site. 4.9km from the proposed grid connection.	- Degraded raised bogs still capable of natural regeneration [7120] - Bog woodland* [91D0]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." (NPWS (2022) Conservation objectives for Derragh Bog SAC [002201]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 2.4km north of the proposed windfarm site and 4.9km from the proposed grid connection and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Moneybeg and Clareisland Bogs SAC (002340) **Distance**: 3.1km from wind farm site 6.1km from the proposed grid connection route	- Active raised bogs* [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, February 2016) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.1km north of the windfarm site 6.1km north of the proposed grid connection route and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Ardagullion Bog SAC (002341) **Distance**: 3.7km from the proposed junction works in Boherquill 7.4km from the windfarm site	- Active raised bogs* [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.7km west of the proposed junction works in Boherquill and 7.4km west of the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Ennell SAC (000685) **Distance**: 4.2km the proposed gird connection route 24km from the wind farm site	- Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, January 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230]. Consequently, following the precautionary principle, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Assessment process. **This site is therefore considered to be within the Likely Zone of Impact.**
Wooddown Bog SAC (002205) **Distance**: 5.8km from the proposed grid connection route 20.7km south east of the windfarm site	- Degraded raised bogs still capable of natural regeneration [7120]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." NPWS (2022) Conservation objectives for Wooddown Bog SAC [002205]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 5.8km east of the proposed grid connection route and 20.7km from the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Lene SAC (002121) **Distance**: 7.5km from the proposed grid connection route 8.5km from the windfarm site	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 7.5km east of the proposed grid connection route and 8.5km from the proposed wind farm site boundary. Lough Lene SAC is located in a separate hydrological catchment to the proposed works. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
White Lough, Ben Loughs and Lough Doo SAC (001810) **Distance**: 8.0km from the proposed windfarm site 9.2km from the grid connection route	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 8.0km east of the proposed wind farm site and 9.2km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Bane and Lough Glass SAC (002120) **Distance:** 10.7km from the proposed wind farm site 11.4km from the grid connection route	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] -	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 10.7km east of the proposed windfarm site and 11.4km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
River Boyne and River Blackwater SAC (002299) **Distance:** 12.7km from the proposed grid connection route	- River lamprey *Lampetra fluviatilis* [1099] - Salmon *Salmon salar* [1106] - Otter *Lutra lutra* [1355] - Alkaline fens [7230] - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Detailed conservation objectives for this site (Version 1, 03 Dec 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 12.7km east of the proposed grid connection route and 14.4km from the proposed windfarm site in a separate hydrological catchment. No complete impact source-pathway-receptor

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
14.4km from the windfarm site boundary			chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Special Protection Area (SPA)			
Lough Owel SPA (004047) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site	- Shoveler *Anas clypeata* [A056] - Coot *Fulica atra* - Wetland and Waterbirds [A999]	This site has the generic conservation objective: “To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA.” This site also has a second conservation objective: “To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.” NPWS (2022) Conservation objectives for Lough Owel SPA [004047]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located within the N4 road corridor along the boundary of the SPA at its closest point. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Lough Derravarragh SPA (004043)	- Whooper swan *Cygnus cygnus* [A038] - Pochard *Aythya farina* [A059] - Tufted duck *Aythya fuligula* [A061]	This site has the generic conservation objective:	The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016).

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.07km from the proposed grid connection route 4.8km from the windfarm site	- Coot *Fulica atra* [A125] - Wetland and Waterbirds [A999]	"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravarragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Derravarragh SPA [004043]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Garriskil Bog SPA (004102) **Distance**: 1.4km from the proposed grid connection route 7.2km from the wind farm site	- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." NPWS (2022) Conservation objectives for Garriskil Bog SPA [004102]. Generic	In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).* The following is an extract from the NPWS site synopsis for the SPA "

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.* Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, **this SPA is within the likely zone of impact and further assessment is required**
Lough Kinale and Derragh Lough SPA **Distance:** 1.8km from the windfarm site 4.4km from the proposed grid connection route	- Pochard *Aythya farina* [A059] - Tufted duck *Aythya fuligula* [A061] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."	SCI species associated with this SPA were not recorded on the site of the proposed development during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the wind farm site and the SPA, displacement related impacts are not anticipated.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Kinale and Derragh Lough SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Kinale and Derragh Lough SPA [004061]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Iron SPA **Distance**: 3km from the proposed junction works in Joanstown and 4.3km from the proposed grid connection route 11.4km from the windfarm site	- Whooper Swan *Cygnus cygnus* [A038] - Wigeon *Anas penelope* [A050] - Teal *Anas creca* [A052] - Shoveler *Anas clypeata* [A056] - Coot *Fulica atra* [A125] - Golden Plover *Pluvialis apricaria* [A140] - Greenland White-fronted Goose *Anser albifrons flavirostris* [A395] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource	Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required. The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		for the regularly-occurring migratory waterbirds that utilise it." To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: (2022) Conservation objectives for Lough Iron SPA [004046]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Glen Lough SPA **Distance:** 3.3km from the proposed junction works in Joanstown and 9.7km from the proposed grid connection route. 13.5 from the windfarm site	› Whooper Swan *Cygnus cygnus* [A038]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." (2022) Conservation objectives for Glen Lough SPA [004045]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	The wind farm site is located in over 13.5 km from the SPA with no habitat or direct surface water connectivity. The development is located outside the identified foraging range of the SCI species associated with the SPA that are listed in SNH (2016). Bird activity surveys between 2015 and 2022 have not revealed the site of the Proposed Development to be located on an identifiable migration route for this species. In addition, the detailed survey work undertaken between 2015 and 2022 has not revealed any potential for significant effect on this species as a result of the proposed development.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Works in relation to the junction upgrade locations and grid connection will be restricted to the existing road corridor with no potential to impact on this species. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Sheelin SPA **Distance:** 3.9km from windfarm site 7.8km from the proposed grid connection route	› Great crested grebe *Podiceps cristatus* [A005] › Pochard *Aythya ferina* [A059] › Tufted duck *Aythya fuligula* [A061] › Goldeneye *Bucephala clangula* [A067]	This site has the generic conservation objective: “To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA.” This site also has a second conservation objective: “To maintain or restore the favourable conservation condition of the wetland habitat at Lough Sheelin SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.” (2022) Conservation objectives for Lough Sheelin SPA [004065]. Generic	SCI species associated with this SPA were not recorded on the wind farm site during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the development site and the SPA, displacement related impacts are not anticipated. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	
Lough Ennell SPA **Distance:** 4.5km from the proposed grid connection route 24.3km from the windfarm site	- Pochard *Aythya ferina* [A059] - Tufted duck *Aythya fuligula* [A061] - Coot *Fulica atra* [A125] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (2022) Conservation objectives for Lough Ennell SPA [004044]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located outside of the designated site. The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. **This site is considered to be within the Likely Zone of Impact and further assessment is required.**

3.3 European Sites with the Potential to be Significantly Affected by the Proposed Development

The following European Sites have the potential to be significantly affected by the Proposed Development:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskill Bog SPA (004102)

Lough Owel SAC

The SAC is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SAC. There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development

Lough Ennell SAC

The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230].

Lough Owel SPA

The SPA is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA.

Lough Ennell SPA

The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

Lough Derravaragh SPA

The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered.

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution.

.Lough Iron SPA

Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required.

The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered.

Garriskil Bog SPA

This SPA is located 1.4km from the proposed grid connection route and 7.2km from the wind farm site. In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).*

The following is an extract from the NPWS site synopsis for the SPA

"*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.*

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, this SPA is within the likely zone of impact and further assessment is required.

3.4 Likely Cumulative Impact of the Proposed Works on European Sites, in-combination with other plans and projects

Where the potential for significant effects on European Sites has been identified in the preceding sections of this document, there is potential for the Proposed Development to result in cumulative effect. This potential is addressed in the NIS that accompanies this application.

Where no pathway for effect on a particular European Site was identified, there is no potential for cumulative effects on that site and no further assessment is required.

4. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

4.1 Concluding Statement

Following an examination, analysis and evaluation of the relevant data and information set out within this Screening Report, it cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the Proposed Development, individually or in combination with other plans and projects, would be likely to have a significant effect on the following sites:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)

As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the Proposed Development in order to assess whether the Proposed Development will adversely impact the integrity of these European Sites.

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Revised Natura Impact Statement

Coole Wind Farm, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm, Co. Westmeath**
Project Number:	**200445g**
Document Title:	**Natura Impact Statement**
Document File Name:	**RNIS D1 – 2022.10.19 – 200445**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	27/10/2022	LK	PR

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1. INTRODUCTION

1.1 Background

McCarthy Keville O'Sullivan Ltd. (MKO) has been appointed to prepare a Natura Impact Statement to allow the competent authority to conduct an Appropriate Assessment under Part XAB of the Planning and Development Acts 2000-2019 of the proposed construction of a 15 No. turbine wind energy development including the grid connection, near Coole, in north Co. Westmeath. This Natura Impact Statement (NIS) has been revised to take account of the request for further information issued by An Bord Pleanála in relation to the project on the 21st April 2022 and the submissions raised by the Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage on the 17th May 2021. This document supersedes the NIS that was submitted with the Planning Application.

An Appropriate Assessment Screening Report has been prepared and is provided in Appendix 1. This Appropriate Assessment Screening Report identified the European Sites upon which the Proposed Development has the potential to result in significant effects and the pathways by which those effects may occur. The Screening Report identifies the European Sites upon which significant effects could not be excluded. Those sites will be assessed in this Natura Impact Statement.

This report has been prepared in compliance with Part XAB of the Planning and Development Acts 2000-2019, the Planning and Development Regulations 2001-2019 and relevant jurisprudence of the European and Irish courts. It has also been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
3. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*
4. *EC (2020) Guidance document on wind energy developments and nature legislation*

1.1.1 Statement of Authority

This report has been prepared by John Hynes (BSc., MSc., MCIEEM) and Laoise Kelly (BSc., MCIEEM) and reviewed by Pat Roberts (B.Sc. Environmental Science, MCIEEM). Pat has over 17 years' experience in ecological management and assessment. John Hynes has over 10 years' professional ecological consultancy experience Laoise Kelly has over 6 years' professional ecological consultancy experience and both are full members of the Chartered Institute of Ecology and Environmental Management. The baseline ecological surveys were undertaken by John Hynes B.Sc. (Env.) M.Sc MCIEEM, Pamela Boyle (PhD), Una Nealon (PhD), Laoise Kelly B.Sc. (Env.), MCIEEM, Aran Von der Geest Moroney (BSc.), Kevin McElduff (BSc. Env.) and Susan Doyle B.Sc. (Env.) M.Sc (Eco). All surveyors have relevant academic qualifications and are competent experts in undertaking habitat and ecological assessments to this level. The bird surveys are undertaken by Patrick Manley (B.Sc.) Project Ornithologist with MKO, Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Patrick Manley, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

2. CONSIDERATION OF THE HABITATS AND SPECIES WITH THE POTENTIAL TO BE AFFECTED

The Article 6(3) Appropriate Assessment Screening report, that is provided as **Appendix 1** to this NIS, concluded that there was potential for the Proposed Development to result in significant effects on the following European Sites:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskil Bog SPA (004102)

This section of the NIS identifies the individual Qualifying Interests/Special Conservation Interests with the potential to be affected in each European Site and the pathways by which any such effects may occur. The location of the Proposed Development and connectivity with these EU designated sites is provided as Figure 2-1.

2.1 Lough Owel SAC

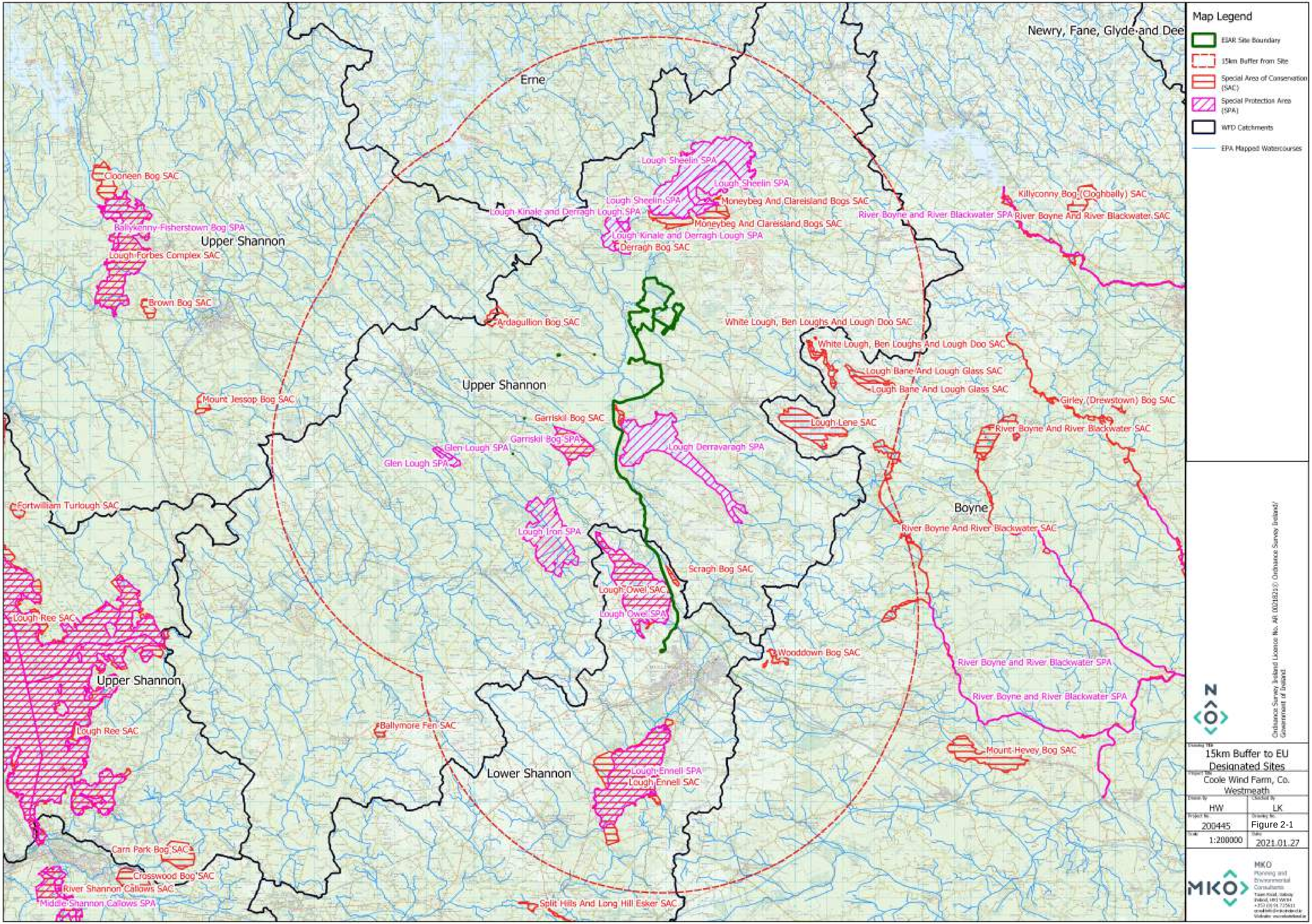
The SAC is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SAC. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]
- Transition mires and quaking bogs [7140]

2.2 Lough Ennell SAC

The SAC is located 24km south of the proposed wind farm site and 4.2km south of the proposed grid connection route. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. Taking a precautionary approach, the proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development potentially resulting in a significant effect on the following habitat for which the site is designated:

- Alkaline fens [7230]



Map Legend
EIAR Site Boundary
15km Buffer from Site
Special Area of Conservation (SAC)
Special Protection Area (SPA)
WFD Catchments
EPA Mapped Watercourses
Newry, Fane, Glyde and Dee
Erne
Upper Shannon
Lower Shannon
Boyne
Clooneen Bog SAC
Ballykenny-Fisherstown Bog SPA
Lough Forbes Complex SAC
Brown Bog SAC
Mount Jessop Bog SAC
Fortwilliam Turlough SAC
Lough Ree SAC
Carn Park Bog SAC
Crosswood Bog SAC
River Shannon Callows SAC
Middle Shannon Callows SPA
Lough Sheelin SPA
Moneybeg And Clareisland Bogs SAC
Lough Kinale and Derragh Lough SPA
Derragh Bog SAC
Ardagullion Bog SAC
White Lough, Ben Loughs And Lough Doo SAC
Lough Bane And Lough Glass SAC
Lough Lene SAC
Garriskil Bog SAC
Garriskil Bog SPA
Glen Lough SPA
Lough Derravaragh SPA
Lough Iron SPA
Lough Owel SAC
Lough Owel SPA
Scragh Bog SAC
Wooddown Bog SAC
Ballymore Fen SAC
Lough Ennell SPA
Lough Ennell SAC
Split Hills And Long Hill Esker SAC
Killyconny Bog (Cloghbally) SAC
River Boyne and River Blackwater SPA
River Boyne And River Blackwater SAC
Girley (Drewstown) Bog SAC
Mount Hevey Bog SAC
Ordnance Survey Ireland Licence No. AR 0021821© Ordnance Survey Ireland/ Government of Ireland
15km Buffer to EU Designated Sites
Coole Wind Farm, Co. Westmeath
HW
LK
200445
Figure 2-1
1:200000
2021.01.27
MKO
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2.3 Lough Owel SPA

The SPA is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection route is located adjacent to the SPA boundary, a potential pathway for significant effect was identified in the form of bird disturbance and deterioration of habitat.

The following SCI species have the potential to be significantly affected as a result of potential deterioration of water quality as well as disturbance and displacement associated with construction activity:

- *Shoveler Anas clypeata [A056]*
- *Coot Fulica atra [A125]*
- *Wetland and Waterbirds [A999]*

2.4 Lough Ennell SPA

The SPA is located 24.3km south of the proposed wind farm site and 4.5km south of the proposed grid connection route. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of the following SCI species.

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

2.5 Lough Derravarragh SPA

The SPA is located 4.8km south of the proposed wind farm site and 70m east of the proposed grid connection route. The Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the remaining bird species associated with the SPA have also been considered. Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. The following SCIs were identified as having potential to be impacted by the Proposed Development and will be assessed further:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

2.6 Lough Iron SPA

The SPA is located 11.4km south west of the proposed wind farm site, 3km from the proposed junction works in Joanstown and 4.3km west of the proposed grid connection route. The windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016). It is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al (2015). However, on a highly precautionary basis the potential for effects on the SCI species is considered in this NIS.

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. However, taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species as listed below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]

2.7 Garriskil Bog SPA

The SPA is located 1.8km from the wind farm site and 4.4km from the proposed grid connection route.In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).*

The following is an extract from the NPWS site synopsis for the SPA "

At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within th e core foraging range of the SCI species of the site:

- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]

3. DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 Site Location

The proposed wind farm site is located approximately 2.4 kilometres north of Coole village (i.e. distance from Coole village centre to the main wind farm site boundary).The town of Castlepollard is located approximately 6.7 kilometres southeast of the wind farm site boundary, at its nearest point. The townlands in which the proposed wind farm site, ancillary works, grid connection route and junction accommodation works are located, are listed in Table 3-1.

Table 3-1 Townlands within which the Project is located

Development Works	Townland
Wind Farm, including Turbines and Access Roads, Substation, Construction Compound	Coole, Monktown, Camagh, Doon, Clonsura, Clonrobert, Mullagh, Newcastle and Carlanstown
Proposed Borrow Pit	Mullagh
Junction Accommodation Works	Boherquill, Coole, Corralanna, Culvin,Joanstown and Mayne
Grid Connection Route	Camagh, Monktown, Coole, Fearmore (Fore by), Newtown (Fore by), Mayne, Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava, Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by)

A previous application for a wind farm development at this location was submitted by Coole Wind Farm Ltd. to Westmeath County Council on the 19th October 2017 and was considered under Pl. Ref. 17/6292. This application comprised of a wind farm consisting of up to 13 No. wind turbines with a tip-height of up to 175 metres, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Westmeath County Council issued their decision to refuse to grant permission on 12th December 2017 based on 1 no. refusal reason. This decision was appealed to An Bord Pleanála on 14th January 2018 and was considered under ABP-300686-18. An Bord Pleanála issued the decision to grant permission for the wind farm on 27th March 2019.

In preparing the NIS, the applicant and design team have considered in full the previous applications for the project, along with Further Information Requests received in relation to the project.

3.2 Characteristics of the Proposed Development

3.2.1 Description of the project

The Proposed Development comprises the provision of the following:

Coole Wind Farm Ltd. intends to apply for planning permission to construct a wind energy development at Coole in north Co. Westmeath. The Proposed Development will comprise of:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

The application is seeking a 10-year planning permission, that is that the planning consent would remain valid for 10 years following a final grant of planning permission.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

Project Location & Access

The Proposed Development site measures approximately 498 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072.

Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site.

Grid Connection

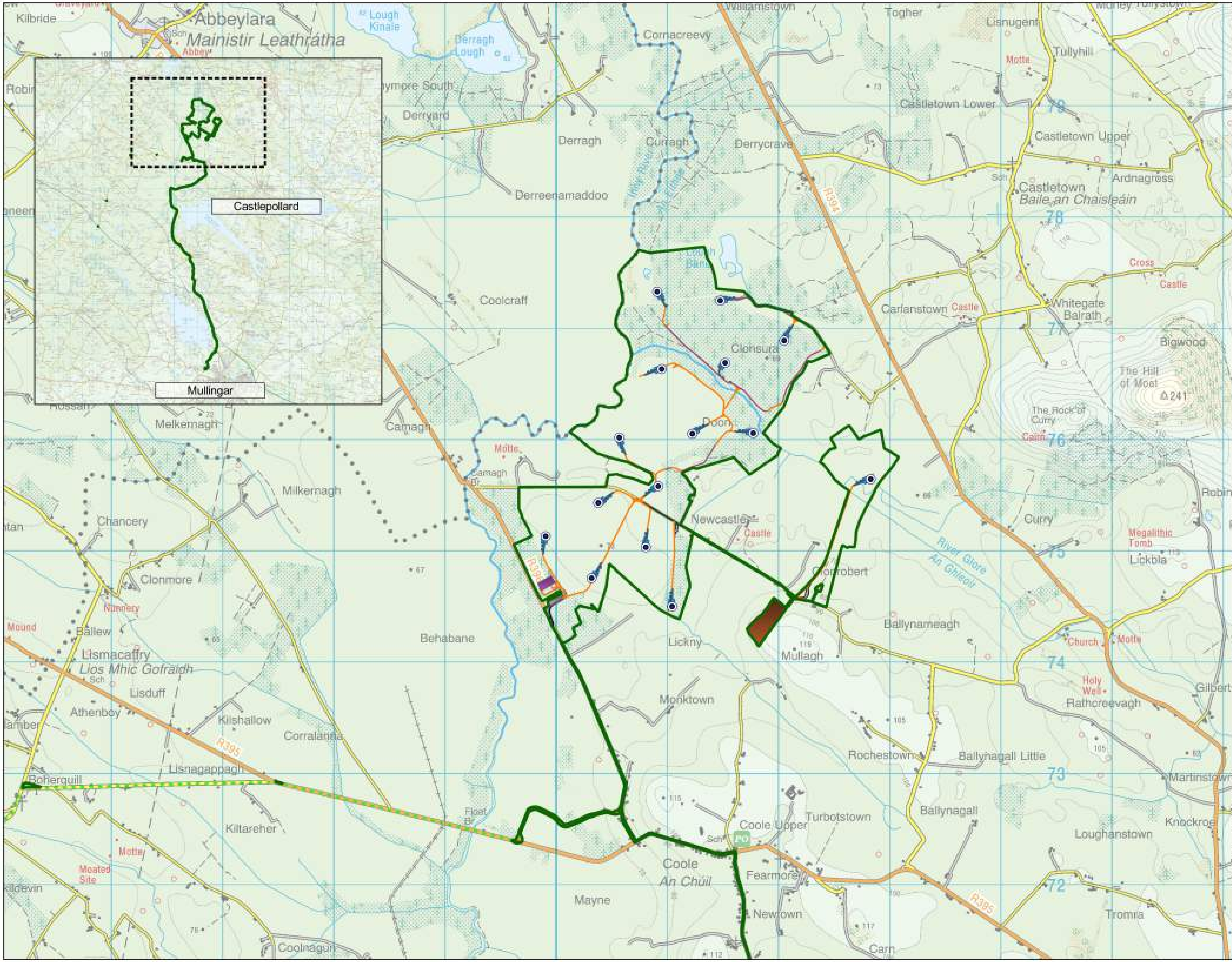
The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing

110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres.

3.2.2 Development Layout

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing over the site. A constraints study, as described in Section 3.3.5, in Chapter 3 of the EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site.

The overall layout of the Proposed Development is shown on Figure 3-1. This figure shows the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to the EIAR.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Proposed Borrow Pit
- Construction Compound
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- External Roads (Upgrades to Existing)
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Turbine Delivery Route
- Temporary Hardcore Surfacing Areas

N

Drawing Title	
Site Layout	
Project Title	
Coole Wind Farm, Co. Westmeath	
Drawn By: HW	Checked By: LK
Project No.: 200445	Drawing No.: Figure 3-1
Scale: 1:30000	Date: 2021.01.27

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3.3 Mitigation Measures and Best practice

The design of the Proposed Development, as described in Chapter 4 of the EIAR sets out very clearly how the wind farm including the grid connection has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses.

A Construction and Environmental Management Plan (CEMP) has been prepared and is included as **Appendix 2** of this report. The CEMP will be in place prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 (Description of the Proposed Development) and in the relevant chapters of the EIAR.

The CEMP also outlines that a Site Supervisor/Construction Manager and/or Environmental Manager will be appointed to maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure will provide a "triple lock" review/interaction by external specialists during the construction phase. Some of the key features of the environmental management strategy are provided below.

3.3.1 Water quality

The Proposed Development has been designed so that all large-scale infrastructure such as turbine and site compounds are located as far from watercourses as possible. These best practice construction measures are designed to avoid impacts on areas that are outside the site including downstream watercourses. The development has been designed to maintain a drainage neutral situation to avoid drainage related impacts (See Chapter 9: Hydrology and Hydrogeology).

The Proposed Development includes a detailed drainage plan that is included in full in Chapter 9 (Hydrology and Hydrogeology) of the EIAR. This plan and all the associated measures have been taken into account in this assessment but are not included in full (to avoid repetition). The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the Construction and Environmental Management Plan (CEMP) and Chapter 9 (Hydrology and Hydrogeology Chapter) of the EIAR.

The Inland Fisheries Ireland (2016): *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*; and the Scottish Natural Heritage (SNH) *Good Practice During Wind Farm Construction* (SNH, 2019, 4th Edition) will also be adhered to.

Section 9.4 of the Hydrology and Hydrogeology Chapter (Chapter 9) of the EIAR accompanying this application sets out in full the mitigation measures that will be implemented to protect water quality.

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). All major infrastructure such as turbines, substations and site compounds will be over 50m from any main watercourse (identified on EPA watercourse mapper) and 10m from any large drainage channels on the site. The only works that will be inside these buffer zones will be where access roads cross drains throughout the site and where there is a proposed upgrade to an existing watercourse crossing. There will be 2 no. crossings over the River Glore as part of the Proposed Development. The first crossing comprises the replacement of an existing timber bridge with a 5m clear span bridge connecting Turbines T5-T12 to Turbines T1-T4. The second crossing will comprise a new 5m clear-span bridge to provide access to T15. A third crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge. Figure 4-24 in Chapter 4 of the EIAR shows the typical clear span bridge design. There will be no in-stream works required as part of the Proposed Development. Additional control measures, which are outlined further on in this section, will be undertaken at the proposed watercourse and drain crossing locations.

There are a total of 16 no. watercourse crossings along the Grid Connection Route, as shown in Figure 3-2. There are 7 no. river/stream crossings (Locations No. 2, 3, 4, 10, 14, 15 & 16), with the remaining crossings being classified as culverts. All the crossings are existing bridges and culverts along the public road.

No in-stream works are required at any of these crossings, however due to the proximity of the streams to the construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work. Mitigation measures are outlined below.

A constraint/buffer zone will be maintained for all crossing locations where possible, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone;

Map Legend

- EIAR Site Boundary
- Grid Connection Route Watercourse Crossing Locations
- Proposed Grid Connection Route

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Grid Connection Route Watercourse Crossing Locations

Coole Wind Farm, Co. Westmeath

EC	MW
200445	Figure 3-2
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Increased surface water runoff during the operational phase of the Proposed Development was considered, due to the replacement of vegetated surfaces with impermeable surfaces including hardstand areas, amenity links and substation.

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

Decommissioning phase impacts will be similar to construction phase but the potential for impacts will be significantly less given that much of the infrastructure will remain in-situ. Temporary drainage measures as outlined in the Hydrology and Hydrogeology Chapter of the EIAR and best practice fuel/hydrocarbon cement management will be employed as required.

3.3.2 Hydrocarbons and Waste Material

The use of hydrocarbons during the construction process leads to the potential for pollution to enter the wider environment, including drainage ditches and watercourses. Leaks in poorly maintained plant and machinery could lead to hydrocarbon dispersal over works areas. Leaks in fuel storage tanks and spillages during refuelling operations could lead to larger releases of hydrocarbons into the environment.

The Construction and Environmental Management Plan (CEMP) provides measures to avoid impacts on the wider environment as a result of pollution and are summarised below.

3.3.2.1 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (Wind Farm Site and Grid Connection Route) and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;

- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building at the Wind Farm Site will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

3.3.2.2 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site/along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute will need to be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be directed into a dedicated concrete wash out pit. Decommissioning of this pit will occur at the end of the construction phase and water and solids will be tanked and removed from the site to a suitable, non-polluting, discharge location;
- All concrete will be paced in shuttering and will not be in contact with soils or groundwater until after it has set;
- Use weather forecasting to plan dry days for pouring concrete; and,
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

4. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

The ecological surveys that were undertaken to inform this NIS are fully described in this section. The specific surveys that were undertaken to assess the potential effects on the identified European Sites are described below.

4.1 Ecological Survey Methodologies

4.1.1 Desk Study methodology

The desk study undertaken for this assessment included a thorough review of the available ecological data associated with the study area of the Proposed Development. Sources of data included the following:

- Review of existing information obtained during the application made in 2017 as part of the permitted Coole Wind Farm.
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Review of NPWS Article 12 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Project is located.
- Review of OS maps and aerial photographs of the site of the Proposed Development.
- Review of other plans and projects within the area.
- MKO field assessments and bird surveys carried out between 2015 and 2022 and as provided in full in the EIAR, NIS and associated appendices and within the response to further information documentation associated with the application.

4.1.2 Scoping and Consultation

A detailed Scoping Document, providing details of the application site, the Proposed Development and the proposed scope of the EIAR, and inviting the comments and input of consultees, was prepared by MKO and circulated on the 31st August 2020. Copies of the scoping responses are included in Appendix 2-2 of the EIAR. Table 4.1 provides a list of the organisations consulted with regard to biodiversity during the scoping process, and notes where scoping responses were received.

The recommendations of the consultees have been taken into consideration in the preparation of this NIS.

Table 4-1 Scoping Response Summary

Consultee	Response
An Taisce	No response received to date
Bat Conservation Ireland	No response received to date
BirdWatch Ireland	No response received to date
Department of Agriculture, Food and the Marine	Response Received on 5th November 2020
Department of Communications, Climate Action & Environment	No response received to date
Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage	Submission received on 17th May 2021.
Forest Service	No response received to date
Irish Wildlife Trust	No response received to date
Geological Survey of Ireland	Response received on 2nd October 2020
Inland Fisheries Ireland	No response received to date
Irish Peatland Conservation Council	No response received to date
Irish Wildlife Trust	No response received to date
Waterways Ireland	No response received to date

4.2 Ecological Survey Methodologies

A comprehensive survey of the biodiversity of the entire site was undertaken by MKO on various dates throughout 2016, 2017, 2019, 2020, 2021and 2022. The following sections fully describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

4.2.1 Ecological Multidisciplinary Walkover Surveys

As part of the original Coole Wind Farm application that was granted in 2019, multidisciplinary walkover surveys associated with the windfarm site were undertaken by MKO in March, April, July, August and September 2016. The survey timing falls within the recognised optimum period for vegetation surveys/habitat mapping, i.e. April to September (Smith et al., 2011). Additional visits were also conducted outside the optimum survey period in March and October 2016 and in March 2017.

Surveys of the windfarm site including the proposed new turbine locations, 14 and 15, and the proposed new grid connection route were carried out on the 21st of November and 16th of December 2019 and the 31st of July and 23rd October 2020 which covered the optimal survey period. Bat surveys for the Wind Farm Site were carried out by Woodrow Sustainable Solutions over the spring, summer and autumn period in 2020. A visual inspection and driven transect of the grid connection route was carried out by MKO on 15th September 2020. These surveys provided up to date baseline data for the windfarm site as well as for the footprint of the new works proposed.

Additional Ecological Multi- Disciplinary Walkover Surveys of site of proposed development including the cable route undertaken in November 2021 and August 2022 to ensure the ecological information on the site baseline is up to date and remains accurate. The surveys were undertaken by Laoise Kelly (B. Sc. Env, MCIEEM) and Aran Von der Geest Moroney (BSc.) on the 17th and 25th of November 2021and on the 3rd , 23rd and 24th of August 2022 by Kevin McElduff (BSc. Env.).

The walkover surveys were designed to detect the presence, or likely presence, of a range of protected species. The survey included a search for badger setts and areas of suitable habitat, potential features likely to be of significance to bats and additional habitat features for the full range of other protected species that are likely to occur in the vicinity of the Proposed Development (e.g. otter etc.). In addition, an inventory of other species of local biodiversity interest was compiled including invertebrates (butterflies, dragonflies, damselflies, beetles), plants, fungi etc.

The multi-disciplinary walkover surveys comprehensively covered the entire study area and based on the survey findings, further detailed targeted surveys were carried out for features and locations of ecological significance. These surveys were carried out in accordance with NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna* on National Road Schemes (NRA, 2009).

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

Other targeted survey methodologies undertaken at the site are described in the following subsections.

4.2.1.1 Turbine Base and Infrastructure Locations

The locations of turbine bases, hard standing areas, the substation, the site compound, internal roads, haul road, borrow pit and grid connection route were visited during the multidisciplinary walkover surveys.

Botanical surveys for all turbines, road infrastructure, susbstation and all other infrastructure were undertaken. These surveys provided an understanding of the baseline and informed further survey work following finalisation of the proposed infrastructure layout. The habitat assessment surveys described in this report have been undertaken with reference to the following guidelines and interpretation documents:

- Perrin, P.M, Martin, J.R., Barron, J.R., Roche & O'Hanrahan, B. (2014) *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland.* Version 2.0. Irish Wildlife Manuals, No. 79. National Parks and Wildlife Service.
- Cross, J. & Lynn, D. (2013) *Results of a monitoring survey of bog woodland.* Irish Wildlife Manuals, No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Fernandez, F., Connolly K., Crowley W., Denyer J., Duff K. & Smith G. (2014) Raised Bog Monitoring and Assessment Survey 2013. Irish Wildlife Manuals, No. 81. National Parks and Wildlife Service, Department of Arts, Heritage and Gaeltacht, Dublin, Ireland.
- Commission of the European Communities (2007) Interpretation manual of European Union habitats. Eur 27. European Commission DG Environment.
- Foss, P.J. & Crushell, P. 2008, *Guidelines for a National Fen Survey of Ireland, Survey Manual.* Report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

- NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1. Unpublished Report, National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: *Habitat Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

4.2.1.2 Faunal Surveys

4.2.1.2.1 *Aquatic surveys*

In 2016, Ecofact Environmental Consultants were commissioned to undertake aquatic surveys of watercourses within and in proximity to the proposed wind farm site. The Aquatic Survey Report provides an overview of the habitats and plants, fish, aquatic macroinvertebrates and biological and chemical water quality at each of the 8 sampling locations. A description of site location, physical characteristics, habitats, vegetation community, macroinvertebrate community, biological water quality, chemical water quality and species specific survey results are detailed on a site by site basis. Surveys were undertaken in June 2016. The relevant extracts from the Aquatic Survey Report are provided as **Appendix 3**.

Of the eight sampling locations, seven (Sites 1, 2, 3, 5, 6, 7 & 8) are pertinent to the Proposed Development. Sampling location 4 was located on the Mayne river and has no hydrological connectivity with the Proposed Development. Sample locations 1-3 are located on the River Inny downstream of the Proposed Development.

In addition to the above assessment, watercourse crossings associated with the proposed grid connection route and locations of Turbine 14 and 15 were assessed by MKO in 2019 and 2020. This comprised a visual assessment of the character of the watercourse, associated vegetation and connectivity with other watercourses and/or sites of interest downstream.

Aquatic surveys were undertaken in 2022 and provide up to date information on the baseline aquatic environment. Details of these surveys are provided in **Appendix 3.**

4.2.1.2.2 *Invasive species survey*

During the multi-disciplinary walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

4.2.1.2.3 *Survey limitations*

Seasonal factors that affect distribution patterns and habits of species were taken into account when conducting the surveys. The potential of the site to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or nocturnal/cryptic habits) was assessed.

4.2.2 Bird Surveys

Field surveys were undertaken during two survey periods: April 2015 – March 2017 and April 2018 - March 2020. The data provided in this report is robust and allows clear, precise and definitive conclusions to be made on the avian receptors identified within the subject site. Field survey methodologies have been devised to survey for the bird species composition and assemblages that occur within the study area. The study area varied with the target species and type of survey.

Further bird surveys were undertaken between March 2021 and March 2022 to verify the results and conclusions of the previous surveys. A bird survey report is provided in **Appendix 4.** These surveys were undertaken to update and verify the previous surveys that informed the original NIS and where appropriate, to corroborate the previous findings. The surveys described below relate to the 2015 – 2018 surveys. Details of the more recent surveys are provided in **Appendix 4.**

4.2.2.1 Initial Site Assessment

Based on the results of the desk study, consultation and reconnaissance site visits, the likely importance of the study area for bird species was ascertained. Based on the collated information available from the above preliminary assessment and adopting a precautionary approach, a site-specific scope for the ornithological survey was developed.

4.2.2.2 Survey Methodologies

The survey work undertaken between October 2015 and September 2017 and April 2018 and March 2020 forms the core dataset for the assessment of effects on ornithology. Separate sections to distinguish the two sets of surveys are clearly distinguished in this assessment.

In the absence of specific national bird survey guidelines, the ornithological surveys were designed and undertaken in full accordance with '*Recommended bird survey methods to inform impact assessment of onshore wind farms'* (SNH, 2017).

The various survey types undertaken are described below.

4.2.2.2.1 *Vantage Point Surveys*

Flight activity data was collected from three vantage point locations (VPs 3, 4 and 5) (see Figure 7-1 in Chapter 7 of the EIAR) to inform a collision risk analysis and identify areas of ornithological importance within the wind farm site. The southern and eastern sections of the Site were surveyed between 2018 and 2020. While the northern section of the Site was surveyed before this, between 2015 and 2017. In total three fixed vantage points (VP3, VP5 in 2018-2020 and VP3, VP4 in 2015-2017) were required to provide adequate coverage of the proposed turbine layout. Further details are provided below.

Survey work 2018-2020

Vantage point surveys were undertaken in accordance with SNH guidance from April 2018 to March 2020. Surveys were conducted monthly throughout this survey period from four fixed vantage points (VP1, VP2, VP3 and VP5) to allow comprehensive coverage of a larger study area. The vantage point locations were selected by undertaking a viewshed analysis, as described below, and confirmed by a recce visit and initial field surveys in April 2018. Following a contraction of the proposed development area and turbine layout, only two of these four VPs have view sheds that overlap with the proposed turbine layout: VP3 and VP5.

Survey work 2015-2017

Vantage point surveys were previously undertaken to SNH guidance between October 2015 and September 2017. Surveys were conducted monthly throughout this survey period from two fixed vantage points (VP3 and VP4). Vantage point 4 provides coverage of the northern section of the wind farm site.

Figure 7-1 in Chapter 7 of the EIAR shows the locations of all vantage points relative to the development Site.

Viewshed Analysis

Viewshed analysis was carried out to show the coverage of the study area from three fixed vantage point locations (i.e. VPs 3, 4 and 5). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional layer suspended at 20 metres, which is representative of the minimum height considered for the Potential Collision Risk Area based on a worst-case scenario turbine model. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance emphasizes the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collisions with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a viewshed point 1.5 meters in height (to represent the height of observer) on a map using 10 metre contours terrain data. The relative height of forestry and its effects on visibility is also accounted for in the analysis. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 20 metres from ground level up to a 2km radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the outer most turbines of the proposed development in line with SNH (2017). The aim of the viewshed analysis is to establish whether the selected vantage points offer adequate coverage of the proposed turbine layout. The visible area within the view sheds at 20m are provided in Figures 7-2, 7-2-1, 7-2-2 and 7-2-3 in Chapter 7 of the EIAR.

Vantage points should provide the best views of potential turbine locations. Although there is a small gap in the view shed, as detailed in Figure 7-2 in Chapter 7 of the EIAR, the coverage of the site in general is considered adequate to inform the collision risk analysis, i.e. the Band Model (2007) presumes random movement of target species within the view shed, therefore given sufficient coverage of the site, the Band Model can account for gaps in the view shed.

Data Recording and Digitisation

Data on bird observations and flight activity was collected from a scanning arc of 180° and a 2km radius by an observer at each fixed location for six hours per month. Surveys were scheduled to provide a spread over the full daylight period including dawn and dusk watches to coincide with the highest peaks of bird activity. Target species were as listed in Appendix 7-1, Table 1-1 in Chapter 7 of the EIAR.

Survey effort for vantage point watches is presented in Appendix 7-2, Table 1-1 in Chapter 7 of the EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Table 4-2 below shows a summary of the VP survey work undertaken.

Table 4-2 Vantage Point Survey Effort

Survey Season	Months	Minimum Effort per VP
2015/2016 Non-Breeding Season (VP3, VP4)	Oct - Mar	36 hours/VP

Survey Season	Months	Minimum Effort per VP
2016 Breeding Season (VP3, VP4)	Apr - Sep	36 hours/VP
2016/2017 Non-Breeding Season (VP3, VP4)	Oct - Mar	36 hours/VP
2017 Breeding Season (VP3, VP4)	Apr - Sep	36 hours/VP
2018 Breeding Season (VP3, VP5)	Apr - Sep	36 hours/VP
2018/2019 Non-Breeding Season (VP3, VP5)	Oct - Mar	36 hours/VP
2019 Breeding Season (VP3, VP5)	Apr - Sep	36 hours/VP
2019/2020 Non-Breeding Season (VP3, VP5)	Oct - Mar	36 hours/VP

Observed flight activity was recorded as per defined flight bands which were chosen in relation to the dimensions of potential turbine models for the Site. Bands were split into 0-10m, 10-25m, 25m-175m and >175m. All recorded flight activity within the height bands 10-25m and 25-175m is considered to be within the Potential Collision Height (PCH) with regard to the rotor swept area, based on a worst-case scenario rotor swept area.

Each flight observation was assigned a unique identifier when mapped in the field and subsequently digitised using GIS software.

4.2.2.2.2 Breeding Bird Surveys (Adapted Brown & Shepherd Survey)

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable or confirmed breeding territories within the study area. The survey methodology followed the adapted Brown and Shepherd method as outlined in Gilbert et al. (1998) and SNH (2017) ('adapted Brown and Shepherd surveys').

Transect routes were devised to ensure coverage of different habitat complexes within the study area. Transects were selected in order to survey every area of suitable breeding/foraging habitat to within 100m, where access allowed. Target species were waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out between daylight hours during the core breeding season months between April and June/July (in 2016, 2017, 2018 and 2019). The timing of visits followed the recommendations of Calladine et al. (2009). Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

Survey effort is presented in Appendix 7-2, Table 1-2 in Chapter 7 of this EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Figure 7-3 in chapter 7 shows the area surveyed.

4.2.2.2.3 Breeding Raptor Surveys

Breeding raptor surveys (i.e. birds of prey and owls) were undertaken within the study area and its immediate surrounds. Survey methodology was as outlined in Hardey et al. (2013), as per SNH (2017) recommendations. The aim of these surveys was to identify occupied territories and monitor their breeding success within the study area. Raptor surveys were undertaken onsite and to a 2km radius from the planning/development boundary, in the form of short VP watches and walked transects. These surveys were undertaken on a monthly basis during the core breeding season period (April to July, in 2016, 2017, 2018 & 2019). All areas of suitable habitat within 2km of the Site boundary were surveyed for the presence of raptor species.

Survey effort details are provided in Appendix 7-2, Table 1-3 in Chapter 7 of the EIAR. Figure 7-4 in Chapter 7 shows the areas surveyed.

4.2.2.2.4 *Winter Transect Surveys*

Winter transect surveys were undertaken to record the presence of bird species of high conservation concern within areas of potential suitable habitat in the study area and within 500m of same.

Transect routes, devised to ensure coverage of different habitat complexes, were visited within the study area during winter months. Methodology was broadly based on adapted Brown and Shepherd methods. Target species included raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Survey effort, including details of survey duration and weather condition, is presented in Appendix 7-2, Table 1-4 in Chapter 7 of the EIAR. Figure 7-5 in Chapter 7 shows the surveyed area.

4.2.2.2.5 Waterfowl Surveys

Significant wetland sites and waterbodies within five kilometres of the study area were surveyed for waterbird populations during the 2018/19 and 2019/20 migratory/winter seasons. The area surveyed exceeded the requirements of SNH (SNH, 2017), i.e., 500m for foraging wildfowl and one kilometre for roosting wildfowl. In addition, the Lough Iron waterbird population situated approximately 12.8km to the south-west of the proposed development Site was monitored one day per month during the same period, with a particular focus on Greenland white-fronted goose. The count methodology was in line with survey guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours from suitable vantage points at the wetland sites.

Survey effort, including details of survey duration and weather condition, is presented in Appendix 7-2, Table 1-5 in Chapter 7 of the EIAR. Figure 7-5 in Chapter 7 shows the surveyed area.

4.2.2.2.6 Breeding Woodcock Surveys

Breeding woodcock surveys were undertaken in accordance with Gilbert et al. (1998). Survey visits were undertaken in June 2016 and June 2017. The survey area extended 500m beyond the Site boundary and was focused in areas of suitable habitat. Surveys commenced one hour before sunset and continued for one hour after sunset or until it was too dark to see. Transects were slowly walked through areas of suitable woodland habitat onsite and to a 500m radius of the development area. All observations of woodcock (as well as the areas covered) are recorded on to a map. The aim of the survey was to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area. This survey method also allowed the observer to survey for owls, i.e. barn owls and long-eared owls.

Survey effort is presented in Appendix 7-2, Table 1-6 in Chapter 7 of the EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Figure 7-6 in Chapter 7 shows the transect routes surveyed.

4.2.2.2.7 Grid Connection Route

Ornithological surveys were conducted as part of the multidisciplinary surveys along the proposed grid connection route carried out by MKO in 2017, 2019 and 2020. These surveys were undertaken in addition to the dedicated bird surveys carried out between 2015 and 2017 as part of the permitted Coole Wind Farm. The grid connection works will be confined to the existing road corridor, conifer plantation and Mullingar substation.

4.3 Desk Study Results

4.3.1 Lough Owel SAC

The SAC is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SAC. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]

- Transition mires and quaking bogs [7140]

The site specific conservation objective document is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000688.pdf.

The relevant QIs and the associated conservation objectives are presented in Table 4-3.

Table 4-3 Qualifying Interest and Conservation Objectives

Qualifying Interest	Conservation Objective
Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]	To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. in Lough Owel SAC
Alkaline fens [7230]	To maintain the favourable conservation condition of Alkaline fens. in Lough Owel SAC
Transition mires and quaking bogs [7140]	To maintain the favourable conservation condition of Transition mires and quaking bogs in Lough Owel SAC
Austropotamobius pallipes (White-clawed Crayfish) [1092]	To maintain the favourable conservation condition of White-clawed Crayfish. in Lough Owel SAC

4.3.1.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SAC were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-4.

Table 4-4 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	F03.01	Hunting	Inside
Medium	D04	Airports, flightpaths	Inside
Medium	D03.01.02	Piers / tourist harbours or recreational piers	Inside
Low	J02.06.02	Surface water abstractions for public water supply	Inside
Medium	D03.01.02	Piers / tourist harbours or recreational piers	Inside
Low	J02.01	Landfill, land reclamation and drying out, general	Inside
Medium	G02.10	Other sport / leisure complexes	Inside
Medium	G01	Outdoor sports and leisure activities, recreational activities	Inside
Medium	H01.05	Diffuse pollution to surface waters due to agricultural and forestry activities	Outside

A pathway for impact with regard to 'Diffuse pollution to surface waters due to agriculture and forestry activities' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.1.2 Qualifying Interests

4.3.1.2.1 *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]*

According to the detailed conservation objectives for this site, Lough Owel is one of the most important and best studied hard water lakes (3140) in Ireland. (Groves and Groves, 1893, 1895; John et al., 1982; Heuff, 1984; Pentecost, 2009; Roden and Murphy, 2013). It was in favourable conservation condition in 2011 (Roden and Murphy, 2013). Information relating to all attributes of the lake is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015). Owel is groundwater fed, has no surface water inlet and no functioning outflow. Fluctuations in lake water level are amplified at Owel by abstractions to provide 66% of Westmeath's drinking water and feed the Royal Canal (Quinlan, 2010). There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.2 *Alkaline fens [7230]*

Alkaline fen has not been mapped in detail for Lough Owel SAC and thus the total area of the qualifying habitat in the SAC is unknown. However, it is known that the areas of alkaline fens (7240) in the SAC are small and occur in close association with transition mire and quaking bogs (7140) in two main areas at the north-west (Bunbrosna) and the south-west (Tullaghan) ends of Lough Owel. Though small in area, the habitat in the SAC is considered a representative example of fen associated with an alkaline lake and possibly springs (NPWS internal files). Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.3 *Transition mires and quaking bogs [7140]*

This habitat dominates two main areas of wetland vegetation in the SAC, at the north-west (Bunbrosna) and the south-west (Tullaghan) ends of Lough Owel. These areas comprise a mosaic of different vegetation types of varying degrees of wetness with the transition mire and quaking bog vegetation grading into alkaline fen (7230), wet grassland and wet woodland (NPWS internal files). Maintenance of a permanently high water level, remaining close to the peat surface all year, with water level fluctuations within natural ranges, is required for this wetland habitat. There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.4 *Austropotamobius pallipes (White-clawed Crayfish) [1092]*

There are few geo-referenced records of white-clawed crayfish (*Austropotamobius pallipes*) from Lough Owel, but the species is mentioned in reports as being widespread in the lake. It is likely that the species is present in all the 1km squares that contain shoreline habitat. See also Reynolds (1988) and O'Connor et al. (2009). There have been outbreaks of crayfish plague (*Aphanomyces astaci*) in Ireland since 2015 and it is thought that human activity, especially the transport of disease vectors on contaminated equipment, has introduced and spread the disease, strict biosecurity is required. There should be no decline in water quality as defined by the targets set for lake habitat 3140 in Lough Owel SAC (see the conservation objective for 3140 in this volume). White-clawed crayfish (*Austropotamobius pallipes*) is tolerant of a wide range of water conditions except for the poorest quality and most acid waters. The water quality targets for lake habitat 3140 are more stringent than white-clawed crayfish require so no specific target is set for the species. There is potential for deterioration in surface water quality of the aquatic habitat associated with this species as a result of the proposed works.

4.3.2 Lough Ennell SAC

The SAC is located 24.2km south of the proposed wind farm site and 4.2km south of the proposed grid connection route. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. Taking a precautionary approach, the proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitat:

- Alkaline fens [7230]

The site specific conservation objective document is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000685.pdf. The relevant QIs and the associated conservation objectives are presented in Table 4.5. The targets and attributes for these habitats, as described in the Site-specific Conservation Objectives document, were reviewed and considered in this assessment.

Table 4-5 Qualifying Interest and Conservation Objectives

Qualifying Interest	Conservation Objective
Alkaline fens [7230]	To maintain the favourable conservation condition of Alkaline fens in Lough Ennell SAC

4.3.2.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SAC were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-6.

Table 4-6 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Medium	H06.01.01 -	Point source or irregular noise pollution	Outside
Low	B02.02 -	Forestry clearance	Outside
Low	F03.01 -	Hunting	Inside
Low	H01.08 -	Diffuse pollution to surface waters due to household sewage and waste waters	Inside

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	H01.05 -	Diffuse pollution to surface waters due to agricultural and forestry activities	Inside
Low	A04.03 -	Abandonment of pastoral systems, lack of grazing	Both
Low	A04.01.01 -	Intensive cattle grazing	Both
Low	J02.05.02 -	Modifying structures of inland water courses	Inside
Low	J02.01 -	Landfill, land reclamation and drying out, general	Inside
Low	F02.03.02 -	Pole fishing	Inside
Low	K03.01 -	Competition (fauna)	Inside
Low	H06.02 -	Light pollution	Inside
Low	D01.01 -	Paths, tracks, cycling tracks	Inside
Low	H06.01.01 -	Point source or irregular noise pollution	Inside
Low	B02.02 -	Forestry clearance	Inside

A pathway for impact with regard to 'Forestry clearance' were identified as there will be some tree felling required as part of the Proposed Development.

4.3.2.2 Qualifying Interests

4.3.2.2.1 *Alkaline fens [7230]*

According to the detailed conservation objectives for this site, alkaline fen has not been mapped in detail for Lough Ennell SAC and thus the total area of the qualifying habitat in the SAC is unknown. The habitat occurs in scattered areas around the shores of Lough Ennell and grades into reed swamp, freshwater marsh and wet woodland in places. It is best developed particularly at Robinstown, Derries, on the eastern side of the lake, and at the inlets and outlets of the River Brosna (NPWS internal files). Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). Regional abstraction of groundwater may affect fen groundwater levels. There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.3 Lough Owel SPA

The SPA is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection route is located adjacent to the SPA boundary, a potential pathway for significant effect was identified in the form of bird disturbance and deterioration of habitat.

The following SCI species have the potential to be significantly affected as a result of potential deterioration of water quality as well as disturbance and displacement associated with construction activity:

- *Shoveler Anas clypeata [A056]*
- *Coot Fulica atra [A125]*
- *Wetland and Waterbirds [A999]*

The generic Conservation Objectives are available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004047.pdf.
The relevant SCIs and their associated conservation objectives are presented in Table 4-7

Table 4-7 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Shoveler	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: ‘*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA*’.
Coot	
Wetland and Waterbirds	*‘To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.’*

4.3.3.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-8.

Table 4-8 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	F03.01	Hunting	Inside

Negative Impacts			
Rank	**Threats and Pressures**		**Inside/Outside**
Medium	F02.03	Leisure fishing	Inside
Medium	B	Sylviculture, forestry	Outside
Medium	A08	Fertilisation	Outside
Low	J02	Human induced changes in hydraulic conditions	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.3.2 Special Conservation Interests

The following relevant information on the special conservation interests of Lough Owel SPA has been extracted from the site synopsis (NPWS, 2014).

> 'Lough Owel is one of the most important Midland lakes for wintering waterfowl, with nationally important populations of Shoveler (142) and Coot (1,825) -figures given are mean peaks for the five seasons 1995/96-1999/00. The populations for both of these species represent a significant proportion (c. 4.7% and 6.5%) of the respective All-Ireland totals. The lake is utilised by Pochard (291), Tufted Duck (227) and Goldeneye (75). The lake has been used as a roost by the internationally important Midland lakes Greenland White-fronted Goose population (200 recorded at the site in 2004/05). The lake also supports populations of Little Grebe (16), Great Crested Grebe (18) and Cormorant (32). Lough Owel is one of the most important fishing lakes in the Midlands and is especially good for Trout. The lake also holds an important population of White-clawed Crayfish (*Austropotamobius pallipes*), a species that is listed on Annex II of the E.U. Habitats Directive.
>
> Lough Owel supports nationally important populations of two species, Shoveler and Coot. It is also notable as it is used as a roost site on occasion by the internationally important Midlands Greenland White-fronted Goose flock. Greenland White-fronted Goose is listed on Annex I of the E.U. Birds Directive. Lough Owel is a Ramsar Convention site.'

4.3.4 Lough Ennell SPA

The SPA is located 24.3km south of the proposed wind farm site and 4.5km south of the proposed grid connection route. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of the following SCI species.

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The generic Conservation Objectives are available at the following link
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004044.pdf
The relevant SCIs and their associated conservation objectives are presented in Table 4-9.

Table 4-9 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Wetland and Waterbirds	*'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
Pochard Aythya ferina [A059] Tufted duck Aythya fuligula [A061] Coot Fulica atra [A125]	*"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

4.3.4.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-10.

Table 4-10 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
High	E01	Urbanised areas, human habitation	Outside
High	A08	Fertilisation	Outside
Low	G05.01	Trampling, overuse	Inside
Medium	G01.02	walking, horseriding and non-motorised vehicles	Outside
Low	F03.01	Hunting	Inside
Medium	B	Sylviculture, forestry	Outside
Medium	G01.01	nautical sports	Inside
Medium	F02.03	Leisure fishing	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.4.2 Special Conservation Interests

Lough Ennell SPA has been assessed for potential impact in relation to water pollution that could result in subsequent habitat deterioration of all SCI species. The following relevant information on the special conservation interests of Lough Ennell SPA has been extracted from the site synopsis (NPWS, 2014).

'The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Pochard, Tufted Duck and Coot. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Lough Ennell is one of the most important Midland lakes for wintering waterfowl, with nationally important populations of Pochard (738), Tufted Duck (1,303) and Coot (433) - all figures are mean peaks for the 5 winters 1995/96-1999/2000. The population of Tufted Duck represents over 3% of the all-Ireland population. The site is also utilised by an internationally important population of non-migratory Mute Swan (340). Other species which occur include Golden Plover (1,000 in 1998/99), Lapwing (673), Mallard (93), Little Grebe (30), Great Crested Grebe (24) and Goldeneye (22).

Lough Ennell is of ornithological significance for wintering waterfowl, with three migratory species having populations of national importance. The occurrence of Golden Plover in the vicinity of the lake is of note as this species is listed on Annex I of the E.U. Birds Directive. Lough Ennell is a Ramsar Convention Site.'

4.3.5 Lough Derravaragh SPA

The SPA is located 4.8km south of the proposed wind farm site and 70m east of the proposed grid connection route. The Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the remaining bird species associated with the SPA have also been considered. Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. The following SCIs were identified as having potential to be impacted by the Proposed Development and will be assessed further:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The generic Conservation Objectives are available at the following link
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004043.pdf

The relevant SCIs and their associated conservation objectives are presented in Table 4-11.

Table 4-11 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Whooper Swan	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA*'.
Pochard	
Tufted Duck	
Coot	

Wetland and Waterbirds	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravaragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

4.3.5.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-12.

Table 4-12 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Medium	F03.01	Hunting	Inside
High	A05.01	Animal breeding,	Outside
Medium	B	Sylviculture, forestry	Outside
Medium	F02.03	Leisure fishing	Inside
High	A08	Fertilisation	Outside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.5.2 SCI Species and Habitats

Lough Derravaragh SPA has been assessed for disturbance to all SCI species as well as Wetland and Waterbirds. The following relevant extracts have been taken from the site synopsis for the SPA (NPWS, 2014);

> 'Lough Derravaragh is one of the most important midland lakes for wintering waterfowl. It supports nationally important populations of Whooper Swan (102), Pochard (3,129), Tufted Duck (1,073) and Coot (1,358) - all counts are mean peaks for the five winters 1995/96-1999/2000. The Pochard population is of particular note as it represents over 6% of the all-Ireland population total, and at times has exceeded the threshold for international importance (i.e. 3,500). Other species which occur include Mute Swan (159), Little Grebe (42) Great Crested Grebe (34), Cormorant (34), Wigeon (207), Teal (52), Mallard (195), Pintail (6), Shoveler (12), Goldeneye (46), Golden Plover (158) and Lapwing (1,079). The lake is occasionally used as a roost site by small numbers of Greenland White-fronted Goose. Lough Derravaragh is of major ornithological importance as it regularly supports nationally important populations of four species, and at times is used by the internationally important population of Greenland White-fronted Goose which is based in the region. Also of note is that three of the species which occur

at the site, Greenland White-fronted Goose, Whooper Swan and Golden Plover, are listed on Annex I of the E.U. Birds Directive. Lough Derravaragh is a Ramsar Convention site '

4.3.6 Lough Iron SPA

The SPA is located 11.4km south west of the proposed wind farm site, 3km from the proposed junction works in Joanstown and 4.3km west of the proposed grid connection route. The windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016). It is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al (2015).

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. However, taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species as listed below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]

The generic Conservation Objectives are available at the following link
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004046.pdf

The relevant SCIs and their associated conservation objectives are presented in Table 4-13.

Table 4-13 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Whooper Swan	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: *'To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'.*
Wigeon	
Teal	
Shoveler	
Golden Plover	
Pochard	
Greenland White Fronted goose	
Coot	

Wetland and Waterbirds	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravaragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

4.3.6.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-14.

Table 4-14 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
High	B	Sylviculture, forestry	Inside
Medium	A04	Grazing	Inside
Medium	B	Sylviculture, forestry	Outside
High	A08	Fertilisation	Outside
Medium	A08	Fertilisation	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.6.2 SCI Species and Habitats

Lough Iron SPA has been assessed for potential impact in relation to water pollution that could result in subsequent habitat deterioration of all SCI species. The following relevant extracts have been taken from site synopsis for the SPA (NPWS, 2014);

> 'Lough Iron is of international importance as a site for wintering waterfowl. It is a traditional haunt for the internationally important Midland lakes Greenland White-fronted Goose flock (426 - five year mean peak between 1994/95 and 1998/99). The site also supports an internationally important population of Whooper Swan (214) and nationally important numbers of Wigeon (1,229), Teal (759), Shoveler (164), Coot (293) and Golden Plover (2,200) - all figures are five year mean peaks for the period 1995/96 to1999/2000).
>
> Lough Iron SPA is of high ornithological importance, primarily for supporting internationally important populations of Whooper Swan and Greenland White-fronted Goose. The site also holds a notable diversity of other waterfowl, including dabbling

duck, diving duck and waders. It is of note that three of the species which regularly occur, Greenland White-fronted Goose, Whooper Swan and Golden Plover, are listed on Annex I of the E.U. Birds Directive. Lough Iron is a Ramsar Convention site and a Wildfowl Sanctuary.'

4.3.7 Garriskil Bog SPA

The SPA is located approx. 1.4km from the proposed grid connection route 7.2km from the wind farm site. In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from 1986/87 (43 individuals). The following is an extract from the NPWS site synopsis for the SPA,

At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species the following SCI associated with Garriskil Bog SPA is considered further:

- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]

The generic conservation objective document for this SPA is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004102.pdf

The relevant SCI and associated conservation objectives are presented in Table 4-15.

Table 4-15 SCI and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Greenland white-fronted goose	Detailed conservation objectives are not available for this site. This SCI species has the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA*'.

4.3.7.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-16.

Table 4-16 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
L	A04	Grazing	Outside
L	J02.05.02	Modifying structures of inland water courses	Inside
L	D01.04	Railway lines, TGV	Outside
L	D01.04	Railway lines, TGV	Inside
L	B01	Forest planting on open ground	Outside
L	J01	Fire and fire suppression	Inside
L	A10	Restructuring agricultural land holding	Outside
L	A04	Grazing	Inside
M	J02.05.02	Modifying structures of inland water courses	Outside

A pathway for impact with regard to 'Modifying structures of inland water courses' was identified as there will be some minor upgrades to water crossings as a result of the Proposed Development.

4.3.7.2 SCI Species and Habitats

Garriskil Bog SPA has been assessed for potential impact in relation to disturbance to Greenland white-fronted goose. The following relevant extracts have been taken from the site synopsis for the SPA (NPWS, 2012);

> 'At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centred around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere. Greenland White-fronted Goose is regarded as a special conservation interest for this SPA.
>
> The site is within the range of the midland lakes Greenland White-fronted Goose flock, which is centred on four major lakes (Derravaragh, Iron, Owel and Ennell). The last record of Greenland White-fronted Goose at this site was in 1986/87 (43 individuals).'

4.3.8 EPA River Catchments and Watercourses

The Proposed Development site is located within three sub-catchments. The main proposed wind farm site is located in the Inny (Shannon) SC_20 with the proposed grid connection route located in the Inny (Shannon)_SC_30 and Brosna_SC_10.

The EPA Envision map viewer was consulted on 3rd February 2021 regarding the water quality status of the Rivers which run within and directly adjacent to the Study Area. The river Glore runs through the Study Area, and the River Monktown borders the mid-eastern boundary of the site. Both rivers join with the river Inny which borders the western edge of the boundary. The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Q-values are assigned using a combination of habitat characteristics and structure of the macro-invertebrate community within the waterbody. Individual macro-invertebrate families are classified according to their sensitivity to organic pollution and the Q-value is assessed based primarily on their relative abundance within a sample.

There are two sampling stations located adjacent to the study area, one on the river Glore downstream of the western border of the site at the Camagh bridge. This sampling station has been assigned a Moderate Status (Q3-4). A second sampling station in proximity is the bridge at Rockbrook located to the east of the site. This sampling station has been assigned a Good Status (Q4).

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The Water Framework Directive Status Report 2010 - 2015, published by the Environmental Protection Agency (EPA). The River Glore where it passes through the Proposed Development site has been assessed as 'At risk'. The River Inny along the western boundary of the main windfarm site has been assessed as 'At risk' along the Proposed Development site boundary and 'Not at risk' where it continues past the southern extent of the site. The River Inny is assessed as 'Not at risk' where it crosses the proposed grid connection route at Shrubbywood and 'At risk' where it discharges from Lough Derravaragh.

4.4 Ecological Survey results

4.4.1 Habitat survey

The Coole study area is dominated by Cutover Raised Bog (PB4) (see Plates 4-1 & 4-2 below). Much of Coole bog comprises milled peat and is divided up by drains, spaced approximately 15m apart, which separate long parallel Peat production fields. The lands to the east of the site comprise agricultural land. The edge of the main windfarm site is bordered by Conifer Plantation to the east and south while the lands surrounding T15 are predominantly agricultural in nature. The River Inny borders the west of the site and the River Glore, a tributary of the Inny, runs in an east to west direction through the study area.

Almost all the cutover bog within the study area has been used for peat production and the existing drainage network is maintained. Cutover bog areas are relatively dry with no vegetation cover, other than occasional plants recorded on the sloping banks of drains.

For ease of description, the main wind farm study area can be divided up into two distinct sections: North of the Glore River and South of the Glore River (including the section to the south of the local road which connects the R396 with the R394). In addition, the proposed borrow pit, grid connection and turbine delivery routes are also described in the sections below. A habitat map of the Proposed Development is provided in Figure 4-1 and 4-2.

North of the Glore River

This area is dominated by milled cutover bog. Conifer plantation is the dominant habitat to the north east and south. To the north east, the cutover bog is fringed by Non-Annex I Bog woodland (Plate 4-3). The bog woodland is quite open and the ground cover is dominated by Bramble (*Rubus fruticosus* agg.), Ivy (*Hedera helix*), Purple Moor-grass (*Molinia caerulea*) and Bracken (*Pteridium aquilinum*). Other species present include Broad Buckler Fern (*Dryopteris dilatata*), Heather (*Calluna vulgaris*), Honeysuckle (*Lonicera periclymenum*) with occasional Hawthorn (*Crataegus monogyna*) and Gorse (*Ulex europaeus*). There are some narrow sections of Degraded raised bog (PB1), dominated by Ling Heather, along the margins. These areas are partially drained (Plate 4-4).

To the north, outside the site boundary is an area that has been stripped entirely of peat. This area is at a significantly lower gradient compared to the remaining cutover bog within the site boundary. To the west, the cutover bog is bordered by an intact area of remnant raised bog habitat which surrounds a small dystrophic lake (Plate 4-5). The dominant vegetation recorded from the remnant bog section comprised Ling (*Calluna vulgaris*) and Common Cottongrass (*Eriophorum vaginatum*). Bryophytes were abundant throughout with *Sphagnum cuspidatum*, *Sphagnum papillosum*, *Sphagnum magellanicum* and *Sphagnum capillifolium* recorded. The lichen *Cladonia portentosa* was common. The dystrophic lake was fringed by a floating mat of poor fen vegetation dominated by Bottle Sedge (*Carex rostrata*). Bog bean (*Menyanthes trifoliata*) was also recorded.

Continuing west, an area of Non Annex I bog woodland was recorded along with a fringe of wet grassland and scrub along the banks of the River Inny. Fringes of Reed and large sedge swamp (FS1), dominated by Common reed (*Phragmites australis*) were recorded immediately adjacent to the River Inny (Plate 4-6).

The Glore River is a tributary of the Inny and was classified as a Lowland depositing river (FW2). The Glore River marks the southern boundary of the northern section of the main proposed wind farm site. The watercourse was surrounded by a narrow strip of Mixed Broadleaved/conifer Woodland (WD2). Species recorded included Poplar (*Populus* sp.), Scots Pine (*Pinus sylvestris*), Spruce (*Picea sitchensis)* and Grey Willow (*Salix cinerea*).

A number of small silt ponds, associated with the existing onsite drainage network, occur and were classified as Other artificial lakes and ponds (FL8). The on-site drainage features (FW4) drain into the silt ponds (Plate 4-7). Vegetation recorded from the ponds included Pondweed (*Potamogeton natans*), Reedmace (*Typha latifolia*) and Water Horsetail *(Equisetum sp.)*.

The banks of the Glore River were heavily vegetated (Plate 4-8). Species recorded included Reed Canary Grass (*Phalaris arundinacea*), Floating sweet grass (*Glyceria fluitans*), Hogweed (Heracleum sphondylium), Angelica (*Angelica sylvestris*), Great Willowherb (*Epilobium hirsutum*), Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*), Brambles (*Rubus fruticosus* agg.), Meadowsweet (*Filipendula ulmaria*), Bindweed (*Calystegia sepium*). *Sparganium emersum* and Pondweed (*Potamogeton* sp.) were the only instream vegetation recorded. Small stands of Bracken (*Pteridium aquilinum*) were also recorded.

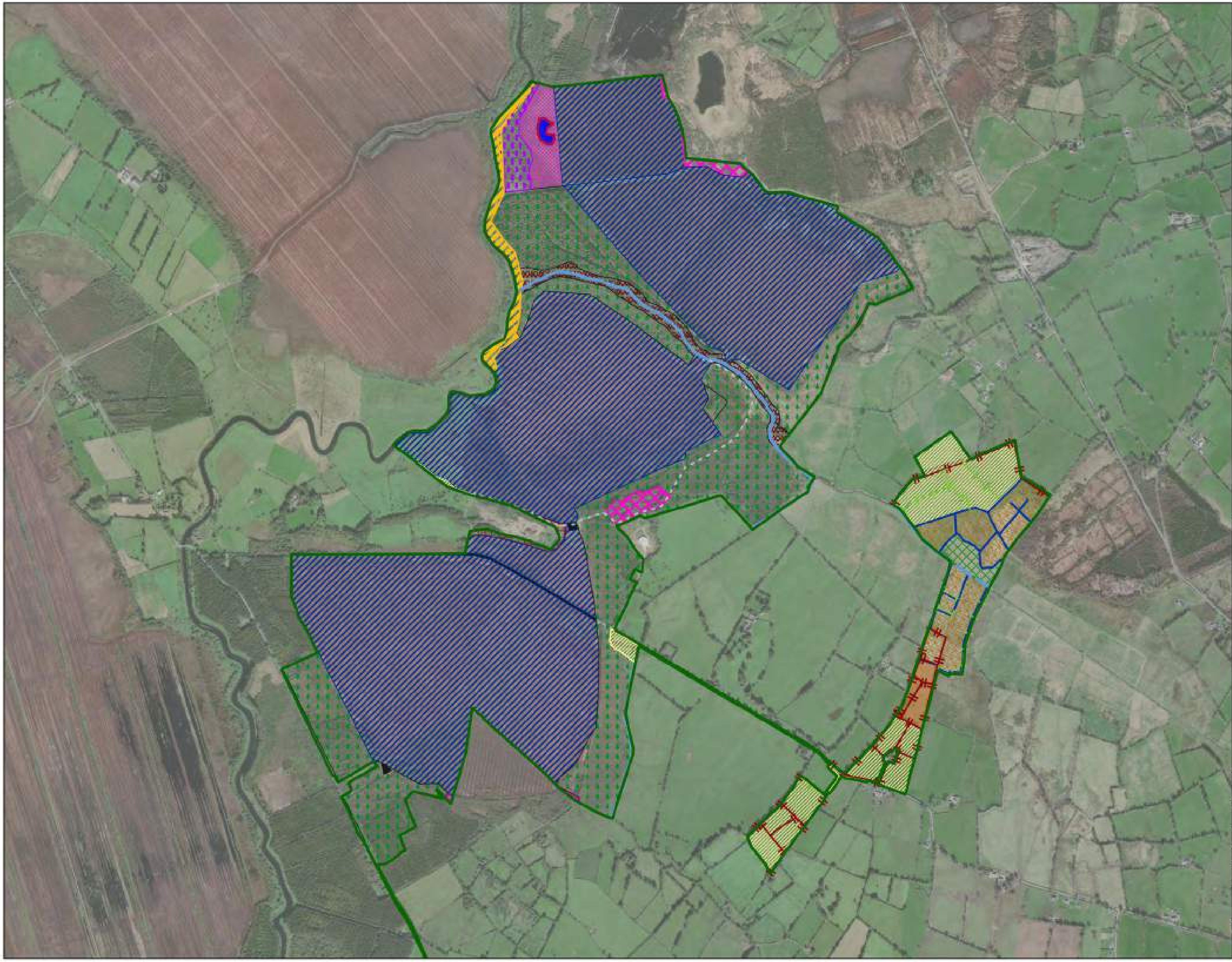
The proposed T15 is located to the east of the site within agricultural grassland categorized as Improved Agricultural Grassland (GA1)/Wet Grassland (GS4). The proposed access road to T15 will follow the local road (L5775) from the centre of the main windfarm site in an easterly direction before travelling north across a number of agricultural fields comprising Improved Agricultural Grassland (GA1), Dry Meadows and Grassy Verges (GS2) and a species rich Wet Grassland (GS4) located immediately north of the Glore River. The grassland habitats supported species including Meadowsweet (*Filipendula ulmaria*), Conglomerate Rush (*Juncus conglomeratus*), Meadow Buttercup (*Ranunculus acris),* Sheep Sorrell (*Rumex acetosa*), Yorkshire Fog (*Holcus lanatus*), Sweet Vernal grass (*Anthoxanthum odoratum*), Broadleaved Dock (Rumex obtusifolius), Silverweed (*Potentilla anserina*), Cock's-foot (Dactylus glomerata), Dandelion (*Taraxcum officinale agg*.) Nettle (*Urtica dioica*), Broadleaved Plantain (*Plantago lanceolata*) and Clover (*Trifolium spp*.) and did not correspond to any grassland habitat listed under Annex I. The access road will cross the River Glore via a clear span bridge to access the turbine location. The fields along the proposed access road are demarcated by Treeline (WL2) (Plate 4-9) and Hedgerow (WL1) (Plate 4-10) supporting species such as Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus),* Willow *(Salix spp.)* and Hawthorn (*Crataegus monogyna*). Species within the field at the proposed Turbine 15 location included Yorkshire Fog (*Holcus lanatus*), Pernnial Rye-grass (*Lolium perenne*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Conglomerate Rush (*Juncus conglomerataus*), Red Fescue (*Festuca rubra*), Tormentil (*Potentilla erecta*), Sheep Sorrell (*Rumex acetosa*) and Cock's-foot (*Dactylus glomerata*) (Plate 4-11).

South of the Glore River

This area is dominated by cutover bog. Conifer plantation, dominated by Lodgepole Pine and (*Pinus contorta*) and Spruce (*Picea stichensis*) is the dominant habitat to the north and east. Exiting forestry access tracks were classified as Spoil and bare ground (ED2).

The River Inny forms the western boundary of the site. The watercourse is fringed by a narrow strip of Wet grassland (GS4). Toward the south western corner of the site is an area which is relatively dry and dominated by a mosaic of degraded/cutover bog and grassland dominated by Yorkshire Fog, Creeping Bent and occasional Soft Rush.

Continuing south, and crossing the existing local road, the study area continues to be dominated by Cutover bog. The proposed new access road to Turbine 14 leaves the local road and travels south traversing Conifer Plantation (WD4) supporting species of Lodgepole Pine and (*Pinus contorta*) and Spruce (*Picea sitchensis*) adjacent to this Cutover Bog (PB4) habitat. Turbine 14 will be located within this conifer plantation approximately 700m south of the local road as shown in Plate 4-12.



Map Legend

- EIAR Site Boundary
- Buildings and artificial surfaces(BL3)
- Dystrophic lakes (FL1)
- Improved agricultural grassland (GA1)
- Dry meadows and grassy verges (GS2)
- Wet grassland (GS4)
- Wet grassland/Scrub (GS4/WS1)
- Raised bog (PB1)
- Cutover bog (PB4)
- Poor fen and flush (PF2)
- Mixed broadleaved/conifer woodland (WD2)
- Conifer plantation (WD4)
- Bog woodland (WN7)
- Scrub (WS1)
- Improved agricultural grass--land/Wet Grassland mosaic (GA1/GS4)
- Bog Woodland/Scrub mosaic
- Spoil and Bare Ground (ED2)
- Depositing/ Lowland Rivers (FW2)
- Drainage Ditches (FW4)
- Hedgerows (WL1)
- Treelines (WL2)

Drawing Title	
Habitat Map	
Project Title: Coole Wind Farm, Co. Westmeath	
Drawn By: HW	Checked By: LK
Project No.: 200445	Drawing No.: Figure 4-1
Scale: 1:15000	Date: 2021.01.27

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Map Legend
EIAR Site Boundary
Buildings and artificial surfaces(BL3)
Dystrophic lakes (FL1)
Improved agricultural grassland (GA1)
Dry meadows and grassy verges (GS2)
Wet grassland (GS4)
Wet grassland/Scrub (GS4/WS1)
Raised bog (PB1)
Cutover bog (PB4)
Poor fen and flush (PF2)
Mixed broadleaved/conifer woodland (WD2)
Conifer plantation (WD4)
Bog woodland (WN7)
Scrub (WS1)
Improved agricultural grass-land/Wet Grassland mosaic (GA1/GS4)
Bog Woodland/Scrub mosaic
Spoil and Bare Ground (ED2)
Depositing/ Lowland Rivers (FW2)
Drainage Ditches (FW4)
Hedgerows (WL1)
Treelines (WL2)
N
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Habitat Map - Link Road
Coole Wind Farm, Co. Westmeath
HW
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200445
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Plate 4-1 Milled peat field (North of Wind Farm Site)

Plate 4-2 Milled peat field and typical drain (South of Glore River)

Plate 4-3 Bog Woodland WN7 Non Annex I (North western Wind Farm Site boundary)

Plate 4-4 Fringe of remnant Raised bog between Cutover Peat and Bog Woodland (North of Wind Farm Site)

Plate 4-5 Dystrophic Lake, fringing poor fen and remnant degraded raised bog.

Plate 4-6 River Inny, fringing reed swamp and adjacent wet grassland and willow scrub.

Plate 4-7 Silt Pond

Plate 4-8 Glore River Corridor

Plate 4-9 Example of Treeline (WL2) along the field boundaries on the proposed access road to Turbine 15

Plate 4-10 Young Hawthorn Hedgerow (WL1) along proposed access road to Turbine 15

Plate 4-11 Proposed location of T15 looking south categorised as a mosaic of Improved Agricultural Grassland (GA1)/Wet Grassland (GS4)

Plate 4-12 Proposed location of T14 within Conifer Plantation (WD4)

4.4.1.1.1 Proposed Borrow Pit

The proposed borrow pit is located approximately 700 metres east of the nearest proposed turbine location (T14). The proposed borrow pit is linked to the main area of the proposed wind farm site via the L5755 local road.

The habitats present at the borrow pit location included Improved agricultural grassland (GA1) surrounded by Hedgerow (WL1) and Treelines (WL2). The grassland is utilised for agricultural purposes. Species recorded form the sward included Perennial Ryegrass (*Lolium perenne*), Cocksfoot (*Dactylis glomerata*), Meadow Foxtail (*Alopecurus pratensis*), Meadow Grasses (*Poa* spp.), Creeping Thistle (*Cirsium arvense*), Chickweed (*Cerastium fontanum*), Soft Rush (*Juncus effuses*) and Nettle (*Urtica dioica*). Species recorded from the hedgerows included Hawthorn, Bramble, Dog Rose (*Rosa canina*). Treelines were dominated by Ash (*Fraxinus excelsior*) and Beech (*Fagus sylvatica*).

4.4.1.1.2 Habitats on the Grid Connection Route

The proposed grid connection route will be located within the carriageway/verge of existing public roads. There is no requirement to use habitats located outside the road carriageway except at the Northern and Southern ends where the connection points leave the public road for termination. All roads within/adjacent to the proposed cable route were classified as Building and Artificial Surfaces (BL3). Much of the cable route was bordered by a verge supporting Dry Meadows and Grassy Verges (GS2). Also present along the road, outside the working area, were Hedgerows (WL1), Treelines (WL2), Earth Banks (BL2), Stone Walls (BL1), Scrub (WS1), Spoil and Bare Ground (ED2), Flower Beds and Borders (BC4) and Buildings and Artificial Surfaces (BL3). No Annex I habitats were recorded within the road carriageway.

Habitats recorded beyond the road boundary included Improved Agricultural Grassland (GA1), Wet Grassland (GS4), Cutover Bog (PB4), Wet Heath (HH3) and Conifer Plantation (WD4). Less frequently recorded habitats included Mixed Woodland (WD2), Broadleaved Woodland (WD1), Amenity Grassland (GA2) and Reed and Large Sedge Swamps (FS1).

Peat Areas

Following consultation and correspondence with Westmeath County Council in relation to the proposed underground grid connection route, a peat stability assessment of sections of public roads underlain by peat of the grid connection route was carried out by Applied Ground Engineering Consultants (AGEC)[1],in April 2017. This geotechnical assessment report was previously submitted as part of the 13 Turbine Coole Wind Farm application, as detailed in Section 2.5.1 in Chapter 2 of the EIAR. The purpose of this assessment was to establish the ground conditions in three priority sections of road (as identified by Westmeath County Council at the time) with respect to construction of the underground cables and the potential effects on the structural integrity of the roads. While additional more detailed investigations have since been carried out into peat depths along the route, resulting in a more refined and robust construction methodology, the report findings in terms of ground conditions are still very useful, and are presented as Appendix 4-4 of Chapter 4 of the EIAR. The sections of road assessed by AGEC measure approximately 8 kilometres in total and are shown in Figure 4-15 of Chapter 4 of the EIAR. Following this, IONIC Consulting Engineers design of the cable and substation works required have incorporated any available historical data and reports described above, in addition to carrying out their own site investigations and are presented in Appendix 4-3 of the EIAR.

To further investigate the grid connection route, a geophysical investigation was conducted by APEX Geophysics Ltd. in October 2019 to determine the presence/thickness of peat along the grid connection route. This has been provided as Appendix 4-5 of the EIAR. As detailed in Section 2.6.3 in Chapter 2 of the EIAR, the intended approach, i.e. confirming that the grid connection could be laid without affecting the integrity of the road, was set out in correspondence issued to the Planning Authority in

[1] *AGEC Ltd were rebranded and became Fehily Timoney (FT) in 2019.*

September 2017 as detailed in Section 2.6.3 of the EIAR. Following that, further details relating to construction methodology and design were discussed at the two pre-planning meetings that took place on the 15th of August 2019, and the 4th of February 2020. The approaches discussed in these meetings were considered satisfactory by the Planning Authority at that time.

In summary, where the existing road is located on peat, specific engineering designs have been carried out in order to accommodate the cable within the road corridor in these areas. Three such areas where this is required were originally identified by geotechnical assessment carried out by AGEC and measure approximately 8km in total as described in Appendix 4-4 of Chapter 4 of the EIAR. In addition, a geophysical investigation was produced by APEX in October 2019 to determine the presence/thickness of peat along the route. This has been provided as Appendix 4-5 of Chapter 4 of the EIAR. and has informed the proposed construction methodologies. There are six options for cable laying in peat areas as detailed in Chapter 4 of the EIAR. IONIC Consulting Engineers design of the cable and substation works required have incorporated any available historical data and reports described above, in addition to carrying out their own site investigations and are presented in Appendix 4-3 of the EIAR.

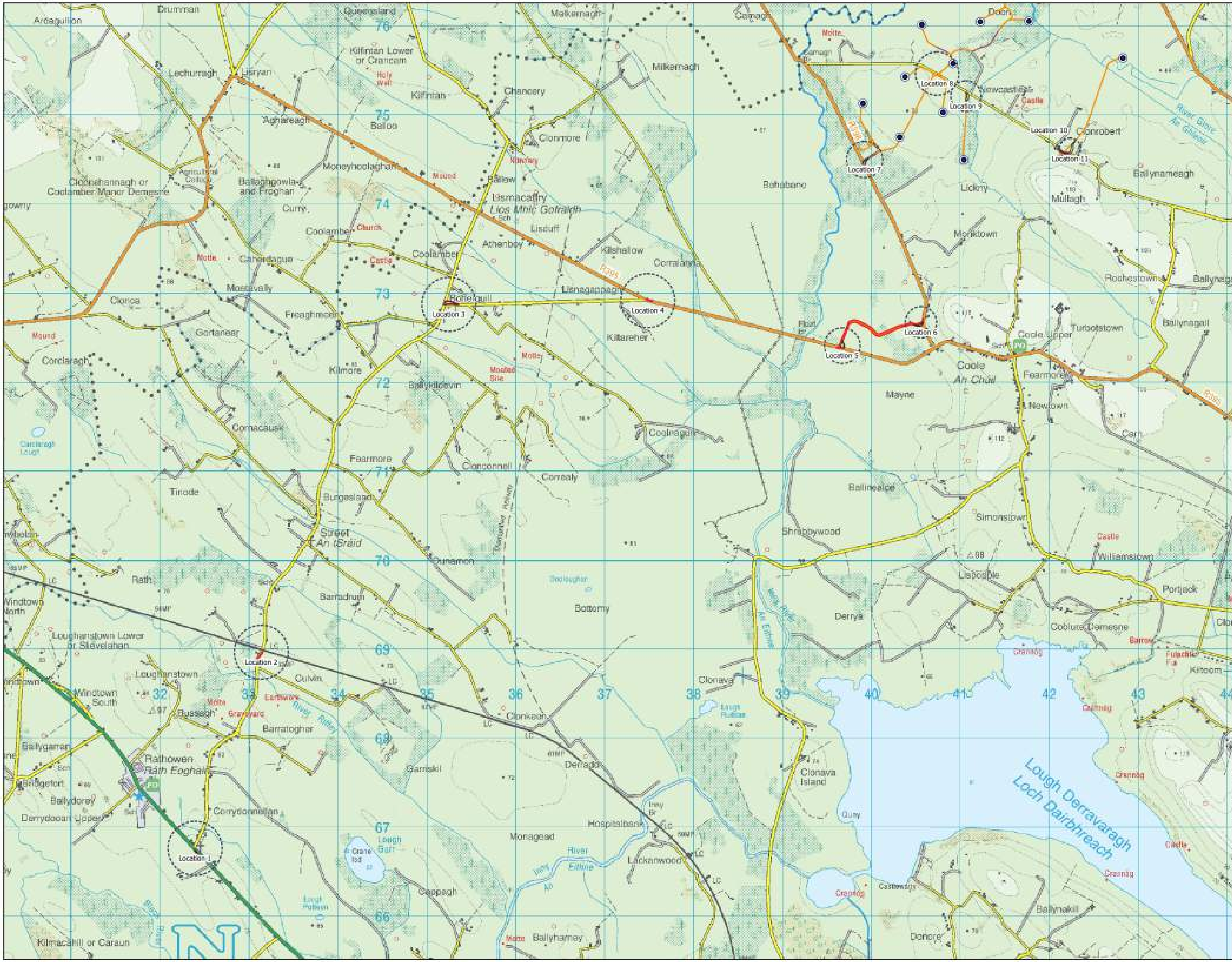
The below drawings are related to both public road and private road construction:
;

- Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)
- Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)
- Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)
- Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)
- Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)
- Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

The exact location of the cable within the public road corridor will be subject to ESB/Eirgrid specifications and in agreement with Westmeath County Council prior to construction.

4.4.1.1.3 *Habitats on the Turbine Delivery Route*

The following locations are proposed for upgrade in order to facilitate the proposed turbine delivery route. These locations are shown in Figure 4-3 and described in the paragraphs below.



Map Legend

- Proposed Turbine Layout
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- Proposed Junction Works Label
- Temporary Hardcore Surfacing Areas

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Drawing Title: Turbine Delivery Route - Junctions

Project Title: Coole Wind Farm Development

Drawn By	Checked By
EC	MW
Project No. 200445	Drawing No. Figure 4-3
Scale 1:37500	Date 04.01.2021

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Planning and Environmental Consultants

Location 1 - N4 Junction with L1927 (Joanstown Townland)
Small areas of Amenity grassland (GA1) and Dry Meadows and Grassy Verges (GS2) (combined total approximately 0.03 ha) on road verge will be surfaced over to allow turbine delivery vehicles to make right-hand turn.

Location 2 – Railway Line Level Crossing on the L1927
Small area of Dry Meadows and Grassy Verges (GS2) and approximately 80m of hedgerow will be temporarily removed to facilitate abnormally sized turbine vehicles to negotiate the rail crossing.

Location 3- L1927 and L5828 Local Roads Junction (Boherquill Townland)
Road widening works are proposed to allow transport vehicles to make right-hand turn. This will result in the loss of road side Dry Meadows and Grassy Verges (GS2), Improved agricultural grassland and a heavily trimmed Hawthorn (*Crataegus monogyna*) dominated Hedgerow (WL1). The total area to be surfaced is approximately 0.31 ha.

Location 4 – Gentle right turn from L5828 onto R395
Road widening works are proposed to facilitate abnormally sized vehicles. This will result in the loss of a minor area of road side Dry Meadows and Grassy Verges (GS2) habitat.

Location 5 and 6 - Site access junctions A and B that provide access/egress onto proposed link road (linking R395 and R396)
The habitat to either side of the junction with the proposed link road as accessed from the R395 comprises an area of Dry Meadows and Grassy Verges (GS2) and Cutover Bog (PB4). The proposed area for surfacing measures approximately 0.34 hectares. There will be no impacts to the south of the R395 as there is oversail only at this junction. There will also be minor impacts to the west of the R396 at access junction B. Approximately 20m of treeline and 14m of hedgerow will require removal at Junction B access/egress from the R396.

Location 7 – Site access junction C that provides access to the site from the R396
It is proposed to widen the turn into the proposed wind farm site to the east of the R396 to facilitate the delivery of turbines. This will result in the loss of 0.21 hectares hectares of trees and scrub associated with the edge of conifer plantation to facilitate hardcore surfacing measures.

Location 8 - Site access junction D which crosses the L5755
The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be able to negotiate this crossing with minor impacts on sections of hedge (over-sail) and grass verges.

Location 9 – Site access junction E which provides access to Turbine T14 located south of L5755
It is proposed to widen the turn into the proposed turbine T14 to the south of the L5755 to facilitate the delivery of the turbine. This will result in the loss of 0.21 hectares of Recolonising Bare Ground (ED3) and Scrub (WS1) dominated by Gorse (Ulex europaeus), Bracken (Pteridium aquilinium), Willow (Salix spp.) and Bramble (Rubus fruticosus agg.).

Location 10 – Site access junction F, which is the access junction off the L5755 to / from the proposed borrow pit
The analyses indicates that temporary visibility splays will be required at this junction in order to accommodate the construction vehicles. Approximately 80m of hedgerow will require removal along the proposed sightlines.

Location 11 - Site access junction G which provides access to turbine number 15 situated to the north of the L5755.

It is proposed to widen the turn into the proposed turbine T15 to the north of the L5755 to facilitate the delivery of the turbine. There are a number of mature Ash (Fraxinus excelsior) and Sycamore (Acer pseudoplatanus) trees that will require removal to facilitate the proposed works. These trees did not show any obvious signs of cracks or crevices but had occasional broken limbs and all supported dense ivy. As a result, these were assessed as having *Low-Moderate* potential to support roosting bats. The proposed area for hardcore surfacing measures 0.41 hectares and will result in the loss of Improved Agricultural Grassland (GA1).

4.4.1.1.4 *Proposed Link Road West of Coole Village*

The link road is described from east proceeding west. The proposed route diverges from the R396 to a minor access road (Building and Artificial Surfaces (BL3)), bordered by Drainage Ditches (FW4), Meadows and Grassy Verges (GS2), Treelines (WL2) and Earth Banks (BL2). Adjacent habitats include agricultural buildings (BL3) and Improved Agricultural Grassland (GA1).

Continuing west the proposed route traverses Conifer Plantation (WD4), comprising Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*), and an area of milled Cutover Bog (PB4) before connecting with the R395 Regional Road.

4.4.1.2 Botanical Species Present

Species listed in Annex II of the EU Habitats Directive or additional flora listed in the Flora (Protection) Order (2015) or red list of vascular plants (Jackson *et. al* 2016) were not recorded.

4.4.1.3 Invasive Alien Species

During field surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

No third schedule species were recorded within the wind farm site.

Bohemian Knotweed (*Fallopia bohemica*), Japanese Knotweed (*Fallopia japonica*), Himalayan Knotweed (*Persicaria walichii*) and Rhododendron (*Rhododendron ponticum*) were recorded along the proposed transport and grid connection routes. The observations were of isolated patches on the roadside verge. (See Table 4-14 below). A map showing the locations of Third Schedule species recorded is shown in Figure 4-4.

Table 4-17 Third Schedule Invasive Species

Common Name	Scientific Name	Grid Ref:	Notes
Bohemian Knotweed	*Fallopia bohemica*	240923; 270540	Recorded on the immediate roadside verge, measuring approx. 20m x 15m
Rhododendron	*Rhododendron ponticum*	239010 267335	Recorded on the immediate roadside verge
Japanese Knotweed	*Fallopia japonica*	240469 263629	Recorded on the immediate roadside verge measuring approx. 7m x 3m
Japanese Knotweed	*Fallopia japonica*	242144 255351	Recorded on the immediate roadside verge measuring approx. 16m x 3m
Himalayan Knotweed	*Persicaria wallicchii*	242601 256010	Along waters edge at bridge crossing of Lough Owel Feeder

Map Legend

- Bohemian Knotweed
- Himalayan Knotweed
- Japanese Knotweed
- Rhododendron
- EIAR Site Boundary

Drawing Title Invasive Species	
Project Title Coole Wind Farm, Co. Westmeath	
Drawn By LK	Checked By PR
Project No. 200445	Drawing No. Figure 4-4
Scale 1:98852	Date 01.02.2021

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4.4.2 Fauna

4.4.2.1 Aquatic Fauna

A baseline assessment of the aquatic ecology in the vicinity of Coole wind farm, lands between Carnagh, Coolcraff, Derragh, Monktown, Clonsura, Doon, Derrycrave, Newcastle, Mullagh, Carlanstown, Clonrobert, Co. Westmeath was undertaken in 2022. This included an assessment of fisheries, biological water quality, protected aquatic species and habitats and serves as an update to an aquatic ecology assessment that was undertaken in 2016 and informed the EIAR and NIS that was prepared for the proposed development. These additional surveys inform build upon the surveys that were previously undertaken and provide additional and more recent baseline information on the aquatic environment in the vicinity of the Coole Wind Farm Site and inform this revised NIS. A summary of the main findings of the assessment is provided below and the Aquatic Baseline Report is provided in full in Appendix 3.

The current survey was undertaken at the same 8 no. survey sites as per Ecofact (2016) (Table 4.15, Figure 4.A). Furthermore, to reflect the addition of a proposed grid connection route (GCR) to the project design, an additional 6 no. sites were included in the current survey (i.e. watercourse crossings). This resulted in a total of n=14 aquatic survey sites. The nomenclature for the watercourses surveyed is per the Environmental Protection Agency (EPA).

Aquatic survey sites were present on the on the River Inny (EPA code: 26I01), Mayne Stream (26M92), Glore River (26G02), Monktown River (26M78), Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (Table 2.1). The n=14 aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments. The proposed wind farm and associated infrastructure were not located within a European site.

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on Thursday 18th and Friday 19th August 2022. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 4.15 & Figure 4.a**). Surveys at each of these sites included a fisheries habitat appraisal, electro-fishing survey (where possible), white-clawed crayfish survey, macrophyte & aquatic bryophyte survey and biological water quality sampling (Q-sampling) or macro-invertebrate sweep sampling. The survey approach ensured that any habitats and species of high conservation value would be detected to best inform mitigation for the wind farm project.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 4.15 Location of n=14 aquatic survey sites in the vicinity of Coole wind farm, Co. Westmeath

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	River Inny	26I01	Coolnagun Bridge	638678	770052
2	River Inny	26I01	Float Bridge	639188	772506
3	River Inny	26I01	Carnagh Bridge	639122	775632
4	Mayne Stream	26M92	Ballin	640517	770359
5	Glore River	26G02	Doon	641798	776069
6	Glore River	26G02	Newcastle	642220	775848
7	Glore River	26G02	Bridge at Rockbrook	644300	774205
8	Monktown River	26M78	Newcastle	641180	775185
B1	Unnamed stream	n/a	GCR crossing, Clonava	638616	769821
B2	Drainage channel	n/a	GCR crossing, Clonava	638615	769557
B3	River Inny	21I01	Inny Bridge	638805	766735
B4	Froghanstown Stream	26F41	GCR crossing, L1819	640562	763362
B5	Ballynafid Stream	26B36	GCR crossing, N4	641296	760577
B6	Brosna North River	26B28	GCR crossing, L1773	642540	756035

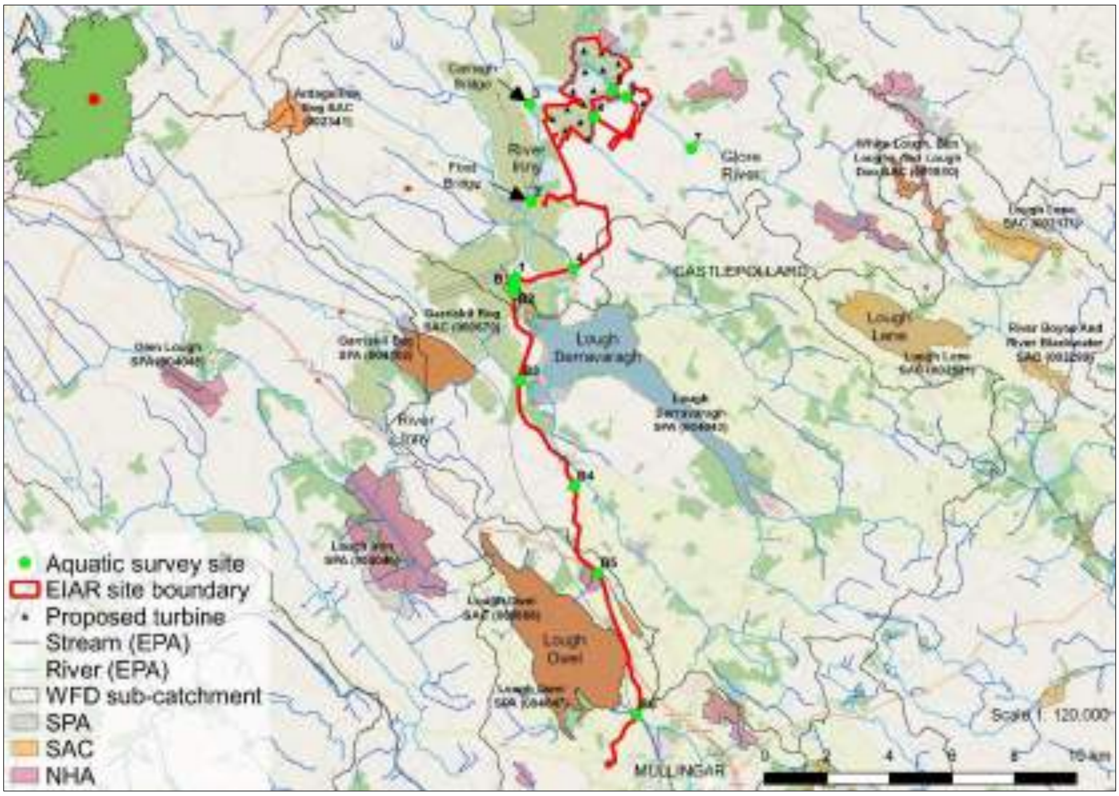

Figure 4a Overview of the n=14 aquatic survey site locations for Coole wind farm, Co. Westmeath

The full results of all the aquatic surveys that were undertaken in 2022 are provided in Appendix 3. In summary, the majority of watercourses in the vicinity of the proposed Coole wind farm were of at least **local importance (higher value)** in terms of their aquatic ecology. However, historical drainage pressures and or siltation have significantly reduced the quality of aquatic habitats on the Mayne Stream, Glore River, Monktown River, Froghanstown Stream, Ballynafid Stream and the Brosna North River.

Typically, larger watercourses with higher flow rates, greater water volumes and better connectivity, such as the River Inny and Glore River, are better able to buffer against such impacts and these watercourses supported the best quality aquatic habitats within the vicinity of the proposed wind farm for aquatic receptors of conservation value, such as salmonids, *Lampetra* sp., otter and or white-clawed crayfish.

With the exception of sites 3 on the River Inny and sites 6 & 7 on the Glore River (Q3-4), biological water quality was of **≤Q3 (poor status)** across all survey sites sampled.

4.4.2.2 Birds – Windfarm Site

Detailed maps and raw data are provided in Chapter 7: Ornithology of the EIAR that was prepared in support of this application and in the bird survey report that describes the surveys that were undertaken in 2021 and 2022 and is provided as Appendix 4. Information on the results of the detailed surveys of the SCI species which are potentially affected are provided below, namely:

- Whooper Swan
- Golden Plover
- Greenland White Fronted Goose
- Shoveler
- Coot
- Pochard
- Tufted Duck
- Wigeon
- Teal

4.4.2.2.1 *Whooper Swan*

Raw survey data for whooper swan is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Vantage Point Surveys

- 2015-2017 surveys

Whooper swan were observed on four occasions during the 2015-2017 Vantage Point Surveys at VP4 (see Appendix 7-4, Figure 7-1-1, Chapter 7 of the EIAR). Flights were recorded between the periods of November-March. Numbers recorded ranged from 1 to 7 birds. All flights were recorded within, or partially within, the potential collision risk zone. All observations were recorded within 500m of the wind farm site.

- 2018-2020 surveys

Whooper swan were observed on five occasions during the 2018-2020 Vantage Point Surveys at VP3 and VP5 (see Appendix 7-4, Figure 7-1-1, Chapter 7 of the EIAR). Flights were recorded between the periods of October-March. Numbers recorded ranged from 1 to 14 birds. All flights were recorded within the potential collision risk zone. All observations were recorded within, or partially within, 500m of the wind farm site.

- 2021-2022 Surveys

Whooper swan were observed on 25 occasions during the 2021 – 2022 Vantage Point Surveys. 19 of these surveys were within 500m of the windfarm site.(See Appendix 2, Figure 1.7 of 2021-2022 Bird Survey Report)

4.4.2.2.2 *Winter Transect Surveys*

- 2015-2017 surveys

Whooper swan were observed on two occasions during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-1, Chapter 7 of the EIAR). On the 30th of October 2016, a flock of twelve birds was observed on a flooded area approximately 2.6km south-west of the Site. On the 28th of January 2017, a flock of eight birds was observed within the Site boundary.

- 2018-2020 surveys

Whooper swan were observed on only one occasion during the 2018-2020 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-1, Chapter 7 of the EIAR). On the 20th of March 2020, three birds were observed travelling over cutover bog and improved agricultural grassland, approximately 1.7km south-west of the proposed wind farm site.

Whooper Swan was not recorded during the winter transect surveys in 2021-2022.

4.4.2.2.3 *Waterfowl Surveys*

- 2015-2017 surveys

Whooper swan were recorded on twenty-three occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Seven observations occurred during the 2016/2017 winter season with a maximum flock number of 40 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the Site. Sixteen observations occurred during the 2016/2017 winter season with numbers of birds ranging from 3 to 18. Whooper swan were observed at Lough Bane, Lough Kinale and Derragh Lough, Lough Sheelin and Lough Derravaragh.

- 2018-2020 surveys

Whooper swan were recorded on ninety-five occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Eighty-nine of these observations were recorded at Lough Iron, approximately 12.8km to the south-west of the proposed wind farm site. Those observations correspond to birds travelling or feeding on the lough. Numbers ranged from 2 to 96 birds. The remaining five observations were recorded at Lough Bane, Sheeling Lough SPA and Lough Derravaragh SPA. A maximum of 7 birds were recorded within 500m of the wind farm site at Lough Bane on a single occasion.

- 2021-2022 Surveys

Whooper Swan was recorded on 36 occasions during the waterfowl surveys with only three of these observations being on the site of the proposed wind farm. The birds were observed at Lough Iron, Derragh Lough, River Inny, Lough Bane and Lough Sheelin. There were no additional observations of this species during any of the other comprehensive surveys (See Appendix 2, Figure 6.7 in 2021 – 2022 Bird Survey Report)

4.4.2.3 Greenland White-fronted Goose

Raw survey data for Greenland white-fronted goose is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3.

Vantage Point Surveys

- 2018-2020 surveys

Greenland white-fronted goose were observed on two occasions during the 2018-2020 Vantage Point Surveys (see Appendix 7-4, Figure 7-1-2). Flights were recorded in October 2018 and in February 2019. Numbers recorded ranged from 12 to 15 birds. Both flights were recorded within the potential collision risk zone. Both observations were recorded within 500m of the wind farm site.

- 2021-2022 surveys

Greenland White Fronted Goose were recorded on one occasion during the vantage point surveys. This was an observation of a flock of 14 birds commuting (See Appendix 2, Figure 1.2)

Winter Walkover Surveys

- 2021-2022 surveys

Greenland White Fronted Goose were recorded on one occasion during the winter walkover surveys. This was observation of five birds commuting over the wind farm site (See Appendix 2, Figure 5.2 of the 2021-2022 Bird Survey Report).

Waterfowl Surveys

- 2018-2020 surveys

Greenland white-fronted goose were recorded on twenty-six occasions during specific Waterfowl Surveys at Lough Iron (see Appendix 7-4, Table 1-5). Flock numbers were comprised between 4 and 238 birds, with an average flock composed of 75 individuals.

- 2021-2022 surveys

Greenland white-fronted goose were recorded on four occasions during the wildfowl surveys with no records within 500m of the wind farm site. All observations were of birds foraging at Piercefield, near Lough Iron (See Appendix 2, Figure 6.3 of the 2021 – 2022 Bird Survey Report)

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4 Golden Plover

Raw survey data for golden plover is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3.

Vantage Point Surveys

- 2015-2017 surveys

Golden plover were recorded on sixty-six occasions during Vantage Point Surveys (see Appendix 7-4, Figure 7-1-3). Forty-six of these flight observations occurred within, or partially within, the Potential Collision Height. The majority of observations of birds in flight were within 500m of the proposed turbine layout. All observations of this species occurred during winter months. Twenty-nine of the sixty-three flights were recorded during the 2015/2016 winter season (October – April) with flocks between 1 and 125 birds recorded in flight and landing on areas of cutover bog. Thirty-seven flights were recorded during the 2016/2017 winter season with flocks ranging from individuals to 140 birds.

- 2018-2020 surveys

Golden plover were recorded on fifteen occasions during Vantage Point Surveys at VP3 and VP5 (see Appendix 7-4, Figure 7-1-3). Only seven of these flight observations occurred within, or partially within, the Potential Collision Height. Most observations of birds in flight were within 500m of the proposed turbine layout.

Fourteen observations of this species occurred during winter months. Seven of these fourteen flights were recorded during the 2018/2019 winter season (October – March) with flocks between 5 and 46 birds recorded in flight and landing on areas of cutover bog. Seven flights were recorded during the

2019/2020 winter season (September-March) with flocks ranging from individuals to 48 birds. The remaining flight occurred in April 2018 when 5 birds were observed travelling over cutover bog, conifer plantation and improved agricultural grassland. This flock is considered to be a migratory population.

- 2021-2022 surveys

Golden plover were recorded on nine occasions during the vantage point surveys, with 8 of these observations being within 500m of the wind farm site. Flocks of between six and 175 birds were recorded commuting or circling over the wind farm site (See . Appendix 2, Figure 1.1 of the 2021-2022 Bird Survey Reort)

Breeding Walkover Surveys

- 2021-2022

A single observation of three golden plover travelling at the beginning of April 2021. Likely remnant wintering birds en route north to summer breeding grounds – not breeding on site..

Winter Transect Surveys

- 2015-2017 surveys

Golden plover were recorded on nine occasions during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-2). Seven observations occurred during the 2015/2016 winter season with a maximum flock number of 30 birds. Two observations occurred during the 2016/2017 winter season with numbers of birds ranging from 1 to 4. Five of the total nine observations were recorded within the Site boundary.

- 2018-2020 surveys

Golden plover were recorded on eleven occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-2). Four observations occurred during the 2018/2019 winter season with a maximum flock number of 140 birds recorded flying over cutover bog. Seven observations occurred during the 2019/2020 winter season with numbers of birds ranging from 2 to 50.

- 2021-2022 Surveys

Golden plover were recorded on four occasions. All were within 500m of the wind farm site and were observations of four to sixteen birds. There were two observations of birds commuting and two of birds roosting on the bog (See Appendix 2, Figure 5.1).

Waterfowl Surveys

- 2015-2017 surveys

Golden plover were recorded on eight occasions during Waterfowl Surveys in 2015/2017 (see Appendix 7-4, Table 1-8). Three observations occurred during the 2015/2016 winter season with a maximum flock number of 85 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the Site. Five observations occurred during the 2016/2017 winter season with numbers of birds ranging from 18 to 500. Golden plover were observed at Lough Kinale and Derragh Lough, Lough Derravaragh and Garriskil Bog.

- 2018-2020 surveys

Golden plover were recorded on two occasions during Waterfowl Surveys in 2018/2020 (see Appendix 7-4, Table 1-8). On the 20th of November 2018, 16 birds were observed roosting at Lough Bane. On the 3rd of January 2020, 58 birds were observed feeding at Lough Sheelin.

- 2021-2022 surveys

Golden plover were recorded on four occasions during these surveys, with none recorded within 500m of the wind farm site and flock =s of between 5 and 160 birds. All observations were of birds commuting or circling (See Appendix 2, Figure 6.2 of the 2021 – 2022 Bird Survey Report).

Incidental Observations

Incidental observations were also recorded during VPs watches (see Appendix 7-4, Table 1-9). These included evidences of roosting, from areas of cutover milled peat, on dates between 2015-2017 and 2018-2020 and non-visual records of calling birds.

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.2 *Shoveler*

Raw survey data for Shoveler is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Winter Transect Surveys

- 2015-2017 surveys

Shoveler was recorded on a single occasion during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-5, Chapter 7 of the EIAR). On the 28th of January 2017, a shoveler was flushed from Lough Bane, north of the Site.

Waterfowl Surveys

- 2015-2017 surveys

Shoveler were recorded on six occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-25, Chapter 7 of the EIAR). One observation occurred during the 2015/2016 winter season with a flock of 3 birds recorded feeding at Lough Derravaragh, situated approximately 5.4km to the south of the Site. The other five observations occurred during the 2016/17 winter season with numbers of birds ranging from 1 to 3. Shoveler were observed at Lough Bane, Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Shoveler were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2018-2020 surveys

Shoveler was only recorded once during Waterfowl Surveys (see Appendix 7-4, Table 7-10, Chapter 7 of the EIAR). On the 7th of February 2020, an individual bird was observed feeding at Lough Derravaragh situated within 5.4km to the south of the proposed wind farm site and 1.9km east of the grid connection route.

- 2021 – 2022 Surveys

Shoveler was recorded on 11 occasions during the wildfowl distribution surveys in 2021 – 2022. None of these sightings were on the wind farm site or within 500m of it with birds recorded at Derragh Lough, Lough Iron and Lough Sheelin (See Appendix 2, Figure 6.10 of 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.3 Coot

Raw survey data for coot is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Vantage Point Surveys

Coot were recorded on four occasions during the 2021-2022 surveys. All of the observations were on or within 500m of the site of the proposed wind farm. All observations were of one or two birds commuting (See Appendix 2, Figure 1.8)

Breeding Bird Surveys

Coot were only recorded on a single occasion during Breeding Bird Surveys (see Appendix 7-4, Figure 7-3-2). On the 26th of June 2019, an individual bird was recorded on a flooded area in bog, approximately 300m north of the proposed grid connection route.

Winter Transect Surveys

- 2015-2017 surveys

Coot were only recorded twice during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-8, Chapter 7 of the EIAR). On the 14th of March 2016, two birds were observed along the cable route approximately 4km south of the Site. On the 27th of March 2017, four birds were observed at Lough Bane, adjacent to the Site boundary.

- 2018-2020 surveys

Coot were only recorded on a single occasion during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-8). On the 20th of March 2020, an individual bird was recorded on a bog pond, approximately 180m north of the proposed grid connection route.

Waterfowl Surveys

- 2015-2017 surveys

Coot were recorded on one hundred and thirty-eight occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-36, Chapter 7 of the EIAR). The species was recorded from the following sites: Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh. A maximum number of 1,565 coot was recorded at Lough Sheelin located approximately 4km from the Proposed Development Site. Coot were recorded at Lough Bane within 500m of the wind farm site on two occasions with a maximum of one bird observed.

- 2018-2020 surveys

Coot were recorded on one hundred and eighty-nine occasions during Waterfowl Surveys (see Appendix 7-4, Table 7-16, Chapter 7 of the EIAR). The species was recorded from the following sites: Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin and Lough Derravaragh. A maximum number of 760 coot was recorded at Lough Sheelin located approximately 4km from the Proposed Development Site. Coot were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2021-2022 Surveys

Coot were recorded on 167 occasions during the waterfowl surveys in 2021 and 2022. No birds were recorded within 500m of the site. Birds observed on Deragh Lough, Lough Iron Lough Kinale, Lough Sheelin, Lough Derravaragh, Bracklagh Lough and along the River Inny (See Appendix 2, Figure 6.8 of 2021 – 2022 Bird Survey Report)

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.4 Pochard

Raw survey data for pochard is provided in Appendix 7-4, Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3, Chapter 7 of the EIAR.

Waterfowl Surveys

- 2015-2017 surveys

Pochard were recorded on thirty-two occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-28, Chapter 7 of the EIAR). Thirteen observations occurred during the 2015/16 winter season with a maximum flock number of 483 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the Proposed Development Site. Nineteen observations occurred during the 2016/17 winter season with numbers of birds ranging from 2 to 211. Pochard were observed at Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

- 2018-2020 surveys

Pochard were recorded on thirty occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-28, Chapter 7 of the EIAR). Fourteen observations occurred during the 2018/2019 winter season with a maximum flock number of 142 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the Proposed Development Site. Sixteen observations occurred during the 2019/2020 winter season with numbers of birds ranging from individuals to 225. Pochard were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh. Pochard were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2021-2022 surveys

Pochard were recorded on 18 occasions during the wildfowl surveys. There were no records within 500m of the wind farm site. Birds observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown (See Appendix 2, Figure 6.9 of 2021 – 2022 Bird Survey report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.5 Tufted Duck

Raw survey data for tufted duck is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3 of the EIAR

Waterfowl Surveys

- 2015-2017 surveys

Tufted duck were recorded on eighty-eight occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Thirty-five observations occurred during the 2015/16 winter season with a maximum flock number of 552 birds recorded feeding at Lough Kinale, approximately 2km north-west of the proposed wind farm site. Fifty-three observations occurred during the 2016/17 winter season with numbers of birds ranging from individuals to 668 birds. Tufted duck were observed at Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

- 2018-2020 surveys

Tufted duck were recorded on ninety-nine occasions during Waterfowl Surveys (see Appendix 7-4, Table 7-14, Chapter 7 of the EIAR). Fifty observations occurred during the 2018/2019 winter season with a maximum flock number of 384 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the proposed wind farm site. Forty-nine observations occurred during the 2019/2020 winter season with numbers of birds ranging from individuals to 408 birds. Tufted duck were observed at Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

Tufted duck were recorded on 48 occasions during the wildfowl surveys. There were no records within 500m of the wind farm site. Birds were observed at Lough Kinale, Bracklagh Lough, Lough Sheelin, Lough Derravaragh, Deragh Lough, Lough Iron and Robinstown (See Appendix 2, Figure 6.12 of the 2021 – 2022 bird survey report).

Incidental Observations

Incidental observations were also recorded during VPs watches (see Appendix 7-4, Table 7-3, Chapter 7 of the EIAR). These included evidence of roosting from areas of cutover milled peat, on dates between 2015-2017 and 2018-2020 and non-visual records of calling birds.

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.6 *Wigeon*

Raw survey data for wigeon is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3 of the EIAR

Winter Transect Surveys

- 2015-2017 surveys

Wigeon was recorded on five occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-6). Two observations occurred during the 2015/16 winter season with numbers ranging from 1 to 7 birds, the remaining three observations occurred during the 2016/17 winter season with numbers up to 17 birds. All observations were recorded at Lough Bane, north of the wind farm site.

- 2021 – 2022 surveys

Wigeon was recorded on one occasion when a flock of eight birds was observed foraging on the wind farm site (See Appendix 2, Figure 5.5 of the 2021 – 2022 Bird Survey Report)

Waterfowl Surveys

- 2015-2017 surveys

Wigeon were recorded on twenty-four occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-27). Six observations occurred during the 2015/16 winter season with a maximum flock number of 39 birds recorded feeding/roosting at Lough Derravaragh, approximately 5.4km to the wind farm site. Eighteen observations occurred during the 2016/17 winter season with numbers of birds ranging from 1 to 78. Wigeon were observed at Lough Bane, Lough Kinale and Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Wigeon were recorded at Lough Bane within 500m of the wind farm site on seven occasions with a maximum of 78 birds observed.

- 2018-2020 surveys

Wigeon were recorded on twenty-two occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-27). Twelve observations occurred during the 2018/2019 winter season with a maximum flock number of 51 birds recorded feeding at Lough Bane, adjacent to the proposed Site boundary. Ten observations occurred during the 2019/2020 winter season with numbers of birds ranging from 2 to 44. Wigeon were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Wigeon were recorded at Lough Bane within 500m of the wind farm site on thirteen occasions with a maximum of 51 birds observed.

- 2021 – 2022 surveys

Wigeon were recorded on 37 occasions during the wildfowl surveys. Only eight of these records were within 500m of the wind farm site. Birds were observed at Derragh Lough, Lough Derravaragh, Lough Sheelin, Lough Iron, Lough Kinale and Lough Bane (See Appendix 2, Figure 6.13 of the 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.7 *Teal*

Raw survey data for teal is provided in Appendix 7-4. Results summary tables are presented in Appendix 7-3 of the EIAR

Vantage Point Surveys

- 2015-2017 surveys

Teal were observed only once during Vantage Point Surveys (see Appendix 7-4, Figure 7-1-10). On the 18th of December 2016, seven birds were observed travelling over an area of cutover bog and woodland, within the proposed wind farm site. This flight was partially recorded at potential collision height.

Winter Transect Surveys

- 2015-2017 surveys

Teal were recorded on nine occasions during the 2015/17 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-7). Seven observations occurred during the 2015/16 winter season with numbers of birds ranging from 1 to 50. Two observations occurred during the 2016/17 winter season with a maximum flock number of 3 birds recorded in drainage ditches. Six observations were recorded within the proposed wind farm site.

- 2018-2020 surveys

Teal were recorded on seven occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-7). Three observations occurred during the 2018/2019 winter season with a maximum flock number of

9 birds recorded flushed from areas of drainage ditch and cutover bog. Four observations occurred during the 2019/2020 winter season with numbers of birds ranging from 1 to 3. All seven observations were recorded along the grid connection route.

- 2021-2022 Surveys

Teal were recorded on three occasions on the wind farm site. There was one observation of two birds commuting, one of two birds roosting and one of a flock of 22 birds foraging (See Appendix 2, Figure 5.4. of the 2021-2022 Bird Survey Report)

Waterfowl Surveys

- 2015-2017 surveys

Teal were only recorded on twenty-five occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-33). Ten observations occurred during the 2015/16 winter season with a maximum flock number of 54 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the proposed wind farm site. Fifteen observations occurred during the 2016/17 winter season with numbers of birds ranging from individuals to 84 birds. Teal were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh. Teal were recorded at Lough Bane within 500m of the wind farm site on five occasions with a maximum of 22 birds observed.

- 2018-2020 surveys

Teal were only recorded on three occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-33). All observations occurred during the 2018/2019 winter season with a maximum flock number of 122 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the proposed wind farm site. In addition, teal were observed at Lough Bane and Lough Kinale and Derragh Lough SPA. Teal were recorded at Lough Bane within 500m of the wind farm site on a single occasion with 6 birds observed.

- 2021-2022 Surveys

There were41 observations of teal during these surveys, with only seven recorded within 500m of the wind farm site. Birds were observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown (See Appendix 2, Figure 6.11 of the 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.5 Birds - Grid Connection Route

Bird surveys were conducted as part of the multidisciplinary surveys along the proposed grid connection route carried out by MKO in 2017, 2019, 2020, 2021 and 2022. These surveys were undertaken in addition to the dedicated bird surveys carried out between 2013 and 2022 as part of the permitted Coole Wind Farm. The grid connection works will be confined to the existing road corridor, conifer plantation and Mullingar substation. No supporting habitat for any SCI species was present, therefore no potential for any habitat loss exists. In addition, due to the location of the works within the existing road corridor and conifer plantation, no potential for disturbance or displacement was identified.

Whooper Swan which is an SCI of Lough Derravaragh SPA was recorded on the River Inny approximately 56m from the road corridor and 1km from the boundary of Lough Derravarragh SPA. No other Annex I or SCI species associated with any European site were recorded.

5. ASSESSMENT OF POTENTIAL EFFECTS AND ASSOCIATED MITIGATION

5.1 Potential for Direct Effects on the European Sites

The proposed wind farm site lies entirely outside of the boundaries of EU designated sites. The proposed grid connection is located within the existing N4 corridor along the boundary of Lough Owel SAC and Lough Owel SPA and will not impact on any habitat listed for protection under these designated sites. There is no potential for direct impact on any European Site.

5.2 Potential for Ex Situ Habitat Loss, Disturbance, Displacement and Collision of SCI Species of European Sites

5.2.1 Non Key Ornithological Receptors

Following the extensive surveys and assessments undertaken, no potential for significant effects in the form of habitat loss, disturbance, displacement or collision as a result of the wind farm on the following SCI species of Screened In European Sites was identified and they were not assessed to be Key Ecological Receptors. This assessment was provided in Section 7.6 of the EIAR and has been confirmed in the 2021-2022 Bird Survey Report.

- Shoveler

This species was not recorded on site during the extensive suite of surveys undertaken. No roosting evidence was recorded. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA or Lough Iron SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Pochard

This species was recorded on the wind farm site on a single occasion during the extensive suite of surveys undertaken. No roosting evidence was recorded during the extensive surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Ennell SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Tufted Duck

This species was not recorded on the wind farm site during the extensive suite of surveys undertaken. No roosting evidence was recorded. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Ennell SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Coot

This species was recorded within 500m of the wind farm site on only seven occasions during the extensive suite of surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA, Lough Ennell SPA, Lough Iron SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

5.2.2 Key Ornithological Receptors

The following SCI species were identified as Key Ornithological Receptors and a more detailed consideration of potential impacts in relation to ex situ habitat loss, disturbance, displacement and collision is provided.

5.2.2.1 Potential for Effect on Whooper Swan

Lough Derravarragh SPA is located 4.8km south of the proposed windfarm site and 70m east of the proposed grid connection route. The development is located within the potential core foraging range of Whooper Swan which is an SCI species of Lough Derravarragh SPA (SNH Guidelines (2016). Consequently, the potential for ex situ impacts on Whooper Swan is assessed further in Table 5-1 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-1 Impact Assessment - Whooper Swan

Analysis of potential effects on Whooper Swan	
Ex-Situ Habitat Loss	The wind farm site is dominated by cutover bog, this is not considered suitable for wintering whooper swan. There were no whooper swans observed utilising the habitats within the wind farm site. The unfavourable nature of this habitat limits the potential for construction activities to result in ecologically significant habitat loss for whooper swan. Adverse effects on any SPA population can be discounted.
Disturbance , displacement and Barrier Effect	There were 25 observations of whooper swan commuting during this period, compared to an average of three flights per winter presented in Section 7.4.1 of the EIAR (twelve flights total over a four-year period). The number of birds per flock remained similar to those presented in Section 7.4.1 of the EIAR, with between two and sixteen birds being observed. However, the number of flights over the wind farm site remains low and given that the habitats on site are unlikely to attract whooper swan significant disturbance impacts are not predicted. Adverse effects on any SPA population can be discounted. No foraging areas were recorded on, or within 500m of, the wind farm site and there was no evidence of roosting on, or within 1km of, the wind farm site. Whooper swan were rarely recorded flying over the wind farm site during surveys presented in the EIAR. The frequency of flights increased slightly between March 2021 and March 2022 compared to data presented in

Analysis of potential effects on Whooper Swan	
	Section 7.4.2 of the EIAR, but whooper swans were still infrequently observed. Survey results indicate that the wind farm site does not lie on a migratory corridor for this species. Therefore, no barrier effect is predicted. Based on the complete dataset there is no potential for significant displacement effects given that whooper swans were not dependent on the habitats of the whooper swan for roosting or feeding. Furthermore, it is unlikely that any significant displacement impact will result during the operational phase, given the low level of flight activity and particularly the low numbers recorded per flight. Adverse effects on any SPA population can be discounted.
Collision	The collision risk has been calculated at a ratio of 0.79 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects on the species are predicted and adverse effects on any SPA population can be discounted.

5.2.2.2 Potential Effect on Greenland White Fronted Goose

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. The development is located outside the potential core foraging range of Greenland White Fronted Goose, which is an SCI species of Lough Iron SPA SPA (SNH Guidelines (2016). Garriskil Bog SPA is located 7.2km from the wind farm site and 1.4km from the grid connection route. It is located within the core foraging range for this species. However, the geese have not been present within the SPA in recent years (since 1987). Notwithstanding the above, following an extremely precautionary principle, the potential for ex situ impacts on Greenland White Fronted Goose is assessed further in Table 5-2 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-2 Impact Assessment – Greenland White Fronted Goose

Analysis of potential effects on Greenland White Fronted Goose	
Ex Situ Habitat Loss	The vast majority of observations were of flocks recorded at Lough Iron, approximately 12.8km from the wind farm site. During surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). There was no evidence of roosting or foraging within 1km of the wind farm site. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.

Analysis of potential effects on Greenland White Fronted Goose	
Disturbance, Displacement and Barrier Effect	This species was not recorded utilising habitats on, or within 500m of, the wind farm site. The species was observed flying over the site on only one occasion between March 2021 and March 2022. Given the low numbers recorded and the abundance of suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. Similar to the data outlined in Section 7.8.2.2 of the EIAR, there was only one observation of birds commuting over the wind farm site between March 2021 and March 2022. Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind farm site. There was no foraging birds recorded on, or within 500m of, the wind farm site. Similarly, there was no evidence of roosting birds on, or within 1km of, the wind farm site. No significant displacement or barrier effects are predicted and no adverse effects on any SPA populations will occur.
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A “Random” collision risk analysis has been undertaken. The collision risk has been calculated to be 0.04 collisions per year, or one bird every 25 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted. and no adverse effects on any SPA populations will occur.

5.2.2.3 Potential for Effect on Golden Plover

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. The development is located outside the potential core foraging range of Greenland White Fronted Goose, which is an SCI species of Lough Iron SPA SPA (SNH Guidelines (2016). However, following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-3 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-3 Impact Assessment – Golden Plover

Analysis of potential effects on Golden Plover	
Ex Situ Habitat Loss	In contrast to the data presented in Section 7.8.2.3 of the EIAR, there were no observations of golden plover utilizing habitats on, or within 500m of, the wind farm site between March 2021 and March 2022.

Analysis of potential effects on Golden Plover	
	Significant effects with regard to direct habitat loss are not predicted, given the development infrastructure is confined to a narrow corridor, therefore direct habitat loss will be minimal. Furthermore, the habitats within the Site are not of particularly high quality and there is an abundance of similar habitat in the surrounding area. No regular commuting/migratory flights were recorded that would constitute evidence of connectivity between any SPA and the Proposed Development area. The evidence of surveys was that the local population was largely resident during the winter months in local areas of cutover bog.
Disturbance, Displacement and Barrier Effect	As per McGuinness et al. (2015) the zone of sensitivity for the species is 800m during the breeding season only. The species is not identified as being particularly sensitive to wind farm developments during the wintering period. This species was recorded commuting or circling over the bog on, or within 500m of, the wind farm site during the winter season. Numbers of county importance were observed on six occasions on, or within 500m of, the wind farm site. This is a marked reduction in the use of the Site compared to the regular use of the Site as reported in the EIAR. Given the abundance of similar suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. A review of 29 studies suggests golden plover will approach wind turbines to an average distance of 175m in non-breeding season (Hötker et al., 2006). There were 10 observations of golden plover within 200m of the proposed turbine layout during surveys between March 2021 and March 2022. In the event of displacement, there are sufficient areas of suitable habitat in the wider area to render such an effect inconsequential. Furthermore, habitats within the wind farm site (e.g. cutover bog) are not of particularly high quality. There is no evidence to suggest that the wind farm site lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated. Significant displacement or barrier effects are not predicted. No adverse effects on any population associated with any SPA are predicted.
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A “Random” collision risk analysis has been undertaken.

Analysis of potential effects on Golden Plover	
	The collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (EIAR Appendix 7-5). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. The evidence of surveys was that the local population was largely resident during the winter months in local areas of cutover bog. As such, no adverse effects on any SPA populations will occur.

5.2.2.4 Potential for Effect on Wigeon

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. Following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-4 below. This impact assessment utilises data from the EIAR as previously submitted with no further update to the impact assessment following the 2021-2022 Bird Surveys as the species was rarely recorded during this period.

Table 5-4 Impact Assessment – Wigeon

Analysis of potential effects on Wigeon	
Ex Situ Habitat Loss	During winter season surveys, the species was regularly recorded feeding/roosting at Lough Bane, approximately 300m from the closest turbine, north of the proposed wind farm site. Wigeon activity was confined to this area locally. No infrastructure is proposed in this location. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.
Disturbance, Displacement and Barrier Effect	Disturbance from construction activities could result in the loss of wigeon wintering habitat at Lough Bane, 300m north of the wind farm site. However, impacts at this location will be limited due to the screening provided by scrub/woodland between the wind farm site and the lough and given the habitats of the lough are not of particularly high quality or unique to the local area. It is noted that the majority of Proposed Development infrastructure will be sited in cutover bog, a habitat of very limited ecological value to this species. Wigeon activity within 500m of the proposed turbines was confined to Lough Bane. A 500m buffer of the proposed turbines would overlap with approx. 50% of the lough. However, impacts at this location will be limited due to the screening provided by scrub/woodland between the wind farm site and the lough and given the habitats of the lough are not of particularly high quality or unique to the local area. It is noted that the majority of the Proposed Development site is located in cutover bog. A habitat not favoured by this species.

Analysis of potential effects on Wigeon	
	Should any potential displacement effect occur, there are extensive areas of suitable habitat in the wider area, to render this potential impact inconsequential. Significant displacement effects are not anticipated at county, national of international scale and, given the abundance of similar suitable habitats in the wider surroundings of the Proposed Development significant impacts are not predicted. No adverse effects on any population associated with any SPA are predicted.
Collision	The species was not recorded during Vantage Point Surveys. Collision related mortality is not likely to significantly impact this species.

5.2.2.5 Potential for Effect on Teal

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. Following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-5 below. This impact assessment utilises data from the EIAR as previously submitted with no further update to the impact assessment following the 2021-2022 Bird Surveys as the species was rarely recorded during this period.

Table 5-5 Impact Assessment – Teal

Analysis of potential effects on Teal	
Ex Situ Habitat Loss	Teal was rarely recorded on Site or within 500m of the wind farm site. The Site is dominated by cutover bog which provides unsuitable wintering habitat for the species. Extensive areas of suitable roosting and foraging habitat will remain post-construction and there is an abundance of suitable habitat in the surrounding area. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.
Disturbance, Displacement and Barrier Effect	In four years of surveying this species was infrequently recorded onsite or within 500m of the wind farm site. The majority of onsite habitats (e.g. cutover bog, forestry and grassland) are unsuitable for this species. Furthermore, the Proposed Development Site does not contain habitats that are unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local teal population. As previously discussed, the Proposed Development Site does not contain habitats that are of a particularly high quality or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local teal population. Furthermore, this species was infrequently recorded onsite or within 500m of the wind farm site. Significant displacement effects are not predicted. No adverse effects on any population associated with any SPA are predicted.

Analysis of potential effects on Teal	
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 7-5 of the EIAR The collision risk has been calculated at a ratio of 0.010 collisions per year or one bird every 97 years. The predicted collision risk is insignificant. As such, no adverse effects on any SPA populations will occur.

5.3 Bird Disturbance as a result of Construction of the Grid Connection

A potential pathway for indirect effects in the form of bird disturbance was identified, potentially affecting the following SPAs as a result of proximity to the proposed wind farm site and/or grid connection route:

- Lough Owel SPA (004047)
  - Shoveler *Anas clypeata [A056]*
  - Coot *Fulica atra*
- Lough Derravaragh SPA (004043)
  - Whooper swan *Cygnus cygnus [A038]*
  - Pochard *Aythya farina [A059]*
  - Tufted duck *Aythya fuligula [A061]*
  - Coot *Fulica atra [A125]*

This section describes the measures that are in place to mitigate adverse negative effects associated with the Proposed Development on avian receptors. Effects on avian receptors have been addressed in two ways:

- Design of the Proposed Development.
- Management of the development phases.

5.3.1 Mitigation by Design

The Proposed Development has been designed to avoid ecologically sensitive areas and has been constraint led from the initial design phase. The project design has followed the basic principles outlined below to eliminate the potential for ecological effects on KERs where possible and to minimise such effects where total elimination is not possible.

The development has been designed to:

- avoid any direct, in-direct or residual adverse effects on European sites or other designated sites for nature conservation.
- to avoid effects on habitats that correspond to those that are listed on Annex I of the EU Habitats Directive outside of the European and nationally designated sites.

- minimise direct or indirect effects on any habitats or species that were classified as being of National, County or Local Importance (Higher Value) in the design of the scheme

Through careful planning and design, direct or indirect effects on receptors of International, National & County importance have been avoided at the design stage. In addition, the proposed development layout minimises the potential for effects on receptors of Local Importance (Higher Value).

During the site surveys, it was noted that all works associated with the proposed grid connection route will be undertaken in the road, short term and typical of road maintenance works. No works are proposed outside the confines of the road corridor and given the nature and scale of the temporary cable laying works no adverse effects relating to disturbance are anticipated. The project design has followed the basic principles outlined below to eliminate the potential for significant effects on avian receptors:

The project design has followed the basic principles outlined below to eliminate the potential for significant effects on avian receptors:

- The grid connection route has been selected to utilise built infrastructure for the majority of its length (i.e. cables to be laid within public roads). Cables will be laid underground to avoid effects on roadside hedgerows and disturbance to nesting birds.

5.3.2 Mitigation During Construction, Operation and Decommissioning

The following section describe the mitigation and best practise measures to be implemented during each phase of the Proposed Development.

5.3.2.1 Construction Phase Mitigation

A Construction and Environmental Management Plan (CEMP) has been prepared. The CEMP will be in place prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 of the EIAR. The CEMP is included as Appendix 2. A summary of the relevant points included in the CEMP are provided below and in the following sections:

- All removal of woody vegetation will be undertaken in accordance with Section 40 of the Wildlife Act 1976 as amended.
- The removal of woody vegetation will be undertaken outside the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context.
- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 350m radius of the lapwing breeding territories, as provided in Confidential Appendix 7-7 in Chapter 7 of the EIAR.
- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 500m radius of the barn owl breeding site, as provided in Confidential Appendix 7-7 in Chapter 7 of the EIAR.
- During the construction phase, noise limits, noise control measures, hours of operation (i.e. dusk and dawn is high faunal activity time) and selection of plant items will be considered in relation to disturbance of birds.
- Plant machinery will be turned off when not in use.

- All plant and equipment for use will comply with the industry best practise Construction Plant and Equipment Permissible Noise Levels Regulations and other relevant legislation.
- An Ecological Clerk of Works (ECoW) will be appointed. Duties will include:
  - Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided.
  - Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development site.
  - Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise.
  - Provide guidance to contractors to ensure legal compliance with respect to protected species onsite.
  - Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.

5.3.2.2 Operational Phase Mitigation

No operational phase impacts associated with the operation of the grid connection requiring mitigation were identified.

5.3.2.3 Decommissioning Phase Mitigation

It is proposed to leave all cable ducts in place following the cessation of operation of the wind farm, with the only works potentially being the removal of the cables, which will be removed from access joints on or adjacent to the public road and without the requirement for excavation. No requirement for mitigation was identified

5.4 Deterioration of Water Quality

There is hydrological connectivity between the Proposed Development and downstream European Sites via watercourses within the site boundary.

The proposed works have the potential to cause deterioration in surface water quality during the construction, operational and decommissioning phase of the development due to the release of pollutants including suspended solids and hydrocarbons, potentially affecting the following QIs/SCIs, in the absence of mitigation:

- Lough Owel SAC (000688)
  - Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
  - Alkaline fens [7230]
  - Transition mires and quaking bogs [7140]
  - *Austropotamobius pallipes* (White-clawed Crayfish) [1092]

- Lough Ennell SAC (000685)
  - *Alkaline fens [7230]*

- Lough Owel SPA (004047)
  - *Shoveler Anas clypeata [A056]*
  - *Coot Fulica atra*
  - *Wetland and Waterbirds [A999]*

- Lough Ennell SPA (004044)
  - *Pochard Aythya ferina [A059]*
  - *Tufted duck Aythya fuligula [A061]*
  - *Coot Fulica atra [A125]*
  - *Wetland and Waterbirds [A999]*

- Lough Derravaragh SPA (004043)
  - *Whooper swan Cygnus cygnus [A038]*
  - *Pochard Aythya farina [A059]*
  - *Tufted duck Aythya fuligula [A061]*
  - *Coot Fulica atra [A125]*
  - *Wetland and Waterbirds [A999]*

- Lough Iron SPA (004046)
  - *Whooper Swan Cygnus cygnus [A038]*
  - *Wigeon Anas penelope [A050]*
  - *Teal Anas creca [A052]*
  - *Shoveler Anas clypeata [A056]*
  - *Coot Fulica atra [A125]*
  - *Golden Plover Pluvialis apricaria [A140]*
  - *Greenland White-fronted Goose Anser albifrons flavirostris [A395]*

5.4.1.1 Mitigation by Design

The design of the Proposed Development, as described in Chapter 4 of the EIAR and in the CEMP, Appendix 4-4 of Chapter 4 sets out very clearly how the Proposed Development, including the underground cabling, has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses. This design includes suitable precautionary mitigation to make certain that the Proposed Development will not adversely affect the integrity of European sites.

The development has been designed to avoid effects on the watercourses that provide connectivity to relevant European Sites. This section demonstrates how this has been achieved:

- All major infrastructure such as turbines, substations and site compounds will be over 50m from any main watercourse (identified on EPA watercourse mapper) and 10m from any large drainage channels on the site.
- There will be 2 no. crossings over the River Glore as part of the Proposed Development. The first crossing comprises the replacement of an existing timber bridge with a 5m clear span bridge connecting Turbines T5-T12 to Turbines T1-T4. The second crossing will comprise a new 5m clear-span bridge to provide access to T15. A third crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge. Figure 4-24 in Chapter 4 of the EIAR shows the typical clear span bridge design. There will be no instream works required as part of the Proposed Development. The typical construction methodology for the installation of clear span bridges is provided below:
  - The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
  - All drainage measures along the proposed road will be installed in advance of the works.
  - The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ

using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the north or opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the southern side of the stream and will be lifted into place from the stream back with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.
- The upgrade of existing access tracks and construction of new tracks will involve some works within 50m of watercourses and new watercourse crossings. However, no instream works are proposed, and a suite of measures are in place to avoid any adverse effects on watercourses. These measures are described in full in the Chapter 9 'Hydrology' of the EIAR.
- No construction materials or construction waste will be placed within a 50-metre buffer zone around watercourses during the windfarm.

5.4.1.2 Morphological Changes to Surface Watercourses and Drainage Patterns

Diversion, culverting, road and grid cable crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Construction of structures over watercourses has the potential to significantly interfere with water quality and flows during the construction phase.

It is proposed that 1 no. existing watercourse crossings will be upgraded and 2 no. new watercourse crossings will be required to facilitate the wind farm access roads within the Wind Farm Site. These crossing are further described in Section 4.8.3 of Chapter 4 of the EIAR and included in Figures 4-23 to 4-25

Along sections of proposed and existing access roads, the Grid Connection Route cable will be constructed within the road crossing. Section 4.8.7.5 in Chapter 4 of the EIAR details the water crossing locations along the proposed Grid Connection Route and describes the proposed crossing construction methodology. Additional details are presented below.

- All proposed new stream crossings will ensure that the existing banks remain undisturbed. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Within the Wind Farm Site where the Grid Connection Route runs adjacent to a proposed access road or an existing access road proposed for upgrade, the Grid Connection Route cable will pass over any culvert (where one exists or is proposed) within the access road;
- Where a Grid Connection Route cable stream crossing is required, the cable will pass over the watercourse via suspended ducting thereby avoiding any morphological impacts;
- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of the proposed crossings. A 10m buffer is applied to the main drain (i.e. drain D1) to allow for future OPW maintenance;
- Works will be completed in accordance with the requirements of "Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters"; and,

- All access road river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

5.4.1.3 Construction Phase Mitigation

Mitigation measures have been incorporated into the Proposed Development for the prevention of water pollution. The Proposed Development includes a detailed drainage plan that is shown in the design drawings included in Appendix 9-3 of the EIAR. This plan and all the associated measures have been taken into account in this assessment. The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the CEMP (see Appendix 2) and Chapter 9 'Hydrology' of the EIAR.

The Inland Fisheries Ireland (2016): *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*; and the Scottish Natural Heritage (SNH) *Good Practice During Wind Farm Construction* (SNH, 2019, 4th Edition) will also be adhered to.

All detailed mitigation measures for the protection of water quality are fully described below and in Section 4.7, Chapter 4 of the accompanying EIAR, the CEMP, Appendix 4-4 of Chapter 4 (and Sections 9.5.3 – 9.5.4 Chapter 9 'Water' of the EIAR. The following subsections describe the mitigation measures proposed for the construction phase of the Proposed Development.

5.4.1.3.1 *Wind Farm Site Watercourse Crossings*

It is proposed to replace the existing timber bridge over the River Glore within the proposed wind farm site with a 5-metre clear span bridge. The proposed bridge crossing will form part of the internal site road network, connecting Turbines T5-T12 to Turbines T1-T4. The crossing location is at Grid Reference E 641,560 N 776,452, as shown in Figure 4-23 of Chapter 4 of the EIAR. The design avoids the requirement for in-stream works.

A second crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge as shown on Figure 4-24 (see Chapter 4 of the EIAR) which shows the typical clear span bridge design.

A third crossing will be required to provide access to Turbine T15 over the River Glore. This will require a 5-metre clear span bridge as shown in Figure 4-25 which shows the typical clear span bridge design (see Chapter 4 of the EIAR). The clear span bridge's will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

5.4.1.3.2 *Underground Cable Watercourse/Culvert Crossings*

A general description of the various construction methods employed at watercourse/ culvert crossings are described in the following paragraphs below. A list of the stream crossings along the underground cable route and the proposed crossing method at each location is provided in Table 4-3, Chapter 4 of the EIAR.

The stream crossing locations are shown in Figure 4-21 of Chapter 4 of the accompanying EIAR. The crossing locations for all culvert crossings are also shown on the underground cable route drawings included as Appendix 4-1, Chapter 4 of the accompanying EIAR . Details of all culvert crossing are also provided in Appendix 4-7, Chapter 4 of the accompanying EIAR.

5.4.1.3.3 Crossings over Culverts – Option 1

The watercourse at any of the crossings will not be disturbed because no instream works or bridge/culvert alterations are proposed. Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the ESB/Eirgrid specified flat formation ducting arrangement will be used where the cable ducts pass over a culvert maintaining 300mm minimum clearance to the top of the culvert. A heavy duty steel plate will be placed over the ducts as distance between the road surface and the ducts will have been reduced. See Figure 4-27 in Chapter 4 of the EIAR.

5.4.1.3.4 Crossing under Piped Culverts – Option 2

Where adequate cover does not exist between the top of the culvert and the finished surface of the road the cable ducts will be passed under the culvert as outlined in Figure 4-28 in Chapter 4 of the EIAR. A 300mm minimum separation distance will be maintained between the top of the ducts and the bottom of the piped culvert. A heavy duty steel plate will be placed above the ducting extending for 1m at either side of the culvert.

5.4.1.3.5 Flatbed Formation over Culverts – Option 3

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved to install the ducts as per option 1, the ducts will be laid in a shallow trench the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESB/Eirgrid specification. This method of duct installation is further detailed in Figure 4-29 in Chapter 4 of the EIAR.

5.4.1.3.6 Outside of Bridge Decking – Option 4

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in an stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 4-30 in Chapter 4 of the EIAR.

5.4.1.3.7 Directional Drilling – Option 5

In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes) or similar. The launch and reception pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any potential adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 4-31 in Chapter 4 of the EIAR.

5.4.1.3.8 *Construction Phase Drainage Management*

Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site. The following best practice drainage measures have been incorporated into the Proposed Development for the protection of surface water quality, as fully described in Section 4.2.4 of the CEMP, Appendix 4-4 of Chapter 4 :

- Interceptor drains will be installed up gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.
- Collector drains or swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase.
- The velocity of flow in the interceptor drains and collector drains, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the collector drain is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.
- A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site, or areas where they are not likely to give rise to peat stability issues.
- Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
- Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase.
- A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.
- Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical

method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.
- Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where watercourse crossings take place.
- Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.
- All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

5.4.1.3.9 *Hydrocarbons and Waste Material*

The use of hydrocarbons during the construction process leads to the potential for pollution to enter the wider environment, including drainage ditches and watercourses. Leaks in poorly maintained plant and machinery could lead to hydrocarbon dispersal over works areas. Leaks in fuel storage tanks and spillages during refuelling operations could lead to larger releases of hydrocarbons into the environment.

The following measures are proposed to avoid impacts on the wider environment as a result of pollution.

Refuelling, Fuel and Hazardous Materials Storage

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (Wind Farm Site and Grid Connection Route), and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building at the Wind Farm Site will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

5.4.1.3.10 *Concrete Pouring*

Because of the scale of the main concrete pours that will be required to construct the Proposed Development, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These will include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

5.4.1.3.11 Outline Peat Stability Management Plan

Minimal peat excavation is likely to be required on site due to the proposed construction techniques for the site. With the exception of Turbine T5 and T15, all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, piled foundations may be required for the substation building. It is anticipated that the substation platform and construction compound platform will likely be constructed using floating techniques. The proposed construction method for all the new proposed access roads is a floated technique.

The total estimated volume of peat and overburden to be excavated during the construction phase of the proposed development is 97,980m3. These quantities were calculated by FT as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of the EIAR

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

A Geotechnical & Peat Stability Assessment Report has been prepared by AGEC which provides a Geotechnical Risk Register for the site and includes details of the required mitigation/control measures. These mitigation measures are summarised below and in Appendix 8-1 of the EIAR.

The peat stability assessment indicates that there is insignificant risk of peat failure. The following mitigation measures are recommended and should be taken into account when preparing Construction Method Statements for the proposed development:

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.

- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits.
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).
- Peat movement monitoring posts will be installed upslope and downslope of access roads and at locations where peat depths are greater than 4.0m.

5.4.1.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) analyses will be carried out by either the Environmental Manager or the Project Hydrologist at all surface water monitoring locations. In-situ field monitoring will be completed on a weekly basis (with some parameters monitored monthly). In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The supervising hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

5.4.1.5 Monitoring Parameters

Parameter	EQS	Event	Methodology
Visual Inspection	No abnormal change	Daily	Field Inspection and photographic record.
pH	4.5<pH>9.0	Weekly	Field Measurement (Handheld probe)
Dissolved Oxygen	No abnormal change	Weekly	Field Measurement (Handheld probe)
Conductivity	No abnormal change	Weekly	Field Measurement (Handheld probe)
Temperature	No abnormal change	Weekly	Field Measurement (Handheld probe)
Ammonia	High Status ≤0.04mg/L Good Status ≤0.065mg/L	Monthly	Accredited Laboratory Analysis

Nitrate	-	Monthly	Accredited Laboratory Analysis
BOD	High Status ≤1.3 mg/L Good Status ≤1.5 mg/L	Monthly	Accredited Laboratory Analysis
Total Petroleum Hydrocarbons	Below Detection Limit	Monthly/Following potential hydrocarbon spill	Accredited Laboratory Analysis
Orthophosphate	High Status ≤0.025 Good Status ≤0.035		
Alkalinity	No abnormal change	Monthly/Following potential cement leaching	

5.4.2 Operation Phase Mitigation

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

5.4.2.1 Decommissioning Phase Mitigation

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the equipment may be replaced with a new technology, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully.

Upon decommissioning of the Proposed Development, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with the same model of cranes that were used for their erection. The turbine will be removed from site using the same transport methodology adopted for delivery to site initially. The turbine materials will be transferred to a suitable recycling or recovery facility.

All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in environment emissions such as noise, dust and/or vibration.

Site roadways will be in use for purposes other than the operation of the Proposed Development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the site. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required.

A Decommissioning Plan has been prepared (Appendix 4-11, Chapter 4 of the EIAR) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the Proposed Development has been fully assessed in the accompanying EIAR and within this NIS.

6. ASSESSMENT OF RESIDUAL ADVERSE EFFECTS

The potential for significant effects on each of the individual Qualifying Interests (QIs) and Special Conservation Interests (SCIs) that were identified as being at risk of potential effects in the AA Screening Report are assessed in this section in view of the Conservation Objectives of those habitats and species.

6.1 Lough Owel SAC

A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- Transition mires and quaking bogs [7140]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]

6.1.1 Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]

The identified pathways for effect are deterioration in water quality during the construction phase of the development, potentially resulting in deterioration of the downstream Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* habitat.

The conservation objective for this QI is:

> *'To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. in Lough Owel SAC.'*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). An assessment of the Proposed Development against the nominated attributes and targets for this habitat is provided in Table 6-1 below.

Table 6-1 Targets and attributes associated with the conservation objectives for Hard oligo-mesotrophic waters with benthic vegetation of Chara spp

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes.	This habitat was not identified within or adjacent to the Proposed Development site. All works a restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the
Habitat distribution	No decline, subject to natural processes	
Typical species	Typical species present, in good condition, and demonstrating typical abundances and distribution	

Attribute	Target	Assessment
Vegetation composition: characteristic zonation	All characteristic zones should be present, correctly distributed and in good condition	construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC.
Vegetation distribution: maximum depth	Maintain maximum depth of vegetation, subject to natural processes	
Hydrological regime: water level fluctuations	Maintain/restore appropriate hydrological regime necessary to support the habitat	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. There will be no alteration to the hydrological regime, lake substratum, water quality or fringing habitat area as a result of the Proposed Development.
Lake substratum quality	Maintain appropriate substratum type, extent and chemistry to support the vegetation	
Water quality: transparency	Maintain/restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	
Water quality: nutrients	Maintain/restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	
Water quality: phytoplankton biomass	Maintain/restore appropriate water quality to support the habitat, including high chlorophyll a status	
Water quality: phytoplankton composition	Maintain/restore appropriate water quality to support the habitat, including high phytoplankton composition status	
Water quality: attached algal biomass	Maintain trace/absent attached algal biomass (<5% cover)	
Water quality: macrophyte status	Maintain high macrophyte status	
Acidification status	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	
Water colour	Maintain appropriate water colour to support the habitat	
Dissolved organic carbon (DOC)	Maintain appropriate organic carbon levels to support the habitat	
Turbidity	Maintain appropriate turbidity to support the habitat	

Attribute	Target	Assessment
Fringing habitat: area and condition	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3140	

6.1.2 Alkaline Fens [7230]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora and regeneration of sedge and reed species that predominate in this habitat.

The conservation objective for this habitat is:

'To maintain the favourable conservation condition of Alkaline fens in Lough Owel SAC.'

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the current development and are described in Table 6-2.

Table 6-2 Assessment of development against targets and attributes of calcareous fens

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site. All works a restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC. There will be no alteration to any alkaline fen habitat within the SAC in terms of size, habitat area or distribution associated with the Proposed Development.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	Maintain soil pH and nutrient status within natural ranges	Following the implementation of mitigation, the pathway for any effect on this habitat is robustly blocked such that there is no potential for alteration to the ecosystem function of this
Ecosystem function: peat formation	Maintain active peat formation, where appropriate	

Attribute	Target	Assessment
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	habitat within the SAC associated with the Proposed Development.
Ecosystem function: hydrology - surface water flow	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	
Ecosystem function: water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological processes that influence the vegetation composition of this habitat.
Vegetation composition: brown mosses	Maintain adequate cover of typical brown moss species	
Vegetation composition: typical vascular plants	Maintain adequate cover of typical vascular plant species	
Vegetation composition: native negative indicator species	Cover of native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
Vegetation composition: soft rush and common reed cover	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	
Vegetation structure: litter	Total cover of litter not more than 25%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%	
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local	

Attribute	Target	Assessment
	distinctiveness, subject to natural processes	

6.1.3 Transition mires and quaking bogs [7140]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora.

The conservation objective for this QI is:

> '*To maintain the favourable conservation condition of Transition mires and quaking bogs in Lough Owel SAC*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). An assessment of the Proposed Development against the nominated attributes and targets for this habitat is provided in Table 6-3 below.

Table 6-3 Targets and attributes associated with the conservation objectives for Transition mires and quaking bogs

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site. All works will be restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	No decline, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. There will be no alteration to the ecosystem function or hydrological regime as a result of the Proposed Development.
Ecosystem function: peat formation	Maintain soil pH and nutrient status within natural ranges	
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate water levels necessary to support the natural structure and functioning of the habitat	

Attribute	Target	Assessment
Ecosystem function: hydrology – flow patterns	Maintain, or where necessary restore, appropriate topography and water movement regime necessary to support the natural structure and functioning of the habitat	
Ecosystem function: water quality	Maintain, or where necessary restore, appropriate water quality to support the natural structure and functioning of the habitat	
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological process that influence the vegetation composition of this habitat.
Vegetation composition: typical vascular plants and bryophytes	Maintain adequate cover of typical vascular plant and bryophyte species	
Vegetation composition: native negative indicator species	Native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Physical structure: drainage	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%.	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	

6.1.4 White-clawed Crayfish [1092]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the habitat which supports White-clawed Crayfish.

The conservation objective for this species is:

> *'To maintain the favourable conservation condition of White-clawed Crayfish in Lough Owel SAC.'*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the Proposed Development and are described in Table 6-4.

Table 6-4 Assessment of development against targets and attributes of alkaline fens

Attribute	Target	Assessment
Distribution	No reduction from baseline. See map 5	The supporting habitat for this species was not identified within or adjacent to the Proposed Development site during the surveys. All works will be restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to block any pathway for effect, it can be concluded that the Proposed Development will not result in any impact which could adversely affect White-clawed Crayfish or the aquatic habitat which supports this species.
Population structure: recruitment	Juveniles and/or females with eggs should be present in all occupied 1km squares, subject to natural processes and availability of suitable habitat	
Negative indicator species	No instances of disease	
Water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of lake habitat 3140	
Habitat quality: heterogeneity	No decline in heterogeneity or habitat quality	

6.1.5 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Owel SAC.

6.2 Lough Ennell SAC

The SAC is located approximately 4.2km south of the proposed grid connection route and 24.2km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitat:

- Alkaline fens [7230]

6.2.1 Alkaline Fens [7230]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora and regeneration of sedge and reed species that predominate in this habitat.

The conservation objective for this habitat is:

> *'To maintain the favourable conservation condition of Alkaline fens in Lough Ennell SAC.'*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the current development and are described in Table 6-5.

Table 6-5 Assessment of development against targets and attributes of calcareous fens

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site during the surveys and no works will take place within 4.2km of the SAC. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC. There will be no alteration to any calcareous fen habitat within the SAC in terms of size, habitat area or distribution associated with the Proposed Development.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	Maintain soil pH and nutrient status within natural ranges	Following the implementation of mitigation, the pathway for any effect on this habitat is robustly blocked such that there is no potential for alteration to the ecosystem function of this habitat within the SAC associated with the Proposed Development.
Ecosystem function: peat formation	Maintain active peat formation, where appropriate	
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	
Ecosystem function: hydrology - surface water flow	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	
Ecosystem function: water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	

Attribute	Target	Assessment
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological process that influence the vegetation composition of this habitat.
Vegetation composition: brown mosses	Maintain adequate cover of typical brown moss species	
Vegetation composition: typical vascular plants	Maintain adequate cover of typical vascular plant species	
Vegetation composition: native negative indicator species	Cover of native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
Vegetation composition: soft rush and common reed cover	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	
Vegetation structure: litter	Total cover of litter not more than 25%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%	
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	

6.2.2 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Ennell SAC.

6.3 Lough Owel SPA

The proposed grid connection route is located within the existing N4 corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA.

The proposed works have the potential to cause deterioration of water quality during the construction, phase of the development These effects could occur in the form of release of suspended solids or hydrocarbons during the works associated with the laying of cable for the grid connection. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA.: On a precautionary basis, due to the close proximity of the grid connection route, a potential pathway for indirect effects was identified in the form of bird disturbance and deterioration of habitat as described above. These impacts have the potential to adversely affect the following SCIs:

- 'Wetland and Waterbirds [A999]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]

6.3.1 Wetland and Waterbirds [A999]

The identified pathways for effect are deterioration in water quality and therefore habitat quality during the construction phase of the development. Following the precautionary principle, this could potentially affect food availability and the nesting/foraging value of the wetland habitat.

The conservation objective for this SCI is:

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment as per the table below.

Table 6-6 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute		Target	Assessment
Habitat area		The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat.

Attribute		Target	Assessment
			A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.3.2 SCI Species (Shoveler and Coot)

According to the bird surveys carried out between 2015-2017, 2018-2020 or 2021 - 2022 shoveler were not recorded at the proposed wind farm site (including 500m buffer). The Proposed Development has no potential to result in direct habitat loss, displacement or barrier effect on Shoveler .

Coot was recorded within 500m of the wind farm site on only seven occasions during the extensive suite of surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

The development Site is not of significance to these species.

Following the precautionary principle, the potential for the construction of the grid connection adjacent to the SPA has the potential to result in disturbance to these species and there is also the potential for water pollution to result in habitat deterioration for the species.

No site-specific conservation objectives are available for Lough Owel SPA, however other sites with this SCI species were reviewed to further inform the assessment. The extrapolated targets and attributes for this SCI have been reviewed and considered in relation to the current development as described below.

Table 6-7 Targets and attributes associated with the nominated conservation objectives for Shoveler and Coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. There is no potential for

		the Proposed Development to adversely affect the population trend within the SPA. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. The Proposed Development will not adversely affect the distribution of the species within the SPA. Similarly, with the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.3.3 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Owel SPA.

6.4 Lough Ennell SPA

The SPA is located 4.5km south of the proposed grid connection route and 24.4km south of the proposed wind farm site. Due to this distance there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of surface water deterioration through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase was identified. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. These include:

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The identified pathways for effect are deterioration in water quality and therefore habitat quality during the construction phase of the development. Following the precautionary principle, this could potentially affect food availability and the nesting/foraging value of the wetland habitat and the habitat of the other SCI species.

Site specific conservation objectives documents are not available for this site. The conservation objectives for this site are::

> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

> '*To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it'.*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.4.1 Wetland and Waterbirds [A999]

Table 6-8 Example targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute	Target	Assessment
Habitat area	The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat.

Attribute	Target	Assessment
		A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.4.2 SCI Species

Table 6-9 Targets and attributes associated with the nominated conservation objectives for pochard, tufted duck and coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	With the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.4.3 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Ennell SPA.

6.5 Lough Derravarragh SPA

Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the SCI species associated with the SPA have also been considered. The following SCIs were identified as having potential to be impacted by the Proposed Development are considered below:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetlands and Waterbirds [A999]

In addition, the Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016) and the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision was considered in this NIS.

The conservation objectives for this SPA are

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravarragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
>
> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.5.1 Wetland and Waterbirds [A999]

Table 6-10 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute		Target	Assessment
Habitat area		The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in

Attribute		Target	Assessment
			any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.5.2 SCI Species affected by Water Pollution and Disturbance

Table 6-11 Targets and attributes associated with the nominated conservation objectives for whooper swan, pochard, tufted duck and Coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The proposed grid connection works will be short-term in duration and restricted to the existing road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. There is no potential for the Proposed Development to adversely affect the population trend within the SPA. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. The Proposed Development will not adversely affect the distribution of the species within the SPA.

		Similarly, with the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.5.3 Whooper Swan

Table 6-12 Targets and attributes associated with the nominated conservation objectives for Whooper Swan

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.5.4 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Derravarragh SPA.

6.6 Lough Iron SPA

Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. The following SCIs were identified as having potential to be impacted by the Proposed Development are considered below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]
- Wetland and Waterbirds [A999]

In addition, following the precautionary principle, the Proposed Development has been assessed for the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision in respect of Greenland white fronted goose, whooper swan and golden plover.

The conservation objectives for this SPA are

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
>
> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.6.1 Wetland and Waterbirds [A999]

Table 6-13 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute	Target	Assessment
Habitat area	The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.6.2 SCI Species affected by Water Pollution

Table 6-14 Targets and attributes associated with the nominated conservation objectives for whooper swan, wigeon, teal, shoveler, golden plover, Greenland white fronted goose and coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	With the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.6.3 SCI Species assessed for Habitat loss, Disturbance and Collision

Table 6-12 Targets and attributes associated with the nominated conservation objectives for Whooper Swan, Greenland white fronted goose and golden plover

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on these species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on these species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.6.4 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Iron SPA.

6.7 Garriskil Bog SPA

Following the precautionary principle, the Proposed Development has been assessed for the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision in respect of Greenland white fronted goose.

The conservation objective for this SPA is

> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.7.1 Greenland white fronted goose

Table 6-12 Targets and attributes associated with the nominated conservation objectives for, Greenland white fronted goose

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.7.2 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Iron SPA.

6.8 Invasive Species

Third Schedule invasive species Bohemian Knotweed, Japanese Knotweed, Himalayn Knotweed and Rhododendron were recorded along the proposed grid connection route (see Table 4-14). The following mitigation will be adhered to in relation to these species:

- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere.
- Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally.
- Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes.
- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.
- Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.
- Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing.
- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.
- When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal.
- Any soils or subsoils contaminated with invasive species will sent for disposal to an appropriately licenced facility.
- The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed*, *'The Management of Invasive Alien Plant Species on National Roads- Standard' and 'The Management of Invasive Alien Plant Species on National Roads- Technical Guidance'*.

6.9 Conclusion of Impact Assessment

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Site.

It will not prevent the QIs/SCIs of any European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive. A definition of Favourable Conservation Status is provided below:

> *'conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;*

The conservation status will be taken as 'favourable' when:

- *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

Based on the above, it can be concluded in view of best scientific knowledge, on the basis of objective information that the Proposed Development will not adversely affect the Qualifying Interests/Special Conservation Interests associated with any European Designated Sites, namely the following:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskil Bog SPA (004102)

7. IN COMBINATION EFFECTS

A search and review in relation to plans and projects that may have the potential to result in cumulative and/or in-combination impacts on European Sites was conducted. This assessment focuses on the potential for cumulative in-combination effects on the European Sites where potential for adverse effects was identified at the screening stage (Appendix 1). This included a review of online Planning Registers, development plans and other available information and served to identify past and future plans and projects, their activities and their predicted environmental effects.

7.1 Development context – Ecological Plans and Policies

The following development plans have been reviewed and taken into consideration as part of this assessment:

- Westmeath County Development Plan 2021-2027
- Westmeath Biodiversity Action Plan 2014 -2020

The review focused on policies and objectives that relate to Natura 2000 sites and natural heritage. Policies and objectives relating to sustainable land use were also reviewed and are detailed in Table 7-1.

Table 7-1 Review of land use and spatial plans 2021 -2027

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
CPO 12.4: It is Council policy to protect and conserve Special Areas of Conservation, candidate Special Areas of Conservation, Special Protection Areas and candidate Special Protection Areas, designated under the EU Birds and Habitats Directives respectively.	The Development plan was comprehensively reviewed, with particular reference to Policies and Objectives that relate to the Natura 2000 network and other natural heritage interests. No potential for cumulative impacts when considered in conjunction with the current proposal were identified. There will be no impact on designated sites as a result of deterioration in water quality. Best practice preventative measures will be implemented to avoid effects on water quality, as outlined in section 3.3 of this report, the hydrology chapter and in the CEMP (Appendix 2). There will be no adverse effects on sensitive aquatic receptors listed as QIs/SCIs of European Sites, as a result of deterioration in water quality. There will be no impact on European designated sites as a result of the Proposed Development. The development will not affect the conservation status of any QI species or habitat or SCI species of any EU designated site. The development will not prevent the QIs/SCIs of the European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive.
CPO 12.5: It is Council policy to Ensure that no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects).	
CPO 12.6: It is Council policy to ensure that any plan or project that could have a significant adverse impact (either by themselves or in combination with other plans and projects) upon the conservation objectives of any Natura 2000 Site or would result in the deterioration of any habitat or any species reliant on that habitat will not be permitted.	
CPO 12.7: It is Council policy to assess any plan or project in accordance with Article 6 of the Habitats Directive to determine whether the plan or project is likely to have a significant effect on the site either individually or cumulatively upon the integrity, conservation objectives and qualifying interest of any Natura 2000 Site.	
CPO 12.8: It is Council policy to require an ecological appraisal for development not directly connected with or necessary to the management of Natura Sites, or a proposed Natura Site and which are likely to have significant effects on that site either individually or cumulatively.	
CPO 12.9: It is Council policy to identify and provide appropriate buffer zones between Designated Sites and local biodiversity features and areas zoned for development	

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
CPO 12.10: It is Council policy prepare Strategic Habitat Management Plans for Natura 2000 Sites in Council ownership in consultation with the National Parks and Wildlife Service and relevant stakeholders.	
CPO 12.11: It is Council policy promote the maintenance and as appropriate, achievement of favourable conservation status of habitats and species and to improve the ecological coherence of the Natura 2000 network, by maintaining and where appropriate, developing features in the landscape which are of major importance for wild fauna and flora.	
CPO 12.12: It is Council policy to require that new development proposals affecting designated sites have regard to the sensitivities identified in the SEA Environmental Report prepared in respect of this plan.	
CPO 12.13 It is Council policy to protect, manage and enhance the natural heritage, biodiversity, landscape and environment of County Westmeath, in recognition of its importance as both a non-renewable resource and a natural asset.	Any treeline and/or hedgerow removed as part of the Proposed Development will be replaced as part of the design of the project. Where removal of woodland is required to widen roads within the site between T5 and T9 these works will be kept to a minimum and the woodland will be retained as part of the operation of the windfarm. All tree removal within the development site has been accounted for in the replanting assessment for this project.
CPO 12.24 It is Council policy to protect and where possible enhance biodiversity and ecological connectivity, including woodlands, trees, hedgerows, semi-natural grasslands, rivers, streams, natural springs, wetlands, geological and geo-morphological systems, other landscape features, natural lighting conditions, and associated wildlife where these form part of the ecological network and/or may be considered as ecological corridors or stepping stones in the context of Article 10 of the Habitats Directive. Appropriate mitigation and/or compensation to conserve biodiversity, landscape character and green infrastructure networks will be required where habitats are at risk or lost as part of a development.	
CPO 12.25 It is Council policy to recognise that nature conservation is not just confined to designated sites and acknowledge the need to protect non-designated habitats and landscapes and to conserve the biological diversity.	
CPO 12.27 Prevent the spread of invasive species within the plan area, including requiring landowners and developers to adhere to best practice guidance in relation to the control of invasive species.	Invasive species listed on the Third Schedule of the European Communities Birds and Habitats Regulations 2011 (S.I. 477/2011) have been identified along the proposed grid connection route. No invasive species were recorded within the Wind Farm Site. Site specific
CPO 12.28 Ensure that proposals for development do not lead to the spread or introduction of invasive species. If developments are proposed on sites where invasive species are or were previously present, the applicant will be required to submit a control and management program for the particular invasive species as part	

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
of the planning process and to comply with the provisions of the European Communities Birds and Habitats Regulations 2011 (S.I. 477/2011).	mitigation in relation to these species has been described within this NIS to prevent the spread of invasive species during the proposed works.
CPO 12.29 Support, as appropriate, the National Parks and Wildlife Service's efforts to seek to control and manage the spread of non-native invasive species on land and water. Where the presence of non-native invasive species is identified at the site of any Proposed Development or where the proposed activity has an elevated risk of resulting in the presence of these species, details of how these species will be managed and controlled will be required.	
Westmeath Biodiversity Action Plan 2014-2020	
<u>**Actions for Biodiversity**</u> Actions for Biodiversity are divided under the following headings : › Protection and Development of the Ecological Network › Monitoring and Research › Raising Awareness **Protection and Development of the Ecological Network** › Promoting habitats connectivity through: ▪ Raising awareness,	The Biodiversity Plan was comprehensively reviewed, with particular reference to Actions that relate to the Natura 2000 network. No potential for cumulative impacts when considered in conjunction with the current proposal were identified.

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
▪ Incorporating planning and legislation, ▪ Education, Protection, ▪ Establishing new connections. › Preparing management plans for conservation worthy habitats. **Monitoring and Research** › Identifying Local Biodiversity Sites. › Assessing gaps in knowledge on Westmeath biodiversity. › Seeking to fill these gaps by both professional and volunteer bodies (applies also to Raising Awareness). › Facilitating free public access to information on Westmeath biodiversity (applies also to Raising Awareness). **Raising Awareness** › Promoting and/or delivering biodiversity education among Members of the Public and Local authorities employees. › Facilitating and promoting free public access to nature enjoyment. › Raising pride of local biodiversity. › Bringing together communities in protecting, enhancing and enjoying nature (applies also to Protection and Development of the Ecological Network).	

7.1.1 Proposed Wind Farm Site

A review of Westmeath Council Planning Register shows the following planning applications lodged within the site of the currently proposed wind farm:

Forestry Entrances Pl. Ref. No. 98/1092

Planning application by Coillte Teo, for new forestry entrances. Permission was granted by the Planning Authority on the 03/12/98 subject to 2 no. conditions.

Permitted Coole Wind Farm Pl. Ref. No. 17/6292/ABP-300686-18
Coole Wind Farm Ltd. applied to Westmeath County Council in October 2017 for planning permission for the construction of a wind farm consisting of 13 no. wind turbines, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Permission was refused by the Planning Authority, however, the Board granted permission for the proposal following a first party appeal under PL25M.300686 in March 2019.

All elements of the permitted project, including an assessment of the proposed cable route were assessed as part of the EIS/EIAR submitted with the above application.

Grid Connection
A planning application for the electrical connection of the permitted Coole wind farm to the national grid which included for expansion of the above-mentioned onsite substation and upgrade works to the existing Mullingar substation was submitted to Westmeath County Council on 22nd May 2020 and was considered under Pl. Ref 20/6121. This application was lodged following An Bord Pleanála confirming that permission should be lodged with Westmeath after considering the S182A status or otherwise of the grid connection works under PL25M.304794. A Further Information Request (FIR) was issued by Westmeath County Council on the 17th July 2020 in relation to that application. That application was subsequently withdrawn. A copy of the Further Information Request is included in Appendix 2-1 of the EIAR. Table 1-2 below provides a summary of the various further information points that were raised and references where these points have been dealt with within the EIAR and application documentation.

In preparing the NIS for the Proposed Development, the applicant and design team have considered in full the previous applications for both Coole Wind Farm and the Coole Grid Connection, along with the Further Information Request that was issued in July 2020.

7.1.2 Applications in the Vicinity of the Proposed Wind Farm Site

The majority of planning applications in the immediate vicinity of the proposed wind farm site are related to the provision and/or alteration of one-off housing and agricultural developments. Applications which are not of an individual domestic or agricultural nature in the vicinity of the EIAR study area include the following:

Peat Operations

- **Pl Ref. 88/313**: Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard. The planning authority granted planning permission on 10th February 1989.
- **ABP-307853-20** - Substitute Consent - Extra Time Westland Horticulture Limited due to be submitted 23rd day of November, 2020

- **ABP 305835 –** Leave to Apply Substitute Consent by Westland Horticulturefor peat harvesting on lands at Lower Coole, Mayne, Ballinealoe and Clonsura County Westmeath was granted on 1st May 2020

- **ABP 306242** - Substitute Consent Application for Peat Extraction Mountdillon, Duil na Gun, Co. Westmeath, Milkernagh, Co. Westmeath and Co. Longford and Coolcraff, Co. Longford. The decision by An Bord Pleanala was subsequently quashed by Order of the High Court in May 2021.

Other Applications

- **Pl Ref. 11/2043**: Planning application relating to Turbotstown House for alterations to the existing return wing and associated south - east elevation as well as removal of later internal partition and the provision of a reversible enclosure of the basement stairwell to main house pantry including ancillary associated works to a building listed as a protected structure, No. 261. The planning authority granted planning permission on the 23rd September 2011 subject to 7 no. conditions.

- **Pl. Ref.81/699**: Planning application for erection of a 38kV sub-station at Tromra. The Planning Authority granted permission on the 29th October 1981.

7.1.3 Applications in the Vicinity of the Proposed Grid Connection Route

The grid connection route from the permitted Coole Wind Farm site is in the general vicinity of over 100 no. valid planning applications made to Westmeath County Council. The majority of these applications are for residential development and were lodged since the early 1980s. The proposed grid connection route is also immediately adjacent to and/or within the general vicinity of a range of consented commercial developments, particularly within Multyfarnham, and ancillary agricultural infrastructure. Of those applications submitted the following are of note:

Energy Infrastructure

- Planning Ref. 18/6063 - Planning Application for a ten-year permission for the construction of an energy storage facility, including an electrical substation building, battery modules, transformer/invertor station modules and ancillary infrastructure (Planning Ref. 186063), located c. 220m west of the proposed grid connection route. The development was granted planning permission by Westmeath County Council in February 2019. This decision was subsequently appealed to An Bord Pleanála. An Bord Pleanála granted permission for the development in July 2019.
- Planning Ref. 81/699: Planning application for erection of a 38 kV sub-station at Tromra. The Planning Authority granted permission on the 29th October 1981.

Peat Operations

- Planning Ref. 88/313: Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard. The planning authority granted planning permission on 10th February 1989.

Residential

- Planning Ref. 16/6001 - Planning Application for the development of 28 no. houses to be constructed in three phases. The planning authority granted planning permission in January 2017.

Community Facilities

There are several applications for community facilities, e.g. education and recreational facilities, located adjacent to or within general proximity of the proposed grid connection, as listed below. The majority of these applications have been submitted within the last 5 no. years.

- Planning Ref. 06/2334 - To remove existing prefabricated classroom and to extend existing school to provide a replacement classroom with toilets, staff room, resource room, wheelchair toilet facilities and a P.E. room. The Planning Authority granted permission for the Proposed Development in January 2007.
- Planning Ref. 10/2021 - To alter & extend part of the existing agricultural training collage buildings to provide a Cancer counselling and retreat centre and a suicide and training centre. The Planning Authority granted permission for the Proposed Development in August 2010.
- Planning Ref. 13/6091 - New single storey classroom extension (45sqm) to the rear of the existing building and the provision of a staff carparking area. The Planning Authority granted permission for the Proposed Development in February 2014.
- Planning Ref. 17/6116 - Change of use of a former agricultural yard to a horticultural based sessional training centre. The Planning Authority granted permission for the Proposed Development in November 2017.
- Planning Ref. 17/6112 - New single storey side extension (42.65 sqm) to the existing building comprising of a new classroom/toilet, disabled toilet and lobby, car-parking. The Planning Authority granted permission for the Proposed Development in July 2017.
- Planning Ref. 18/6174 - The installation of a multi-purpose playground unit. The Planning Authority granted permission for the Proposed Development in August 2018.
- Planning Ref. 18/6233 - A proposed sports and recreational development adjacent to the existing Community Centre and playing filed. Permission is also sought to upgrade the existing car parking area and to construct a new car parking area with a total number of 224 spaces and 2 no. bus parking bays. The Planning Authority granted permission for the Proposed Development in December 2018.

7.1.4 Forestry and Replanting

The majority of the proposed wind farm site is occupied by commercial cutover peat, with some areas occupied by commercial forestry. As part of the Proposed Development, some tree felling is required within and around the development footprint to allow the construction of turbine bases, access roads and other ancillary infrastructure. There are two turbines within the Proposed Development that are located within an area of forestry; T5 and T14. It should be noted that all forestry on the site of the proposed wind farm was originally planted as a commercial crop and will be felled in the coming years should the proposed wind farm proceed or not.

In line with the Forest Service's published policy on granting felling licenses for wind farm developments, areas cleared of forestry for turbine bases, access roads, and any other wind farm-related uses will have to be replaced by replanting at an alternative location.

A total of 16.36 hectares of new forestry will be replanted as a condition of any felling licence that might issue in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement replanting of forestry can occur anywhere in the State subject to licence. A potential replanting area has been identified in the townland of Maheraboy, approximately 1.4 kilometres east of

Ballaghdereen, Co. Roscommon. An area at this site measuring 16.53 hectares has been granted Forest Service Technical Approval for afforestation. If these replant lands become unavailable, other similarly approved lands will be acquired for replanting should the proposed wind farm receive planning permission. A description of the proposed replanting land and an assessment of the potential impacts including cumulative impacts associated with afforestation at this location are presented in Appendix 4-6 of the EIAR and have been taken into account as part of this assessment.

7.1.5 Other Wind Farm Sites

There is only 1 No. permitted wind turbine located within 20 kilometres of the proposed wind turbines, as shown in Figure 2-2 in Chapter 2 of the EIAR. The relevant planning history of wind farm applications within the wider area is summarised below. This record lists the main relevant application in relation to the wind turbine applications. It is not intended to be exhaustive and list every application associated with the sites.

7.1.5.1 County Westmeath

Dryderstown Wind Turbine

- **Pl Ref 12/2054**: Application by Reforce Energy Ltd. for a single electricity generating wind turbine of hub height up to 64m and rotor diameter up to 48m, a hardstanding, Control Building, Associated site roads, drainage & site works
- **Development Address:** Dryderstown, Delvin. The site is located approximately 21 kilometres southeast of the nearest proposed wind turbine.
- **Decision:** 1 no. turbine granted by the Planning Authority (Westmeath County Council) subject to 12 no. conditions.

Crowinstown Wind Farm

- **Pl. Ref. 08/2174:** Application by Gaelectric Developments Ltd.seeking to amend planning ref 03/2064 (An Bord Pleanála Ref 25C.205586) relating to the development of a wind farm comprising of 3 wind turbine generators, 1 control building, 1 control building compound, associated access roads and 1 meteorological tower. This amendment seeks to increase the height of the wind turbine generators from a hub height of 78m to 85m and the rotor diameter from 72m to 80m. This will result in a maximum rotor blade tip height of 125m previously 114m. In addition, this application seeks to amend condition 2 to allow the 20-year permission period to commence from the commissioning date of the wind farm rather than from the date of the grant which was 22nd of June 2004.
- **Development Address:** Townlands of Crowinstown Great, Delvin, Co. Westmeath
  The site is located approximately 24.9 kilometres southwest of the nearest proposed wind turbine.
- **Decision:** 3 no. turbines granted by the Planning Authority (Westmeath County Council) subject to 13 no. conditions.

Proposed Ballivor Wind Farm

- Bord na Móna is proposing to develop a wind farm within the Ballivor Bog Group located in Counties Meath and Westmeath. This project is currently undergoing pre-application consultation with An Bord Pleanála under the provisions of ABP 307471-20. The proposed development will be located on bogs within the Ballivor Bog Group in counties Meath and Westmeath, namely Ballivor, Bracklin, Carranstown, Lisclogher and

Lisclogher West bogs. The site is located approximately 25.6 kilometres southwest of the nearest proposed Coole wind turbine.

Proposed Bracklyn Wind Farm

- Gaeltech Energy Developments Ltd is proposing to develop a wind farm of approximately 11 no. turbines in the townland of Bracklin, Co. Westmeath. The project is at the early design and consultation stage. The site is located approximately 24.9 kilometres southwest of the nearest proposed wind turbine.

7.1.5.2 County Cavan

Existing Ballyjamesduff Wind Turbine

- **Pl Ref 14/103ABP Ref. PL 02.243776:** Application by Liffey Energy for a development consisting of the erection of a single turbine with a hub height of 100m and rotor diameter of 103m, overall height not exceeding 152m and all associated site development works, including foundations, crane hardstanding, access track and underground cabling. Also, the construction of 20kV switchroom building with a floor area 50sqm, and temporary alteration of existing factory entrance of the L30130.
- **Development Address:** Townlands of Cloggagh,Ballyjamesduff
  This site is located approximately 16.4 kilometres northeast of the the nearest proposed wind turbine.
- **Decision:** 1 no. turbines granted by the Planning Authority (Cavan County Council) subject to 11 no. conditions.

Proposed Ballyjamesduff Wind Turbine

- **Pl Ref 19/447 ABP Ref. PL 02.309478:** Application by Liffey Energy for a development consisting of the erection of a single turbine with a maximum height of 169m, associated access and reinstatement works including turbine foundation, hardstanding area, site access tracks, 1 no. temporary site entrance and underground electrical cabling.
- **Development Address:** Townlands of Kilquilly and Cloggagh, Ballyjamesduff
  This site is located approximately 16 kilometres northeast of the the nearest proposed wind turbine.
- **Decision:** Cavan County Council refused permission for the proposed on 22nd January 2021, the application was appealed to An Bord Pleanála and was refused permission by the Bord on 23rd June 2021.

7.2 Other Projects

7.2.1 Projects Considered in Cumulative Assessment

The projects considered in relation to the potential for cumulative impacts and for which all relevant data was reviewed include those listed below.

Peat Extraction

Commercial peat harvesting at the Proposed Development site, as described in Section 2.6.2 in Chapter 2 of the EIAR.

Whilst the future of peat harvesting on the areas surrounding the wind farm is uncertain, the precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation. Proposed in the EIAR as submitted is the establishment of an 'Integrated Management Group' which will be made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities. All parties within this group will collaborate to ensure that any proposed repurposing of the site or rehabilitation will be considered and carried out appropriately. Should the peat cutting operations permanently cease, any rehabilitation or repurposing of the site will be the subject of ecological assessment, Screening for Appropriate Assessment or full Appropriate Assessment and any such assessment would take account of the potential cumulative effects of any permitted or proposed wind farm. It is likely that the ecological impacts of any rehabilitation would be of a lower significance than those associated with the ongoing peat cutting.

Forestry

Some areas within the site are planted with commercial forestry.

Road Scheme

Proposed upgrade to a 52km section of the N4 between Mullingar and Longford (Roosky). A second Public Consultation on the Route Corridor Options is currently underway.

Other Wind Turbines

There is only one turbine permitted within a 20-kilometre radius of the proposed development site, located near Ballyjamesduff, Co. Cavan, as detailed in Section 2.7.4 above. This turbine is located approximately 16.4 kilometres from the nearest proposed turbine location at Coole. An application for a single turbine approximately 10 kilometres North East of the proposed development site has been appealed to An Bord Pleanála (Pl Ref 20/105 / ABP-307863-20) and is due to be decided by 14th December 2020.

Where the potential for the Proposed Development to result in adverse effects on European Sites on its own was identified, there was potential for it to contribute to in combination effects when considered in combination with other plans and projects. In the absence of mitigation, the potential for the Proposed Development to contribute to in combination effects on water quality within downstream the following SACs and SPAs:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)

In addition, and following the precautionary principle, the Proposed Development has the potential to contribute to disturbance and displacement effects on the following SPAs:

- Lough Owel SPA (004047)
- Lough Derravaragh SPA (004043)
- Garriskil Bog SPA (004102)

Following the implementation of the best practice measures outlined in section 5 of this report, in the hydrology chapter of the EIAR accompanying this application and in the CEMP (Appendix 2), all potential impact pathways have been blocked. There is therefore no potential for the Proposed Development to contribute to any in-combination impact on EU Designated Sites in combination with other plans and projects.

7.3 Conclusion of Cumulative Assessment

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Site and cannot contribute to any cumulative or in-combination effect when considered alongside any other plan or project.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was there any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Development.

8. CONCLUDING STATEMENT

This NIS has provided an assessment of all potential direct or indirect adverse effects on European Sites.

Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures as set out within this report and its appendices. The measures ensure that the construction, and operation of the Proposed Development does not adversely affect the integrity of any European sites.

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Sites, either alone or in combination with other plans or projects.

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APPENDIX 1

APPROPRIATE ASSESSMENT SCREENING REPORT

Revised Appropriate Assessment Screening Report

Coole Wind Farm, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm Optimisation**
Project Number:	**200445**
Document Title:	**Appropriate Assessment Screening Report**
Document File N	**RAASR -F – 2022.09.09 – 200445g**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	09/09/2022	LK	PR

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1. INTRODUCTION

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Screening for Appropriate Assessment of the proposed construction of a 15 No. turbine wind energy development including the grid connection, near Coole, in north Co. Westmeath. This Screening Assessment report has been revised to take account of the request for further information issued by An Bord Pleanála in relation to the project on the 21st April 2022 and the submissions from the Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage on the 17th May 2021. This document supersedes the Appropriate Assessment Screening Report that was submitted with the Planning Application.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Part XAB of the Planning and Development Act 2000, as amended. Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The current project is not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

The data underpinning this revised AA Screening Report was obtained through a desk study and field surveys undertaken between 2015 and 2020. In addition, further surveys were undertaken in 2021 and 2022 to ensure that all baseline information was up to date and relevant. Using this data, MKO has assessed the potential for the Proposed Development to result in significant effects on European sites in the absence of any best practice, mitigation or preventative measures.

This revised Appropriate Assessment Screening Report has been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
3. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*
4. *EC (2020) Guidance document on wind energy developments and nature legislation*

1.1 Appropriate Assessment

1.1.1 Screening for Appropriate Assessment

Screening is the process of determining whether an Appropriate Assessment is required for a plan or project. Under Part XAB of the Planning and Development Act, 2000, as amended, screening must be carried out by the Competent Authority. As per Section 177U of the Planning and Development Act, 2000, as amended '*A screening for appropriate assessment shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or Proposed Development, individually or in combination with another plan or project is likely to have a significant effect on the European site*'. The Competent Authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and should be recorded. The Competent Authority may request information to be supplied to enable it to carry out screening.

Consultants or project proponents may provide for the competent authority, the information necessary for them to determine whether an Appropriate Assessment is required and provide advice to assist them in the Article 6(3) Appropriate Assessment Screening decision.

Where it cannot be excluded beyond reasonable scientific doubt at the Screening stage, that a proposed plan or project, individually or in combination with other plans and projects, would have a significant effect on the conservation objectives of a European site, an Appropriate Assessment is required.

Where an Appropriate Assessment is required, the Competent Authority may require the applicant to prepare a Natura Impact Statement.

The term Natura Impact Statement (NIS) is defined in legislation[1]. An NIS, where required, should present the data, information and analysis necessary to reach a definitive determination as to 1) the implications of the plan or project, alone or in combination with other plans and projects, for a European site in view of its conservation objectives, and 2) whether there will be adverse effects on the integrity of a European site. The NIS should be underpinned by best scientific knowledge, objective information and by the precautionary principle.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provisions of section 177U of the Planning and Development Act 2000 as amended.

1.1.2 Statement of Authority

This report has been prepared by John Hynes (BSc., MSc., MCIEEM) and Laoise Kelly (BSc., MCIEEM) and reviewed by Pat Roberts (B.Sc. Environmental Science, MCIEEM). Pat has over 17 years' experience in ecological management and assessment. John Hynes has over 10 years' professional ecological consultancy experience Laoise Kelly has over 6 years' professional ecological consultancy experience and both are full members of the Chartered Institute of Ecology and Environmental Management. The baseline ecological surveys were undertaken by John Hynes B.Sc. (Env.) M.Sc MCIEEM, Pamela Boyle (PhD), Una Nealon (PhD), Laoise Kelly B.Sc. (Env.), MCIEEM and Susan Doyle B.Sc. (Env.) M.Sc (Eco). All surveyors have relevant academic qualifications and are competent experts in undertaking habitat and ecological assessments to this level. The bird surveys are undertaken by Patrick Manley (B.Sc.) Project

[1] As defined in Section 177T of the Planning and Development Act, 2000 as amended, an NIS means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a Proposed Development, on its own and in combination with other plans and projects, for a European site in view of its conservation objectives. It is required to include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for the European site in view of its conservation objectives

Ornithologist with MKO, Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

1.1.3 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of existing information obtained during the application made in 2017 as part of the permitted Coole Wind Farm.
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Review of NPWS Article 12 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Project is located.
- Review of OS maps and aerial photographs of the site of the Proposed Development
- Review of other plans and projects within the area.
- MKO field assessments and bird surveys carried out between 2015 and 2022 and as provided in full in the EIAR, NIS and associated appendices.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed wind farm site is located approximately 2.4 kilometres north of Coole village (i.e. distance from Coole village centre to the main wind farm site boundary). The town of Castlepollard is located approximately 6.7 kilometres southeast of the wind farm site boundary, at its nearest point. The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. Mullingar Substation is located in the townland of Irishtown approximately 2 kilometres northwest of Mullingar town. The proposed grid connection route measures approximately 26m from the proposed wind farm site to the existing substation near Mullingar.

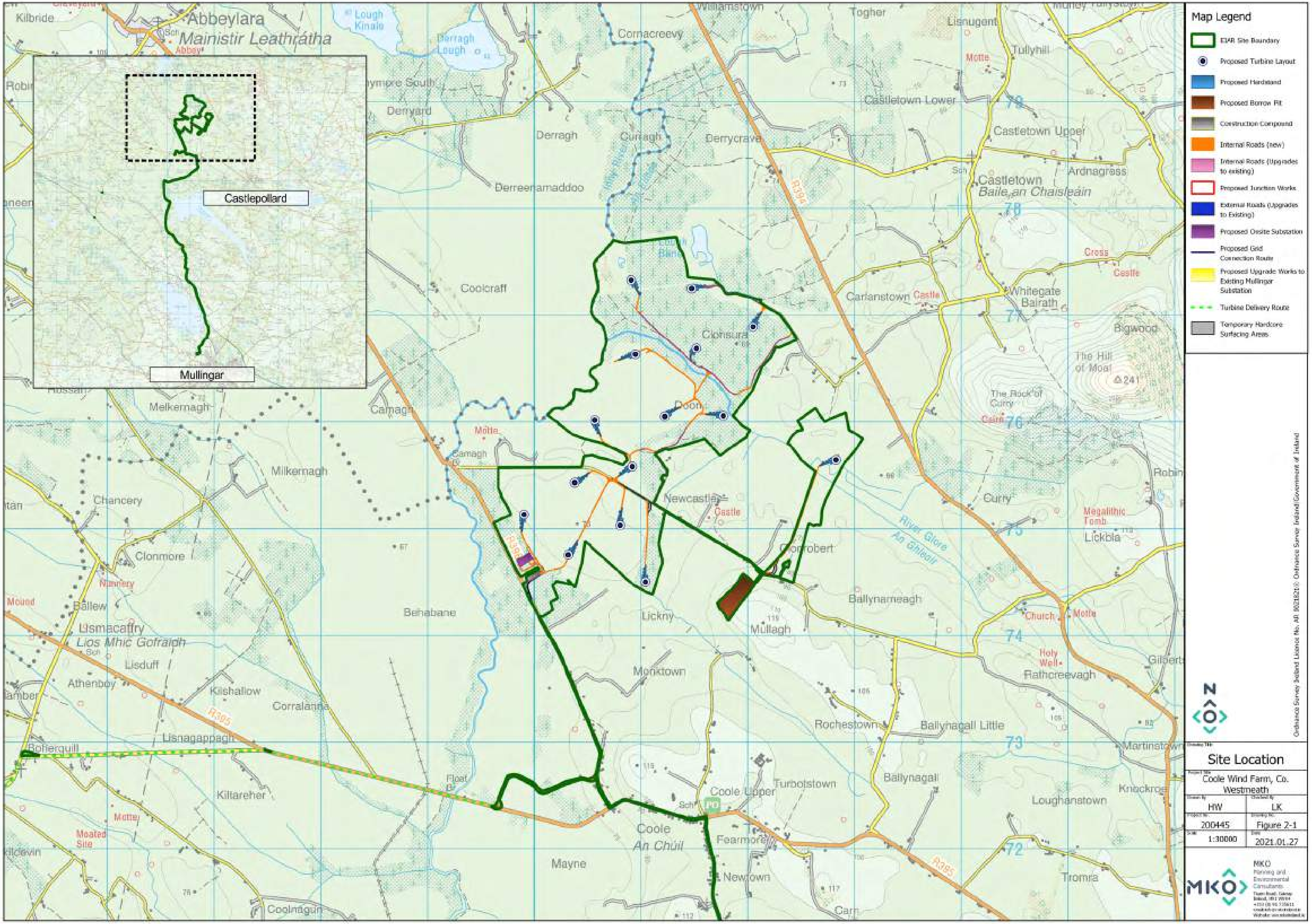
The townlands in which the proposed wind farm site, ancillary works, grid connection route and junction accommodation works are located include; Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle, Mullagh, Boherquill, Coole, Corralanna, Culvin, Joanstown, Mayne, Fearmore (Fore by), Newtown (Fore by), Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava, Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by).

The location of the proposed works is shown in Figure 2-1.

2.2 Characteristics of the Proposed Development

Project Description

A previous application for a wind farm development at this location was submitted by Coole Wind Farm Ltd. to Westmeath County Council on the 19th October 2017 and was considered under Pl. Ref. 17/6292. This application comprised of a wind farm consisting of up to 13 No. wind turbines with a tip-height of up to 175 metres, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Westmeath County Council issued their decision to refuse to grant permission on 12th December 2017 based on 1 no. refusal reason. This decision was appealed to An Bord Pleanála on 14th January 2018 and was considered under ABP-300686-18. An Bord Pleanála issued the decision to grant permission for the wind farm on 27th March 2019.



Drawing Title: Site Location

Project Title: Coole Wind Farm, Co. Westmeath

Drawn by	Checked by
HW	LK
Project No. 200445	Drawing No. Figure 2-1
Scale 1:30000	Date 2021.01.27

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The Proposed Development will comprise the construction and operation of up to 15 No. wind turbines and all associated works. The proposed turbines will have a tip height of up to 175 metres. The full description of the Proposed Development, as per the public planning notices, is as follows:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

The application is seeking a 10-year planning permission, that is that the planning consent would remain valid for 10 years following a final grant of planning permission.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

Project Location & Access

The Proposed Development site measures approximately 498 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072.

Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site.

Grid Connection

The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing 110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres.

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the Proposed Development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 03/03/2021. The datasets were utilised to identify European Sites which could feasibly be affected by the Proposed Development.
- All European Sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European Sites within a distance of 15km surrounding the development site are shown on Figure 3.1. Information on these sites with regard to their conservation objectives is provided in Table 3-1[2]. Sites that were further away from the proposed development were also considered. Given the nature, scale and location of the Proposed Development no potential for significant effect on sites that are located outside the 15km buffer were identified. The nearest downstream site outside the 15km buffer is Lough Ree SAC and SPA located over 40km hydrological distance from the proposed works and buffered by the intervening waterbody of Lough Iron. Consequently, based on distance and the existing intervening waterbodies (e.g. Lough Iron and Lough Ennell) no pathway for significant effect on these or any other European sites outside the 15km buffer was identified.
- In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the Scottish Natural Heritage (SNH) Guidance, '*Assessing Connectivity with Special Protection Areas* (SPA)' (2016) was consulted. This document provides guidance in relation to the identification of connectivity between proposed development and Special Protection Areas. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
- The site of the proposed development was not found to lie on any significant migration route for any species. The results of these surveys (including those submitted in response to the Further Information Request), provide the scientific evidence to support this conclusion.
- In addition, the results of the detailed bird surveys that were undertaken between 2015 and 2022 were taken into account during the assessment.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the Proposed Development and any European Sites. The hydrological catchments are also shown in Figure 3.1.
- The hydrological studies and analysis that was presented in the EIAR that supports the application were also taken into account in this AA Screening assessment, as was the hydrological information that is presented in response to the request for further information.
- Table 3.1 provides details of all relevant European Sites as identified in the preceding steps and assesses which are within the likely Zone of Impact.
- The results of the extensive bird surveys carried out between 2015 and 2022 were consulted in the course of this screening exercise and provided information on whether the birds recorded on the site could potentially be associated with any European Site.

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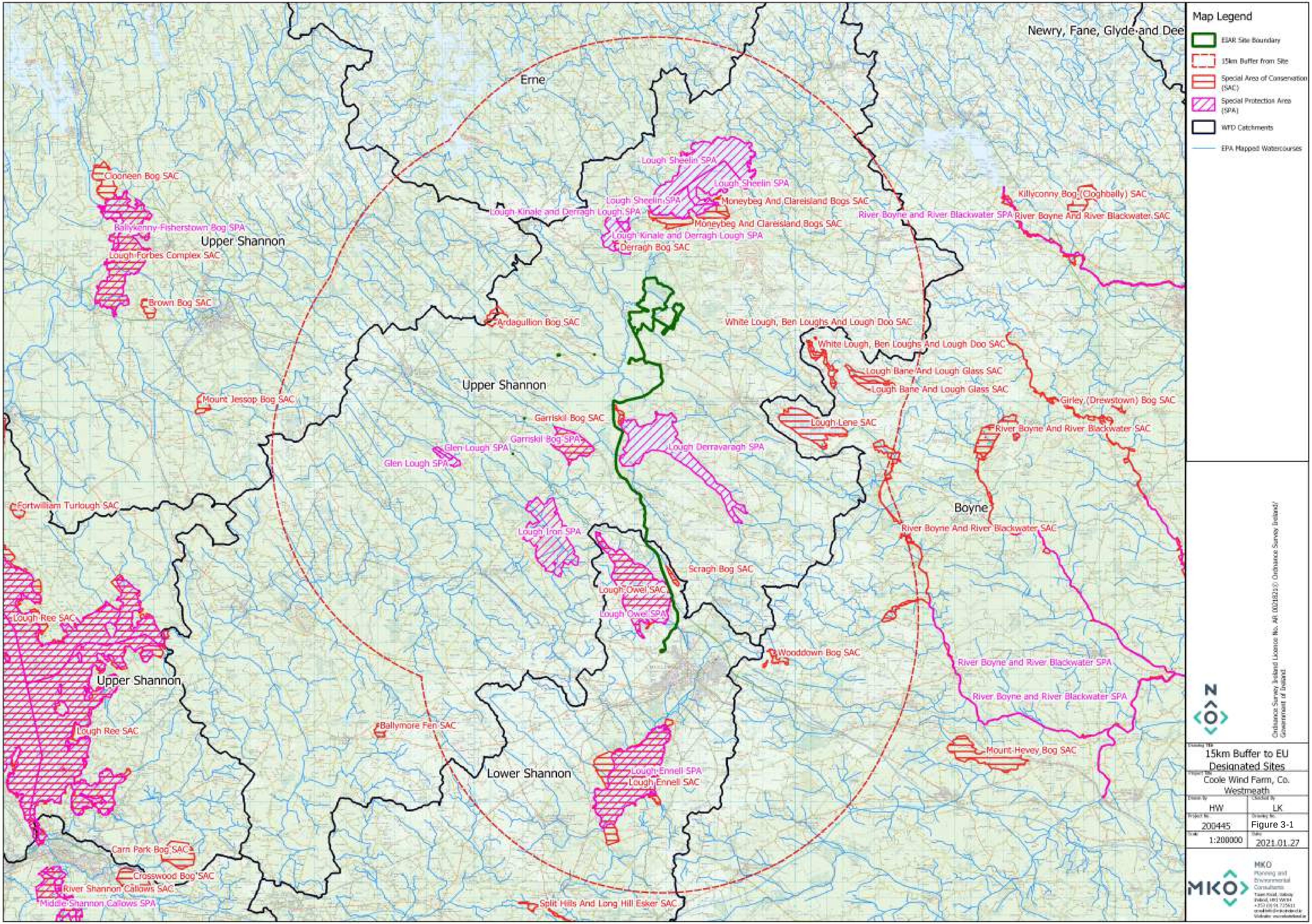
[2] *Office of the Planning Regulator (2021) guidance; 'OPR Practice Note PN01 Appropriate Assessment Screening for Development Management', utilises the Source-Pathway-Receptor model. This Appropriate Assessment Screening Report follows this guidance as well as providing information on European sites located within 15km of the proposed development as recommended in guidance provided by DEHLG (2010).*

- The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report. Figure 3.1 shows the location of the Proposed Development in relation to all European sites within 15km of the Proposed Development.
- Where potential pathways for Significant Effect such as habitat or hydrological connectivity are identified, the site is included within the Likely Zone of Impact.

3.2 Assessment of Potential for Significant Effects on European Sites

This Appropriate Assessment Screening Report considers any potential for likely direct or indirect impacts of the Proposed Development, both alone and in combination with other plans and projects, on European Sites by virtue of the following criteria: size and scale, land-take, distance from the European Site or key features of the site, resource requirements, emissions, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this screening assessment.

Table 3.1 below identifies which European Sites are located within the Zone of Likely Impact and identifies pathways by which impacts may occur. All European Sites that are within the Zone of Likely Impact are Screened In following the precautionary principle and assessed within the Natura Impact Statement. In addition, the individual pathways by which effects may occur are identified in Table 3-1 below.



Map Legend
EIAR Site Boundary
15km Buffer from Site
Special Area of Conservation (SAC)
Special Protection Area (SPA)
WFD Catchments
EPA Mapped Watercourses
Newry, Fane, Glyde and Dee
Erne
Upper Shannon
Upper Shannon
Upper Shannon
Lower Shannon
Boyne
Clooneen Bog SAC
Ballykenny-Fisherstown Bog SPA
Lough Forbes Complex SAC
Brown Bog SAC
Mount Jessop Bog SAC
Fortwilliam Turlough SAC
Lough Ree SAC
Lough Ree SAC
Carn Park Bog SAC
Crosswood Bog SAC
River Shannon Callows SAC
Middle Shannon Callows SPA
Lough Sheelin SPA
Lough Sheelin SPA
Lough Sheelin SPA
Moneybeg And Clareisland Bogs SAC
Moneybeg And Clareisland Bogs SAC
Lough Kinale and Derragh Lough SPA
Lough Kinale and Derragh Lough SPA
Derragh Bog SAC
Ardagullion Bog SAC
Garriskil Bog SAC
Garriskil Bog SPA
Glen Lough SPA
Glen Lough SPA
Lough Derravaragh SPA
Lough Iron SPA
Scragh Bog SAC
Lough Owel SAC
Lough Owel SPA
Wooddown Bog SAC
Ballymore Fen SAC
Lough Ennell SPA
Lough Ennell SAC
Split Hills And Long Hill Esker SAC
White Lough, Ben Loughs And Lough Doo SAC
White Lough, Ben Loughs And Lough Doo SAC
Lough Bane And Lough Glass SAC
Lough Bane And Lough Glass SAC
Lough Lene SAC
Killyconny Bog (Cloghbally) SAC
River Boyne and River Blackwater SPA
River Boyne And River Blackwater SAC
Girley (Drewstown) Bog SAC
River Boyne And River Blackwater SAC
River Boyne And River Blackwater SAC
River Boyne and River Blackwater SPA
River Boyne and River Blackwater SPA
Mount Hevey Bog SAC
N
Ordnance Survey Ireland Licence No. AR 0021821© Ordnance Survey Ireland/ Government of Ireland
Drawing Title
15km Buffer to EU Designated Sites
Project Title
Coole Wind Farm, Co. Westmeath
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Planning and Environmental Consultants

Table 3-1 Identification of Designated Sites within the Likely Zone of Impact and assessment of potential for significant effects

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Special Area of Conservation (SAC)			
Lough Owel SAC (000688) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site.	White-clawed crayfish *Austropotamobius pallipes* [1092] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140] Transition mires and quaking bogs [7140] Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development Consequently, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate Assessment process. This site is therefore considered to be **within the Likely Zone of Impact**.
Garriskil Bog SAC (000679)	Active raised bogs* [7110] Degraded raised bogs still capable of natural regeneration [7120]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.06km east of the proposed grid connection route. 4.5km from windfarm site.	- Depressions on peat substrates of the *Rhynchosporion* [7150]		The SAC is located approximately 60m east of the proposed grid connection route (at its closest point.) and 4.5km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Gariskil Bog SAC There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Scragh Bog SAC (000692) **Distance:** 0.3km east of the proposed grid connection route. 14.4km from windfarm site.	- Slender green feather-moss *Drepanocladus vernicosus* [1393] - Transition mires and quaking bogs [7140] - Alkaline fens [7230] -	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 300m east of the proposed grid connection route and 14.4km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA. There is no connectivity pathway for pollution or drainage related impacts. No

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Derragh Bog SAC (002201) **Distance:** 2.4km north of the windfarm site. 4.9km from the proposed grid connection.	- Degraded raised bogs still capable of natural regeneration [7120] - Bog woodland* [91D0]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." (NPWS (2022) Conservation objectives for Derragh Bog SAC [002201]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 2.4km north of the proposed windfarm site and 4.9km from the proposed grid connection and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Moneybeg and Clareisland Bogs SAC (002340) **Distance**: 3.1km from wind farm site 6.1km from the proposed grid connection route	- Active raised bogs* [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, February 2016) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.1km north of the windfarm site 6.1km north of the proposed grid connection route and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Ardagullion Bog SAC (002341) **Distance**: 3.7km from the proposed junction works in Boherquill 7.4km from the windfarm site	- Active raised bogs* [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.7km west of the proposed junction works in Boherquill and 7.4km west of the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Ennell SAC (000685) **Distance**: 4.2km the proposed gird connection route 24km from the wind farm site	- Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, January 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230]. Consequently, following the precautionary principle, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Assessment process. **This site is therefore considered to be within the Likely Zone of Impact.**
Wooddown Bog SAC (002205) **Distance**: 5.8km from the proposed grid connection route 20.7km south east of the windfarm site	- Degraded raised bogs still capable of natural regeneration [7120]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." NPWS (2022) Conservation objectives for Wooddown Bog SAC [002205]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 5.8km east of the proposed grid connection route and 20.7km from the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Lene SAC (002121) **Distance**: 7.5km from the proposed grid connection route 8.5km from the windfarm site	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 7.5km east of the proposed grid connection route and 8.5km from the proposed wind farm site boundary. Lough Lene SAC is located in a separate hydrological catchment to the proposed works. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
White Lough, Ben Loughs and Lough Doo SAC (001810) **Distance**: 8.0km from the proposed windfarm site 9.2km from the grid connection route	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 8.0km east of the proposed wind farm site and 9.2km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Bane and Lough Glass SAC (002120) **Distance:** 10.7km from the proposed wind farm site 11.4km from the grid connection route	- White-clawed crayfish *Austropotamobius pallipes* [1092] - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] -	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 10.7km east of the proposed windfarm site and 11.4km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
River Boyne and River Blackwater SAC (002299) **Distance:** 12.7km from the proposed grid connection route	- River lamprey *Lampetra fluviatilis* [1099] - Salmon *Salmon salar* [1106] - Otter *Lutra lutra* [1355] - Alkaline fens [7230] - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Detailed conservation objectives for this site (Version 1, 03 Dec 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 12.7km east of the proposed grid connection route and 14.4km from the proposed windfarm site in a separate hydrological catchment. No complete impact source-pathway-receptor

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
14.4km from the windfarm site boundary			chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Special Protection Area (SPA)			
Lough Owel SPA (004047) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site	- Shoveler *Anas clypeata* [A056] - Coot *Fulica atra* - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Owel SPA [004047]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located within the N4 road corridor along the boundary of the SPA at its closest point. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Lough Derravarragh SPA (004043)	- Whooper swan *Cygnus cygnus* [A038] - Pochard *Aythya farina* [A059] - Tufted duck *Aythya fuligula* [A061]	This site has the generic conservation objective:	The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016).

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.07km from the proposed grid connection route 4.8km from the windfarm site	- Coot *Fulica atra* [A125] - Wetland and Waterbirds [A999]	"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravarragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Derravarragh SPA [004043]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Garriskil Bog SPA (004102) **Distance**: 1.4km from the proposed grid connection route 7.2km from the wind farm site	- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." NPWS (2022) Conservation objectives for Garriskil Bog SPA [004102]. Generic	In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).* The following is an extract from the NPWS site synopsis for the SPA "

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.* Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, **this SPA is within the likely zone of impact and further assessment is required**
Lough Kinale and Derragh Lough SPA **Distance:** 1.8km from the windfarm site 4.4km from the proposed grid connection route	- Pochard *Aythya farina* [A059] - Tufted duck *Aythya fuligula* [A061] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: “To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA.”	SCI species associated with this SPA were not recorded on the site of the proposed development during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the wind farm site and the SPA, displacement related impacts are not anticipated.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Kinale and Derragh Lough SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Kinale and Derragh Lough SPA [004061]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Iron SPA **Distance**: 3km from the proposed junction works in Joanstown and 4.3km from the proposed grid connection route 11.4km from the windfarm site	- Whooper Swan *Cygnus cygnus* [A038] - Wigeon *Anas penelope* [A050] - Teal *Anas creca* [A052] - Shoveler *Anas clypeata* [A056] - Coot *Fulica atra* [A125] - Golden Plover *Pluvialis apricaria* [A140] - Greenland White-fronted Goose *Anser albifrons flavirostris* [A395] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource	Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required. The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		for the regularly-occurring migratory waterbirds that utilise it." To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: (2022) Conservation objectives for Lough Iron SPA [004046]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Glen Lough SPA **Distance:** 3.3km from the proposed junction works in Joanstown and 9.7km from the proposed grid connection route. 13.5 from the windfarm site	› Whooper Swan *Cygnus cygnus* [A038]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." (2022) Conservation objectives for Glen Lough SPA [004045]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	The wind farm site is located in over 13.5 km from the SPA with no habitat or direct surface water connectivity. The development is located outside the identified foraging range of the SCI species associated with the SPA that are listed in SNH (2016). Bird activity surveys between 2015 and 2022 have not revealed the site of the Proposed Development to be located on an identifiable migration route for this species. In addition, the detailed survey work undertaken between 2015 and 2022 has not revealed any potential for significant effect on this species as a result of the proposed development.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Works in relation to the junction upgrade locations and grid connection will be restricted to the existing road corridor with no potential to impact on this species. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Sheelin SPA **Distance:** 3.9km from windfarm site 7.8km from the proposed grid connection route	- Great crested grebe *Podiceps cristatus* [A005] - Pochard *Aythya ferina* [A059] - Tufted duck *Aythya fuligula* [A061] - Goldeneye *Bucephala clangula* [A067]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Sheelin SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (2022) Conservation objectives for Lough Sheelin SPA [004065]. Generic	SCI species associated with this SPA were not recorded on the wind farm site during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the development site and the SPA, displacement related impacts are not anticipated. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	
Lough Ennell SPA **Distance:** 4.5km from the proposed grid connection route 24.3km from the windfarm site	- Pochard *Aythya ferina* [A059] - Tufted duck *Aythya fuligula* [A061] - Coot *Fulica atra* [A125] - Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (2022) Conservation objectives for Lough Ennell SPA [004044]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located outside of the designated site. The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. **This site is considered to be within the Likely Zone of Impact and further assessment is required.**

3.3 European Sites with the Potential to be Significantly Affected by the Proposed Development

The following European Sites have the potential to be significantly affected by the Proposed Development:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskill Bog SPA (004102)

Lough Owel SAC

The SAC is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SAC. There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development

Lough Ennell SAC

The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230].

Lough Owel SPA

The SPA is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA.

Lough Ennell SPA

The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

Lough Derravaragh SPA

The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered.

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution.

.Lough Iron SPA

Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required.

The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered.

Garriskil Bog SPA

This SPA is located 1.4km from the proposed grid connection route and 7.2km from the wind farm site. In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).*

The following is an extract from the NPWS site synopsis for the SPA

"*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.*

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, this SPA is within the likely zone of impact and further assessment is required.

3.4 Likely Cumulative Impact of the Proposed Works on European Sites, in-combination with other plans and projects

Where the potential for significant effects on European Sites has been identified in the preceding sections of this document, there is potential for the Proposed Development to result in cumulative effect. This potential is addressed in the NIS that accompanies this application.

Where no pathway for effect on a particular European Site was identified, there is no potential for cumulative effects on that site and no further assessment is required.

4. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

4.1 Concluding Statement

Following an examination, analysis and evaluation of the relevant data and information set out within this Screening Report, it cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the Proposed Development, individually or in combination with other plans and projects, would be likely to have a significant effect on the following sites:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)

As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the Proposed Development in order to assess whether the Proposed Development will adversely impact the integrity of these European Sites.

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APPENDIX 2

CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

Construction and Environmental Management Plan

Coole Wind Farm Development, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm Development, Co. Westmeath**
Project Number:	**200445**
Document Title:	**Construction and Environmental Management Plan**
Document File Name:	**CEMP F - 2021.03.16 - 200445**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	10.02.2021	PH	MW/EOS
02	Draft	11.02.2021	PH	MW/EOS
03	Draft	08.03.2021	PH	MW/EOS
04	Draft	10.03.2021	PH	MW/EOS
05	Draft	11.03.2021	PH	MW/EC
06	Draft	11.03.2021	PH	MW/EC
07	Final	16.03.2021	PH	MW/EC

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1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by MKO on behalf of Coole Wind Farm Ltd., who intend to apply to An Bord Pleanála for planning permission to construct a wind energy development and all associated infrastructure, as well as the provision of an underground grid connection (c. 26.km in length) suitable to link the proposed substation to the national electricity transmission network via the existing Mullingar substation at Irishtown, near Mullingar. The proposal also includes upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable.

This CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) which will accompany the planning application for the proposed development to be submitted to An Bord Pleanála. This report is intended as a single, amalgamated document that can be used during the future phases of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike.

This report provides the environmental management framework to be adhered to during the pre-commencement, construction and operational phases of the proposed development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur. This report has been prepared in accordance with the mitigation measures and commitments made in the EIAR, Appropriate Assessment Screening Report (AASR), Natura Impact Statement (NIS) and other planning documents for the development.

Should the project secure planning permission, the CEMP will be updated, in line with all conditions and obligations which apply to any grant of permission. The CEMP should be read in conjunction with the EIAR and planning drawings.

1.1 Potential Amendment Scenario's

The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during construction.

Triggers for amendments to the CEMP will include:

- When there is a perceived need to improve performance in an area of environmental impact;
- As a result of changes in environmental legislation applicable and relevant to the project;
- Where the outcomes from auditing establish a need for change;
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and
- As a result of an incident or complaint occurring that necessitates an amendment. Complaints will be documented in the site complaints log and the Environmental Manager will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager. A copy of the complaints procedure is included in Appendix 1 of this document.

1.2 Scope of the Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed Coole Wind Farm. It outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to construct the wind farm in an appropriate manner. The report is divided into nine sections, as outlined below.

- Section 1 provides a brief introduction as to the scope of the report and the planning conditions it is intended to satisfy.
- Section 2 outlines the site and project details, detailing the targets and objectives of this plan along with providing an overview of anticipated construction methodologies that will be adopted throughout the proposed project.
- Section 3 sets out an overview of the construction methodologies for all elements of the proposed development
- Section 4 sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage measures, peat management, invasive species management, traffic management and a waste management plan are also included in this section.
- Section 5 sets out a fully detailed implementation plan for the environmental management of the proposed project outlining the roles and responsibilities of the project team.
- Section 6 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.
- Section 7 provides a summary of the Safety and Health Plan for the proposed development outlining the responsibilities and inputs required from the project team
- Section 8 consists of a summary table of all mitigation proposals to be adhered to during the implementation of the proposed project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 9 consists of a summary table of all monitoring requirements and proposals to be adhered to during the implementation of the proposed project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 10 sets out an anticipated programme for the timing of the proposed works.
- Section 11 outlines the proposals for reviewing compliance with the provisions of this report.

1.3 Targets and Objectives

In so far as they have been completed to date, or are to be further completed in future, the construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues and this is enhanced by the works proposals.

The key site targets are as follows;

- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the EIAR, AASR, NIS and associated planning documentation;
- Ensure construction works and activities are completed in accordance with all planning conditions for the development and that the CEMP is updated as required;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;

- Ensure construction works and activities have no adverse effect on the integrity of any European Site;
- Adopt a sustainable approach to construction; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, e.g. excavated stone, clay and peat material;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keeping all watercourses free from obstruction and debris;
- Correct implementation of the SuDS drainage design principles;
- Keep impact of construction to a minimum on the local environment, watercourses, and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping to be implemented;
- Air and noise pollution prevention to be implemented; and,
- Monitoring of the works and any adverse effects that it may have on the environment. Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Comply with all relevant water quality legislation;
- Ensure a properly designed, constructed and maintained drainage system appropriate to the requirements of the site is kept in place at all times.

2. SITE AND PROJECT DETAILS

2.1 Site Location

The site of the proposed wind farm development is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. Table 2-1 sets out the townlands in all elements of the wind farm, grid connection route and ancillary works are located.

The proposed permanent footprint of the Proposed Development measures approximately 26.4 hectares. The overall layout of the Proposed development is shown on Figure 2-1a and 2-1b. Land-use on the subject site is associated with commercial peat harvesting, commercial forestry and pastoral agriculture. Land-use in the wider landscape comprises a mix of large-scale peat extraction, pastoral agriculture, low density residential and commercial forestry.

The site is partially bound by the Inny River to the west, agricultural land to the south and east, and coniferous forestry and an active peat harvesting bog to the north. The River Glore intersects the northern section of the site as it flows from southeast to northwest.

It is proposed to deliver turbines to the site from the port of delivery (i.e. Dublin, Cork or Waterford) via the M4 motorway and then the N4 National Primary Road single-lane carriageway between Mullingar and Edgeworthstown. From the N4, the turbine delivery route turns northwards on the L1927 local road, then turns right onto the L5828 at Boherquill, and from here onto the R395 Regional Road at Corralanna. From the R395, the turbine delivery route will then connect to the R396 via a proposed new section of access road ("link road") in the townland of Coole, thereby avoiding the existing left-hand-turn in Coole village. A Traffic Management Plan is located in Section 4.12.3 of this CEMP with further information on traffic and transportation outlined in Chapter 14 of the EIAR.

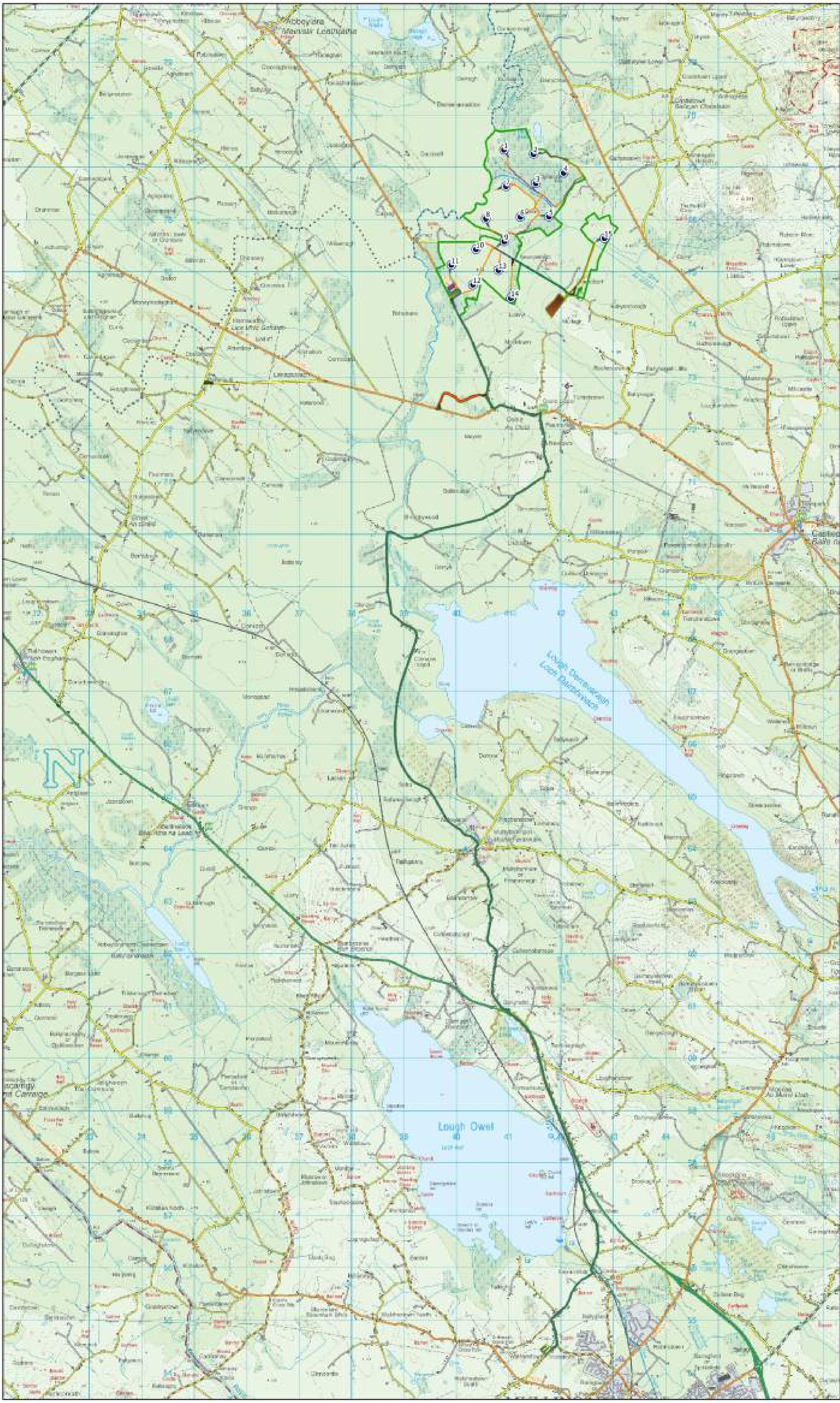
The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. The proposed grid connection route measures approximately 26km in length from the proposed wind farm site to the existing substation near Mullingar. The grid connection route would comprise underground cabling located primarily within the public road corridor, with a short section of underground cabling (approximately 700m) across private lands at the northernmost end.

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the Proposed Development consisting of the construction of an additional dedicated bay to facilitate connection of the cable.

Table 2-1 Townlands within which the Proposed Development is located

Development Works	Townland
Wind Farm, including Turbines and Access Roads, Substation, Construction Compound	Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle.
Proposed Borrow Pit	Mullagh
Junction Accommodation Works	Boherquill, Coole, Corralanna, Culvin,Joanstown and Mayne
Grid Connection Route	Camagh, Monktown, Coole, Fearmore (Fore by), Newtown (Fore by), Mayne, Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava,

Development Works	Townland
	Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by)



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- External Roads (Upgrades to Existing)
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Temporary Hardcore Surfacing Areas

Drawing Title: Proposed Site Layout

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 2-1a
Scale: 1:65000	Date: 11.02.2021

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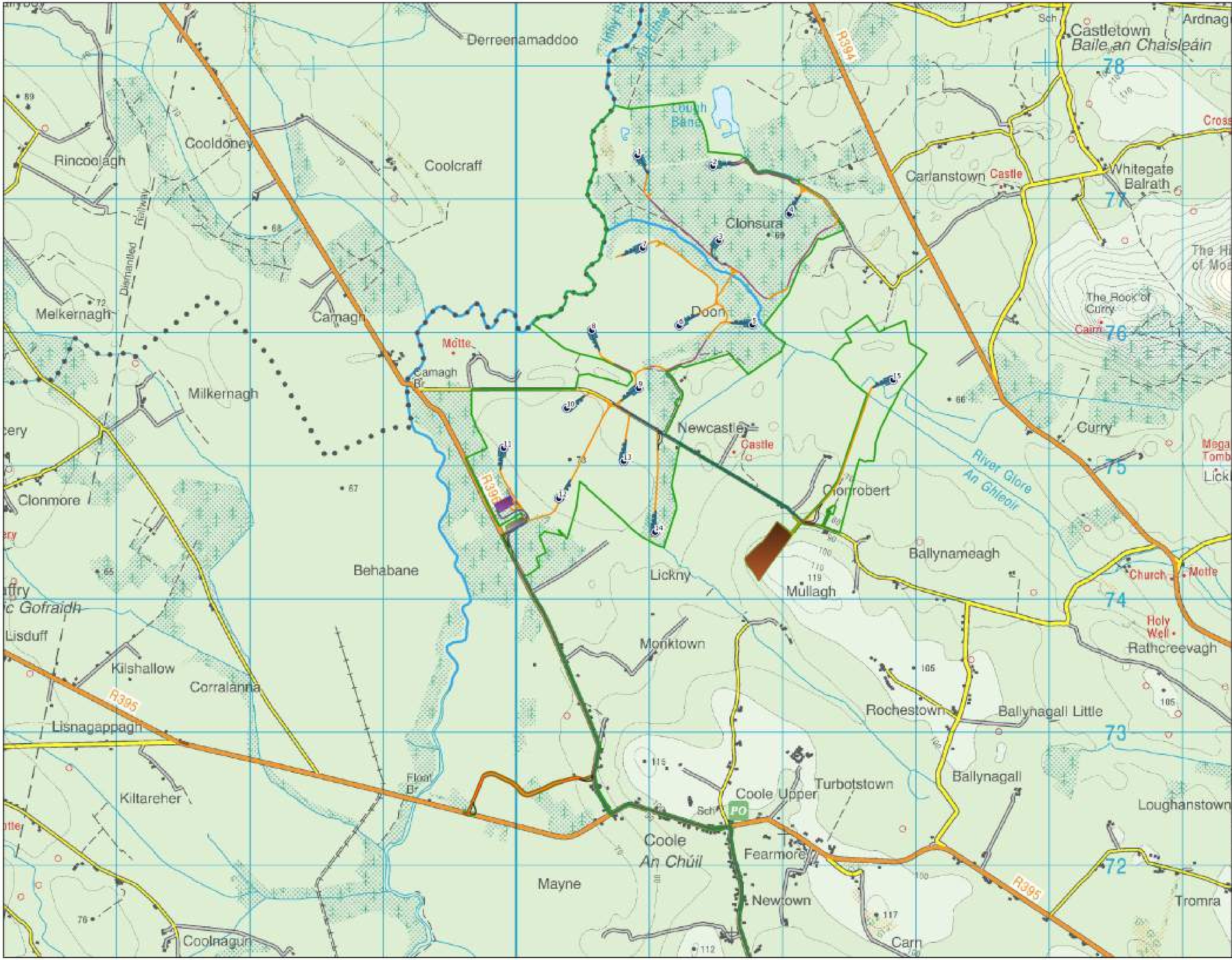

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Drawing Title: Proposed Site Layout

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 2-1b
Scale	Date
1:25000	11.02.2021

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2.2 Geological Conditions

The ground conditions at the Wind Farm Site (including the link road area) can be categorised into the following deposits:

- Peat – Typically described as brown/dark brown fibrous and amorphous peat. Peat thicknesses from peat probing, window sampling and drilling ranged from 0 to 12.5m. The average peat depths recorded at infrastructure locations across the Wind Farm Site was 3.9m.
- Calcareous Mud/Shell Marl – Soft cream coloured mud with local deposits of shell fragments.
- Lacustrine Clay – Locally grey to dark grey soft to firm clay. The marl is considered to be a lacustrine deposit.
- Glacial Granular Soils – Locally loose to dense wet grey sandy clayey silty gravel. The glacial granular soils are likely to have a mixed strength/density.
- Weathered Bedrock – Possible weathered bedrock was only encountered in trial pit TP2-C. Arisings from the trial pit comprised of large angular cobbles and a matrix of sandy silt and angular gravel.
- Limestone bedrock – Limestone bedrock was encountered during the rotary core boreholes drilled at 13 no. locations. The bedrock is described as generally medium strong to strong, dark grey, fine grained, thinly to thickly bedded Limestone.

The ground conditions at the borrow pit can be typically categorised into the following deposits:

- Topsoil – Typically described as sandy gravelly clay.
- Glacial Till – Consisted of orange to brown slightly gravelly Clay.
- Weathered Bedrock – Typically consisting of angular gravels, cobbles and boulders of weathered limestone in a clay matrix.
- Bedrock – Bedrock comprises of strong intact limestone at typically 1.5 metres below ground level.

The published soils map (www.epa.ie) for the area indicates that the majority of the Grid Connection Route, north of Multyfarnham, including the area of the proposed onsite substation, is mapped as cut over peat, while the area around Coole village is mapped as basic, well drained mineral soil (BminDW). South of Multyfarnham, soils are mapped as being predominantly acidic, well drained mineral soil (AminDW) with some pockets of Fen Peat. The soils between the southern tip of Lough Owel and Mullingar town are mapped as BminDW. Subsoils in the area are mapped by the GSI as generally cut over raised peat and Tills derived from Limestone north of Multyfarnham, transitioning to Tills derived from chert, raised peat and minor areas of Tills derived from Limestone.

A peat stability assessment was carried out to determine the stability i.e. Factor of Safety (FoS), of the peat slopes where construction is proposed during the development of the wind farm. The findings, which involved analysis of over 200 no. locations, showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development. The findings include recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety as set out in the Peat Stability Management Section 4.6 of this CEMP.

2.3 Hydrological Conditions

On a regional scale, the proposed wind farm is located in the Inny River surface water sub-catchment which is in the Upper Shannon catchment within Hydrometric Area 26 of the Shannon International River Basin District (SIRBD).

On a more local scale the site is located in the Inny River sub-catchment and two sub basins of the Inny River. The majority of the site is within the Inny_050 sub basin with a small section in the south of the site near the R396 within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The western section of the site drains directly to the Inny River via a number of settlement ponds and outfall channels which are discussed further below in the site drainage section. The River Glore flows from across the northern section of the site from east to west and merges with the Inny River on the western boundary of the site.

A drain (henceforth known as drain D1), which divides the northern basin in two sections, discharges directly to the Inny River northwest of the Wind Farm Site. Lough Bane, proposed Natural Heritage Area (pNHA) is located adjacent to the northern boundary of the Proposed Development site; however, no part of the Proposed Development footprint is located within the pNHA. Lough Bane itself is located approximately 180 metres north of the internal access road between Turbines T2 and T4. An unnamed small dystrophic lake is located on the northwestern corner of the site.

The proposed link road is located within the Inny River catchment, and the junction improvement works are also located within sub-catchments to the Inny River. The Inny River flows south from the Wind Farm Site into Lough Derraverragh approximately 7.5km downstream of the site.

The Grid Connection Route is located within the Shannon International River Basin District. With respect to regional hydrology, the Grid Connection Route is located in 2 no. regional surface water catchments (the River Inny and the River Brosna) and 3 no. regional surface water sub-catchments. The southern section of the Grid Connection Route, along the eastern edge of Lough Owel and on to Mullingar (~8km long) is located within the Brosna sub-catchment (Brosna_SC_010) within the regional Lower Shannon catchment (25A). The area north of Lough Owel to the northern edge of Lough Derravargh is located within the Inny sub-catchment (Inny[Shannon]_SC_030). North of Lough Derravargh, towards Coole, falls within the boundary of the Inny sub-catchment (Inny[Shannon]_SC_020). Both of these subcatchments are located within the regional Upper Shannon Catchment (26F).

Drainage measures on the site will include swales, silt traps, settlement ponds, field drains and headland drains as discussed further in Section 4.2 below.

2.4 Ecological Conditions

The Coole Wind Farm Site study area is dominated by Cutover Bog (PB4). Much of Coole bog comprises milled peat and is divided up by drains, spaced approximately 15m apart, which separate long parallel peat production fields. The lands to the east of the site comprise agricultural land. The edge of the main wind farm site is bordered by Conifer Plantation (WD4) to the east and south while the lands surrounding T15 are predominantly agricultural in nature. The proposed Turbine 15 is located to the east of the site within agricultural grassland categorized as Improved Agricultural Grassland (GA1)/Wet Grassland (GS4). The proposed Turbine 5 and Turbine 14 are located within Conifer Plantation (WD4). The remaining turbines locations are situated in Cutover Bog (PB4).

The proposed grid connection route will be located within the carriageway/verge of existing public roads. There is no requirement to use habitats located outside the road carriageway except at the Northern and Southern ends where the connection points leave the public road for termination. All roads within/adjacent to the proposed cable route were classified as Building and Artificial Surfaces (BL3). Much of the cable route was bordered by a verge supporting Dry Meadows and Grassy Verges (GS2).

Third Schedule invasive species, Rhododendron (Rhododendron ponticum), Japanese Knotweed (Fallopia japonica) and Bohemian Knotweed (Fallopia bohemica) were recorded at 5 locations along the grid connection route in the townlands of Clonava, Multyfarnham and Ballinealoe. All works in these areas will be confined to the existing road. Best practice measures are in place to ensure no Third Schedule invasive plants are spread as a result of the Proposed Development.

The assessment identifies a number of Key Ecological Receptors: Degraded Raised Bog, Dystrophic Lake, River Glore Corridor and River Inny, Bog Woodland, Otter, Badger and Bat species. Habitats listed in Annex I of the EU habitats Directive were not recorded within the development footprint or along the turbine delivery or grid connection routes. No Annex I habitats will be impacted as a result of the Proposed Development. Levels of faunal activity were extremely low and evidence recorded was associated with the periphery of the site.

2.5 Archaeological Conditions

Through a detailed examination of the baseline data available and a detailed site inspection, it was concluded that while the archaeological potential of the area is high, however no new sites were noted within the peatland areas of the Proposed Development, nor are any recorded archaeological or architectural assets located therein. One new potential archaeological monument was detected within the Wind Farm Site boundary at Clonrobert townland. It comprises an enclosed rectangular area in pasture c. 74m east of the proposed access road to T15. No direct impacts to this potential monument as a result of the proposed development have been identified. Furthermore, direct impacts to recorded archaeological and architectural assets as a result of the proposed turbines, substation, associated infrastructure and borrow pit have not been identified.

Where potential impacts are possible appropriate mitigation measures have been recommended in order to minimise any such impacts. Recommended mitigation includes re-assessment surveys due to the changing levels within the bog as a result of peat harvesting, pre-development archaeological testing where turbine bases, roads etc will be excavated and archaeological monitoring during the construction stage of the project. Indirect effects on the setting of National Monuments within 15km, RMPs within 5km and RPS/NIAH within 5km were included in order to assess impacts on setting in the wider landscape.

The proposed Grid Connection Route was subject to assessment. All cultural heritage assets within 100m of either side of the route were assessed for potential impacts to same as a result of the proposed Grid Connection Route. No direct impacts to the recorded or unrecorded archaeological, architectural or cultural heritage resource as a result of the proposed Grid Connection Route have been identified. Mitigation measures are recommended where deemed appropriate and include archaeological monitoring of ground works in specified areas along the proposed route. An assessment of potential impacts as a result of proposed Junction Accommodation Works along the proposed Turbine Delivery Route was also carried out. No direct or indirect impacts to the recorded archaeological or cultural heritage resource were identified.

An archaeological assessment will be completed in areas prior to the commencement of works. The details of the required assessment are summarised in Section 4.7 below.

3. CONSTRUCTION MANAGEMENT

3.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase. The appointed contractor for the works will be required to comply with this CEMP and any revisions made to this document.

The proposed wind farm development will comprise of the following:

i. *Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;*
ii. *1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;*
iii. *1 no. temporary construction compound;*
iv. *Provision of new site access roads, upgrading of existing access roads and hardstand areas;*
v. *Excavation of 1 no. borrow pit;*
vi. *All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;*
vii. *Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;*
viii. *Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;*
ix. *Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;*
x. *Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;*
xi. *Site Drainage;*
xii. *Forestry Felling;*
xiii. *Signage, and;*
xiv. *All associated site development works.*
xv. *This application is seeking a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

The developer and/or contractor for the main construction works will liaise directly with Westmeath County Council and An Garda Síochána in relation to securing any necessary permits to allow the works to take place including for example:

- Commencement notice
- Special Permits in relation to oversized vehicles on public roads
- Temporary Road Closures (if required)
- Road Opening Licence (if required)

Complaints will be documented in the site complaints log and the Site Environmental Officer will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager. A copy of the complaints procedure is included in Appendix 1 of this document.

An overview of the proposed anticipated Construction Methodologies is provided below.

3.1.1 Overview of Proposed Construction Methodology

The proposed anticipated construction methodology is summarised under the following main headings:

- Temporary Construction Compound;
- Tree Felling
- Borrow Pit;
- Road Construction
- Hard Standing Areas;
- Turbine Foundations;
- Electricity Substation and Control Buildings;
- Proposed upgrade works to the existing 110kV Mullingar substation;
- Peat and Spoil Management;
- Grid Connection Cable Trench
- Existing Underground Services
- Grid Connection Watercourse/Culvert Crossings and Irish Rail Level Crossing
- Link Road Junction Accommodation and Public Road Works

3.1.1.1 Temporary Construction Compound

A temporary construction compound is proposed, located inside the wind farm site entrance from the R396 Regional Road, as shown in Figure 2-1. The proposed compound area measures approximately 6,610m2. The layout of the proposed compound comprises of temporary site offices, staff facilities and car-parking areas.

A dedicated waste management area will be located within the compound, with waste to be sorted and collected from site by permitted collectors. Potable drinking water will be supplied via water coolers located within the staff facilities, which will be restocked on a regular basis as required during the construction phase. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required for the duration of the construction period.

Temporary port-a-loo toilets located within portacabins will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. Power will be supplied by a diesel generator, located within the compound. The construction compound will be used for temporary storage of some construction materials, prior to their delivery to the required area of the site.

3.1.1.2 Tree Felling

The majority of the proposed wind farm site is occupied by cutover peat, with some areas occupied by commercial forestry and agricultural grassland. As part of the Proposed Development, some tree felling is required within and around the development footprint to allow the construction of turbine bases, access roads and other ancillary infrastructure. There are two turbines within the Proposed Development that are located within an area of forestry; T5 and T14. It should be noted that all forestry on the site of the proposed wind farm was originally planted as a commercial crop, and will be felled in the coming years should the proposed wind farm proceed or not.

A total of 16.36 hectares of forestry is required to be felled within and around the Proposed Development footprint.

The tree felling activities required as part of the Proposed Development will be the subject of a Felling Licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the wind farm be submitted with the felling licence applications; therefore the felling licenses cannot be applied for until such time as planning permission is obtained for the Proposed Development.

3.1.1.3 Borrow Pit

It is proposed to develop 1 No. borrow pit as part of the Proposed Development, the location of which is shown on Figure 2-1 and in the design drawings in Appendix 4-1 of the EIAR. The site of the proposed borrow pit is located on agricultural grassland, approximately 700 metres southeast of the nearest proposed turbine location (T14). The proposed borrow pit will be accessed from the L5755 local road, which will connect the borrow pit to the proposed wind farm site. The borrow pit access road is located less than 0.1 kilometre west of the access road to T15.

It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pit. Usable rock may also be won from other infrastructure construction including the substation and the turbine base excavations.

The borrow pit will, on removal of all necessary and useful rock, be reinstated and made safe from a health and safety perspective and the slopes will be graded using the subsoils and topsoil currently at this location. A gate will be in place at the borrow pit entrance location, set back from the local road.

3.1.1.4 Road Construction

3.1.1.4.1 *New Floating Roads*

New roadways will be required onsite for access to turbine locations, with the majority of these access roads floated unless ground conditions permit the use of excavated roads. New roadways will have a running width of approximately five metres, with wider section at corners and on the approaches to turbine locations. The proposed road layout also incorporates 2 No. passing bays to allow two trucks pass each other while travelling around the site.

All new roadways will be constructed with a camber to aid drainage and surface water runoff. The gradient and slope of the camber will depend on the site characteristics where the road is actually being constructed.

Construction of floating access roads across the peat is the proposed technique for the majority of the site access roads. Given the flat topography and deep nature of peat on site, floating access roads are deemed an appropriate construction technique.

The general construction methodology for floating access roads, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR, is summarised as follows:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 4m.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator.
- Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
- The finished road width will be approximately 5m, with wider sections on bends and corners.

- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.
- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.
- Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

3.1.1.4.2 Upgrade of Existing Access Roads or Tracks

Upgrading of existing tracks through peat is proposed for limited sections of access track across the site. Given the flat topography and deep nature of peat on site, upgrading of existing excavated access roads is deemed appropriate only where specified.

The general construction methodology for upgrading of existing sections of onsite roads or tracks, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR, is summarised below.

- This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations. Access road construction shall be to the line and level requirements as per design/planning conditions.
- For upgrading of existing excavated access roads the following guidelines apply:
  - Excavation of the widened section of access road should take place to a competent stratum beneath the peat and backfilled with suitable granular fill.
  - Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.
  - The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.
  - Access roads to be finished with a layer of capping across the full width of the track
  - A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road
  - For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

- For upgrading of existing floated access tracks (Type B – Figure 4-6) the following guidelines apply:
  - The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are

localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.
- The surface of the existing access track should be levelled prior to the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
- Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access track.
- Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.
- The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.

- The finished road width will have a running width of 5m, with wider sections on bends and corners.
- On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
- At transitions between new floating and existing excavated roads a length of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.

Where possible, internal cabling may be placed within the internal road corridor, subject to ESB/Eirgrid specifications.

3.1.1.4.3 Excavated Road Construction Methodology

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

- Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
- Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
- Excavation of roads swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
- Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.
- Excavation of materials with respect to control of peat stability:

- Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.
- Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
- All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas.

- Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.
- The excavated access road will be constructed with up to 1000mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- Access roads to be finished with a layer of capping across the full width of the road.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum.
- At transitions between floating and excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.
- Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.
- A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

3.1.1.4.4 *Hardstanding Areas*

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation and tower is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The hard-standing area is intended to accommodate a crane during turbine assembly and erection. The proposed hard standing areas shown on the detailed layout drawings included in Appendix 4-1 of the EIAR are indicative of the sizes required, but the extent of the required areas at each turbine location may be optimised on-site depending on topography, position of the site access road, the proposed turbine position and the turbine supplier's exact requirements.

3.1.1.5 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier. The turbine foundation transmits any load on the wind turbine into the ground.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower or the "Anchor Cage" is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level.

3.1.1.6 Electricity Substation and Control Buildings

It is proposed to construct one on site electricity substation within the Proposed Development site, as shown in Figure 2-1. The proposed substation site is located within an area of forestry, which will screen it from view from the R396 Regional Road, located approximately 40 metres west of the substation at its nearest point.

The footprint of the proposed electricity substation compound measures approximately 142 metres by 72 metres, and will include a wind farm control building and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid.

The substation compound will be surrounded by a 2.65-metre high steel palisade fence (or as otherwise required by ESB/Eirgrid), and internal fences will also segregate different areas within the main substation. The construction and exact layout of electrical equipment in the electricity substation will be to ESB/Eirgrid networks specifications.

A wind farm control building will be located within the substation compound. The building will measure approximately 25.6 metres by 15 metres, and approximately 7.8 metres in height. The layout and elevation of the proposed wind farm control building are shown on Figure 4-14a of the EIAR. The wind farm control building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the proposed project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin.

An IPP (independent power producer) building and ESB control rooms will also be located withing the substation compound. The building will measure approximately 20.37 metres by 5.83 metres, and approximately 5.5 metres in height. The layout and elevation of the proposed IPP control building are shown on Figure 14-14b of the EIAR. The IPP building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the Proposed Development.

It is proposed to install a rainwater harvesting tank adjacent to the control building. During the operational phase, potable drinking water will be supplied by a water cooler at the control building. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required on a regular basis.

It is proposed to manage wastewater from the staff welfare facilities in the control building by means of a sealed storage tank located adjacent to the building, with all wastewater being tankered off site by a permitted waste collector to a wastewater treatment plant. Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and settlement ponds constructed to eliminate any material level of suspended solids within surface water running off the site. The drainage regime will be installed in accordance with details submitted in the EIAR.

3.1.1.7 Proposed Upgrade works at Existing Electricity Substation

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the proposed wind farm development. The upgrade works at the substation will consist of the construction of an additional dedicated bay. Three potential connection points have been identified for this connection in consultation with ESB and EirGrid with the exact location to be identified at detail design stage, as indicated on the planning drawings in Appendix 4-1 of the EIAR.

3.1.1.8 Proposed Watercourse Crossings

It is proposed to replace the existing timber bridge over the River Glore within the proposed wind farm site with a 5-metre clear span bridge. The proposed bridge crossing will form part of the internal site road network, connecting Turbines T5-T12 to Turbines T1-T4. The crossing location is at Grid Reference E 641,560 N 776,452, as shown in Figure 4-23 of the EIAR and the design avoids the need for in-stream works.

A second crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge as shown on Figure 4-24 of the EIAR which shows the typical clear span bridge design.

A third crossing will be required to provide access to Turbine T15 over the River Glore. This will require a 5-metre clear span bridge as shown in Figure 4-25 which shows the typical clear span bridge design. The clear span bridge's will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

The typical construction methodology for the installation of clear span bridges is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the north or opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the southern side of the stream and will be lifted into place from the stream back with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

3.1.1.9 Peat and Spoil Management

The management of excavated peat and spoil, and the methods of storage are described in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR and summarised below.

The peatland areas of the Proposed Development site have been extensively harvested using mechanical harvesting equipment, resulting in a well-drained and extensively trafficked peat. Experience has shown that the most environmentally sensitive and stable way of handling and moving peat is its placement across the site and at locations as close as possible to the excavation areas. The peat and overburden that is excavated as part of the construction works will be placed/spread locally alongside the excavations for the infrastructure elements.

The proposed methodology for the placement and storage of peat, as described in the FT's Peat and Spoil Management Plan, is summarised below.

- The peat and overburden that is excavated as part of the construction works will be locally placed/spread alongside the excavations for the infrastructure elements. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.
- During the construction process, the spoil will be relayed locally to the side of the excavation by an excavator and spread on the bog on one or both sides of the excavations.
- The spoil will be spread to a depth not exceeding 1.0m in height over a typical width of 5m. The placed peat shall be tracked in to ensure it is adequately compacted and stable and graded to complement the topography and drainage system on the site.
- Where practical, it will be ensured that the surface of the placed material is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spread material shall be carried out as placement of material progresses. This will reduce the likelihood of debris run-off and ensure stability of the spread material.
- The placement of excavated material will be avoided without first establishing the adequacy of the ground to support the load. This may involve a visual inspection by competent personnel. The placement of material may require the use of long reach excavators and low ground pressure machinery in localised areas.
- Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface.
- Finished/shaped side slopes in the placed material is likely to be in the region of 1 (v): to 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker material are encountered then slacker slopes may be required.
- All placed/spread material will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively, and possibly in addition, seeding of the placed material could be carried out which would aid in stabilising the placed material in the long term.

3.1.1.10 Grid Connection Cable Trench

Underground electrical cables will connect the proposed wind turbines to the proposed onsite substation. From here, the proposed wind farm will connect to the national grid via an underground cable connection between the site and the existing Mullingar 110 kV substation. The grid connection route follows the public road network and the exact location of the cable within the road curtilage will be subject to ESB/Eirgrid specifications and agreement with Westmeath County Council. The specifications for cables and cable installation will be in accordance with Eirgrid/ESB requirements.

What is provided below are the grid connection methodologies for:

- Cable Trench Installation in non-peatland environments
- Cable Trench Installation through peatland
    - Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)
    - Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)
    - Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)
    - Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)
    - Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)

- Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

3.1.1.10.1 Typical Cable Trench Installation in Non-Peatland Environments

The underground cable required to facilitate grid connection will be laid beneath the surface of the site and/or public road using the following typical methodology:

- The area where excavations are planned will be surveyed, prior to the commencement of works, to identify all existing underground services.
- Two teams consisting of tracked excavators, dumpers and a tractor and stone cart with side-shoot or similar will dig the trench and lay approximately 300m of the underground cable ducting between them per day.
- One team will start at one end of the grid route with the other team starting approximately half way along the grid connection route. Both teams will be constructing in the same direction.
- The excavators will open a trench at the edge of the road surface, the trench will be a maximum of approximately 600mm wide and 1,250mm deep.
- The excavated material will be loaded into the dumpers to be transported to a designated temporary stockpiling area to be reused as backfilling material where appropriate.
- Clay plugs will be installed at 50m intervals to prevent the trench becoming a conduit for surface water runoff.
- Once the trench has been excavated, a level 65mm blinding layer with semi-dry lean-mix concrete will be placed at the base of the trench;
- The cable trefoil 160mm HDPE power ducts will be placed in the trench and tied at 3m intervals to keep the trefoil formation;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the top trefoil duct where a red cable marker strip will be placed;
- Two 125mm HPDE comms cable ducts will be laid, spaced a clear 200mm apart using appropriate spacers;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the comms duct where a red cable marker strip will be placed
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- The trench will be surfaced as per the road surface specifications of the national, regional or local public road.
- Cable joint pits will be located at approximately 500m intervals or as otherwise required by ESB/Eirgrid requirements along the proposed cable route, each joint pit will be approximately 2.5m x 6m in size and contain a communications chamber, an earth link box and a cable joint bay, all of which will be located in the road edge and accessible for cable pulling and future maintenance.

3.1.1.10.2 Cable Trench Installation through peatland

The following are a list of typical general requirements for the ducting work in peat:

- The ducting shall be placed in the trench as per the specific cable design drawings to ESB / Eirgrid specifications, generally following the sequence outlined below.
- Appropriate traffic management would be implemented on site. This will involve road closures.
- Suitable drainage and environmental mitigation measures would be established along the section of road.
- Detailed method statement regarding the ducting works will be provided by the contractor.

- An assessment of all areas of natural drainage from the area of works will be carried out, and measures put in place to prevent any material draining from the trenching works into adjacent drainage ditches or streams.
- Spill kits shall be available during trenching. A spill mat will be used by the fuel tanker while refuelling.
- Following the trench excavation, ducts will generally be installed and surrounded with concrete. The placement of the concrete will be controlled in such a manner as to prevent any concrete entering adjacent drainage ditches or streams.
- Upon completion of trenching works the site shall be cleaned and any waste will be disposed of at a licenced facility.
- Note that monitoring of floating road settlement may be required before, during and after construction to ensure the stability of the trench and the floating road.
- Where the road surface is to be sealed, a suitable road surfacing build-up/reinforcement will be agreed with the road authorities.
- Where the depth of the peat is greater than 2.5m, generally roads and grid route infrastructure would be constructed at the surface of the existing road or verge, in order to limit excavation of the underlying peat for the trench.

3.1.1.10.3 Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.1 in Appendix 4-3 of the EIAR:

- Existing road build-up will be planed off/excavated as required.
- The trench will be excavated within the road build-up.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.4 Trench Type B (Through Floating Road Trench in Verge with >2.5 to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.2 in Appendix 4-3 of the EIAR:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install a two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.5 *Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.3 in Appendix 4-3 of the EIAR:

- Existing verge will be excavated to the trench width.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.

- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.6 Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.4 in Appendix 4-3 of the EIAR:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation. A layer of brash or timber logs may be required on the verge side beneath the geogrid layer.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.7 Trench Type E1 (Through Floating Grid Route Track with >2.5 to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.5 in Appendix 4-3 of the EIAR:

- Fell trees within the construction corridor.

- Where required, turn the tree stumps over to create a starting platform for the access track and/or lay a layer of brash or timber logs.
- Lay the combigrid and construct the lower section of the road to act as a construction access track. Install drainage crossings along the route as it progresses (usually corrugated pipes slung down beneath the road into the existing drains or incorporated into the road itself).
- The trench will be excavated within the track build-up.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable ducts, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

3.1.1.10.8 Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.6 in Appendix 4-3 of the EIAR:

- Fell trees within the construction corridor.
- Peat would be excavated to subgrade, with stone placed to build up the lower sections of the road.
- Install drainage crossings along the route as it progresses (usually corrugated pipes incorporated into the road build up).
- Lay a layer of combigrid and construct the lower section of the road to act as a construction access track.
- The trench would be excavated within the track build-up.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.

- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

3.1.1.11 Existing Underground Services

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations, an additional layer of marker tape will be installed between the communications layer and yellow top level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

3.1.1.11.1 *Joint Bays*

Joint bays are pre-cast concrete chambers where lengths of cable ducting will be connected. They will be located at various points along the ducting route approximately every 500 meters or as otherwise required by ESB requirements along the proposed cable route. Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction, the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed they will be backfilled temporarily until cables are being installed.

3.1.1.12 Grid Connection Watercourse/Culvert Crossings and Irish Rail Level Crossing

There is a total of 16 no. watercourse crossings along the proposed grid connection, the locations of which are shown in Figure 3-1. There are 7 no. river/stream crossings (Locations No. 2, 3, 4, 10, 14, 15 & 16), with the remaining crossings being classified as culverts.

The proposed grid connection route will traverse one Irish Rail level crossing in the townlands of Farranistick and Culleen More adjacent to water course crossing No 16. Any such works on properties of Córas Iompair Éireann (CIE) who are the authority for such properties requires a license agreement to be put in place between the developer and CIE.

The preferred methodologies for the provision of the grid connection at these locations is set out in Appendix 2, which provides a summary of the watercourse crossing/culvert survey and description of works for all crossings. Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Westmeath County Council prior to works commencing. A description of each crossing option is provided below. Instream works are not required at any watercourse crossing along the proposed grid connection.

3.1.1.12.1 *Crossings over Culverts – Option1*

The watercourse at any of the crossings will not be disturbed because no instream works or bridge/culvert alterations are proposed. Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the ESB/Eirgrid specified flat formation ducting arrangement will be used where the cable ducts pass over a culvert maintaining 300mm minimum clearance to the top of the culvert . A heavy duty steel plate will be placed over the ducts as distance between the road surface and the ducts will have been reduced. The cable trench will pass over the culvert in a standard trench as outlined in Figure 3-2.

3.1.1.12.2 *Crossing under Piped Culverts – Option 2*

Where the watercourse crossing is a piped culvert consisting of either a socketed concrete or sealed plastic pipe where there is inadequate cover above the culvert to excavate, a trench will then be excavated beneath the culvert and cable ducts will be passed under the sealed pipe as outlined in Figure 3.3. If this duct installation method cannot be achieved due to the invert level of the existing culvert or due to the composition of the culvert e.g. stone culverts, the ducts will be installed by alternative means as set out in the following sections as outlined in Figure 3-3.

3.1.1.12.3 *Flatbed formation over Culverts – Option3*

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in a stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 3-4.

3.1.1.12.4 *Outside of Bridge Decking – Option 4*

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in a stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 3-5

3.1.1.12.5 *Directional Drilling – Option 5*

In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes) or similar. The launch and reception pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any potential adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

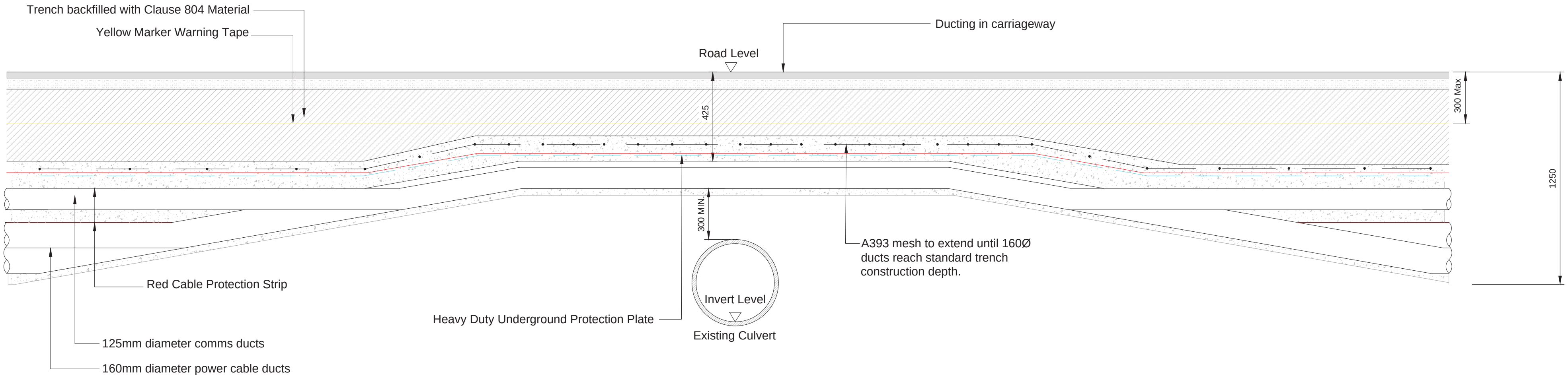
Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 3-6.

Map Legend

- EIAR Site Boundary
- Grid Connection Route Watercourse Crossing Locations
- Proposed Grid Connection Route

Drawing Title: Grid Connection Route Watercourse Crossing Locations	
Project Title: Coole Wind Farm, Co. Westmeath	
Drawn By: EC	Checked By: MW
Project No: 200445	Drawing No: Figure 3-1
Scale: 1:100000	Date: 11/02/2021

MKO
Planning and Environmental Consultants



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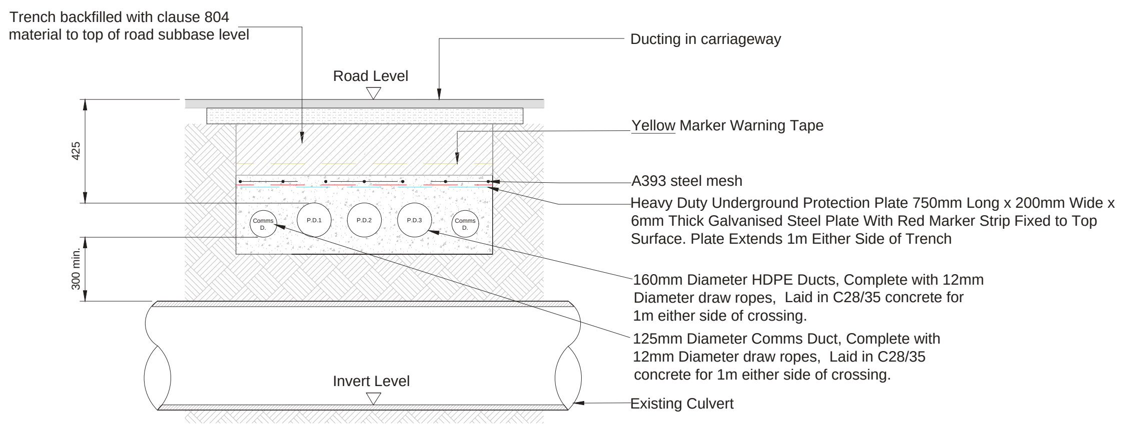

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Figure 3-2

Option 1 - Crossing over Culvert

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
A	17.01.2020	M.B.	J.S.	FIRST ISSUE

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CLIENT

PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - OVER

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
J. SHANAHAN	19/01/2020	DRAFT	COLE d005.4.3

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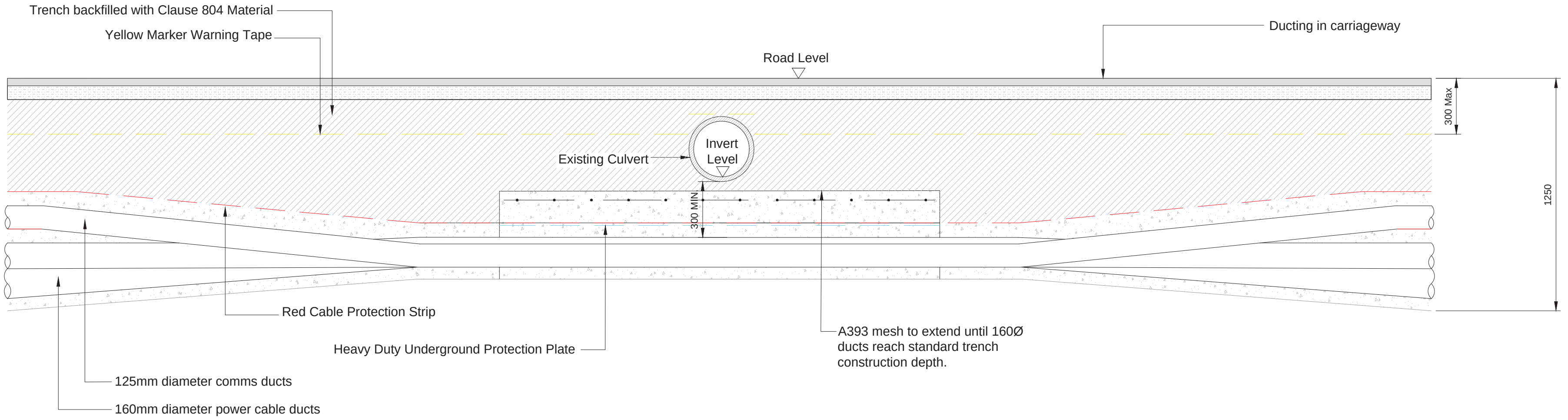

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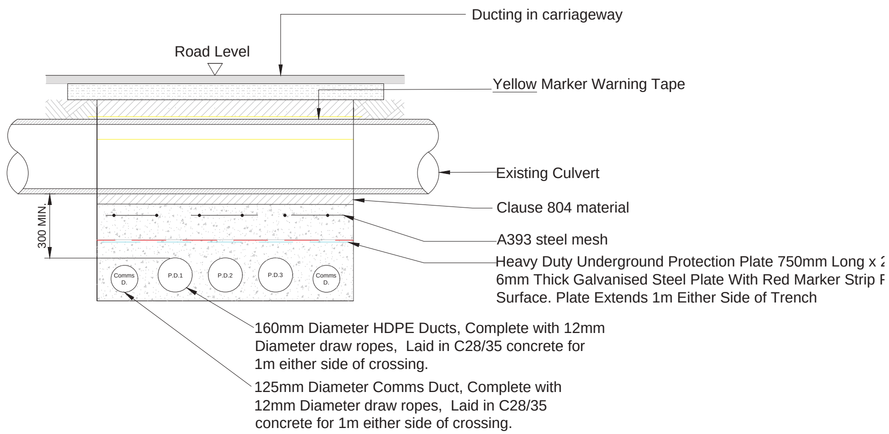

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Figure 3-3

Option 2 - Crossing under Piped Culvert

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A	19.01.2020	M.B.	J.S.	FIRST ISSUE

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PROJECT
COOLE WIND FARM
GRID ROUTE

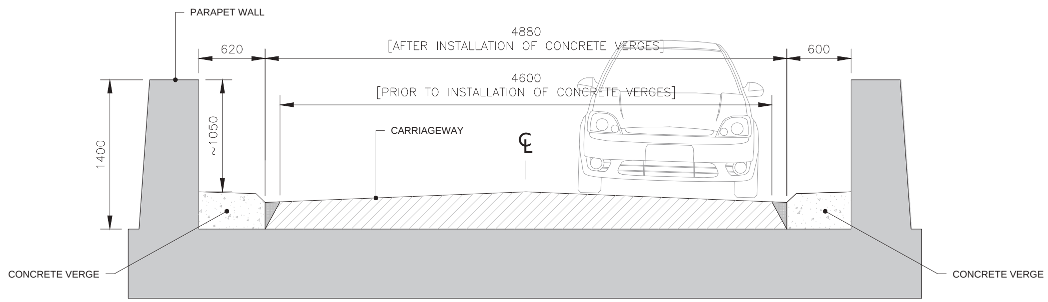
TITLE
WATER CROSSINGS
TYPICAL DETAIL - UNDER CULVERT

REVISION
A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	19/01/2020	DRAFT

DRAWING NUMBER
COLE d005.4.4



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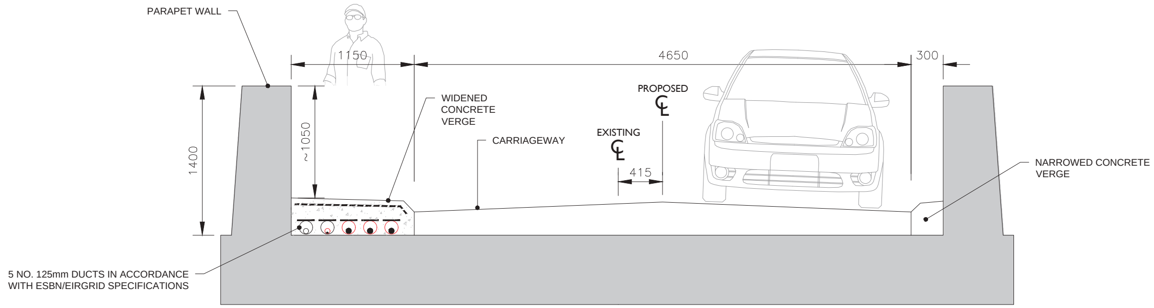

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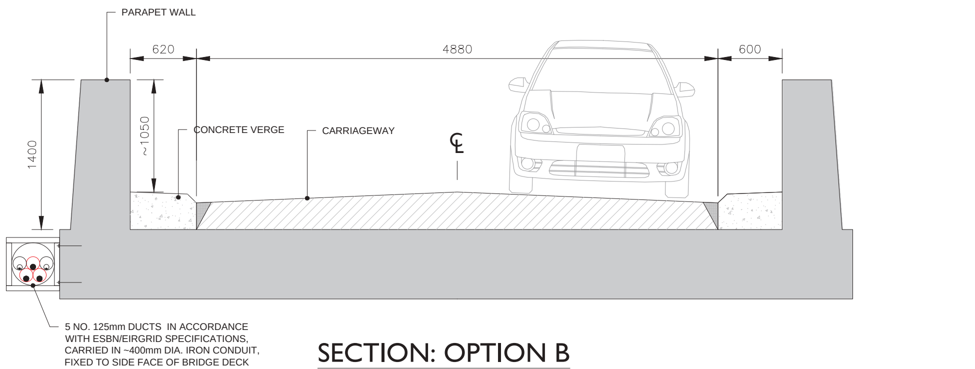

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SCALE 1:50

Figure 3-4

Option 3 - Flatbed Formation over Culverts

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
B	17.01.2020	M.B.	J.S.	DUCT NOTE & PLAN UPDATED
A	10.12.2019	M.B.	J.S.	FIRST ISSUE

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GRID ROUTE

TITLE
BRIDGE CROSSINGS
WH-L1825-001.00

REVISION
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DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	09/12/2019	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	09/12/2019	DRAFT

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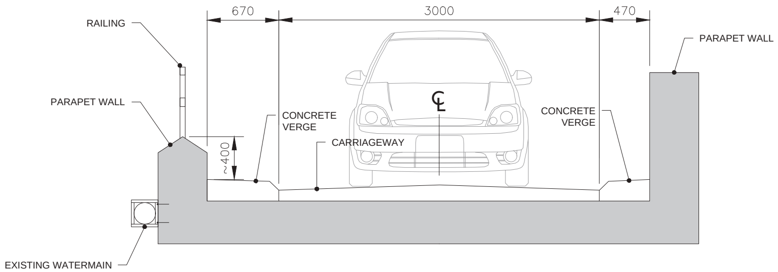
COLE d005.3.1



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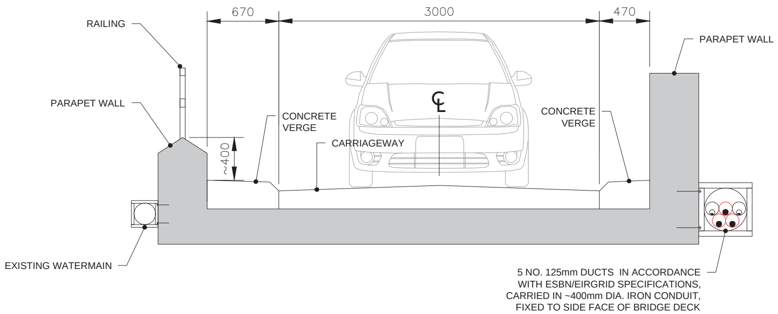

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Figure 3-5

Option 4 - Outside of Bridge Decking

NOTES

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B	24.01.2020	M.B.	J.S.	DUCT NOTE & PLAN UPDATED
A	19.12.2019	M.B.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

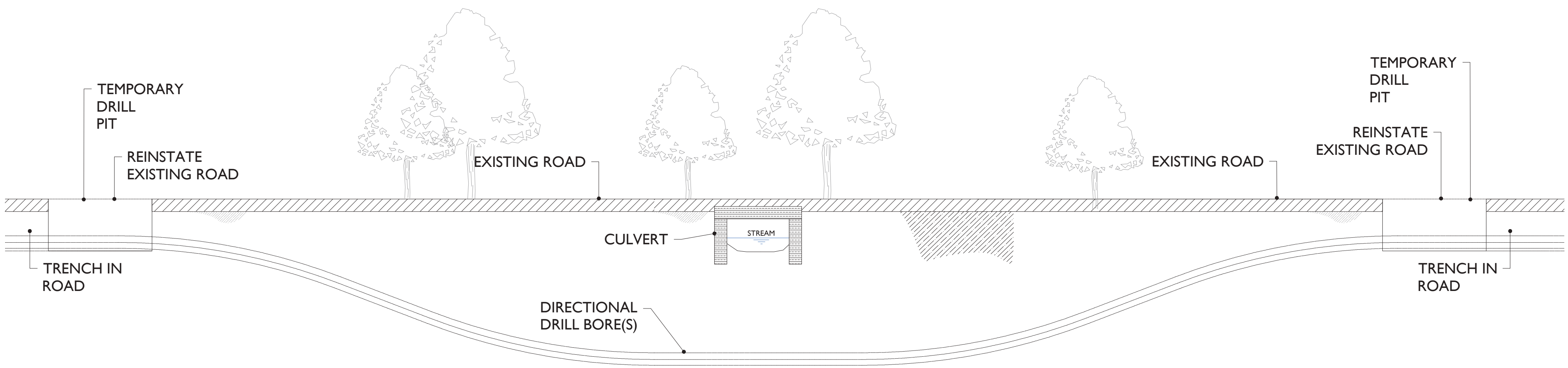
TITLE: BRIDGE CROSSINGS WH-L1825-002.00

REVISION: B

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	09/12/2019	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	09/12/2019	DRAFT

DRAWING NUMBER: COLE d005.3.2



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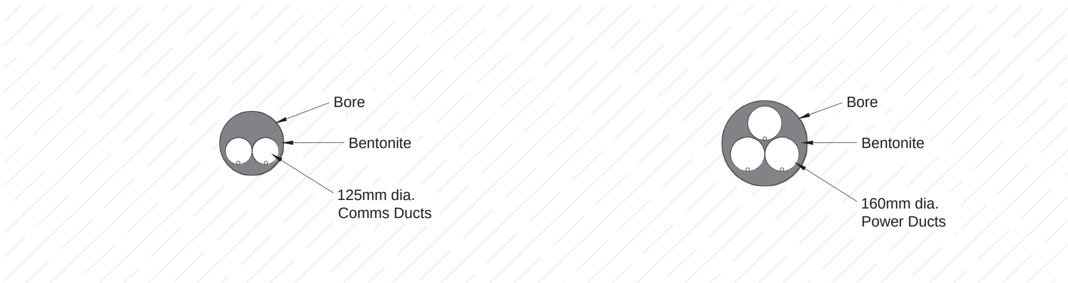

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NOTE: No. and diameter of bores to be confirmed at detailed design.

Figure 3-6

Option 5 - Directional Drilling

NOTES

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A	20.01.2020	M.B.	J.S.	FIRST ISSUE

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CLIENT

PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - DIRECTIONAL DRILL

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	20/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	20/01/2020	DRAFT

DRAWING NUMBER: COLE d005.4.5

3.1.1.13 Link Road, Junction Accommodation and Public Road Works

Improvements and modifications to the existing public road network to facilitate turbine delivery will be required as part of the Proposed Development works. This will include construction of a link road between the R395 and R396 Regional Roads and junction improvement works, including providing hardsurfacing at eleven locations; along the public road corridor at: the N4 junction with the L1927 in the townland of Joanstown, clearing of existing verge and vegetation to the south east of the railway line level crossing on the L1927, hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill, clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points contained within the proposed wind farm site at junctions along the L5755.

The proposed link road between the R395 and R396 measures approximately 1.2 kilometres in length with a running width of approximately 5m. The road will traverse areas of cutover peat and improved agricultural grassland. The construction methodology for the link road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing as required.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular fill and final surface running layer will be left in situ, within the works areas.
- A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate.
- Gates/barriers will be left in situ post construction to prevent access.

Leaving the granular fill and final surface running layer in place within the link road will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase).

The minor junction improvement works will require clearing back the existing road verge and field vegetation at the junctions, and excavation of material to allow the placing of stone/hard surfacing within the proposed areas. A series of removable bollards and/or temporary fencing will be placed along the existing road edge in order to preserve the structure of the junctions outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except as stated otherwise.

A Method Statement for the junction improvement works along the turbine delivery route is included in Appendix 3. All accommodation and link road works will be the subject of a method statement and traffic management plan prepared by the appointed contractor with the approval of Westmeath County Council, prior to the commencement of construction works.

4. ENVIRONMENTAL MANAGEMENT

4.1 Introduction

This CEMP includes all best practice measures required to construct the Proposed Development. It sets out the drainage proposals that will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in the EIAR, NIS and all other relevant planning documents. The following sections give an overview of the drainage design proposals, tree felling, refuelling, dust and noise control measures. An outline of the management of invasive species, waste materials, archaeological features, traffic, site reinstatement and decommissioning is also provided.

4.2 Protecting Water Quality

4.2.1 Introduction

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES). The drainage design has been prepared based on experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. There is an existing drainage system and surface water discharges from the site. The Proposed Development's drainage design has been proposed specifically with the intention of having no negative impact on the water quality of the site and discharges from the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems.

No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses in so far as possible. One existing water crossing within the proposed wind farm site will be upgraded as part of the Proposed Development, with the construction of two clear span bridges over the River Glore in the northern sections of the site – see Section 4.8.3 of the EIAR for further details.

There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made via settlement ponds, and over vegetation filters at a significant distance from natural watercourses.

Section 1.4.1 in Chapter 1 of the EIAR provides detail on the coordinated management of site activities, including drainage, between peat harvesting operations on the site should they continue and the construction and operation of the Proposed Development.

4.2.2 Existing Drainage Features

On a regional scale, the proposed wind farm site is located in the Inny River surface water sub-catchment, which is in the Upper Shannon catchment within Hydrometric Area 26 of the Shannon International River Basin District (SIRBD). On a more local scale, the proposed wind farm site is located in the Inny River sub-catchment and two sub-basins of the Inny River. The majority of the site is within the Inny_050 sub basin with a small section in the south of the site near the R396 Regional Road within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The elevation of the proposed wind farm site ranges between approximately 60m OD and 66m OD. The vast majority of the site is situated on cutover peatland The site comprises three separate peat basins, the northern, central and southern basins, each with its own separate drainage system. Further details on outfall drainage directions in each area of the site are provided in Section 9.3.5 of the EIAR:

A drain, which divides the northern basin in two sections, discharges directly to the Inny River northwest of the site. Lough Bane proposed Natural Heritage Area(pNHA) is located adjacent to the northern boundary of the Proposed Development site; however, no part of the Proposed Development footprint is located within the pNHA. Lough Bane itself is located approximately 180 metres north of the internal access road between Turbines T2 and T4. An unnamed small dystrophic lake is located on the north western corner of the site. The presence of perimeter boundary drains and intermediate high banks (uncut sections of high bog) means that there is no runoff from the peat harvesting area into Lough Bane or the dystrophic lake.

The western section of the proposed wind farm site drains directly to the Inny River via a number of settlement ponds and outfall channels. The River Glore flows from across the northern section of the site from east to west and merges with the Inny River on the western boundary of the site.

The proposed wind farm site has parallel-running peat drains that are spaced approximately every 12-15 metres on the bog surface for surface water runoff removal. Surface water runoff collected in these drains is conveyed to a headland silt trap, from where it flows into a larger boundary drain and then onto a sedimentation basin for retention and controlled discharge. The parallel running bog surface drains are only approximately 1.5m deep and therefore do not intercept the mineral subsoil underlying the peat. These internal field drains are deepened as harvesting progresses. The larger boundary drains are generally deeper and regularly intercept the mineral subsoils.

The proposed underground grid connection route is located within the Shannon International River Basin District. With respect to regional hydrology, the grid route is located in 2 no. regional surface water catchments (the River Inny and the River Brosna) and 3 no. regional surface water sub-catchments. The southern section of the proposed grid route, along the eastern edge of Lough Owel and on to Mullingar (~8km long) is located within the Brosna sub-catchment (Brosna_SC_010) within the regional Lower Shannon catchment (25A). The area north of Lough Owel to the northern edge of Lough Derravargh is located within the Inny sub-catchment (Inny[Shannon]_SC_030). North of Lough Derravargh, towards Coole, falls within the boundary of the Inny sub-catchment (Inny[Shannon]_SC_020). Both of these subcatchments are located within the regional Upper Shannon Catchment (26F).

4.2.3 Drainage Design Principles

Drainage water from any works areas of the site will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 4-1 below.

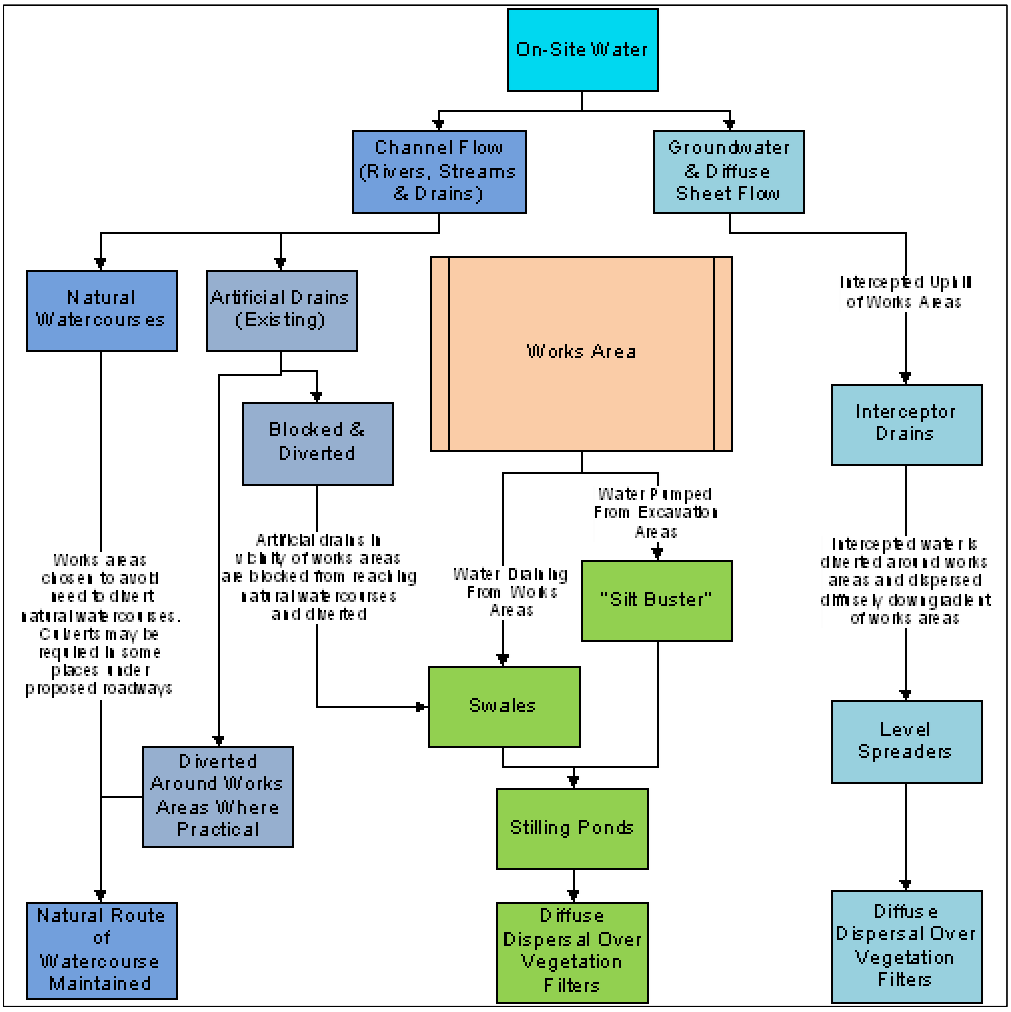

Figure 4-1 Schematic drawing of proposed drainage design

4.2.4 Drainage Design

A preliminary drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in the drainage design drawings in Appendix 4-9 to the EIAR and Appendix 4 of this document. The drainage design employs the various measures further described and is cognisant of the following guidance documents:

- Environmental Requirements for Afforestation (Forest Service, 2016a);
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);

- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.2.4.1 Interceptor Drains

Interceptor drains will be installed up gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting as conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.2.4.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader. Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.2.4.2 Collector Drains/Swales

Collector drains or swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above.

Collector drains will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Collector drains will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.2.4.3 Check Dams

The velocity of flow in the interceptor drains and collector drains, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the collector drain is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where collector drains connect in.

The proposed check dams will be made up of 4/40mm non-friable crushed stone. The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150 mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place where required at the end of the construction phase to limit erosive linear flow in the collector drain during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

4.2.4.4 Level Spreaders

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site, or areas where they are not likely to give rise to peat stability issues.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain will be used to transfer the water to a suitable location.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip, and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

4.2.4.5 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling (settlement) ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.2.4.6 Silting Ponds/Settlement Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

Stilling ponds will be located towards the end of collector drains, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a collector drain will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

Stilling ponds will be inspected weekly and following rainfall events with sediment cleaned out as required. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

4.2.4.7 Siltbuster

A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-2 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

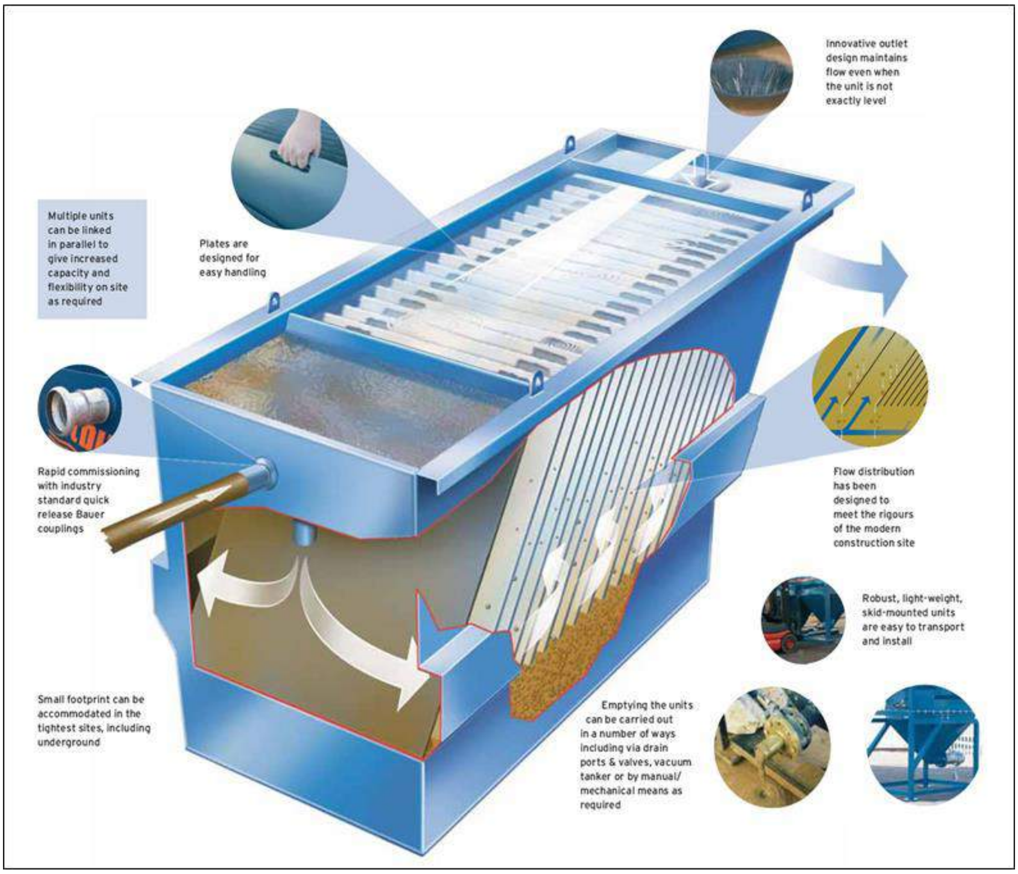

Figure 4-2 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.2.4.8 Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.

Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the collector drain and will be located, wherever it is deemed appropriate, throughout the site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of peaty silt into any stream.

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plates 4-1 4-2 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility.


Plate 4-1 Silt Bag with water being pumped through


Plate 4-2 Silt bag under inspection

4.2.4.9 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where watercourse crossings take place.

Silt fences can be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series.

Silt fences will be emplaced along drains and parallel to access roads edges as required, down-gradient of all new roads and turbine locations. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral subsoils of glacial and glacio-fluvial origin, and entrained in surface water runoff.

Inspection and maintenance of these structures during the construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Site fence material will be Terra Stop Premium as per the specifications provided at https://www.hy-tex.co.uk/products/geotextiles/terrastop-premium-silt-fence or equivalent manufacturer certified CE mark for erosion control of EN13253 or similar.

The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4-1 of the EIAR to be just a single line, silt fences may be installed in series on the ground.

Site fences will be inspected regularly to ensure water is continuing to flow through and the fence is not coming under strain from water backing up behind it.

4.2.4.10 Sedimats

Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

4.2.4.11 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the Proposed Development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.2.5 Borrow Pit Drainage

The proposed borrow pit will extract bedrock below the local groundwater table and therefore there is some moderate potential to impact on local groundwater levels. The proposed borrow pit is located on an elevated area of ground and drainage by gravity will ensue after reinstatement. The pit will be relatively shallow (5m), and therefore the potential for groundwater level impacts to extend significant distances from the pit is negligible. Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

The following guidelines will be implemented the construction and reinstatement of borrow pits outlined by Fehily Timoney as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of this EIAR:

- Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arisings.
- An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.
- Control of groundwater within the borrow pit may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
- A silting pond may be required at the lower side/outfall location of the borrow pit.
- Where possible, the topsoil shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the spoil within the borrow pits.

4.2.6 Floating Road Drainage

Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed at these locations below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

4.2.7 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time, and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should rainfall generate runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 4.6.4.9 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.2.8 Site Drainage Management

4.2.8.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing. An adequate amount of clean stone, silt fencing, stakes, etc will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.2.8.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.2.8.3 Reactive Site Drainage Management

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor or collector drains as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground at the particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

4.2.8.4 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the ECoW or the Supervising Hydrologist.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

An adequate amount of clean stone, Terra Stop (or similar silt fencing material), stakes, straw bales (rectangular bales, to be used in emergency only), etc. will be kept on site at all times to ensure the drainage system can be fully maintained throughout the construction phase of the wind farm and ensure that personnel are fully equipped to provide an emergency facility to control the discharge from settlement ponds and react to any accidental silt discharges.

Silt traps will be inspected weekly during the construction phase of the project and following rainfall events with sediment build-up removed as required. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.3 Tree Felling Management Plan

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Felling will take place prior to groundworks commencing.

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) shall be appointed to oversee the keyhole and extraction works. The ECoW shall be experienced and competent, and shall have the following functions:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.

- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix 3 (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements.*
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples shall be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling shall be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite shall be used: pH, EC, TSS, BOD, Total P, Ortho-P, Total N, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

All relevant measures set out in the *Forestry & Freshwater Pearl Mussel Requirements, Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines* will apply. To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- Works will be overseen by an ECoW as described above.
- The extent of all necessary tree felling will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected prior to any machinery being brought on site to commence the felling operation. No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones.

- All new collector drains will taper out before entering the aquatic buffer zone to ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but removing of natural debris deflectors will be avoided.

Table 4-1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

4.4 Cement Based Products Control Measures

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. Alternatively, a Siltbuster-type concrete wash unit or equivalent (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) may be used. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 4-3 and Plate 4-4 below.

Plate 4-3 Concrete Wash Out Area

Plate 4-4 Concrete Wash Out Area

The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents will be tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

Due to the volume of concrete required for each turbine foundation, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site, but will be directed back to their batching plant for washout.
- Site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the site roads will not be provided until all bases have been poured. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.4.1 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the Proposed Development, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.

- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.5 Refuelling, Fuel and Hazardous Materials Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site in bunded areas.
- On-site refuelling of machinery will be carried out at dedicated refuelling locations 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer or similar will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use.
- Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be used during all refuelling operations.
- Fuels volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical control building should be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Emergency Response Plan (Section 6). Spill kits will be available to deal with an accidental spillage.

4.6 Outline Peat Stability Management Plan

Minimal peat excavation is likely to be required on site due to the proposed construction techniques for the site. With the exception of Turbine T5 and T15, all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, piled foundations may be required for the substation building. It is anticipated that the substation platform and construction compound platform will likely be constructed using floating techniques. The proposed construction method for all the new proposed access roads is a floated technique.

Quantities of peat and overburden to be excavated during the construction phase of the proposed development were calculated by FT as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of this EIAR.

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

A Geotechnical & Peat Stability Assessment Report has been prepared by AGEC which provides a Geotechnical Risk Register for the site and includes details of the required mitigation/control measures. These mitigation measures are summarised below and in Appendix 8-1 of the EIAR.

4.6.1 General recommendations for Good Construction Practice

The peat stability assessment indicates that there is insignificant risk of peat failure. The following mitigation measures are recommended and should be taken into account when preparing Construction Method Statements for the proposed development:

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.
- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits.
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).
- Peat movement monitoring posts will be installed upslope and downslope of access roads and at locations where peat depths are greater than 2.0m.

4.7 Outline Archaeological Management Plan

Archaeological monuments are safeguarded through national and international policy, which is designed to secure the protection of the cultural heritage resource.

Through a detailed examination of the baseline data available and a detailed site inspection, it was concluded that while the archaeological potential of the area is high no new sites were noted within the peatland areas of the areas proposed development, nor are any recorded archaeological or architectural assets located therein. One new potential archaeological monument was detected within the Wind Farm Site boundary at Clonrobert townland. It comprises an enclosed rectangular area in pasture c. 74m east of the proposed access road to T15. No direct impacts to this potential monument as a result of the proposed development have been identified. Furthermore, direct impacts to recorded archaeological and architectural assets as a result of the proposed turbines, substation, associated infrastructure and borrow pit have not been identified. Therefore, the following mitigation proposed is the protection and preservation of potentially new and previously undiscovered sites:

- A pre-construction walkover survey / inspection of areas proposed for excavation will be undertaken to re-assess the bog for new sites that may be exposed.
- If present, the sites shall be archaeologically excavated under licence prior to construction. The archaeologist will liaise with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs regarding the methods being proposed for excavation.
- Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. A report setting out the findings will be submitted to the relevant authorities.
- Archaeological monitoring of ground works and metal detection of spoil during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

In the event of the discovery of archaeological finds or remains, the National Monuments Service and the National Museum of Ireland shall be notified immediately. If features are revealed, the archaeological finds or remains will need to be investigated, and no further development will take place in that area until the site is fully identified, recorded and excavated or alternatively avoided to the satisfaction of the statutory authorities.

4.8 Dust Control & Air Quality

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Site Environmental manager for cleanliness, and cleaned as necessary;
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;
- All construction related traffic will have speed restrictions on un-surfaced roads to 15 kph;

- Daily inspection of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper.
- If necessary, water will be taken from stilling ponds in the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust.
- Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust.
- Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.
- A road sweeper will be available if any section of the public roads requires cleaning due to construction traffic associated with the Proposed Development.

4.9 Noise & Vibration Control

Regarding construction activities, reference will be made to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*, which offers detailed guidance on the control of noise & vibration from demolition and construction activities. It is proposed that various practices be adopted during construction, including:

- managing the hours during which site activities likely to create high levels of noise or vibration are permitted as detailed below;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- keeping site access roads even to mitigate the potential for vibration from lorries.

Furthermore, a variety of practicable noise control measures will be employed. These include:

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and;
- regular maintenance and servicing of plant items.

It is recommended that vibration from construction activities be limited to the values set out in Table 11-3 in Chapter 11 of this EIAR. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the wind farm. Proposed measures to control noise include:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.

- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Chapter 11 using methods outlined in British Standard BS 5228-1:2014+A1:2019 Code of practice for noise and vibration control on construction and open sites – Noise.
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, large turbine component delivery, rotor/blade lifting) it could occasionally be necessary to work outside of these hours which will be agreed with the local authority where required.

Where rock breaking is employed in relation to the proposed borrow pit location, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities:

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency.
- Ensure all leaks in air lines are sealed.
- Use a dampened bit to eliminate ringing.
- Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured.
- Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

4.9.1 Vibration

While it was concluded above that there will be no significant vibration impacts associated with the construction of the Proposed Development and that no specific mitigation measures were required, it is recommended that vibration from construction activities will be limited to the values set out in Section 11.3.2.1.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

4.9.2 Operational Phase Mitigation

An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 11.3.2.2 in Chapter 11 of this EIAR. The findings of the assessment identified that there are two NSLs where potential exceedances are predicted. If confirmed during post-construction monitoring, a curtailment strategy will be implemented to reduce noise levels due to the wind farm to within the criteria at all NSLs.

In the unlikely event that an issue with low frequency noise is associated with the Proposed Development, it is recommended that an appropriate detailed investigation be undertaken. Due consideration should be given to guidance on conducting such an investigation which is outlined in Appendix VI of the EPA document entitled *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4) (EPA, 2016). This guidance is based on the threshold values outlined in the Salford University document *Procedure for the assessment of low frequency noise complaints, Revision 1, December 2011*.

The following programme of measures would be implemented in the event of an issue of aerodynamic modulation being identified and associated with the site:

- A detailed noise survey conducted by an appropriately qualified acoustic consultant will be commissioned in order to confirm the presence or not of the issue, the extent of the issue (i.e. number of locations, wind speeds and environmental conditions in which it is occurring);
- Based on the findings of this work and where aerodynamic modulation is identified a schedule of measures will be formulated and agreed with the planning authority, which would typically be envisaged to focus on control and regulation of the operation of turbine unit(s) in certain atmospheric and meteorological conditions.

4.9.3 Monitoring

Commissioning noise surveys are recommended to ensure compliance with any noise conditions applied to the Proposed Development. In the unlikely instance that an exceedance of these noise criteria is identified, the assessment guidance outlined in the IoA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) should be followed and relevant corrective actions undertaken.

4.10 Invasive Species Management

Third Schedule invasive species Bohemian Knotweed, Japanese Knotweed, Himalayan Knotweed and Rhododendron were recorded along the proposed grid connection route (see Table 6-14 of the EIAR). The following mitigation will be adhered to in relation to these species:

- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere.
- Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally.
- Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes.
- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.
- Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.
- Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing.
- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.

- When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal.
- Any soils or subsoils contaminated with invasive species will sent for disposal to an appropriately licenced facility.

The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed.*

The bio security requirements in relation to all plant and equipment as set out in the Inland Fisheries Ireland (IFI) Bio-Security Protocol (copy provided in Appendix 6) will be implemented as required.

4.10.1 Good Practice on Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk. The Best Practice Management Guidelines produced by Invasive Species Ireland (Maguire et al, 2008) and is included in Appendix 5 of this document.

4.10.2 Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- A series of test pits will be dug within the footprint of the proposed cable route in order to confirm presence or absence of parent plant rhizomes. This will be completed under the supervision of a suitably qualified ecologist.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- An environmental manager/suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

4.10.3 Decontamination of Vehicles

- Personnel may only clean down if they are familiar with the plant and rhizome material, and can readily identify it.
- Decontamination will only occur within designated wash-down areas.

- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

4.11 Waste Management Plan

This section of the CEMP provides a Waste Management Plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage. Disposal of waste will be seen as a last resort.

- This WMP has a number of key objectives as outlined below:
- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

4.11.1.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the proposed development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*'.

4.11.2 Preliminary Plan

The Department of the Environment guidelines state that, at the design stage of the project, only a preliminary WMP is required,

> "Formal production and presentation of the Plan may be at a later stage but a clear 'waste management philosophy' needs to be adopted...at the initial conceptual stage of the Project..."

This preliminary WMP has a number of key objectives as outlined below:

- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

4.11.3 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:
The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:
Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:
There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

4.11.4 Construction Phase waste Management

4.11.4.1 Description of the Works

The construction of the proposed development will involve the construction of up to 15 no. turbines, new site access tracks & upgrade of existing tracks, internal cabling and grid connection, substation & control buildings, borrow pit, junction upgrade along the turbine haul and the provision of a link road for turbine delivery and upgrade works to the existing 110kV Mullingar substation.

The proposed turbines will be manufactured off site and delivered to site where on site erection will occur.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower or the “Anchor Cage” is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level.

The construction of the substation will comprise of piled concrete foundations, the piles will most likely be constructed by coring and inserting a steel sleeve which will be filled with reinforced concrete prior to sleeve removal. The reminder of the substation will consist of concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from the onsite borrow pit.

The waste types and list of waste (LoW) codes arising from the construction phase of the proposed development are outlined in Table 4-2 below.

Table 4-2 Expected waste types arising during the Construction Phase

Materials type	Example	LoW Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05

Materials type	Example	LoW Code
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03
Soil & Stone	Soils and subsoils	17 05 04

Hazardous wastes that may occur on site during the construction phase of the proposed development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes that contamination does not occur.

4.11.4.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

4.11.4.3 Waste Arising from Construction Activities

All waste generated on site that will be contained in waste skips at a waste storage area on site. This waste storage area will be kept tidy with a waste skip clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the wind farm site. Therefore, all wastes streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited into the on-site skips and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the road as only the quantity of stone necessary will be excavated from the borrow pit or brought on site on an 'as needed' basis.

Site personnel will be instructed at induction that no under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

4.11.4.4 Waste Arising from Decommissioning

The design life of the wind farm is 30 years after which time a decision will be made to determine whether or not the turbines will be replaced by new turbines or if decommissioning will occur. The lengthy time frame between the completion of the construction phase and decommissioning will result in the only materials remaining on site at that time will be infrastructural material such as the turbine foundations, turbines and the granular material used to construct roads. If the site is decommissioned, cranes will disassemble each turbine tower and all equipment. The associated components will be removed from site for re-use, recycling or waste disposal. Any structural elements that are suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the development are outlined in Table 4.3below.

Table 4-3 Expected waste types arising during the Decommissioning Phase

Material Type	Example	LoW Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead and iron	17 04 07
Inert Materials	Crushed Stone, Concrete	17 01 07

4.11.4.5 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated peat can be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

4.11.4.6 Recycling

If a certain type of construction material cannot be reused onsite, then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The anticipated volume of all waste material to be generated at the proposed development is low which provides the justification for adopting this method of waste management.

4.11.4.7 Implementation

4.11.4.7.1 *Roles and Responsibilities for Waste Management*

Prior to the commencement of the proposed development a Construction Waste manager will be appointed by the project team. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the management plan.

4.11.4.7.2 *Training*

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the construction phase of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

4.11.4.7.3 *Record Keeping*

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and LoW Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail

- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

4.11.4.8 Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy will always be employed to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

4.12 Outline Construction Traffic Management Plan

4.12.1.1 Introduction

The Construction Traffic Management Plan can only be finalised when a contractor has been appointed to carry out and schedule the works. It is also appropriate that the Project Supervisor Construction Stage when appointed, along with the turbine supplier shall have an input in the preparation and review of the Traffic Management Plan.

The purpose of this Outline Construction Traffic Management Plan is to set out the volume of traffic generated by each element of the works. The plan will be reviewed and updated by the appointed contractor prior to the commencement of construction

4.12.2 Construction Phases

The construction phase of the proposed development will run for between 12 - 18 months. Due to the size of the site, its general layout and the total number of turbines proposed, it is unlikely that the construction phase will require phasing. Therefore, the following sequence of construction activities are proposed:

- Construction of main road access and site entrances.
- Initial installation of on-site tracks and drainage.
- Installation of new access tracks and upgrade of existing.
- Development of the construction compound and any other temporary works.
- Construction of substation and control building.
- Preparation of crane hard standings.
- Construction of turbine foundations.
- Installation of internal site cabling within wind farm
- Installation of the grid connection cabling
- Wind Turbine erection
- Land reinstatement.

4.12.2.1 Site Access Tracks

The internal access tracks will provide the required access to all turbine and associated infrastructure. The new and proposed upgraded access tracks have been designed to provide a minimum 5m running width along the straight sections of track with wider sections proposed at bends where required. Passing bays will be installed to allow a mechanism for two-way traffic. Appropriate signage at the location of these passing bays as well as instruction on priority vehicles will be installed throughout the site. The running surface on the existing and proposed new access tracks will facilitate the delivery of large and abnormal loads on oversized trucks.

Where upgrade of existing public road junctions as well as the provision of the link road for turbine deliveries are to be completed as outlined in Section 3 above, the traffic management on the public road at these locations will be provided by the appointed contractor with the approval of Westmeath County Council.

4.12.2.2 Access to the Site from National Roads

It is proposed to upgrade the existing forestry track entrance off the R396 Regional Road for use as the wind farm site entrance for the construction and operational phases. This entrance will be widened to facilitate the delivery of the construction materials and turbine components. The site entrance was subject to Autotrack assessment to identify the turning area required, as described in the Traffic and Transport Assessment in Section 14.1 of the EIAR. Appropriate sightlines will be established to the north and south of the proposed site entrance for the safe egress of traffic. The proposed works will result in a permanent upgrade of this current site access from the R396 Regional Road, which will also form the wind farm site entrance during the operational phase. The site entrance location is shown in Figure 4-1, and included in the detailed layout drawings in Appendix 4-1 of the EIAR.

The delivery of all turbine and construction materials to the site will be via the site entrance off the R396. From here, the vehicles will use the internal site roads to access the proposed infrastructure locations within the site.

The delivery of turbine and construction materials to Turbines T14 & T15 will be via the L5755 from the aforementioned crossing point on the L5755. There will be an entrance south to T14 approximately 0.3 kilometres east of the crossing point on the L5755 and an entrance north to T15 approximately 1.6 kilometres east of the crossing point on the L5755. Appropriate sightlines will be established to the east and west of these access junctions for the safe egress of traffic. The proposed works will result in permanent upgrade of the L5755 local road which will also form part of the wind farm site entrances to T14 and T15 during the operational phase. The section of L5755 and entrances to T14, T15 and the proposed borrow pit will be controlled appropriately to allow the safe passage of construction vehicles along the road, as described in the Traffic Management Plan in section 4.12.3. Priority along the section of road and at the site entrances will be maintained for public traffic.

4.12.2.3 Turbine Components Delivery

The proposed turbine delivery route is described in Section 4.3.17 of the EIAR. All deliveries of turbine components to the site will be by way of the proposed transport route outlined in Figure 4-18 of the EIAR.

Other construction materials will be delivered to the site via the proposed haul routes shown on Figure 4-19 of the EIAR. This general construction traffic will use the Regional roads in the area surrounding the site.

4.12.2.4 Grid Connection Consents

The proposed grid connection route will require a Road Opening Licence (ROL) prior to the commencement of any grid connection works on the public road. The ROL will require a detailed traffic management plan for the grid connection cabling works which will set out any proposed road closures, diversions, signage etc. The final details of such a traffic management proposals cannot be determined without the input of the appointed contractor.

The proposed grid connection route will traverse an Irish Rail level crossing in the townlands of Farranistick and Culleen More. Any such works on properties of Córas Iompair Éireann (CIE) who are authority for such properties requires a license agreement to be put in place between the developer and CIE. This license can only be agreed and signed a maximum of one year prior to the undertaking of any works at CIE properties as CIE put a one year expiry on all such agreements to allow for amendments to any of the conditions should the standards change.

4.12.3 Detailed Traffic Management Plan

A detailed Traffic Management Plan (TMP), incorporating all the mitigation measures set out in the Outline TMP will be prepared by the appointed contractor which will details in respect of traffic management agreed with the roads authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:

Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.

Delivery Programme – a programme of deliveries will be submitted to Westmeath County Council in advance of deliveries of turbine components to site.

Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (if required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out prior to construction commencement to record the condition of the road. A post construction survey will be carried out after works are completed. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Liaison with the relevant local authority - Liaison with the relevant local authority including the roads sections of local authorities that the delivery routes traverse and An Garda Siochana, during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Liaison with the relevant local authority including the roads sections of local authorities that the cable route traverses. Once the surveys have been carried out and “prior to commencement” status of the relevant roads established, the Roads section will be informed of the name and contact number of the Project Supervisor of the construction stage as well as the Site Environmental Manager.

Implementation of temporary alterations to road network at critical junctions – At locations highlighted in Section 14.1.8. of the EIAR.

Identification of delivery routes – These routes will be agreed and adhered to by all contractors.

Travel plan for construction workers – While the assessment above has assumed the worst case that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of a routes to / from the site and identification of an area for parking.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at all key junctions, including all new junctions providing access to the site and temporary access road on the R395, R396 and the L5755. All measures will be in accordance with the *“Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works”* (Department of Transport, Tourism and Sport (DoTT&S)) and “Guidance for the Control and Management of Traffic at Roadworks” (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times and at each construction site location along the Grid Connection Route.

Delivery times of large turbine components - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated as described in section 14.1.8. A roads conditions survey (and any other analyses required by the Roads Section of the Council) would be undertaken immediately prior to construction commencement of the project to assess the condition of the road network at that time and to agree any required works with the local authority. Such a survey would be repeated immediately after completion of the construction phase of the project in order to ensure that any reinstatement works were carried out to a satisfactory standard as required by the local authority.

Road Opening Licence – Roads works associated with the grid connection cabling will be undertaken in line with the requirements of a road opening licence as agreed with Westmeath County Council.

Diversions and road closures – reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the Grid Connection Route works. The details of this will be agreed with the roads authority in advance of works taking place. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact owing to the Grid Connection Route works.

Trench Reinstatement - Trenches on public roads, once backfilled, will be temporarily reinstated to the satisfaction of the roads authority. Following temporary reinstatement of trench sections on public roads along which the Grid Connection Route travels will receive a surface overlay subject to agreement with the roads authority. The roads conditions survey, which will be undertaken immediately prior to construction commencement of the project, will ensure that any section of road along the grid connection route is not left in a degraded condition. The repetition of the survey immediately after completion of the construction phase of the Proposed Development will ensure that any reinstatement works were carried out to a satisfactory standard.

4.13 Outline Site Reinstatement Plan

4.13.1 Post-Construction

Upon the completion of the major infrastructural elements of the project such as site roads, turbine bases and the substation, the initial site restoration will commence. This will involve the removal of machinery from the site which will have come to its end of use such as excavators, haulage vehicles and storage containers. As this equipment is removed, particularly from stoned areas such as the temporary construction compound, these areas will then be restored to their original state to promote revegetation. The restoration procedure for the site areas adjacent to infrastructure for which the original site conditions have been altered for the purpose of the construction of the wind farm are outlined in the following sections.

4.13.1.1 Site Roads and Turbine Foundations

Where the upgrade of existing roads and the construction of new roads has been completed, the restoration of either side of these roads will be carried out immediately after construction of this element of the works. The restoration along these road edges will mainly involve backfilling and landscaping with the material which will be removed during excavation and set aside for this purpose. The turbine foundations when complete will also be backfilled with this material. The replacing of this material will restore the areas adjacent to the construction to its original state and will enhance revegetation opportunities.

4.13.1.2 Temporary Construction Compound

The site compound will be constructed using a similar methodology to that of the new site roads. This compound will be removed after the commissioning of the turbines. The stoned area will be excavated and all stone transported off site by a licensed haulier for reuse or recovery at an appropriately permitted site. The peat or overburden excavated prior to the installation of the site compound will be transported back to this original location and levelled with the area being restored to the original ground level.

Where restoration takes places in areas which have been previously used for agricultural purposes then the area will be reseeded for agricultural grassland. In areas of peat or blanket bog the areas in question will be restored with the similar material and will be allow to recolonise naturally. All restoration procedures will be carried out under the supervision and guidance of the supervising project ecologist.

4.13.1.3 Drainage Features

The supervising project hydrologist will provide supervision throughout the construction phase of the project. On completion of the construction phase, any drainage features which have been installed (as outlined in Section 4.2.4 prior to or during the construction phase and are deemed to be unnecessary for the operational phase by the hydrologist will be removed. Each area which has a drainage feature removed will be restored to its original condition. This will again be carried out under the supervision of the supervising project hydrologist.

4.13.1.4 Junction Works

All road junction will be reinstated once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except where stated otherwise.

For the proposed link road between the R395 and R396 which measures approximately 1.2 kilometres in length the granular fill and final surface running layer will be left in place within the link road and will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate

4.13.2 Decommissioning Plan

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The substation will remain in place as it will be under the ownership of ESB/EirGrid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the wind farm by the time the decommissioning of the Proposed Development is to be considered, and therefore it is considerd more appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. The underground cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible.

A Decommissioning Plan has been prepared (Appendix 4-11 of the EIAR) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the proposed renewable energy development has been fully assessed in the EIAR.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".

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5. IMPLEMENTATION

5.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or Environmental Manager are the project focal point relating to construction-related environmental issues.

In general, the Environmental Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The Environmental Manager will act as the regulatory interface on environmental matters by reporting to and liaising with Westmeath County Council and other statutory bodies as required.

The Environmental Manager will report directly to the Site Supervisor/Wind Farm Construction Manager. An Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Archaeologist and Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is as follows:

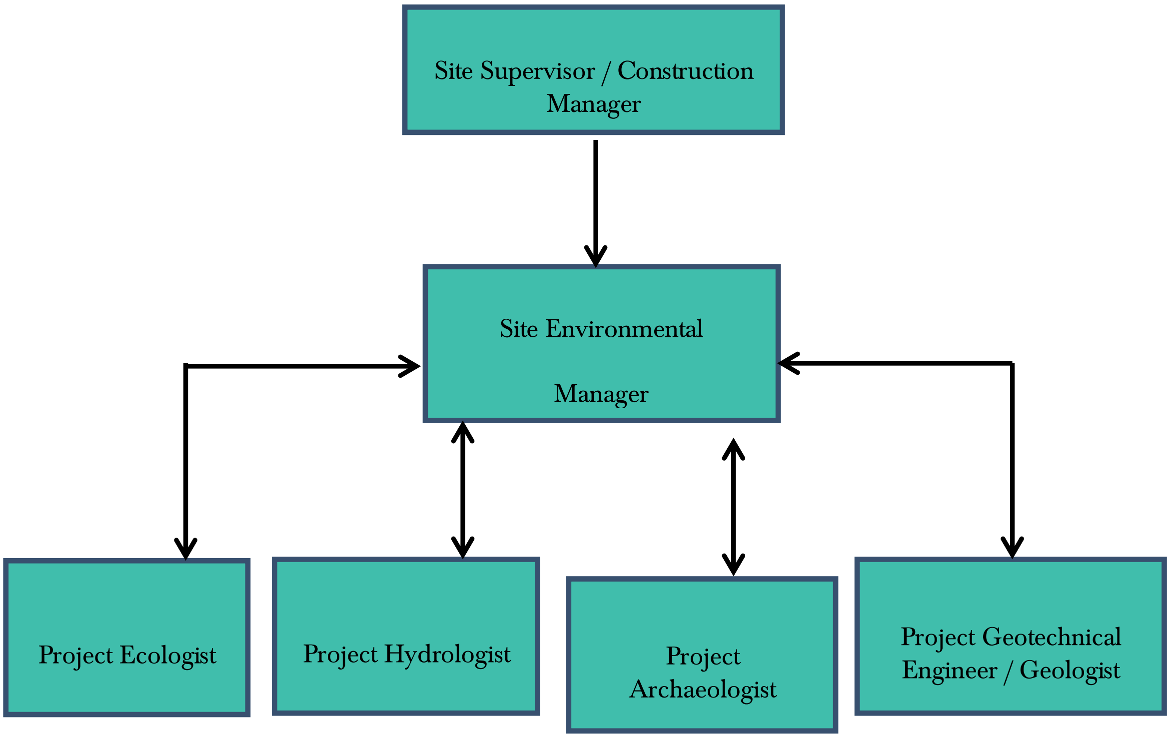


Figure 5-1 Site Management Chain of Command

Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, shall certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

There are currently peat extraction activities ongoing at the proposed development site. In order to ensure adequate interaction between the ongoing peat activities and the construction and operation of the wind farm an Interactions Management Group (IMG) will be set up. Refer to Section 5.1.7 for further details.

5.1.1 Wind Farm Construction Manager/Site Supervisor

The Site Supervisor/Construction Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Site Supervisor/Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the Project CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Take advice from the Environmental Manager on legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

5.1.2 Environmental Manager

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Manager, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The Environmental Manager will report to the Site Supervisor/Construction Manager. The responsibilities and duties of the Environmental Manager will include the following:

- Preparation of the CEMP and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required Environmental Monitoring;
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
  - Prevention of environmental pollution and improvement to existing working methods;
  - Changes in legislation and legal requirements affecting the environment;
  - Suitability and use of plant, equipment and materials to prevent pollution;
  - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure proper mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;

- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,
- Identify environmental training requirements, and arrange relevant training for all levels of site based staff/workers.
- The level, detail and frequency of reporting expected from the Environmental Manager for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

5.1.3 Project Ecologist

The Project Ecologist will report to the Environmental Manager and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will visit the site when required to fulfil ones duties.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with Environmental Manager, oversee and provide advice on all relevant ecology mitigation measures set out in the EIAR and planning permission conditions;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority.

5.1.4 Project Hydrologist

The Project Hydrologist will report to the Environmental Manager and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of proposed drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.5 Project Archaeologist

The Project Archaeologist will report to the Environmental Manager and is responsible for archaeological monitoring of the site during the construction phase. This will include monitoring of site investigations and excavation works as well as the monitoring and metal detection of spoil during construction.

If new archaeological material is detected, during the pre-construction re-inspection, testing or monitoring, the project archaeologist will be responsible for ensuring they are preserved by record (archaeologically excavated) and therefore permanently removed with a full record made.

5.1.6 Project Geotechnical Engineer/Geologist

The Geotechnical Engineer or Project Geologist will report to the Environmental Manager and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during the construction phase and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Geotechnical Risk Register and that these are subject to ongoing monitoring; and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and at the borrow pit and peat repository areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.7 Interactions Management Group

As detailed above there are currently peat extraction activities ongoing at the proposed development site. In order to ensure adequate interaction between the ongoing peat activities and the construction and operation of the wind farm at the proposed site an Interactions Management Group (IMG) will be set up. The key role of the IMG will be to establish an interface between the wind farm and peat activities at the proposed site. The setup of the IMG will allow for a co-ordinated approach in the management of site activities where there will be interactions between the two activities and to allow for the environmental management of all activities associated with the proposed wind farm including site drainage, ecology, archaeology, geology etc. The IMG will include the applicable Developers Construction/Operations Project Manager, the Main Contractors Construction Manager and Site Environmental Manager and the Operations Manager or Site Supervisor from each of the peat companies operating at the proposed development site. Coole Wind Farm Ltd will have control over the construction, operation and maintenance of the wind farm development for the lifetime of the project including its drainage system and any surface water discharges. The IMG will be set up prior to construction commencement and will continue for the duration of the lifetime of the wind farm project.

5.2 Water Quality Monitoring

5.2.1 Pre-construction Baseline Monitoring

Baseline water quality field testing and laboratory analysis will be undertaken where required prior to commencement of felling and construction at the site. The baseline monitoring programme will be subject to agreement with Westmeath County Council.

Analysis will be for a range of parameters with relevant regulatory limits along with EQSs and sampling will be undertaken for each stream that drains from the construction site.

Baseline sampling will be completed on at least two occasions and these should coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell.

5.2.2 Construction Phase Monitoring

5.2.2.1 Daily Visual Inspections

Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction be higher than the existing levels, the source will be identified and additional mitigation measures implemented.

5.2.2.2 Continuous Turbidity Monitoring

Turbidity monitors or sondes can be installed where required at locations surrounding the wind farm and Grid Connection site. The sondes will provide continuous readings for turbidity levels in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations as outlined in the sections below.

5.2.2.3 Monthly Laboratory Analysis

Baseline laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each watercourse e.g. at SW01 to SW05 in the wind farm as outlined in Section 9 of the EIAR and along all primary watercourses along the grid connection route on a monthly basis. This will not be restricted to these four locations and further sampling points will be added as deemed necessary by the Environmental Manager in consultation with the Project Hydrologist and Site Manager.

5.2.2.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) analyses will be carried out by either the Environmental Manager or the Project Hydrologist at all surface water monitoring locations. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The supervising hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

5.2.2.5 Monitoring Parameters

The analytical determinants of the monitoring programme (including limits of detection and frequency of analysis) will be as per S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The likely suite of determinants will include:

- pH (field measured)
- Electrical Conductivity (field measured)
- Temperature (field measured)
- Dissolved Oxygen (field measured)
- Total Phosphorus
- Chloride
- Nitrate
- Nitrite
- Total Nitrogen

- Ortho-Phosphate
- Ammonia N
- Biochemical Oxygen Demand
- Total Suspended Solids

5.2.3 Construction Phase Drainage Inspections

Drainage performance will form part of the civil works contract requirements. During the construction phase the effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treatment of potentially silt-laden water from the works areas will be monitored periodically (daily, weekly, and event based monitoring, i.e. after heavy rainfall events) by the Environmental Manager and/or the Project Hydrologist. The Environmental Manager will respond to changing weather and drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained.

Prior to the commencement of construction an inspection and maintenance plan for the on-site drainage system which will be prepared by the Environmental Manager in consultation with the Project Hydrologist. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Regular inspections of all existing and installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system. Any excess build-up of silt levels at check dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

The following periodic inspection regime is likely to be proposed:

- Daily general visual inspections by Environmental Manager;
- Weekly (existing & new drains) inspections by the Environmental Manager and/or the site Construction Manager;
- Inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement;
- Event based inspections by the Environmental Manager as follows:
  - >10 mm/hr (i.e. high intensity localised rainfall event);
  - >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
  - Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).
- Monthly site inspections by the Project Hydrologist during construction phase; and,
- Quarterly site inspections by the Project Hydrologist after construction for a period of one year following the construction phase.
- A written record will be maintained or available on-site of all construction phase monitoring undertaken.

5.2.4 Surface Water Monitoring Reporting

Visual inspection and laboratory analysis results of water quality monitoring shall assist in determining requirements for any necessary improvements in drainage controls and pollution prevention measures implemented on site.

It will be the responsibility of the Environmental Manager to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings.

Reports on water quality will consider all field monitoring and visual inspections, and results of laboratory analysis completed for that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. Any proposed alteration to sampling frequency will be agreed with Westmeath County Council in advance.

5.2.5 Post-Construction Monitoring

5.2.5.1 Monthly Laboratory Analysis Sampling

Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six months after construction is complete. The supervising hydrologist will monitor and advise on the readings being received from the testing laboratory.

5.3 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case by case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;
- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the environmental Incident Management Procedure.

5.3.1 Toolbox Talks

Tool box talks would be held by the Environmental Manager/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the tool box talks are to identify the specific proposed work activities that are scheduled for that day. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities. The toolbox talks will include training and awareness on:

- Ecological Sensitivities on site
- Buffers to be upheld – watercourses, archaeology, ecology
- Sediment and Erosion Control
- Good site practice
- On-site Traffic Routes and Rules
- Keeping to tracks – vehicle rules
- Strictly adhering to the development footprint
- Fuel Storage
- Materials and waste procedures

Site meetings would be held on a regular basis involving all site personnel. The objectives of the site meetings are to discuss the coming weeks proposed activities and identify the relevant work method statements and sub plans that will be relevant to that week's activities. Additionally, any non-compliance identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

6. EMERGENCY RESPONSE PLAN

An Emergency Response Plan (ERP) has been prepared to provide details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection during the construction and operational phases of the Coole Wind Farm Development. The construction phase of the development will have the highest volume of works activity and site personnel resulting in this phase being the most likely to engage this ERP should a situation require it. The operational phase is a much less intensive phase of the development. The physical site presence during operation is significantly reduced with every element of the site monitored remotely.

The decommissioning phase will adopt this ERP during that phase in the event of an incident during the works associated with decommissioning and site restoration

6.1 Emergency Response

The chain of command during an emergency response sets out who is responsible for coordinating the response. The appointed Site Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 6-1. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 6-1. This will be updated throughout the various stages of the project.

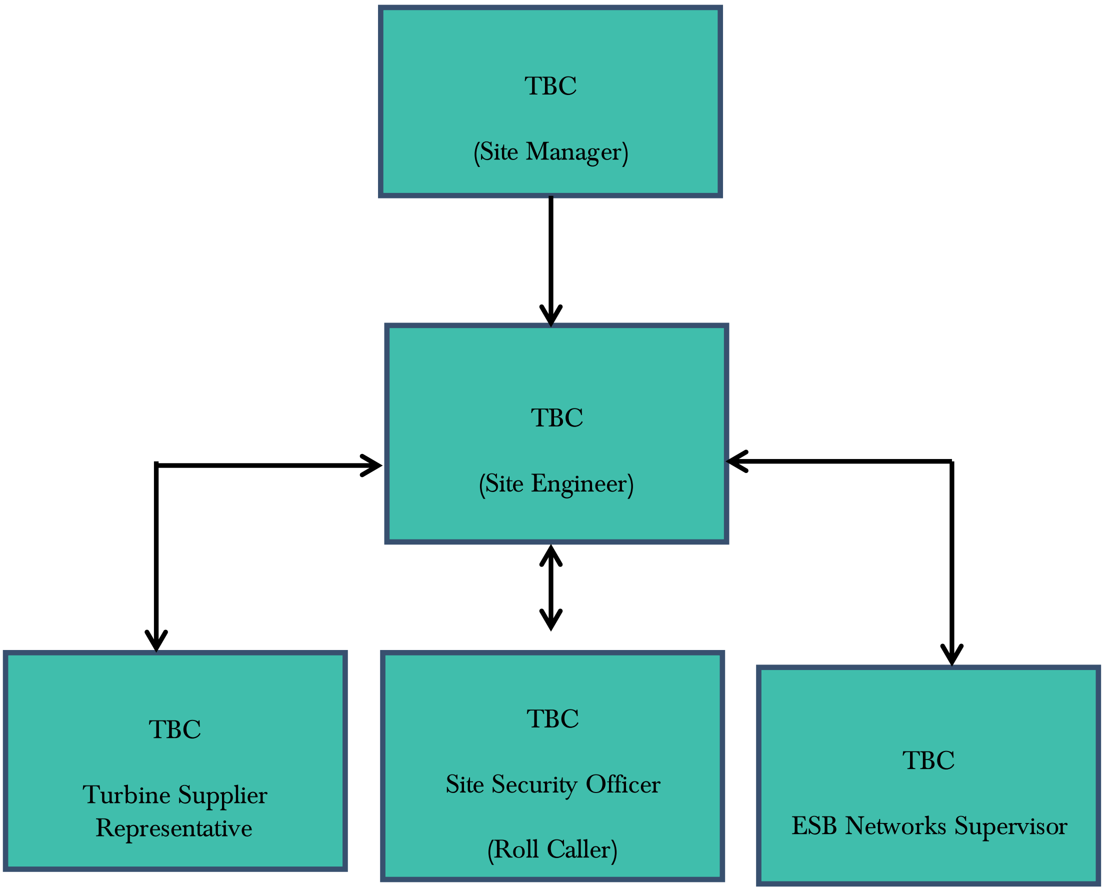


Figure 6-1 Emergency Response Procedure Chain of Command

6.1.1 Initial Steps

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 6-1 Hazards associated with potential emergency situations

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 6-1 the Site Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site. The Site Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare and if there are no injured personnel at the scene that require assistance. The Site Manager will be required to use his own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 6.1.2
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone if he is unable to do so. If delegating the task, ensure that they follow the procedures for contacting the emergency services as set out in Section 6.3.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks the numbers for which as provided in Section 6.3.2.
- Contact the next of kin of any injured personnel where appropriate. The procedure for this is outlined in Section 6.3.3.

6.1.2 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog horn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Manager when all personnel have been accounted for. At this time the Site Manager will decide the next course of action which be determined by the situation that exists at that time. The Site Manager will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

6.2 Environmental Emergency Response Procedure

6.2.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

- All construction activities shall cease within the affected area.
- Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
- Re-commencement of limited construction activity shall only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.

6.2.1.1 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

- On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- Where considered possible action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
- For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

6.2.2 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the proposed project. Oil/Fuel spillages are one of the main environmental risks that will exist on the proposed site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The Environmental manager will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Environmental Manager will notify the appropriate regulatory body such as Westmeath County Council, and the Environmental Protection Agency (EPA), if deemed necessary.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The Environmental manager must be immediately notified.
- If necessary, the Environmental manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site (pSPA or cSAC), the Environmental manager will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the Environmental manager will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the Environmental manager and the Main Contractor. These records will be made available to the relevant authorities such as Westmeath County Council, EPA if required.

The Environmental Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

6.3 Contacting the Emergency Services

6.3.1 Emergency Communication Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

Stay calm. It's important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, is an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but don't get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There's a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you don't understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

6.3.2 Contact Details

A list of emergency contacts is presented in Table 6-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 6-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Coole Surgery	044 9661104

Hospital – Midland Regional Hospital, Mullingar	044 9340221
ESB Emergency Services	1850 372 999
Bórd Gais Emergency	1850 20 50 50
Gardaí –Multyfarnham Garda Station	044 9371112
Health and Safety Co-oordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): McCarthy, Keville, O' Sullivan Ltd.	091 735611
Client – Coole Wind Farm	021 2427786

6.3.3 Procedure for Personnel Tracking

All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming in an emergency situation where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

6.4 Induction Checklist

Table 6-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 6-3 Emergency Response Plan Items Applicable to the Site Induction process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction.	
Due to the location of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	

All operatives on site without any exception will have undergone a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

7. SAFETY & HEALTH MANAGEMENT PLAN

7.1 Introduction

The Safety and Health Management Plan (SHMP) sets out the work practices procedures and management framework and responsibilities for the management of health and safety during the design, construction and operational phases of the proposed Coole Wind Farm development. The Safety and Health Management Plan shall be finalised by the appointed contractor who will ensure that all site personnel are familiarised with their individual responsibilities as set out the SHMP. The contractor will ensure that adequate site induction and ongoing training of site personnel will inform all operatives of their responsibilities.

7.2 Project Supervisor Design Process

MKO have been appointed to the role of Project Supervisor Design Process (PSDP) for the proposed Coole Wind Farm. In fulfilling this role, the PSDP is required to:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project
- Eliminate the hazards or reduce the risks, where possible,
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the safety and health plan
- Ensure that the work of designers is coordinated to ensure safety
- Organise co-operation between designers
- Prepare a written safety and health plan for any project and deliver it to the client prior to tender

7.2.1 Preliminary Safety and Health Plan

A Preliminary Health and safety Plan has been developed by PSDP. The Safety, Health and Welfare at Work Act 2005 requires under Section 15 that the appointed Project Supervisor for the Construction Stage (PSCS) assume the responsibility of the 'person in control of places of work'. The PSCS is required to ensure that access, egress, articles or substances are safe and pose no risk to health.

This Preliminary Health and safety Plan has been developed by the PSDP as required by Regulation 12 of The Safety, Health and Welfare at Work (Construction) Regulations 2006. This document provides a general description of the project, client's considerations and management requirements, environmental restrictions and existing on-site risks i.e. Safety hazards, health hazards and any significant design and construction hazards. This information may assist the PSCS in the further development of the Health & Safety Plan as required under Regulation 16 of The Safety, Health & Welfare (Construction) Regulations 2006, in order to demonstrate that appropriate account will be taken of the health and safety arrangements, prior to the commencement of works on site.

- The preliminary safety and health plan includes the following information:
- General Project Description
- Construction Activities Overview
- Designers Risk Assessment
- Management and Site Rules
- Construction timing

7.3 Project Supervisor Construction Stage

The role of Project Supervisor Construction Stage will be awarded to the appointed contractor undertaking the construction phase of the works. The PSDP will facilitate the handover of the Preliminary Health & Safety Plan as well as all other necessary documents prepared during the planning process to enable the PSCS prepare the Construction Stage Health & Safety Plan.

7.3.1 Construction Stage Safety and Health Plan

On awarding of the contract, the PSCS shall submit to the developer before commencing the works, his customised Construction Phase Site Specific Safety and Health Plan. This document will include a Hazard Identification and Risk Assessment Plan for their activities on site during the execution of the Works. This plan must also include safety barrier analysis for the works proposed. Site Specific Risk Assessments and Method Statements will be submitted on behalf of each of the subcontractors before works commence on Site.

The Site-Specific Method Statements and Risk Assessments shall be subject to revision in order to maintain compatibility with the Construction Stage Safety and Health Plan prepared for the site. The PSCS will be responsible for preparing this plan before Works commence on site, and for maintaining and updating this plan as part of their role as PSCS.

A Daily Job Safety Plan is to be completed before each task commences with each work crew. This practice is to be followed by all contractors on site.

The Contractor shall be required to ensure that individual responsibility for safety measures are detailed in his Site-Specific Safety and Health Plan. This should be taken into account at the tendering, planning and execution stages of the work. The Construction Stage Safety and Health shall include but not be limited to the following:

- Provisions for the management of safety during the construction phase including a management organisation chart clearly showing those who perform a statutory safety role;
- Method statements for each and every component of their works on site;
- Risk assessments for site hazards identified prior to site mobilisation and provisions for subsequent hazard identification and risk assessment procedures for the site;
- A comprehensive inspection checklist, which the Contractor shall use on a weekly basis on site to ensure implementation of the controls detailed in this site-specific safety statement;
- Provisions for safety training of personnel upon their induction on Site and subsequently as the project proceeds;
- Provisions for the safe control and use of chemicals on site;
- Provisions for the control of the Contractor's and Subcontractor's activities on the site including permit to work, entry into confined spaces, hot work permits, etc.;
- The provision and maintenance of safe electrical supplied on the site;
- The provision of fire-fighting facilities on the Site;
- Site emergency procedures (fire, accident, etc.);
- Site first aid facilities and trained personnel;
- Arrangements for the promotion of safety on Site;
- Disciplinary procedures for breaches in safety by site personnel, including management staff;
- Personal protective equipment (PPE) policy;
- Inspection and control of work equipment;
- Recording of weekly Contractor/Subcontractor site labour returns;
- Accident reporting, recording and investigation;

- Provisions for ensuring the adequacy of Subcontractors safety standards prior to their appointment on site; and
- Safety consultation procedures for site workforce. This should Illustrate how the Contractor will meet the execution and deliverable requirements of the HSSE Obligations.

Should the extent, nature or method of working be changed in the course of its execution, the Contractor shall take account of the change by amending the Construction Stage Safety and Health for the works and submitting it for approval of the Employer. The Contractors revised risk assessments and method statements for works that change during the course of its execution must also be submitted to the PSCS. The amended Safety and Health must be distributed and fully understood by all the relevant persons before works relating to the revised Statement take place.

8. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR submitted as part of the planning permission application.

This section of the CEMP groups together the mitigation measures presented in the EIAR. It is intended that the CEMP would be updated where required prior to the commencement of the development, to include all mitigations measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

All mitigation measures which will be implemented during the pre-commencement, construction and operational phases of the project are outlined in Table 8-1. The mitigation measures have been grouped together according to their environmental field/topic and are presented under the following headings:

- Construction Management
- Drainage Design and Management
- Felling
- Peat, subsoils and bedrock
- Flora and Fauna
- Noise
- Air Quality/Dust
- Landscape and Visual
- Traffic

By presenting the mitigation proposals in the below format, it provides an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audit.

Table 8-1 Monitoring Measures

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase					
MM1	Environmental Management	EIAR Chapter 4	All proposed site activities will be provided for in an Environmental Management Plan, prepared prior to the commencement of any operations onsite. The environmental management plan will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
MM2	Environmental Management	EIAR Chapter4 CEMP Section 4	The Environmental Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office.		
MM3	Environmental Management	EIAR Chapter 4 CEMP Section 4	A Site Environmental Manager will oversee the site works and implementation of the Environmental Management Plan and provide on-site advice on the mitigation measures necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the Site Environmental Manager for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM4	Environmental Management	EIAR Chapter 6	› An Ecological Clerk of Works (ECoW) will be appointed. Duties will include: o Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			o Inform and educate on-site personnel of the ornithological and ecological sensitivities within the proposed development site. o Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise o Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. o Liaise with officers of consenting authorities and other relevant bodies where required with regular updates in relation to construction progress.		
MM5	Concrete Deliveries	EIAR Chapter 4 CEMP Section 4	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures.		
MM6	Wastewater Management	EIAR Chapter 4, 9 CEMP Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007.		
MM7	Site Drainage Plan	CEMP Section 4	The Project Hydrologist/Design Engineer will complete a site drainage plan before construction commences.		
MM8	Drainage Swales	EIAR Chapter 4, 9.	Drainage swales will be installed in advance of any construction works commencing.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
MM9	Culverts	EIAR Chapter 4. CEMP Section 4	Culverts will be installed at locations where drainage channels cross the new proposed track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM10	Protection of watercourses	EIAR Chapter 4	All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing. An adequate amount of clean stone, silt fencing, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.		
MM11	Pre-emptive site drainage management	EIAR Chapter 4. CEMP Section 4	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM12	Drainage Inspection	CEMP Section 5	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.		
MM13	Drainage Maintenance	EIAR Chapter 4.	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 5	installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site Environmental Manager or the supervising hydrologist.		
MM14	Earthworks	EIAR Chapter 8	Drainage and associated pollution control measures will be implemented onsite before the main construction works commence. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.		
MM15	Earthworks	EIAR Chapter 8	A 50-metre buffer zone will be maintained around watercourses during the windfarm construction. With the exception of road crossings of streams and associated culvert construction, no other development infrastructure, construction activity or stock-piling of construction materials or construction waste will take place within this zone.		
MM16	Felling	EIAR Chapter 6 CEMP Section 10	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected.		
MM17	Archaeology	EIAR Chapter 13	› A pre-construction walkover survey / inspection of areas proposed for excavation will be undertaken to re-assess the bog for new sites that may be exposed. › If present, the sites shall be archaeologically excavated under licence prior to construction. The archaeologist will liaise with the Department of Arts, Heritage, Regional, Rural and		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			Gaeltacht Affairs regarding the methods being proposed for excavation. - Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. Liaise with DAHRRGA should archaeology be uncovered. - A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.		
MM18	Traffic Management Plan	EIAR Chapter 4, CEMP Section 4	A detailed Traffic Management Plan (TMP) will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include a Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.		
Construction Phase					
Construction Management					
MM19	Health and Safety	EIAR Chapter 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM20	Health and Safety	EIAR Chapter 5	Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate health and safety signage will be erected at locations around the site		
MM21	Health and Safety	EIAR Chapter 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan		
MM22	Groundwater quality,	EIAR Chapter 4, 5, 9 CEMP Section 4	On-site refuelling will be carried out 100m from watercourses using a mobile double skinned, bunded fuel bowser. The fuel bowser will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm development. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
MM23	Potential Release of Hydrocarbons	EIAR Chapter 4, 5, 9 CEMP Section 4	› All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site; › Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction; › The electrical control building will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM24	Plant and Equipment Inspections	EIAR Chapter 9. CEMP Section 4	A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the construction phase.		
MM25	Fuel and hazardous material storage	EIAR Chapter 5, 9 CEMP Section 4	Fuel and lubricant oils will be stored within a bunded area, sized to 110% of the volume of stored oils. The storage area will be located within a safe part of the sub-station building, with due attention to fire hazard. The bunded area will be roofed to prevent the ingress of rainwater and will be equipped with an appropriate oil interceptor.		
MM26	Accidental Spillage of Hydrocarbons	EIAR Chapter 4, 9 CEMP Section 6	The contractor will nominate an approved, certified clean-up consultant and will be available on 24-hour notice to commence a clean-up in the event of a hydrocarbon spillage from plant or vehicles the details of whom will be included in the Emergency Response Plan to be finalised by the appointed contractor.		
MM27	Temporary water supply and onsite Sanitation	EIAR Chapter 9	Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location. Potable water will be supplied via water coolers located within the staff facilities, which will be restocked on a regular basis as required during the construction phase. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required on a regular basis.		
MM28	Pre-emptive site drainage management	EIAR Chapter 4, 9	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
MM29	Protection of Watercourses	EIAR Chapter 9	During the near stream construction work and tree felling, double row silt fences may be emplaced immediately down-gradient of the working areas for the duration of the construction phase.		
MM30	Concrete Deliveries and Management	EIAR Chapter 9	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Only ready-mixed concrete will be used during the construction phase, with all ready-mixed concrete being delivered from local batching plants in sealed concrete delivery trucks.		
MM31	Concrete Deliveries and Management	EIAR Chapter 9	No washing out of any plant used in concrete transport or concreting operations will be carried out onsite. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be directed back to their batching plant for washout.		
MM32	Concrete Deliveries and Management	EIAR Chapter 4, 9	No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.		
MM33	Concrete Deliveries and Management	EIAR Chapter 4	Clearly visible signs in prominent locations will be placed close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site		
MM34	Concrete Deliveries and Management	EIAR Chapter 4	Main pours will be planned days or weeks in advance. Large pours will be avoided when prolonged periods of heavy rain are forecast.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM35	Concrete Deliveries and Management	EIAR Chapter 4	Concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete.		
MM36	Concrete Deliveries and Management	EIAR Chapter 4	Excavations will be sufficiently dewatered before concreting begins. Dewatering will continue while concrete sets.		
MM37	Concrete Deliveries and Management	EIAR Chapter 4	Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.		
MM38	Concrete Deliveries and Management	EIAR Chapter 4	Surplus concrete after completion of a pour will be returned to the concrete suppliers batching plant for recycling.		
MM39	Road Cleanliness	EIAR Chapter 4. CEMP Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.		
MM40	Road Cleanliness	EIAR Chapter 4 CEMP Section 4	Where it is deemed necessary, wheel washes will be provided near all site entrances to the public road		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM41	Construction Traffic	EIAR Chapter 4	Construction traffic will be subject to standard construction health and safety requirements which will ensure traffic speeds are limited to 15 mph/25 kmph.		
MM42	Waste Materials	CEMP Section 4	All waste materials will be removed to an appropriately licenced facility		
MM43	Felling	EIAR Chapter 4,	The tree felling activities required as part of the proposed development will be the subject of a Felling Licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses		
MM44	Staff Facilities	EIAR Chapter 9	- At the site compound a self-contained port-a-loo with an integrated waste holding tank will be used within the works area and at the site compound (substation), maintained by the providing contractor, and removed from site on completion of the construction works; - At the site compound the water supply for the site office (if necessary) and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location; and, No water will be sourced along the works area/at the site or discharged to same.		
Drainage Design and Maintenance					
MM45	Wastewater Management	EIAR Chapter 4, 9. CEMP Section 4	During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase. Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location; and, No water will be sourced on the site or discharged to the site.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM46	Watercourse Buffer	EIAR Chapter 4, 9, CEMP Section 4	It is proposed to limit any works in any areas located within 50m of any water course including the stockpiling of excavated soils and subsoils. A constraint/buffer zone will be maintained for all crossing locations where possible whereby all watercourses will be fenced off		
MM47	Drainage Swales	EIAR Chapter 4, CEMP Section 4	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation as per the drainage design.		
MM48	Interceptor Drains	EIAR Chapter 4, CEMP Section 4	Interceptor drains will be installed up-gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow as per the drainage design.		
MM49	Transverse drains	EIAR Chapter 9	On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;		
MM50	Silt Fences	EIAR Chapter 4, CEMP Section 4	Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.		
MM51	Check dams	EIAR Chapter 4, CEMP Section 4	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam as per the drainage design.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM52	Level Spreaders,	EIAR Chapter 4, 9. CEMP Section 4	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.		
MM53	Vegetation filters	EIAR Chapter 4, 9. CEMP Section 4	Vegetation filters, that is areas of existing vegetation, accepting drainage water issuing from level spreaders as sheet flow, will remove any suspended sediment from water channelled via interceptor drains or any remaining sediment in waters channelled via swales and settlement ponds.		
MM54	Settlement ponds	EIAR Chapter 4, 9. CEMP Section 4	Settlement ponds, placed either singly or a pair in series, will buffer volumes of run-off discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to water courses as per the drainage design.		
MM55	Dewatering Silt Bag	EIAR Chapter 4. CEMP Section 4	Dewatering silt bags will be used which allow the flow of water through while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.		
MM56	Culverts	EIAR Chapter 4	Culverts will be installed at locations where interceptor drains cross the new proposed track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM57	Culverts	EIAR Chapter 9	Where possible all proposed new stream crossings will be bottomless culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing location.		
MM58	Culverts	EIAR Chapter 9	Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of the proposed crossings. A 10m buffer is applied to the main drain (*i.e.* drain D1) s to allow for future OPW maintenance;		
MM59	Culverts	EIAR Chapter 9 CEMP Section 4	The following mitigation is proposed for completion of the watercourse crossings: › Protection of the riparian zone watercourses by implementing a constraints zone around stream crossings, in which construction activity will be limited to. › No stock-piling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area; › The shuttered for the bridge deck to be poured over the precast concrete slabs will be sealed and water tested before concrete pouring can commence. › When pouring concrete during the construction of the clear-span crossing, concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete. › No concrete truck chute cleaning is permitted in this area; › Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Plant will travel slowly across bare ground at a maximum of 5km/hr. Bog mats will be employed to protect tracked areas as necessary; - Machinery deliveries shall be arranged using existing structures along the public road; - All machinery operations shall take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur; - Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility; - Spill kits shall be available in each item of plant required to complete the stream crossing; and, Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required		
MM60	Grid Connection	EIAR Chapter 4, 9	Within the wind farm site where the proposed grid connection cable route runs adjacent to a proposed access road or an existing access road proposed for upgrade, the cable will pass over the culvert (where one exists or is proposed) within the access road;		
MM61	Silt Fences,	EIAR Chapter 4, 9. CEMP Section 3	Silt fences will be installed along the routes of existing watercourses or drainage ditches where site roads pass over the watercourses, immediately downstream of the construction area.		
MM62	Sediment disposal	EIAR Chapter 4	Sediment that is removed from settlement ponds, check dams, silt bags etc. as part of routine maintenance will be carefully disposed of away from all aquatic		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4	zones, or will be transported off-site for disposal or re-use elsewhere if deemed necessary.		
MM63	Temporary Stockpiles	EIAR Chapter 4, 9 CEMP Section 4	Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets as required and surrounded by silt fences to ensure sediment-laden run-off does not occur.		
MM64	Temporary Material Storage Areas Drainage Controls	EIAR Chapter 4 CEMP Section 4	Construction and drainage controls around temporary stockpiles will be implemented prior to the development of the stockpile where temporary management of surface water run-off during stockpile filling may require pumping to a local settlement pond for sedimentation and water treatment prior to discharge;		
MM65	Grid Connection Drainage	EIAR Chapter 9	Where construction of the grid cable connection route is undertaken along sections of proposed access road or existing roads requiring upgrade, the proposed wind farm drainage infrastructure (as outlined above) will be in place to manage and control runoff from the trench excavation area. Where the cable trench is to be constructed off-road (within the development site) or along public roads surface water control measures such as silt fences will be employed when work is required within hydrological buffer zones.		
MM66	Timing of Site Construction Works	EIAR Chapter 9	Construction of the site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Felling					
MM67	Felling Licence	EIAR Chapter 4	Felling will be carried out under the terms of a licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses for wind farm developments		
MM68	Clear felling of Coniferous Plantation	EIAR Chapter 9. CEMP Section 4	Best practice Forestry Service Guideline mitigation measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses as follows: › Machine combinations will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; › Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works; › Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground; - In areas particularly sensitive to erosion, it may be necessary to install double or triple sediment traps. This measure will be reviewed on site during construction; - All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone; - Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled; - Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction should be suspended during periods of high rainfall;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Timber will be stacked in dry areas, and outside a local 50m watercourse buffer. Check dams to be emplaced on the down gradient side of timber storage/processing sites; - Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off; - Checking and maintenance of roads and culverts will be on-going through the felling operation; - Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity; - Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and, - Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.		
MM69	Clear Felling of Coniferous Plantation	EIAR Chapter 9	Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled		
Peat, Subsoils and Bedrock					
MM70	Waste Material Generation and Management	EIAR Chapter 8	With the exception of peat and overburden which will be spread adjacent to the excavations of the development infrastructure, no waste materials, either from the site or introduced construction materials will be left on site but will be removed to suitable waste facilities.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM71	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	Peat removed from the turbine no. 5, 14 and 15 location will be locally placed/spread alongside the excavations for the infrastructural elements.		
MM72	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	In order to minimise runoff during the construction phase, stripping of peat should not take place during excessively dry weather (to prevent dust generation) or extremely wet periods (to prevent increased silt rich runoff).		
MM73	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	Bog mats and brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		
MM74	Peat, Subsoil Excavation and Bedrock Excavation		› Placement of turbines and associated infrastructure in areas with shallower peat where possible; › Use of piled foundations in areas of deeper peat and soft mineral soils; › Use of floating roads (where geotechnically acceptable to do so) to reduce peat excavation volumes (i.e. along wind farm access tracks and the link road); › The peat and subsoil which will be removed during the construction of turbine hardstands (will be localised to the turbine locations. The peat will be placed/spread locally alongside the excavations (refer to Figure 7-1 of Appendix 4-2); › Small volumes of peat will be excavated and used for landscaping along proposed access/link roads; › No turbines or related infrastructure will be constructed in any designated sites such as NHAs or SACs;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Construction of settlement ponds will be volume neutral, and all excess material will be used locally to form pond bunds and surrounding landscaping; - Placement of internal cable trenching will also be volume neutral, and all excess material will be used locally as landscaping; - Subsoils will be reinstated back into the cable trench along the proposed grid connection route where possible; and, - Peat/mineral soil excavated along the Grid Connection Route, will only be stored in low mounds (~0.5m high) directly adjacent to the excavated trench, and will be stored for no more than 24 hours before being backfilled where possible. The soil/subsoil will be covered in the event of heavy rainfall which would suspend further construction works along the Grid Connection Route.		
MM75	Erosion of Exposed Subsoils and Peat		- Peat removed from the turbine locations and associated access roads will be used for landscaping or placed/spread locally alongside the excavation. A full Peat and Spoil Management Plan for the Proposed Development is shown as Appendix 4-2. - In order to minimise erosion of mineral subsoils, stripping of peat will not take place during extremely wet periods (to prevent increased silt-rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase. - In forestry areas brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. - Peat and subsoil removed from the cable trench will be used to reinstate the trench where possible or removed to an appropriately licenced facility. Peat and subsoil removed from the proposed		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			substation groundworks will be removed and either used for Wind Farm Site reinstatement/landscaping works or taken to an appropriately licenced facility.		
MM76	Peat Instability	EIAR Chapter 8	- Appointment of experienced and competent contractors; - The site should be supervised by experienced and qualified personnel; - Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement); - Prevent undercutting of slopes and unsupported excavations; - Maintain a managed robust drainage system; - Prevent placement of loads/overburden on marginal ground; - Set up, maintain and report findings from monitoring systems; - Ensure construction method statements are followed or where agreed modified/ developed; and, - Revise and amend the Geotechnical Risk Register as construction progresses		
MM77	Peat Instability	EIAR Chapter 4, 8	Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 4m.		
MM78	Peat Instability	CEMP Section 4	A Geotechnical Risk Register will be maintained throughout the construction phase by the Project Engineer which will provide the means to carry out a geotechnical risk assessment and recommend remedial action.		
Biodiversity					
MM79	Removal of Vegetation	EIAR Chapter 4, 6, 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 10	- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 350m radius of lapwing breeding territories. - In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 500m radius of barn owl breeding site. - No works shall be permitted within the buffer for the given timeframe, until it can be demonstrated that the roost/nest is no longer occupied.		
MM80	Bats	EIAR Chapter 6	- Pre-construction roost surveys will be required to identify and protect any bats potentially occupying roosts in vegetation earmarked for removal. For any trees found to be occupied by roosting bats prior to construction, an exclusion zone will be implemented to prevent disturbance during times of occupancy. Table 20 of the Bat Survey and Impact Assessment Report provided in Appendix 6-2 provides optimal time periods for works at different roost types, and therefore by extension restrictive periods for construction works, during which the exclusion zone for construction work would be applicable. The extent of the exclusion zone can be up to 30m for any notably disruptive works such as pile-driving; however, the mitigation measure should be proportional to the disturbance levels emanating from the construction activity. Pre-construction surveys will inform the application to undertake		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			appropriate mitigation actions as required to ensure the conservation of bats, if found to be utilising roosts within the construction corridor. - The loss of approximately 960m of treeline and 220m of hedgerow will be replaced as part of the Proposed Development. This will take place along the access road to T15. - Treeline lost along the proposed link road will be replaced 'like for like'. - Where treeline is lost in the woodland habitat between T5 and T9 the remaining woodland will be retained. The buffer created around T5 will be maintained throughout the operation of the wind farm in order to maintain a homogenous habitat around the turbine throughout its lifespan.		
MM81	Habitat Fragmentation	EIAR Chapter 6	The welfare of Otters will be ensured primarily through the provision of continued safe access for Otters along the river corridor. Adequate provision for Otters at the River crossing is required to allow the species to retain continued access to their foraging areas. The watercourses will be crossed by a clear span structure and part of the riverbank will be retained to provide dry passage for Otter under the structure.		
MM82	Habitat Fragmentation	EIAR Chapter 6	The Proposed Development has been deliberately designed to minimise loss of bog woodland. Vegetation removal will be conducted in line with the provisions of the Wildlife Act. Tree line that is lost as part of the Proposed Development will be replaced along the proposed access road to T15.		
MM83	Invasive Species	EIAR Chapter 6 CEMP Section 4	- The outline Invasive Species Management Plan will be further developed A following a preconstruction invasive survey. This report will describe the best practice measures to be adhered to during the laying of the cable route in proximity to identified stands of invasive species. Good construction site hygiene will be employed to prevent the introduction and spread of invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species - All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the contractor's method statement. - Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present. - All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron.		
MM84	Invasive Species	EIAR Chapter 4, 6	- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere. - Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally. - Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes. - Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist. - Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licensing. › The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area. › All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works. › Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g., excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species. › When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal. › Any soils or subsoils contaminated with invasive species will sent to an appropriate licenced facility.		
MM85	Aquatic Species	EIAR Chapter 6	› No watercourse will be interfered with as part of the proposed works. › During periods of heavy precipitation and run-off, works will be halted or working surfaces/pads will be provided to minimise soil disturbance.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Any requirement for temporary fills or stockpiles will be covered with polyethylene sheeting to avoid sediment release associated with heavy rainfall. - Silt fences will be used to prevent siltation of watercourses in or surrounding the study area.		
Noise and Vibration					
MM86	Construction Phase Noise, Noise from Construction Activities	EIAR Chapter 4, 11	Equipment will be sensitively located, taking account of local topography and natural screening. It is proposed that various practices be adopted during construction, including: - managing the hours according to the CEMP [Appendix 4-8 during which site activities likely to create high levels of noise or vibration are permitted; - establishing channels of communication between the contractor/developer, Local Authority and residents; - appointing a site representative responsible for matters relating to noise and vibration; - monitoring typical levels of noise and vibration during critical periods and at sensitive locations; - keeping site access roads even to mitigate the potential for vibration from lorries. - selection of plant with low inherent potential for generation of noise and/ or vibration; - placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; - regular maintenance and servicing of plant items.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM87	Construction Phase Noise,	EIAR Chapter 4, 11	The following list of measures will be implemented on site, to ensure compliance with the relevant construction noise criteria: - No plant used on site will be permitted to cause an on-going public nuisance due to noise. - The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. - All vehicles and mechanical plant will be fitted with effective exhaust silencers if required and maintained in good working order for the duration of the contract. - Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. - Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. - Any plant, such as generators or pumps, which is required to operate close to NSLs outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.		
MM88	Construction Phase Noise,	EIAR Chapter 4, 11	All construction work will be restricted to the specified working hours between 7:00hrs and 19:00hrs Monday to Saturday. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.		
MM89	Construction Phase Noise,	EIAR Chapter 4, 11	Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
	Noise from Construction Activities				
MM90	Construction Phase Noise Control,	EIAR Chapter 4, 11. CEMP Section 4	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.		
MM91	Construction Phase Noise, Noise from Construction Activities	EIAR Chapter 4, 11	All construction operations shall comply with guidelines set out in British Standard documents *'BS 5338: Code of Practice for Noise Control on Construction and Demolition Sites'* and *'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'.*		
MM92	Noise	EIAR Chapter 4, 11	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.		
MM93	Noise	EIAR Chapter 4, 11	Where rock breaking is employed in relation to the proposed borrow pit, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities: › Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency. › Ensure all leaks in air lines are sealed.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Use a dampened bit to eliminated ringing. - Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured. - Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.		
Air Quality/Dust					
MM94	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Truck wheels will be washed to remove mud and dirt before leaving the site.		
MM95	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Construction traffic will be restricted to defined routes and a speed limit of 15 kph will be implemented.		
MM96	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;		
MM97	Construction Phase Air Quality	EIAR Chapter 10	All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM98	Dust	EIAR Chapter 10 CEMP Section 4	The roads adjacent the site will be regularly inspected for cleanliness, and cleaned as necessary; Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air.		
MM99	Dust	EIAR Chapter 10	The transport of soils or other material, which has significant potential to cause dust, will be undertaken in tarpaulin-covered vehicles where necessary;		
MM100	Greenhouse Gases	EIAR Chapter 10	› All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise. › Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority. › Aggregate materials for the construction of the proposed wind farm will be obtained from the proposed borrow pit. This will significantly reduce the number of delivery vehicles accessing the site from significant distances, thereby reducing the amount of emissions associated with vehicle movements.		
MM101	Waste Management	EIAR Chapter 10	The Material Recovery Facility will be local to the Proposed Development site to reduce the amount of emissions associated with waste management vehicle movements. The nearest licensed waste facility to the site is located approximately 22 km south of the Proposed Development.		
Cultural Heritage					
MM102	National Monuments or	EIAR Chapter 13	A buffer zone of 20m should be established around the unnamed bridge to the north-west of the proposed access road to T15 and maintained for the duration of the construction stage of the project.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
	recorded monuments				
Landscape and Visual					
MM103	Construction Phase: Visual Impact	EIAR Chapter 12	One main construction compound will be used for the storage of all construction materials.		
MM104	Borrow Pit	EIAR Chapter 12	Following the completion of the construction phase, the borrow pit will be reinstated. the borrow pit will be levelled, covered over with overburden and allowed to re-vegetate naturally. Overburden will also be deposited along the edge of the borrow pit, which will be allowed to re-vegetate and this will reduce visibility of the pit. Safety fencing and signage will be constructed. Following this, the gravel road will be allowed to re-vegetate		
MM105	Borrow Pit	EIAR Chapter 12	Maintain natural screening around the perimeter of proposed borrow pit.		
Material Assets and Traffic					
MM106	Management of Large Deliveries	EIAR Chapter 14	All deliveries comprising abnormally large loads will be made outside the normal peak traffic periods to avoid disruption to work and school related traffic.		
MM107	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	A detailed Traffic Management Plan will be prepared by the appointed contractor and will include details of: › The appointed Traffic Management Co-ordinator › Turbine delivery programme, schedule and times › Procedure for providing information to locals to keep them informed of any upcoming traffic related matters e.g., temporary lane/road closures › Agreements with local authority and An Garda Siochana on delivery phases etc.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Temporary alterations of road junctions - Delivery routes for construction materials - Travel plan for construction workers - Temporary traffic signs - Diversions and road closures Trench and road surface reinstatement		
MM108	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	All traffic management at the required locations will comply the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (DoT now DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times.		
MM109	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	The contractor will consult with the roads section of the local authority that the delivery routes traverses and An Garda Siochana during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required		
MM110	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14 CEMP Section 4	Phased development will be employed to allow for construction traffic to be managed and to minimise the volume of construction traffic using the road network at any one time.		
MM111	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14.	The contractor will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and an area for non-work vehicle parking.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
			Operational Phase		
MM112	Wastewater Management	EIAR Chapter 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007.		
MM113	Site Drainage	CEMP Section 4	The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below: - Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces; - Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader; - Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains; - Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; - Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and, - Settlement ponds will be designed in consideration of the greenfield runoff rate.		
MM114	Site Drainage	EIAR Chapter 9	The proposed onsite substation will be located on the south west of the Wind Farm Site. It is proposed to drain the onsite substation using shallow swales, with a stilling pond at the end of the swale run. The stilling pond will remain in place following the construction period		
MM115	Site Drainage	EIAR Chapter 9	A rainwater harvesting system will be used for toilet flushing at the Substation Control Building in the Wind Farm Site. There will be a very small net loss of water to local streams but this will be imperceptible over the course of a year		
MM116	Site Drainage	EIAR Chapter 9	It is proposed to install a sealed underground holding tank for effluent (wastewater) from the onsite substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. Should the level of the tank rise to a predetermined 'high 'level a warning shall appear on the overall SCADA system for the Wind Farm Site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the Wind Farm Site, and therefore there is no potential to impact groundwater or surface water quality.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM117	Borrow Pit Drainage	CEMP Section 4	Appropriate operational phase drainage will be implemented to attenuate drainage water.		
MM118	Bats	EIAR Chapter 6	In order to reduce the value of the habitat for bat species in the areas surrounding the turbines, a buffer of at least 50m between the tip of the blade and any trees or other tall vegetation that could provide high quality foraging habitat for bat species will be implemented. Full details of this mitigation and how it is calculated is provided in Appendix 6-2 and summarised below: › A three-year monitoring programme is recommended for bats, with monitoring in years 1, 2, and 3 post-construction, and will include several elements, including bat activity surveys and collision monitoring, which incorporates turbine searches and scavenger removal trails.		
MM119	Noise	EIAR Chapter 11	An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 11.3.2.2 in Chapter 11. The findings of the assessment identified that there are two NSLs where potential exceedances are predicted. If confirmed during post-construction monitoring, a curtailment strategy will be implemented to reduce noise levels due to the wind farm to within the criteria at all NSLs.		
MM120	Shadow Flicker	EIAR Chapter 5	Where shadow flicker occurrences are experienced at buildings, a site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. If annoyance is found, suitable mitigation measures such as screening and/or wind turbine control measures including turbine shutdown will be employed to limit the shadow flicker to zero at the affected property.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM121	Fuel Control	EIAR Chapter 8, 9	Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures		
MM122	Air Quality	EIAR Chapter 4	Any vehicles or plant brought onsite during the operational phase will be maintained in good operational order that comply with the Road Traffic Acts 1961 as amended, thereby minimising any emissions that arise.		
MM123	Telecoms and other service interference	EIAR Chapter 4	In the event of interference to the transmission or reception of RTÉ Transmission Network (operating as 2rn) or radio waves as a result of the operation of the proposed wind farm, the appropriate measures as set out in the 2rn Protocol Document will be carried out in order to rectify this. This Protocol Document has been prepared by 2rn and signed by the wind farm developers.		
MM124	Telecommunications	EIAR Chapter 14.	Ai Bridges approached Ripplecom with the following mitigation measures for the telecoms link that would potentially be impacted by turbine T15: - A new lattice structure be erected at the Ripplecom end of the link and the link dish at the customer end of the Ripplecom link would be relocated to the corner of the customer building. This would provide a clearance between T15 and the Ripplecom link. - Alternatively, should fibre broadband be installed in the area and be utilised by Ripplecom prior to the commissioning of the Proposed Development, the above mitigation measures would not be required and there would be no interference as the link through the development would no longer be required . These mitigation measures have been accepted by Ripplecom and are further detailed in Appendix 14-3 attached.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM125	Aviation	EIAR Chapter 14	Coole Wind Farm Ltd. will agree an acceptable aviation obstacle warning lighting scheme with the Department of Defence and the Irish Aviation Authority (IAA) ahead of turbine construction and will supply the coordinates and elevations for built turbines to the IAA, as is standard for wind farm developments.		
MM126	Construction Phase: Visual Impact	EIAR Chapter 12	The construction compound will be fully re-instated at the end of the construction phase.		
MM127	Health and Safety	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits. Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include: › Buried cable route markers at 50m (maximum) intervals and change of cable route direction; › Directions to relevant turbines at junctions; › "No access to Unauthorised Personnel" at appropriate locations; › Speed limits signs at site entrance and junctions; › "Warning these Premises are alarmed" at appropriate locations; › "Danger HV" at appropriate locations; › "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance; › "No unauthorised vehicles beyond this point" at specific site entrances; and › Other operational signage required as per site-specific hazards.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM128	Borrow Pit	EIAR Chapter 13	The operational phase of the proposed borrow pit will not impact on the immediate setting of any National Monuments, Recorded Monuments, Protected Structures or NIAH structures/gardens. Maintain natural screening around the perimeter of proposed borrow pit.		
MM129	Substation	EIAR Chapter 13	The substation site may have a slight negative impact on the surrounding archaeological and cultural heritage landscape as it will result in a change to their wider setting. Existing screening will be maintained to alleviate any potential impacts on setting.		
Decommissioning Phase					
MM130	Drainage on Decommissioning	EIAR Chapter 9	Following decommissioning of the wind farm at the end of its life restoration of the hydrological regime will take place by the blocking of all the drains associated with the wind farm development. Some additional drains may also be blocked in order to restore natural drainage conditions of adjacent bog and peat habitat.		
MM131	Decommissioning	EIAR Chapter 4 DP Section 3	The following mitigation measures are proposed to avoid release of hydrocarbons at the site: › Road-going vehicles will be refuelled off site wherever possible; › On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required › Only designated trained and competent operatives will be authorised to refuel plant on site. › Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The plant used will be regularly inspected for leaks and fitness for purpose; and, - An emergency plan for the decommissioning phase to deal with accidental spillages will be developed (refer to Section 4) Spill kits will be available to deal with and accidental spillage in and outside the refuelling area. A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.		
MM132	Decommissioning	EIAR Section 7	A Decommissioning Plan has been prepared (see Appendix 4-11 of the EIAR) The following measures are proposed for the decommissioning phase: - During the decommissioning phase, disturbance limitation measures will be as per the construction phase (see Chapter 7 of the EIAR). - Plant machinery will be turned off when not in use. - All plant and equipment for use will comply with the Construction Plant and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 (S.I. No. 632 of 2001). A project ecologist will be appointed to oversee the decommissioning phase, with similar duties to those outlined above during the construction phase.		
MM133	Decommissioning	EIAR Chapter 4 DP Section 2	On removal of turbines, soil will be spread and graded over the foundation using a tracked excavator and revegetation enhanced by spreading of an appropriate seed mix to assist in revegetation and accelerate the resumption of the natural drainage management that will have existed prior to any construction		
MM134	Site rehabilitation during decommissioning	EIAR Chapter 8	In order to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas and site compound, covering with peatland vegetation/scraw or		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation is proposed.		
MM135	Noise	EIAR Chapter 8	The mitigation measures that will be considered in relation to any decommissioning of the site are the same as those proposed for the construction including: › managing the hours according to the CEMP [Appendix 4-8 during which site activities likely to create high levels of noise or vibration are permitted; › establishing channels of communication between the contractor/developer, Local Authority and residents; › appointing a site representative responsible for matters relating to noise and vibration; › monitoring typical levels of noise and vibration during critical periods and at sensitive locations; › keeping site access roads even to mitigate the potential for vibration from lorries. Furthermore, a variety of practicable noise control measures will be employed. These include: › selection of plant with low inherent potential for generation of noise and/ or vibration; › placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; › regular maintenance and servicing of plant items.		
MM136	Traffic	EIAR Chapter 14	In the event that the Proposed Development is decommissioned after the 30 years of operation, a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM137	Ornithology	EIAR Chapter 7	• During the decommissioning phase, disturbance limitation measures will be as per the construction phase. • Plant machinery will be turned off when not in use. • All plant and equipment for use will comply with industry best practise Construction Plant and Equipment Permissible Noise Levels Regulations.		

9. MONITORING PROPOSALS

All monitoring measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR submitted as part of the planning permission application.

This section of the CEMP groups together the monitoring measures presented in the EIAR. It is intended that the CEMP would be updated where required prior to the commencement of the development, to include all monitoring measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

All mitigation measures which will be implemented during the pre-commencement, construction and operational phases of the project are outlined in Table 9-1. The monitoring proposals are presented in terms of the monitoring requirement, frequency of monitoring and the mechanism for reporting results where applicable.

By presenting the monitoring proposals in the below format, it is intended to provide a monitoring schedule that can be reviewed and tracked during all phases of the project.to ensure all the required monitoring is completed as required.

Table 9-1 Schedule of Monitoring Measures

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
Pre-Commencement Phase			
MX1	Water Quality and Monitoring	EIAR Chapter 9	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works.
MX2	Water Quality and Monitoring	CEMP Section 5	Turbidity monitors or sondes can be installed where required at locations surrounding the wind farm and will provide continuous readings for turbidity levels in the watercourse.
MX3	Water Quality and Monitoring	CEMP Section 5	Baseline sampling will be completed on at least two occasions and these should coincide with low flow and high flow stream conditions.
MX4	Water Quality and Monitoring	EIAR Chapter 9	Sampling will be completed before, during and after the felling activity. The 'before' sampling should be conducted within 4 weeks of the felling activity, preferably in medium to high water flow conditions.
MX5	Invasive Species	CEMP Section 4	A pre-commencement invasive species survey shall be completed for the site
MX6	Mammal Survey	EIAR Chapter 6	A pre-construction mammal survey will be undertaken to identify any Otter holts or Badger setts within the works areas associated with the proposed development. The survey will be undertaken to ensure that Otter or Badger have not taken up residence within or close to the development footprint
MX7	Ornithology	EIAR Chapter 7	Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows
MX8	Archaeological Testing	EIAR Chapter 13	Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. A report will be submitted to the relevant authorities for consideration
Construction Phase			

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX9	Water Quality and Monitoring	EIAR Chapter 9	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based).
MX10	Water Quality and Monitoring	EIAR Chapter 9	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling
MX11	Daily Monitoring	EIAR Chapter 9 CEMP Section 5	Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped and a geotechnical assessment undertaken
MX12	Water Quality and Monitoring	CEMP Section 5	The following periodic inspection regime is likely to be proposed: › Daily general visual inspections by Environmental Manager; › Weekly (existing & new drains) inspections by the Environmental Manager and/or the site Construction Manager; › Inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement; › Event based inspections by the Environmental Manager as follows: › >10 mm/hr (*i.e.* high intensity localised rainfall event); › >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, › Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			- Monthly site inspections by the Project Hydrologist during construction phase; and, - Quarterly site inspections by the Project Hydrologist after construction for a period of one year following the construction phase. A written record will be maintained or available on-site of all construction phase monitoring undertaken.
MX13	Check Dams	EIAR Chapter 4 CEMP Section 4	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.
MX14	Settlement Ponds	EIAR Chapter 4 CEMP Section 5	Settlement ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose.
MX15	Culverts	EIAR Chapter 4 CEMP Section 4	All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.
MX16	Drainage Management	EIAR Chapter 4 CEMP Section 4	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental manager or supervising hydrologist on-site. The environmental manager or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX17	Plant and Equipment Inspections	EIAR Chapter 7 CEMP Section 4	The plant used should be regularly inspected for fuel leaks, unnecessary noise generation and general fitness for purpose.
MX18	Drainage Inspection	EIAR Chapter 9 CEMP Section 5	Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.
MX19	Water Quality Monitoring	EIAR Chapter 9 CEMP Section 5	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each watercourse (*i.e. at sample points SW1, SW2 & SW3 used in this assessment*) and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based). This will be completed in consultation with the Inland Fisheries Board.
MX20	Wheel wash effectiveness	CEMP Section 4	The effectiveness of the wheel wash will be monitored as part of road cleanliness inspections. The water will be replaced in the wheel wash enclosure as required.
MX21	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works and metal detection of spoil will be carried out during the construction phase. The archaeological monitoring will be undertaken with the benefit of a licence from the Department of Arts, Heritage and Gaeltacht (DAHG). If archaeological features or finds re encountered during site works the archaeologist will report the findings to the relevant authorities to discuss a suitable means of preservation of the features (preservation by record or *in situ* may be required). A report on the monitoring will be submitted to the Local Authority and DAHG

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			Archaeological monitoring of ground works during construction will also be carried out at the following locations with a report on the results of the monitoring compiled and submitted to the relevant authorities on completion of the project: › If the works extend immediately adjacent to ringfort WM012-088 › Where the works extend past the ecclesiastical site at Abbeyland › Where the works extend past the church and graveyard WM006-061 and WM006-061001. Where the works extend past the NIAH/Protected Structures at Farranistick.
MX22	Archaeological Monitoring	EIAR Chapter 13	The remains of a 19th-20th century stone building are extant adjacent to the eastern end of the proposed link road. The building is not a Protected Structure or listed in the NIAH. It is proposed to carry out: › Pre-construction archaeological building survey of remains accompanied by measured drawings. › Archaeological monitoring of ground works in this area and removal of stone structure if necessary. A report on the monitoring should be compiled on completion of the work and submitted to the relevant authorities. Archaeological monitoring of ground works for proposed junction accommodation works. A report on the monitoring should be compiled and the results submitted to the relevant authorities.
MX23	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the church and graveyard at Mayne. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX24	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the church and graveyard WM006-061 and WM006-061-001. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX25	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works where the grid connection route extends past the Water mill (WM006-076) and Ecclesiastical site (WM006-059). A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project
MX26	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works where the grid connection route extends past the recorded monuments WM012-088 - 090 (ringforts) will be required during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX27	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the NIAH/Protected Structures at Farranistick. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX28	Archaeological Monitoring	EIAR Chapter 13	A bridge is denoted on the proposed route on the 2nd ed. OS map at Shrubbywood/Clonva townlands where the public road crosses the River Inny. Archaeological monitoring of ground works during construction where it extends past the bridge. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX29	Dust Monitoring	EIAR Chapter 10	Dust monitoring will also take place during the construction phase, with dust jars been placed at the same monitoring locations and left in situ for 30 days at a time. It is proposed to carry out this monitoring on a quarterly basis. The dust monitoring locations around the Proposed Development site boundary will be selected with regard to the location of these nearest sensitive receptors
Operational Phase			
MX30	Vantage Point Surveys	EIAR Chapter 7 – Appendix 7-6	Vantage point surveys will be undertaken monthly between January and December during operational years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm. The methodology for vantage point watches will follow guidelines issued by the SNH (2009) and SNH (2017). The proposed vantage point watches will adhere to a minimum of 36 hours/VP per season as per guidelines issued by SNH. Monthly visits will be undertaken throughout the year.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			During each visit, six-hour vantage point watches will be undertaken from each fixed vantage point location that offers an un-interrupted view of the study area .
MX31	Breeding Bird Walkover Surveys	EIAR Chapter 7 – Appendix 7-6	Survey methodology will be similar to methods employed for baseline EIAR surveys which will allow a comparison of data to be made for each monitoring year in years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm.
MX32	Collision Searches (Bird Casualties)	EIAR Chapter 7 – Appendix 7-6	It is proposed to undertake a minimum of one visit per month during each survey year in years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm. During each visit, searches will be undertaken at each operating turbine location by a team of two surveyors. A plot measuring 130m x 130m from the centre of each turbine location will be the subject of target searches for bird casualties. Searches will incorporate the use of transects spaced at 10m intervals apart with the observer covering 5m on either side for each transect. Locations and coordinates of transect routes will be confirmed using a portable GPS recording device. Recording sheets will be used to document bird carcasses encountered in the field.
MX33	Reporting	EIAR Chapter 7 – Appendix 7-5	A report summarising the findings of the bird monitoring surveys will be submitted to the Planning Authority at the end of each monitoring year.
MX34	Bats	EIAR Chapter 6	Ongoing monitoring of bat activity will be undertaken for at least three years' post construction of the wind farm. This will provide data and information on the actual recorded impact of the wind turbines on the local bat populations. Details of the proposed monitoring programme are provided in Appendix 6-2 of this EIAR
MX35	Drainage Inspection	EIAR Chapter 4, 9	Monitoring the effectiveness of drainage measures installed during the construction phase will continue to be monitored into the operational phase. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX36	Water Quality and Monitoring	CEMP Section 5	During the operational phase field testing and laboratory analysis of a range of parameters will continue for six months after construction is complete.
MX37	Drainage Inspection	EIAR Chapter 9	Monitoring the effectiveness of drainage measures installed during the construction phase will continue to be monitored into the operational phase. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.
MX38	Operational Phase Noise	EIAR Chapter 11	The following programme of measures would be implemented in the event of an issue of aerodynamic modulation being identified and associated with the site: › A detailed noise survey conducted by an appropriately qualified acoustic consultant will be commissioned in order to confirm the presence or not of the issue, the extent of the issue (i.e. number of locations, wind speeds and environmental conditions in which it is occurring); Based on the findings of this work and where aerodynamic modulation is identified a schedule of measures will be formulated and agreed with the planning authority, which would typically be envisaged to focus on control and regulation of the operation of turbine unit(s) in certain atmospheric and meteorological conditions.
Decommissioning Phase			
MX39	Decommissioning	DP Section 3	The Site Manager in consultation with the ECoW will be responsible for employing the services of a suitably qualified ecologist and any other suitably qualified professionals as required throughout the decommissioning works.
MX40	Decommissioning	DP Section 3	Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of any material proposed for use as part of foundation backfilling.

10. PROGRAMME OF WORKS

10.1 Construction Schedule

It is estimated that the construction phase will take approximately between 12 – 18 months from starting on site to the commissioning of the electrical system. In the interest of breeding birds, removal of woody vegetation will be conducted outside of the general breeding bird season (1st of March to 31st of August).

Works during the construction phase of the development, including delivery of construction materials will be limited to avoid unsociable hours as per Section 8.5 (d) of the code of practice for BS 5228: Part 1: 1997. Construction operations shall generally be restricted to between 07:00 hours and 19:00 hours Monday to Saturday. However, to ensure that optimal use is made of good weather period or at critical periods within the programme it could occasionally be necessary to work out with these hours. It may also be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Any such out of hours working would be agreed in advance with the local planning authority.

Work on Sundays or public holidays will only be conducted in exceptional circumstances or in an emergency. Additional emergency works may also be required outside of normal working hours as quoted above. This work, if required, will be agreed through notification and consultation with the affected parties as deemed necessary.

Delivery of abnormal loads such as turbine tower sections and blades will take place at night outside of peak traffic hours.

The anticipated phasing and scheduling main construction task items are outlined in Figure 10-1 below.

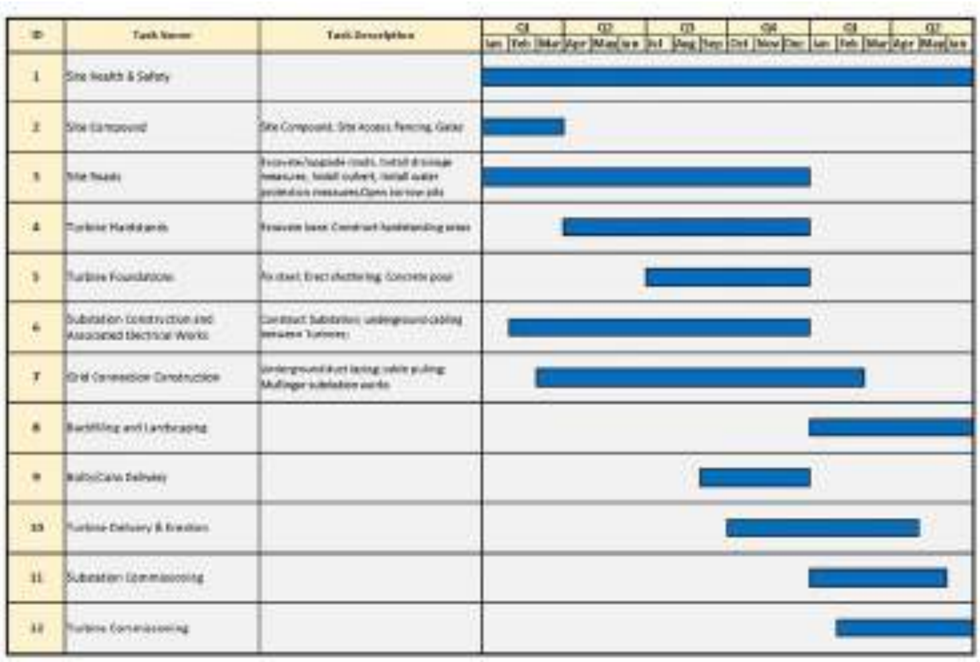


Figure 10-1 Indicative Construction Schedule

11. COMPLIANCE AND REVIEW

11.1 Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Site Environmental Manager and the Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and any subsequent updates to this document. Environmental site inspections will be carried out by suitably trained staff.

11.2 Auditing

Environmental audits will be carried out during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

11.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

11.4 Corrective Action Plan Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site Environmental manager. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Construction Manager and the Site Environmental manager will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

11.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and also every six months thereafter during the construction phase of the project.

APPENDIX 1

PROCEDURE FOR PUBLIC COMPLAINTS

Coole Wind Farm Limited,
Building 4200,
Cork Airport Business Park,
Cork.
Tel: +353 (0)21 2427786

PROCEDURE FOR PUBLIC COMPLAINTS FOR OPERATIONAL WIND FARMS

Communicate

Coole Wind Farm Limited - Operations Management is committed to ensuring that all our communications and interactions with the general public will be simple in its message and easy to complete.

If a member of the general public wants to communicate about any aspect of an operating wind farm they can make contact through the following channels:

Telephone & Email

Contact the 'Operational Controller':

- *Tel:* TBA
- *E mail:* TBA

This number and e-mail will be monitored on a continuous basis and will be the primary points of contact for access control to the wind farm and communications for works and emergencies on the wind farm.

The 'Operational Controller' number will be posted on the information noticeboard which will be located at the entrance to the wind farm.

Contact the Operations Manager TBA:

- Tel: TBA
- E-mail: TBA

Contact the head office directly

- Tel: TBA
- Fax: TBA
- E-mail: TBA

or

Writing

Write to:

TBA

Group Operations Manager

Head office address TBA

Coole Wind Farm Limited,
Building 4200,
Cork Airport Business Park,
Cork.
Tel: +353 (0)21 2427786

Listen

- Irrespective of the context of the communication, we will listen to what is being said and the message being conveyed with both understanding and empathy.
- We will record all aspects of the communication to allow us have a better understanding of the conveyed message.
- We will respond to all contacts in an organised and professional manner and treat all contact seriously.
- We will deal with all contacts quickly and politely and we will aim to learn from all feedback.

Respond

- If an issue is communicated in person or over the phone, we will try to resolve the issue there and then.
- If an issue is communicated by email or in writing we will endeavour to acknowledge the communication within 7 days and do everything we can to resolve it within 28 days.
- If this is not possible to resolve an issue within these timeframes, we will explain why and provide a plan for addressing the issues in the longer term.

APPENDIX 2

WATERCOURSE CROSSING METHODOLOGIES

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
1	1500 x 3000mm high stone bridge	600mm	n/a (5100mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow trench in the deck of the bridge. Alternatively if the structure of the bridge deck cannot accommodate a trench of any depth, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 3 or 5	None. No in-stream works required.
2	900mm Ø concrete pipe.	1100mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
3	18m long X 6m high concrete bridge	900mm	n/a (8500mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to place the cables in a stainless steel ducts secured to the outside deck of the bridge. Alternatively, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 4 or 5	None. No in-stream works required.
4	Pipe outlet not visible	1200mm. est.	n/a	No in-stream works required at this culvert crossing. It is assumed the culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid.. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
5	900mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
6	600mm Ø concrete pipe.	1800mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
7	600mm Ø concrete pipe.	1300mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
8	2 no. 300mm Ø concrete pipes.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
9	600mm Ø concrete pipe.	800mm.	1900mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
10	80m long x 5m high	900mm	n/a	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow	Option 3, 4 or 5	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
	concrete bridge		(7500mm where directional drilling required)	trench in the deck of the bridge or else place the cables in a stainless steel duct secured to the outside deck of the bridge. Alternatively, if the structure of the bridge deck cannot accommodate either option above, the cable ducts will be installed under the watercourse by means of directional drilling. All options will ensure that no contact will be made with the watercourse during the works.		
11	600mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
12	500mm Ø concrete pipe.	1000mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
13	1000mm Ø concrete pipe.	600mm	2100mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
14	3500 x 1200mm high concrete bridge	500mm	n/a	No in-stream works required at this culvert crossing. It is proposed to construct the ducts in a flatbed formation over the culvert. Therefore, no contact will be made with the stream during the works.	Option 3	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
15	1000mm Ø concrete pipe.	300-500mm est.	2000mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
16	3000 x 1500mm high stone bridge	300mm	3300mm	Due to the lack of cover over the existing stone bridge and its proximity to the railway level crossing, the cable will be installed under this culvert by means of directional drilling which will ensure that no contact will be made with the stream during the works.	Option 5	None. No in-stream works required.

APPENDIX 3

METHOD STATEMENT FOR LINK ROAD, JUNCTION ACCOMMODATION AND PUBLIC ROAD WORKS

METHOD STATEMENT FOR LINK ROAD, JUNCTION ACCOMMODATION AND PUBLIC ROAD WORKS

COOLE WIND FARM DEVELOPMENT, CO. WESTMEATH

1.1 Scope of the Works

Improvements and modifications to the existing public road network to facilitate turbine delivery will be required as part of the Proposed Development works. This will include construction of a link road between the R395 and R396 Regional Roads and junction improvement works, including providing hardsurfacing at eleven locations; along the public road corridor at: the N4 junction with the L1927 in the townland of Joanstown, clearing of existing verge and vegetation to the south east of the railway line level crossing on the L1927, hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill, clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points contained within the proposed wind farm site at junctions along the L5755.

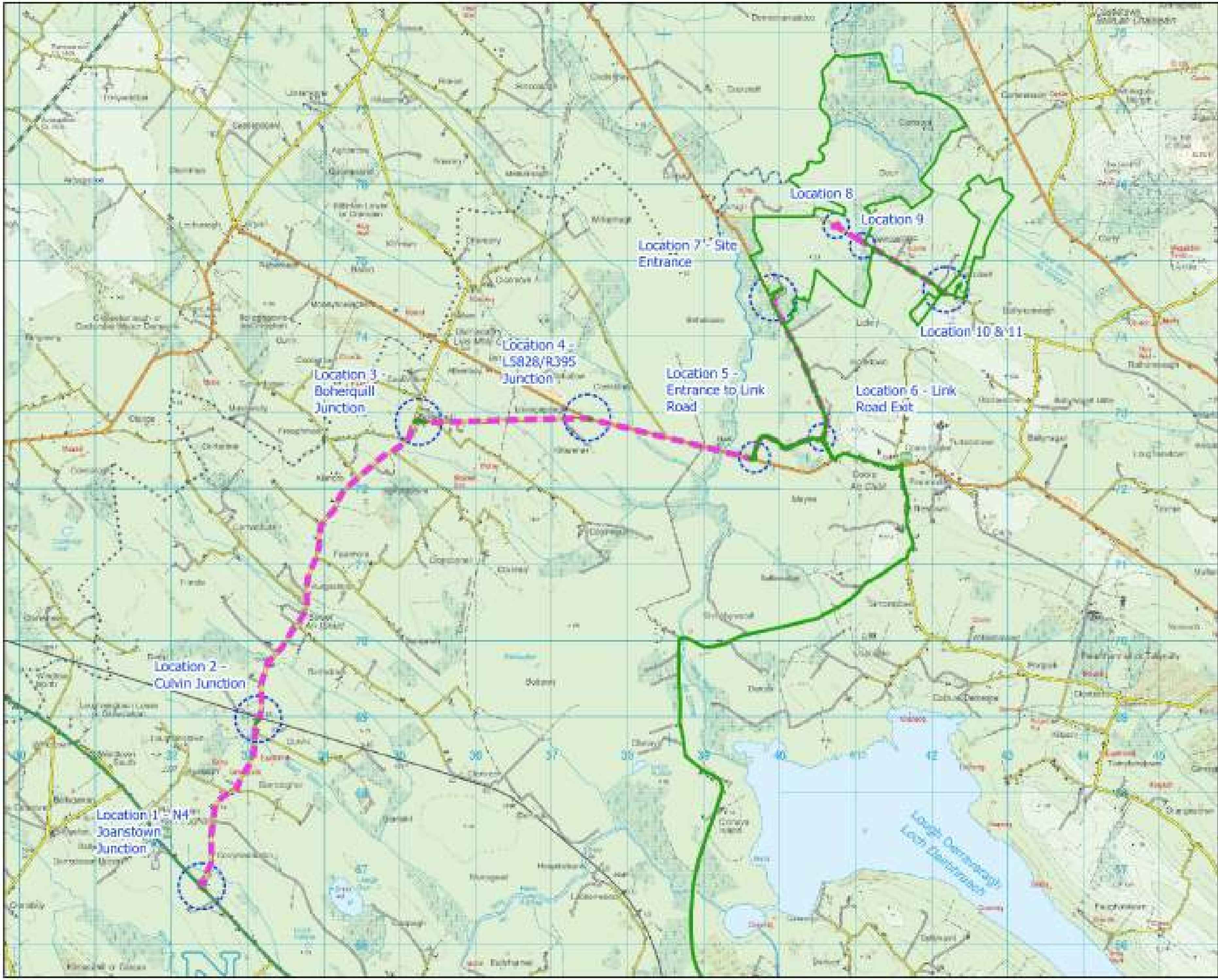
The proposed link road between the R395 and R396 measures approximately 1.2 kilometres in length with a running width of approximately 5m. The road will traverse areas of cutover peat and improved agricultural grassland.

Leaving the granular fill and final surface running layer in place within the link road will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase).

The minor junction improvement works will require clearing back the existing road verge and field vegetation at the junctions, and excavation of material to allow the placing of stone/hard surfacing within the proposed areas. A series of removable bollards and/or temporary fencing will be placed along the existing road edge in order to preserve the structure of the junctions outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except as stated otherwise.

1.2 Location

- The location of the works are outlined in Figure 1-1 below.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Delivery Route
- Turbine Delivery Route Junction Works Locations

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Drawing Title	Turbine Delivery Route Junction Works Locations
Project Title	Coole Wind Farm, Co. Westmeath
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 1-1
Scale: 1:65000	Date: 11.02.2021

MKO
Planning and Environmental Consultants

1.3 Timeframe/Timescale

The construction phase of the entire wind farm will take approximately 12-18 months to complete from starting on site to the commissioning of the electrical system and export of electricity from site. The junction accommodation works will be completed in advance of the delivery of abnormal loads. The junction accommodation works at Boherquill will be complete over 4 - 5 days with the widening of the road verge at Joanstown taking 1-2 days to complete

1.4 Materials and Equipment

- 360º Excavator
- Roller
- Trucks (stone)
- Lighting tower
- 4” - 6” stone
- Cl 804 granular fill
- Geogrid
- Temporary fencing
- Permanent fencing materials
- Temporary bollards

1.5 Construction Methodology

- The works proposed at both locations will involve the same methodology and sequence of works. The existing soils and overburden at each location will be excavated and replace with granular fill material which will be finished to provide a suitable running surface. A traffic management plan for each location will be prepared in advance of the works
- The following provides a detail of the proposed works:
- On the implementation of the traffic management at each works locations, the area will be secured with temporary fencing to ensure the general public are prevented from coming in contact with the works
- The works at Joanstown will utilise 1 no. rigid truck and 1 no. 360º Excavator due to the size of the proposed works area. The Boherquill accommodation works will utilise 2-3 trucks due to the larger works area.
- The proposed accommodation works shall be to the line and level given in the design requirements with the construction carried out under the supervision of the design engineer.
- Peat and overburden will be excavated to bedrock, where practical or to a competent stratum as determined by the design engineer.
- The excavated overburden material from the accommodation works at Boherquill will be stockpiled for any future bank and verge reinstatement. The overburden from the Joanstown works will be exported off site to licenced facility.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer) and at the top of each subsequent layer of granular fill.
- Geogrid will be hand rolled with no plant or equipment permitted to travel on the geogrid prior to the placement of the fill material

- A final unbound surface layer shall be placed on the, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.
- The finished level of all accommodation works will be relative to the adjacent public road level
- All fill material will be compacted with the tracked excavator initially and finished with a vibrating roller.
- The junction accommodation works at Boherquill will be secured with temporary fencing to prevent public access upon completion and will only be accessible to vehicles delivering abnormally large loads. A permanent stockproof fence will be installed after all abnormal deliveries have taken place and a hedgerow will be planted outside the fencing
- The Joanstown works will not require fencing due to the scale of the area. The final arrangement will be agreed with the Westmeath County Council Roads Engineer

The construction methodology for the link road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing as required.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular fill and final surface running layer will be left in situ, within the works areas.
- A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate.
- Gates/barriers will be left in situ post construction to prevent access.

1.6 Environmental Considerations

- The following measures are proposed to minimise any environmental or ecological impacts:
- The excavations at the two locations will be undertaken during a period of dry weather conditions to prevent any potential run-off the from the works areas.
- Measures will be installed to prevent surface water run discharging to the public. Measures which include suitable cambers and collector channels which will be considered during the detailed design.
- Re-fuelling will be carried out at designated locations with spill kits contained in all plant and equipment.
- If increased dust levels are encountered during the accommodation works, dust suppression will take place using water

1.7 Health and Safety Considerations

The appointed contractor will carry out a risk assessment which identifies the hazards which will be encountered during the works and the most appropriate techniques to manage the risk as well as training requirements. General site arrangements and emergency contacts are outlined in the following section which will be further populated prior to the commencement of works.

1.7.1 Personal Protective Equipment

The following is a list of the Personal Protective Equipment (PPE) required for each operative undertaking the described works.

No.	Item
1	Hard Hat (Worn at all times)
2	Hi-Visibility Jacket/Vest (Worn at all times)
3	Steel Toe Cap Boots (Worn at all times)
4	Gloves (Worn when required)
5	Eye Protection (Worn when required)
6	Ear Protection (Worn when required)
7	Additional PPE (as required)

1.7.2 Emergency Arrangements

In the case of an emergency, all operatives are to follow the emergency procedures as detailed in the site induction for Fire, Injury or Bog slide. General arrangements are;

- Assess/Attend to casualty if one is present
- Raise the alarm and call 999/112
- Alert the other site personnel as to the emergency
- Locate at the site assembly point and do not return to work until instructed that it is safe to do so
- Substation construction assembly point located at the site entrance gate

First Aid

The appointed contractor will provide details on the location of First Aid kits at site induction

Emergency Contacts

No.	Item
1	Emergency Numbers – 999/112
2	Doctor – Coole Surgery 044 9661104
3	Hospital - Midlands Regional Hospital, Mullingar– 066 718 4000
4	Multyfarnham Garda Station – 044 9371112
5	TBC – Project Manager – TBC
6	TBC – Safety Officer – TBC

No.	Item
7	TBC – Site Engineer – TBC

APPENDIX 4

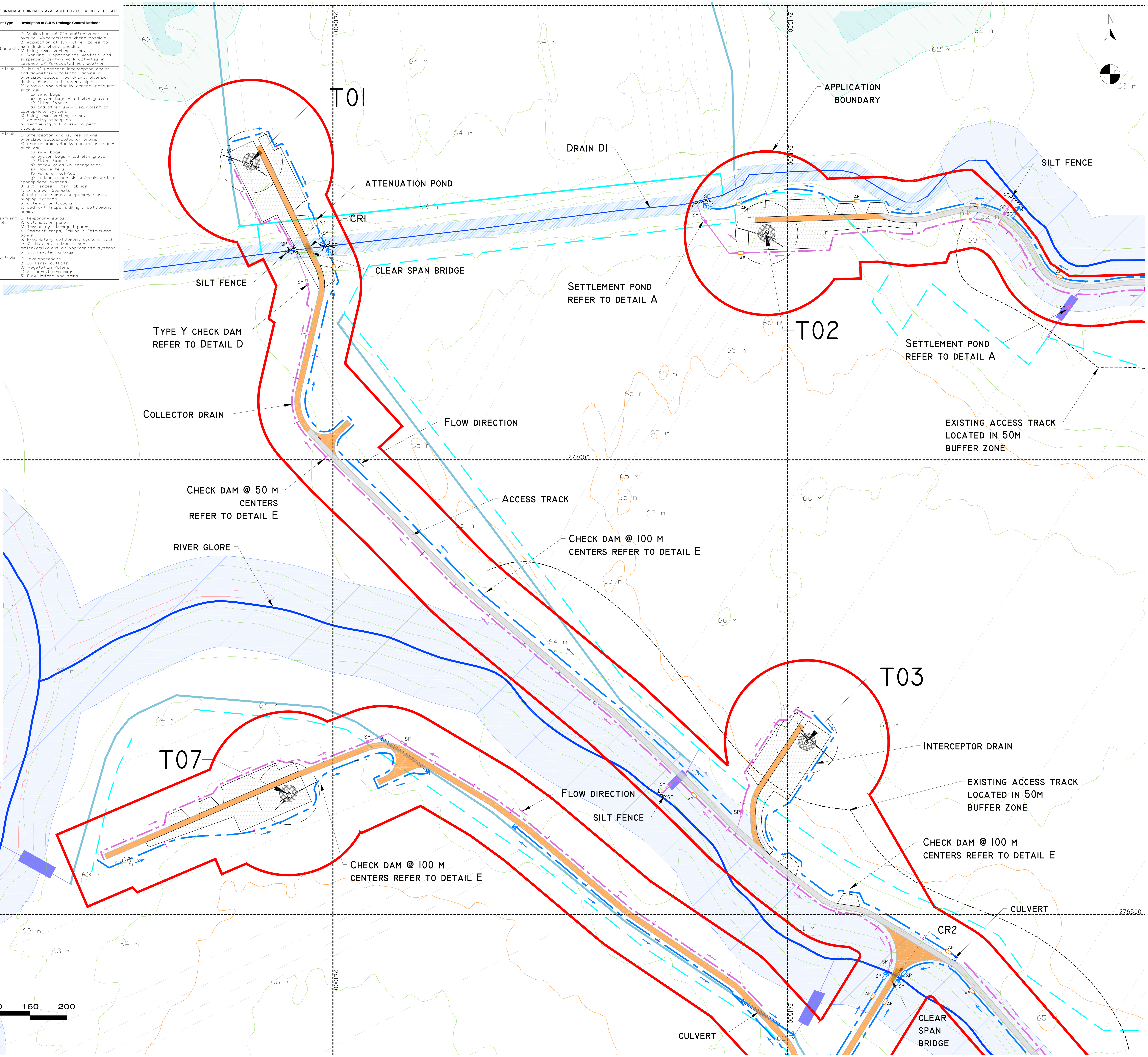
SITE DRAINAGE PLAN

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

PROPOSED DRAINAGE
- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

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7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 1 OF 7

Figure No: D101

Drawing No: P1320-2-0221-A1-D101-00A	
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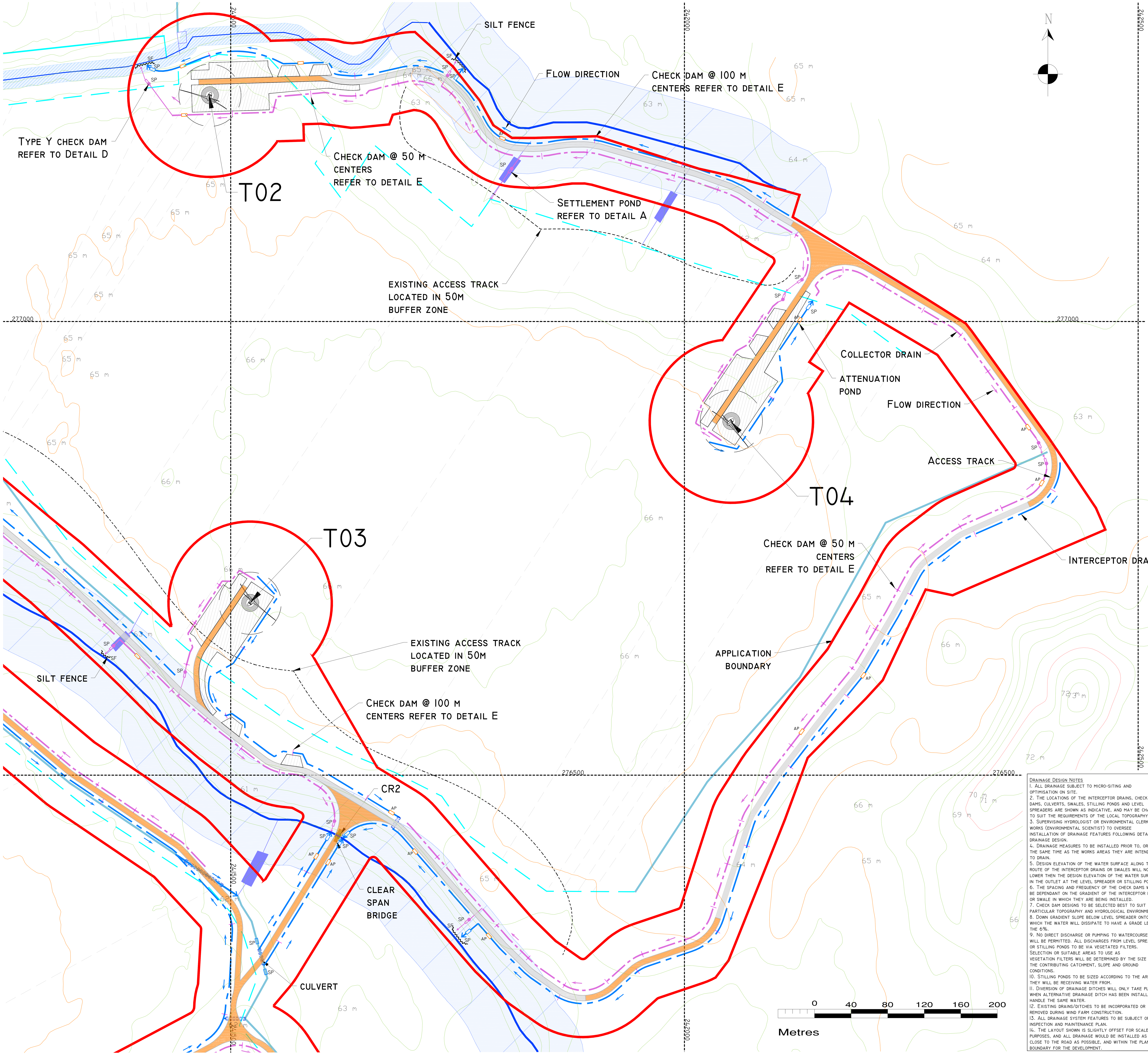
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAWING LEGEND :

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- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

PROPOSED DRAINAGE

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- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
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- DRAIN 10M BUFFER
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- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY.
2. DRAWINGS NOT TO BE USED FOR CONSTRUCTION /CONTRACT CONDITIONS.
3. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
4. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.
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6. THE USE OF OR RELIANCE UPON THIS DRAWING SHALL BE DEEMED TO BE ACCEPTANCE OF THESE CONDITIONS OF USE UNLESS OTHERWISE AGREED IN WRITING, SUCH WRITTEN AGREEMENT TO BE SOUGHT FROM AND ISSUED BY THE COPYRIGHT HOLDER TO THE USE OR RELIANCE UPON THIS DRAWING.
7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Date	Description	Chkd	Signed

Revisions

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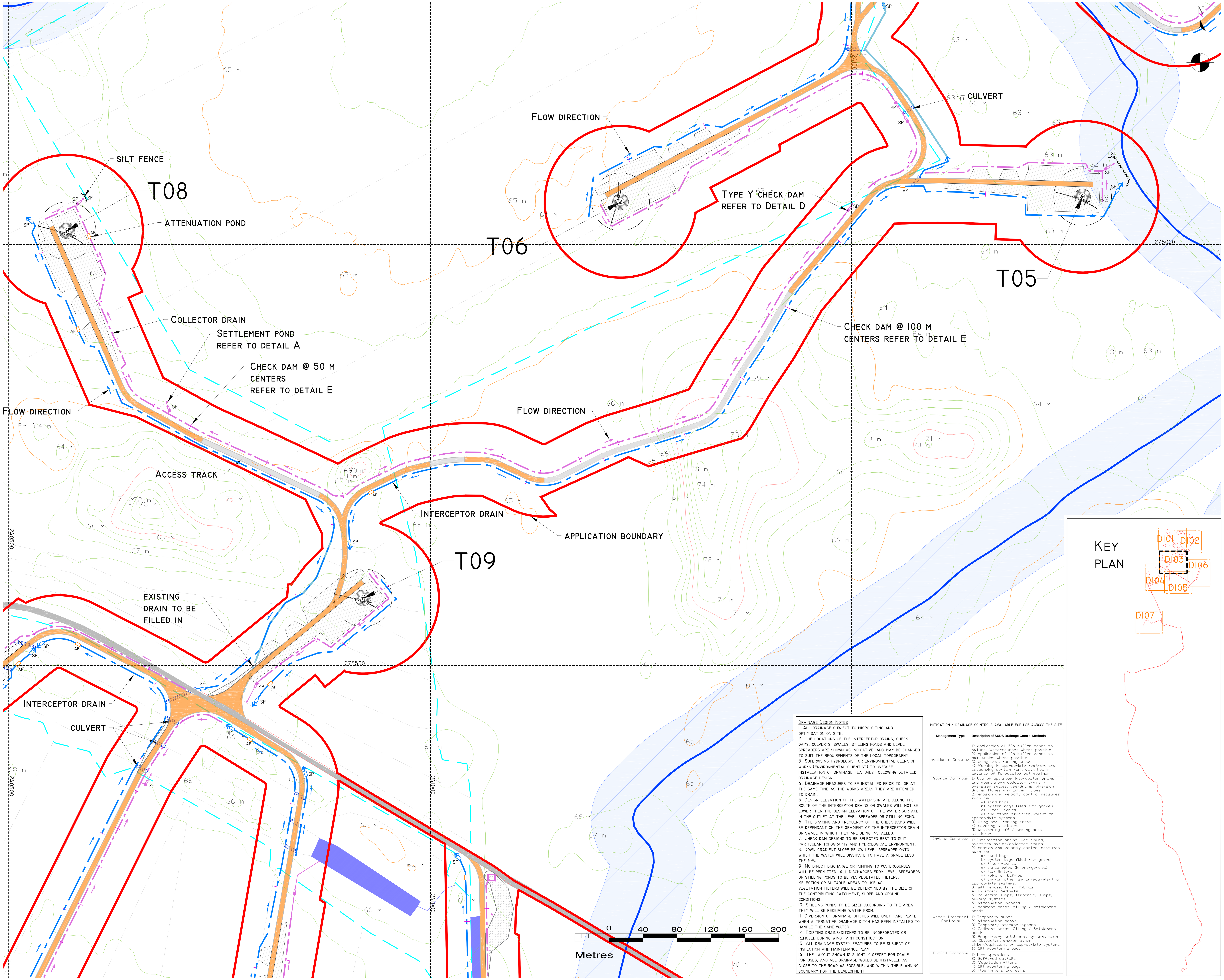
Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 2 OF 7

Figure No: D102

Drawing No: P1320-2-0221-A1-D102-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAINAGE DESIGN NOTES

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2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
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6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

DRAWING LEGEND :

PROPOSED DRAINAGE
- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

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7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 3 OF 7

Figure No: D103

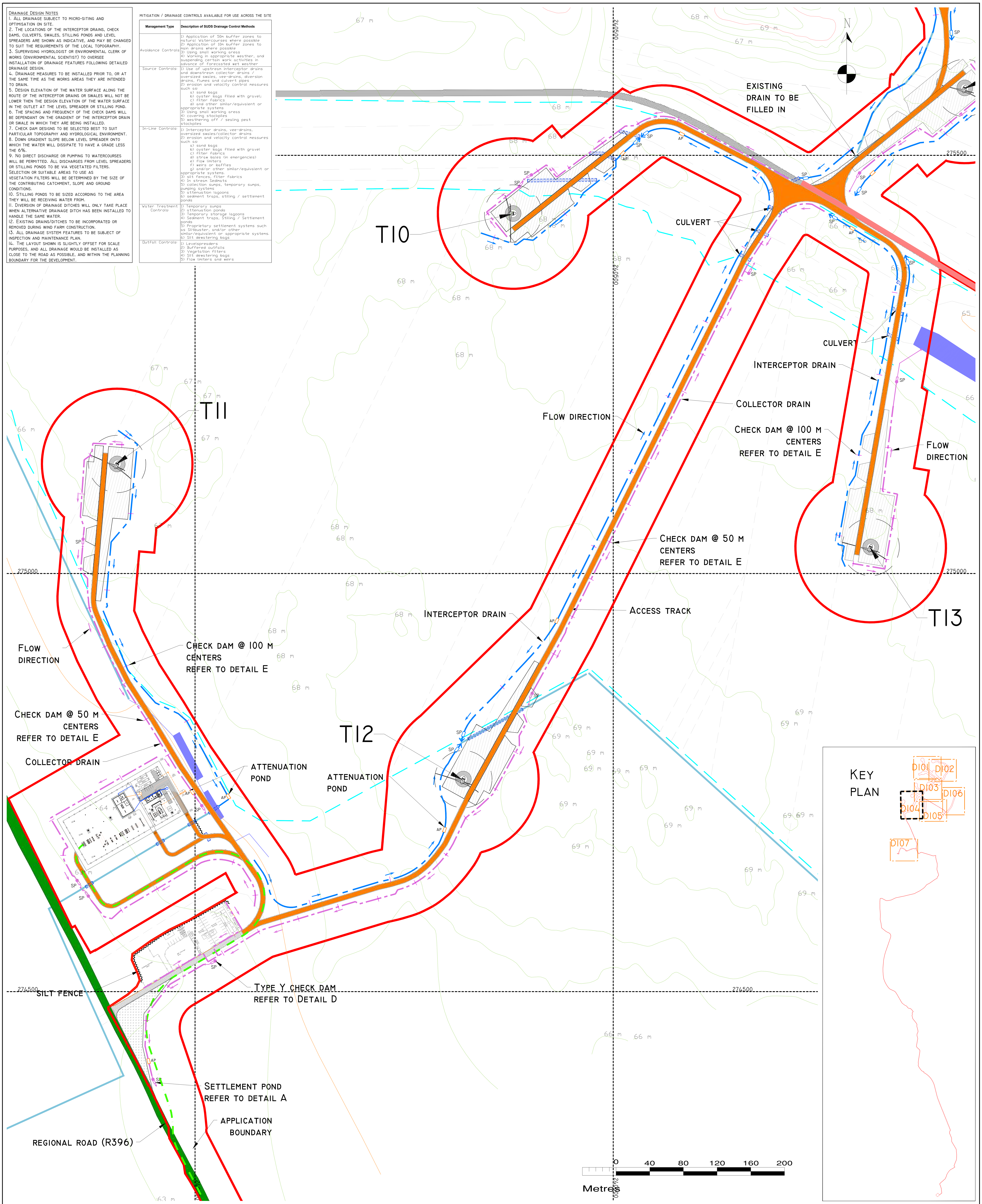
Drawing No: P1320-2-0221-A1-D103-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

Proposed Drainage:
- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt fence (SF)
- Headland drain
- Field drain
- CR - New stream/river crossing location
- Clear span bridge
- Existing settlement pond

Other legend items:
- Application boundary
- Existing ground surface majour contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Rivers/streams
- Lakes
- Natural rivers/streams 50m buffer
- Drain 10m buffer
- Lake 50m buffer
- Turbine and swept area
- Turbine foundation
- Regional road
- Local road
- Proposed road
- Internal existing road to be upgraded
- External existing road to be upgraded
- Passing bay
- Crane platform
- Borrow pit

Drawing Notes

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3. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
4. All dimensions are in metres.

Date	Description	Chkd	Signed

Revisions

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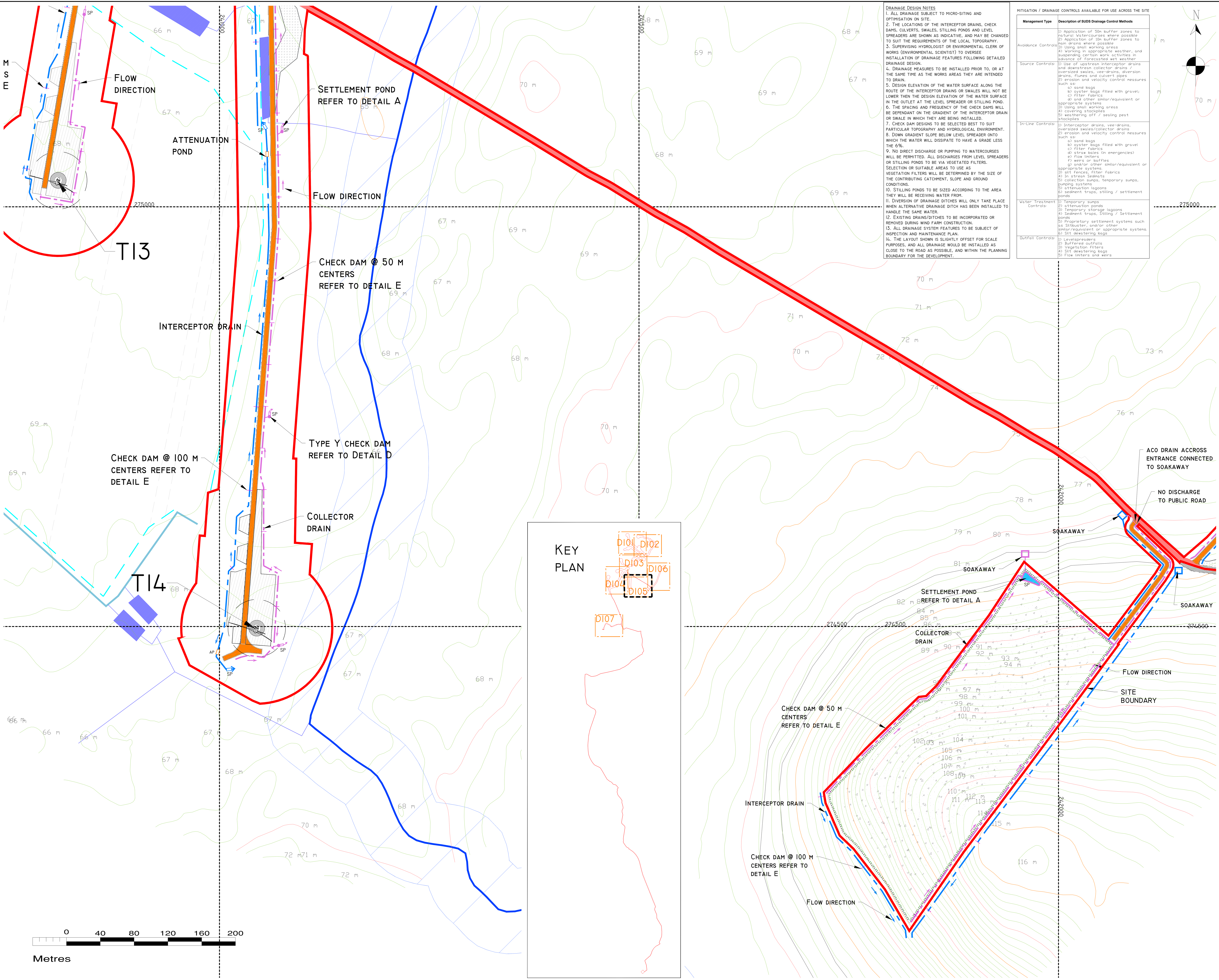
Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 4 of 7

Figure No: D104

Drawing No: P1320-2-0221-A1-D104-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAINAGE DESIGN NOTES

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5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
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DRAWING LEGEND :

PROPOSED DRAINAGE
- UPSTREAM INTERCEPTOR DITCHES
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- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- INTERNAL EXISTING ROAD TO BE UPGRADED
- EXTERNAL EXISTING ROAD TO BE UPGRADED
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Revisions

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Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 5 OF 7

Figure No: DI05

Drawing No: P1320-2-0221-A1-D105-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
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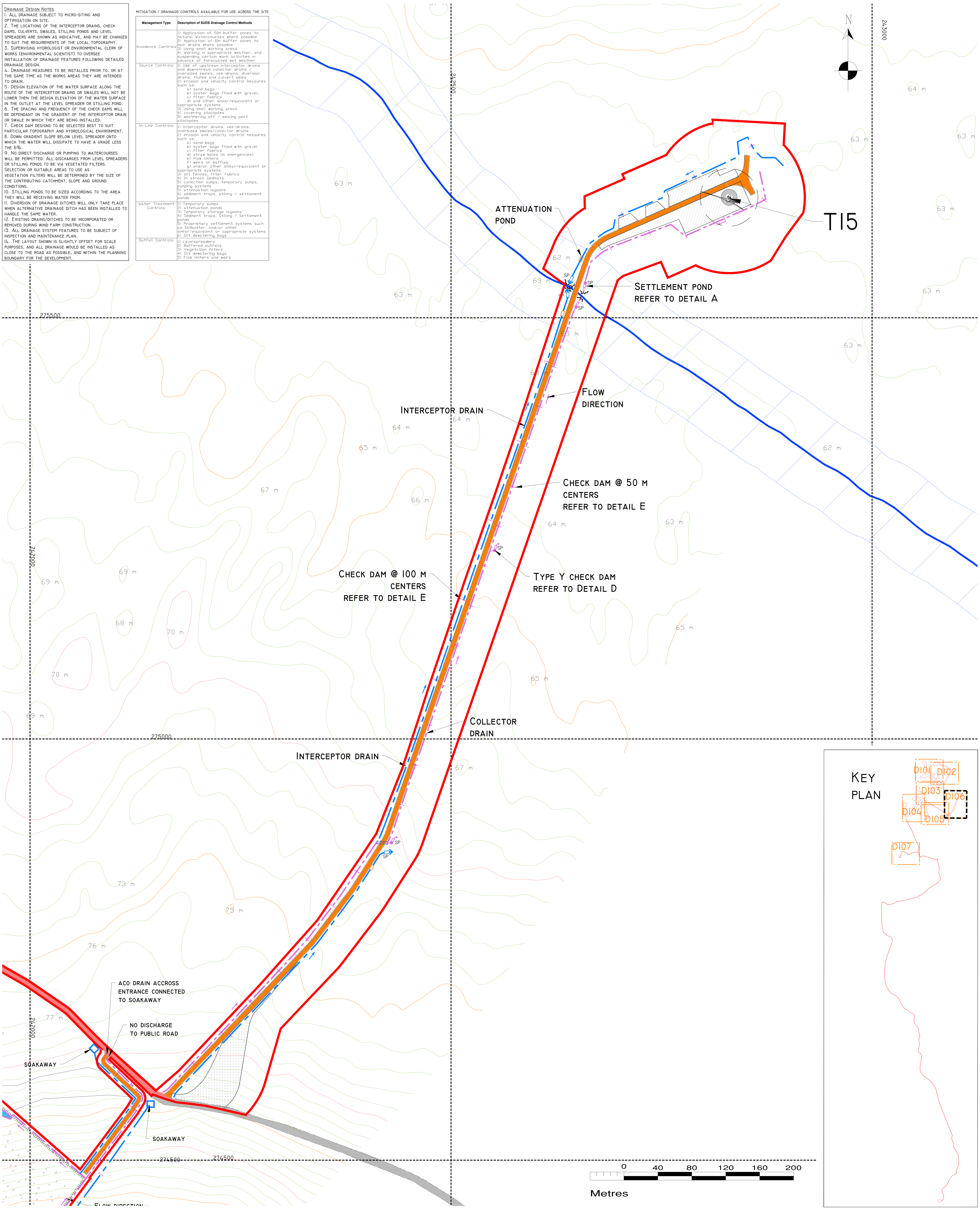
Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

Proposed Drainage

- Application Boundary
- Existing Ground Surface Majour Contour (5 m interval)
- Existing Ground Surface Minor Contour (1 m interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation
- Regional Road
- Local Road
- Proposed Road
- Internal Existing Road to be Upgraded
- External Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

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Revisions

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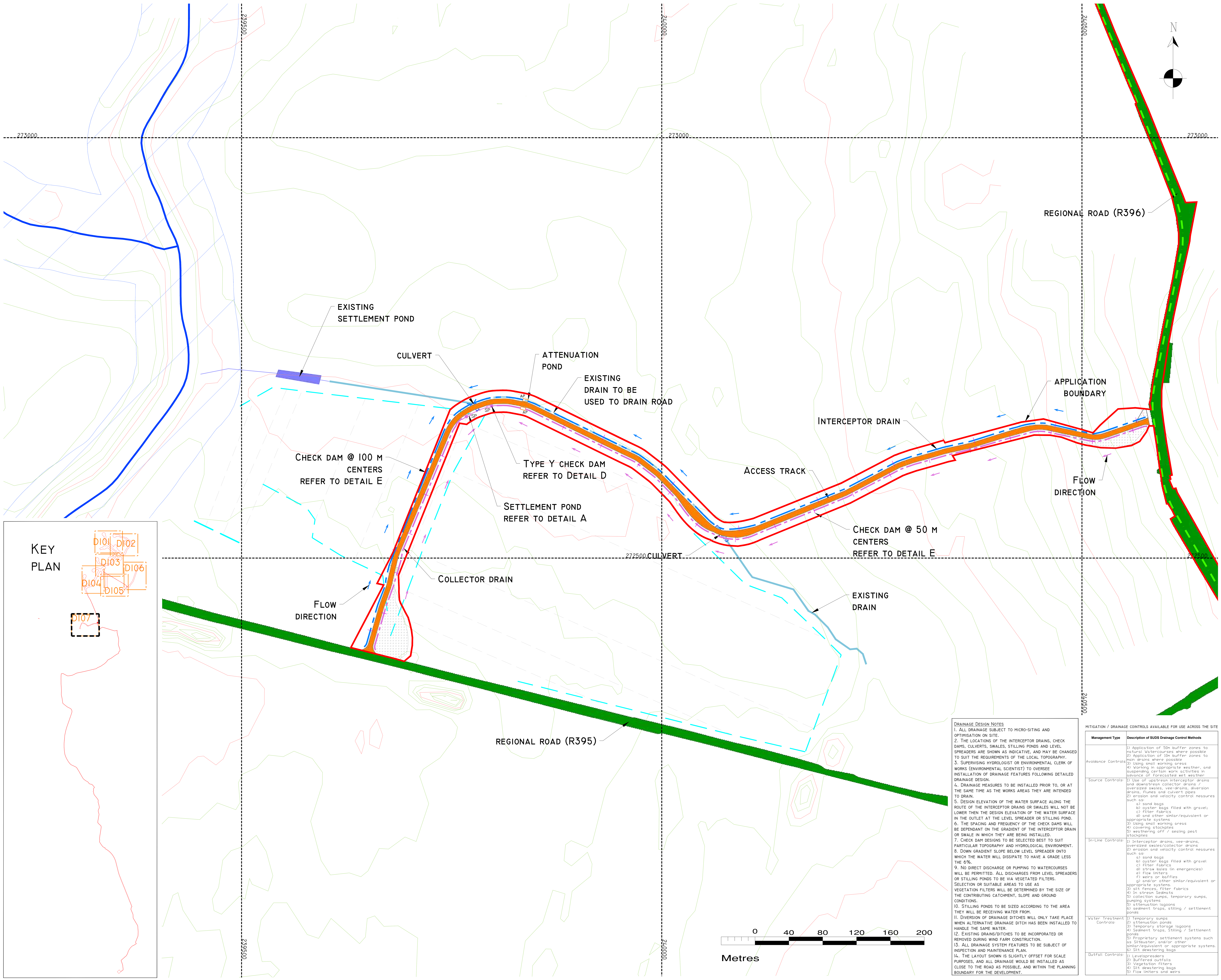
Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 6 of 7

Figure No: D106

Drawing No: P1320-2-0221-A1-D106-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAWING LEGEND :

- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

PROPOSED DRAINAGE

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- INTERNAL EXISTING ROAD TO BE UPGRADED
- EXTERNAL EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

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7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
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Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Date	Description	Chkd	Signed

Revisions

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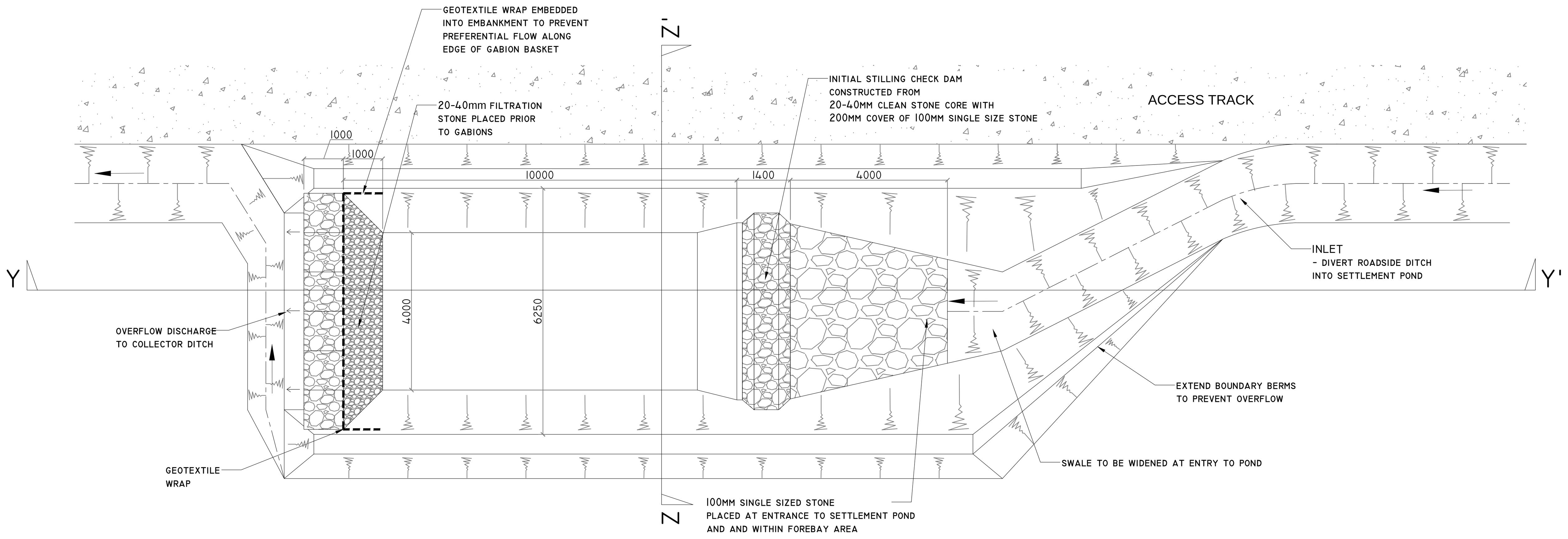
Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 7 OF 7

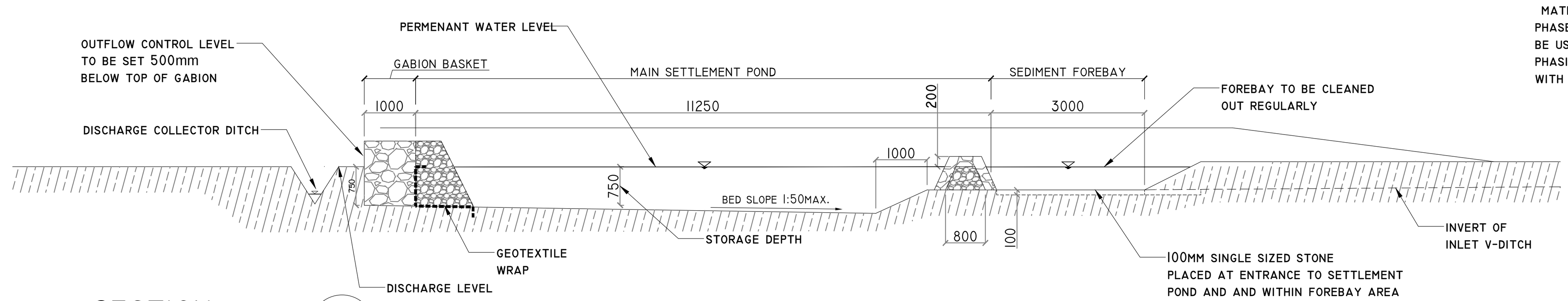
Figure No: D107

Drawing No: P1320-2-0221-A1-D107-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

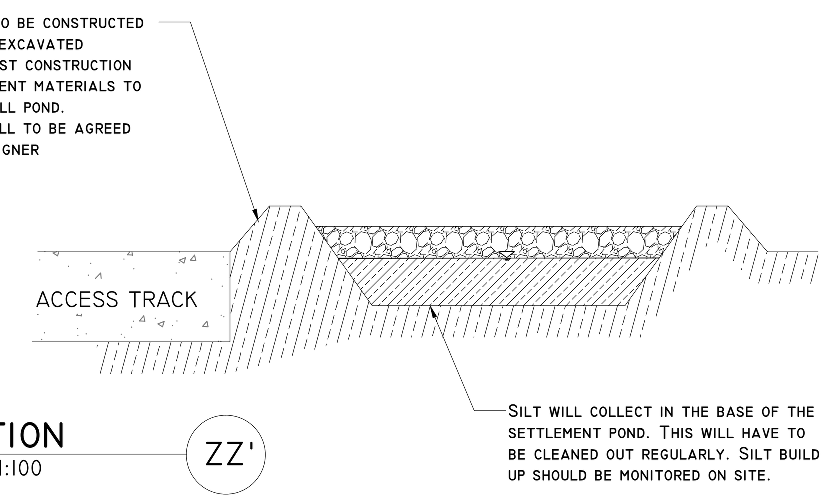
DETAIL A



TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE)



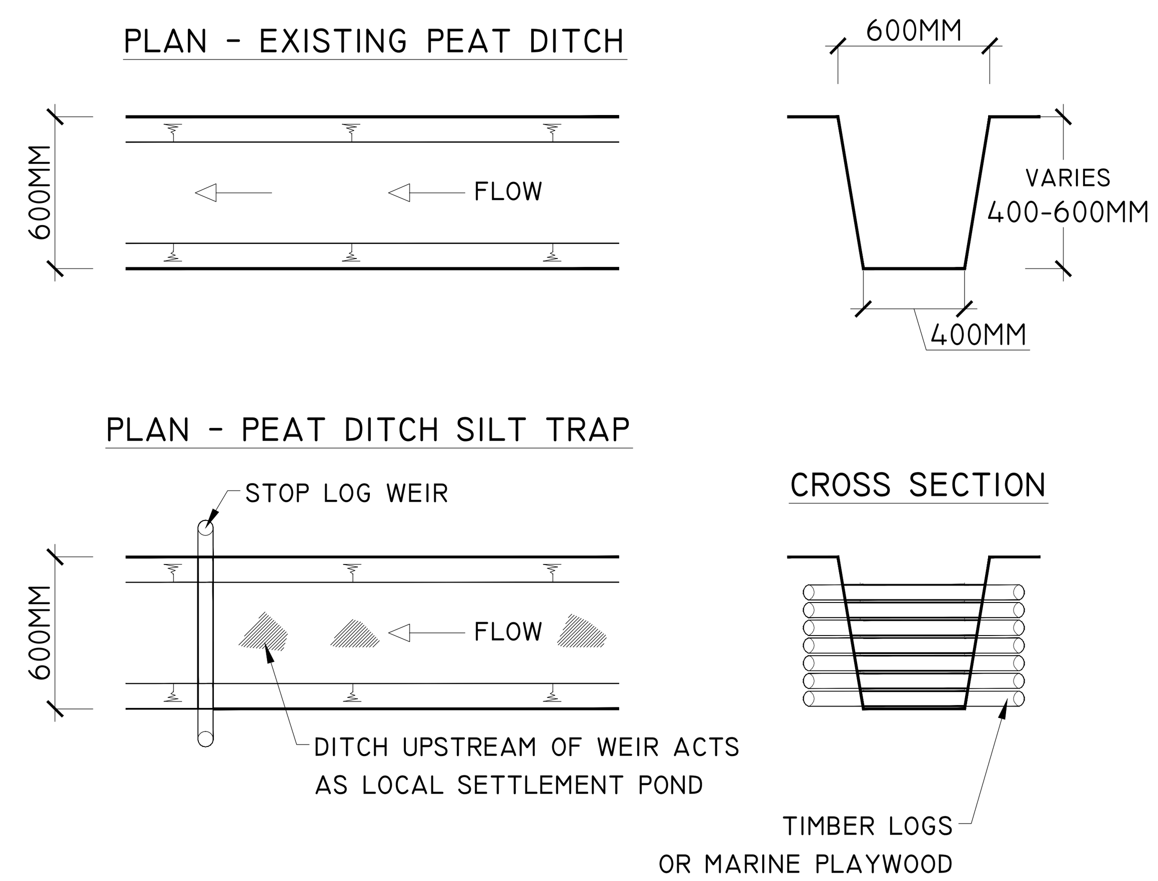
SECTION YY'
SCALE 1:100



SECTION ZZ'
SCALE 1:100

DETAIL B

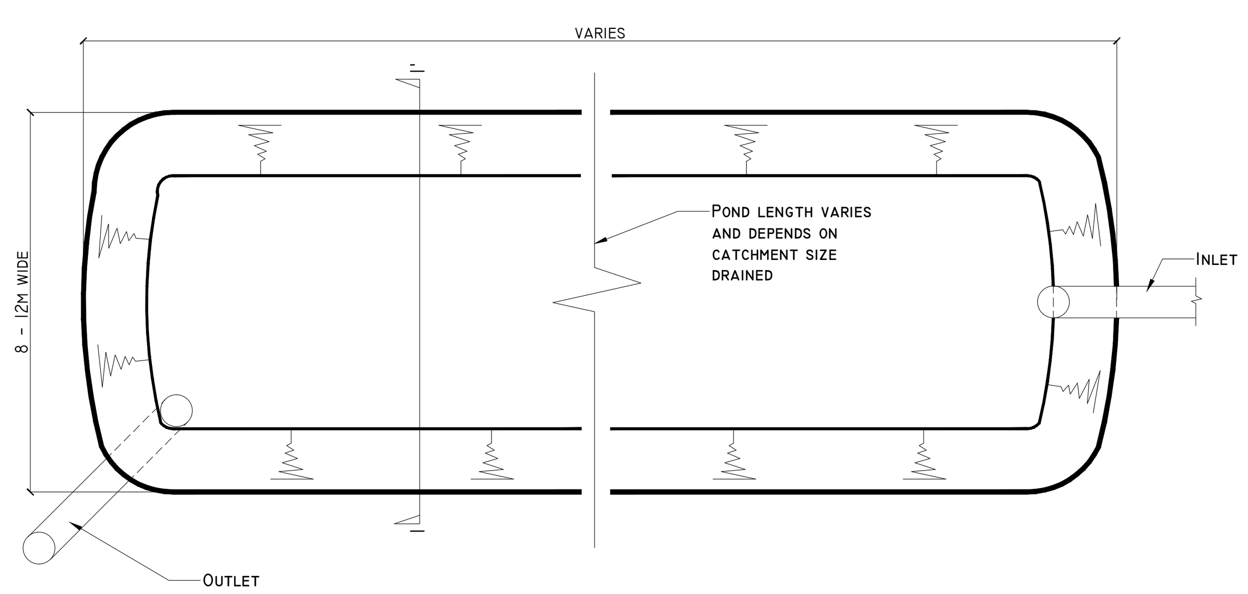
PEAT DITCH SILT TRAP
SCALE 1:25



DETAIL C

Typical Peatland Site Settlement pond detail
SCALE 1:200

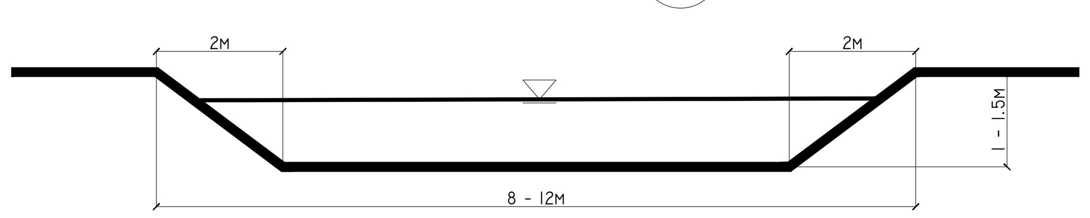
PLAN



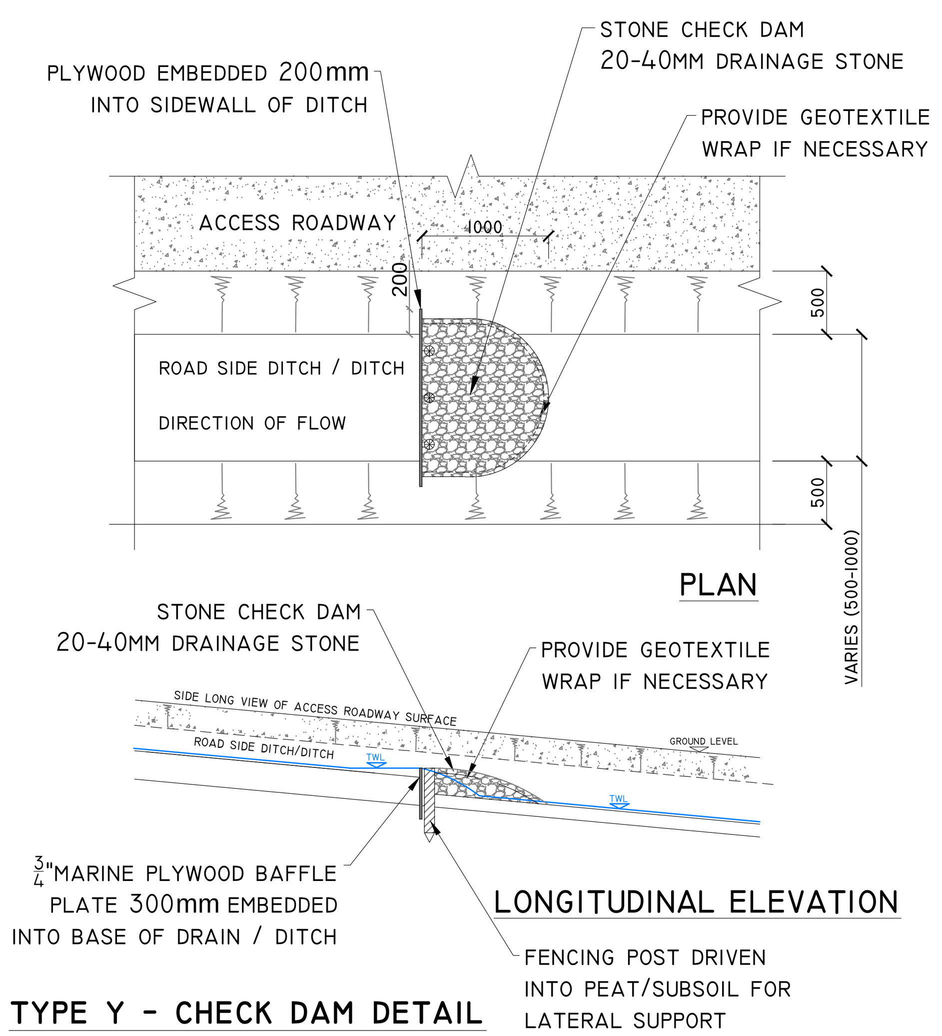
NOTES-

- ALL SETTLEMENT PONDS OPERATE TO LICENCE REQUIREMENTS OF IPPC LICENCE REG NO. P0914-01 AND P0974-01.
- SIZING LIKELY BASED ON ACCUMULATION OF 100 M^3/HA/YEAR SILT
- PONDS TYPICALLY CLEANED MINIMUM TWICE A YEAR (I.E. SILT DESIGN CAPACITY OF LAGOONS, MIN 50 M^3 PER NET HA OF BOG SERVICED), ONCE BEFORE DITCHING AND ONCE BEFORE HARVESTING, OR AS INSPECTIONS MAY DICTATE
- GENERALLY - 8 - 12 M WIDE, AND 1 - 1.5 M DEEP
- LIKELY VELOCITY THRESHOLD OF 0.1 M/SEC

SECTION II'
SCALE 1:100

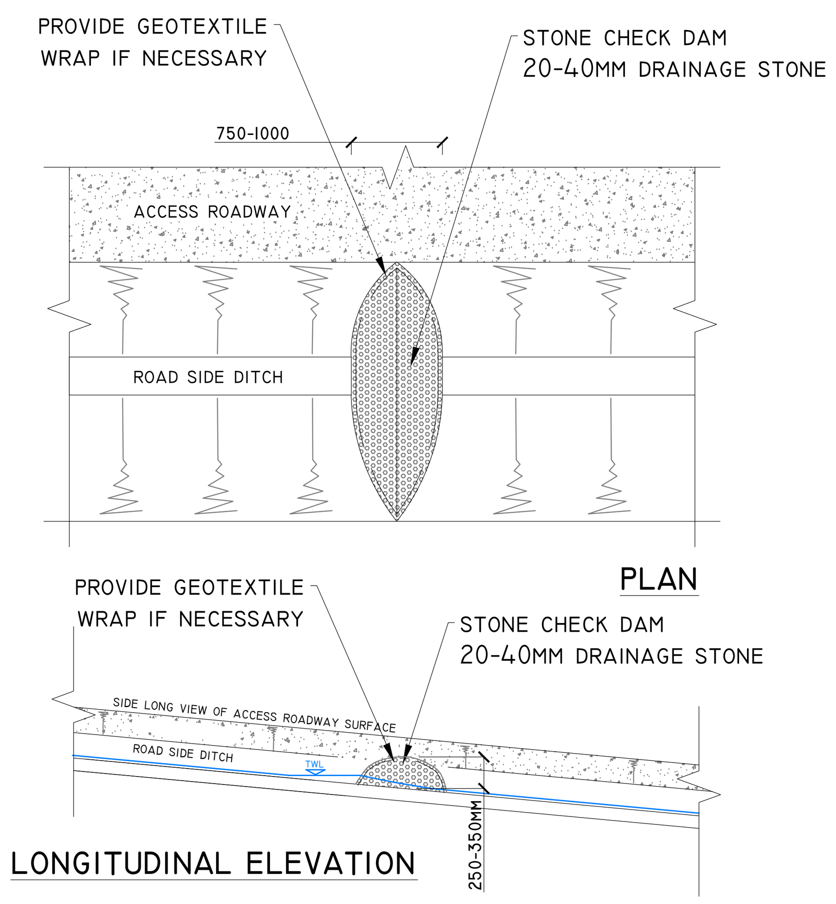


DETAIL D



TYPE Y - CHECK DAM DETAIL
SCALE 1:50

DETAIL E



TYPE X - CHECK DAM DETAIL
SCALE 1:50

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, settlement ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or settlement pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade <6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Settlement ponds to be sized according to the catchment area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage will be installed as close to access tracks/roads as possible.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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Job: Coole WF, Co. Westmeath

Title: Drainage Details 1

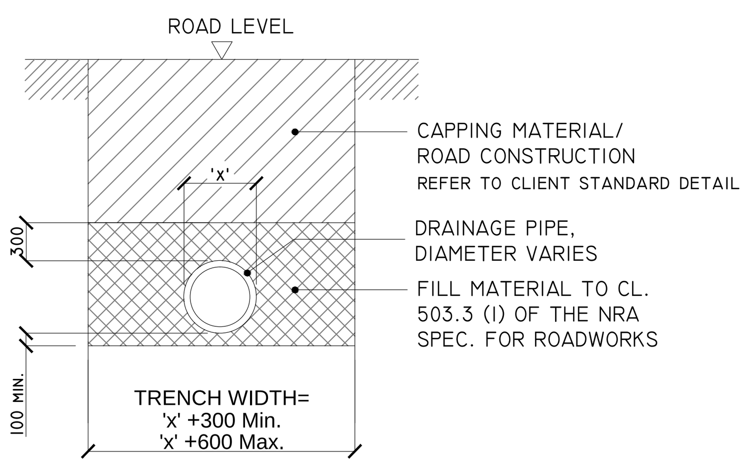
Figure No: 501

Drawing No: P1320--2-0221-A1-501-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/2021	Checked By: M.G.

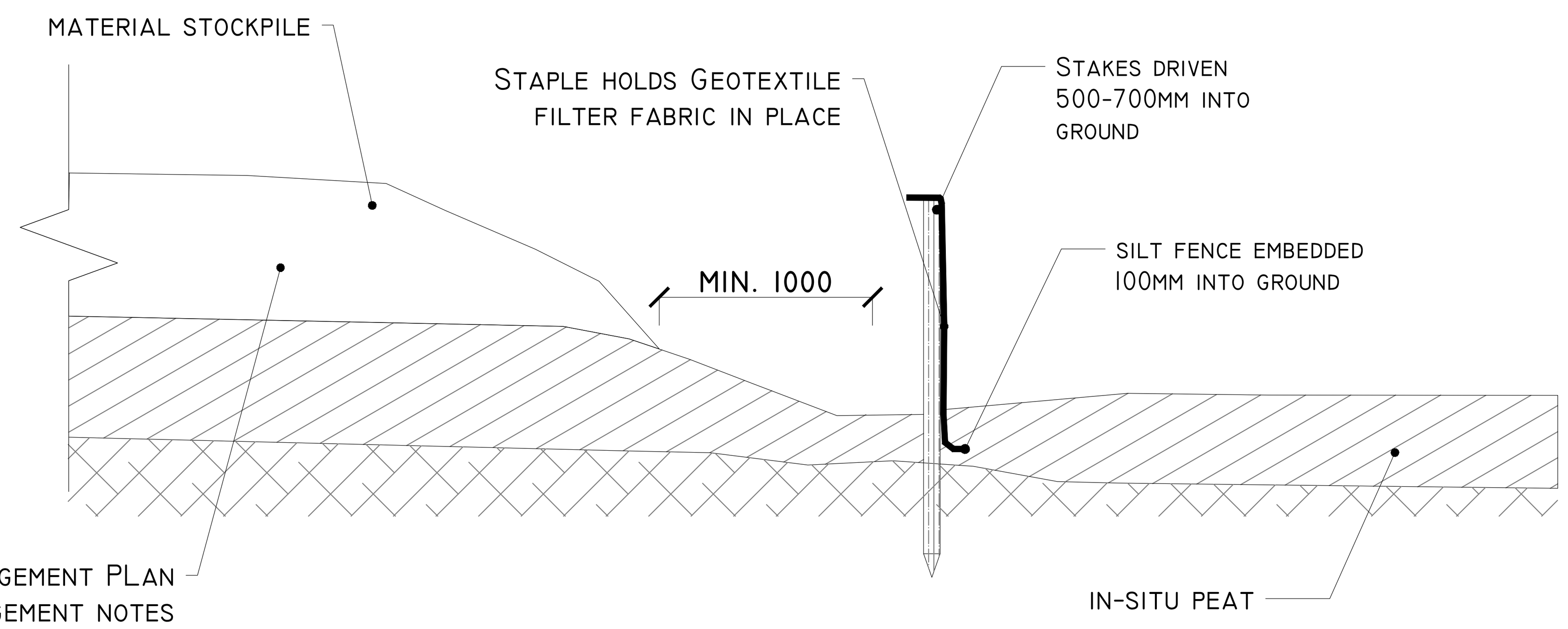
DETAIL F

'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD

SCALE 1:50



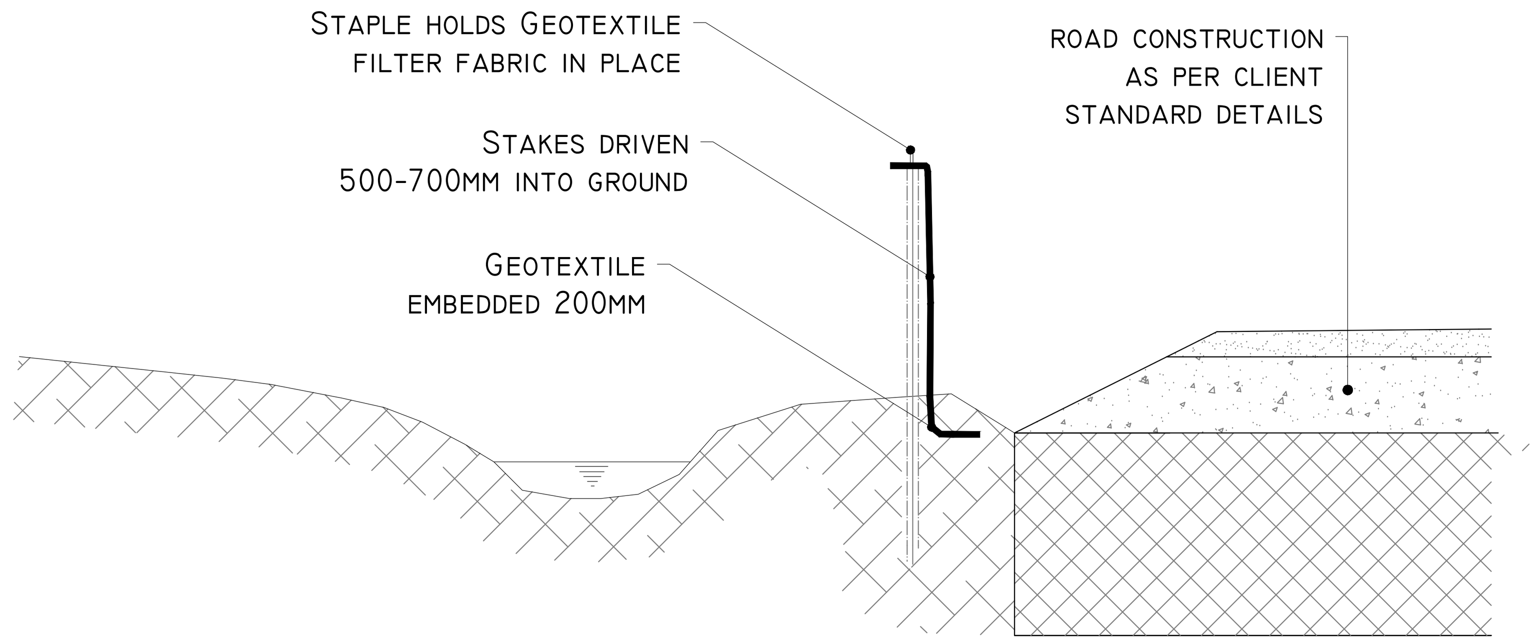
DETAIL G-I



SILT FENCE

SCALE 1:25

DETAIL G-II



SILT FENCE FOR WATERCOURSE PROTECTION

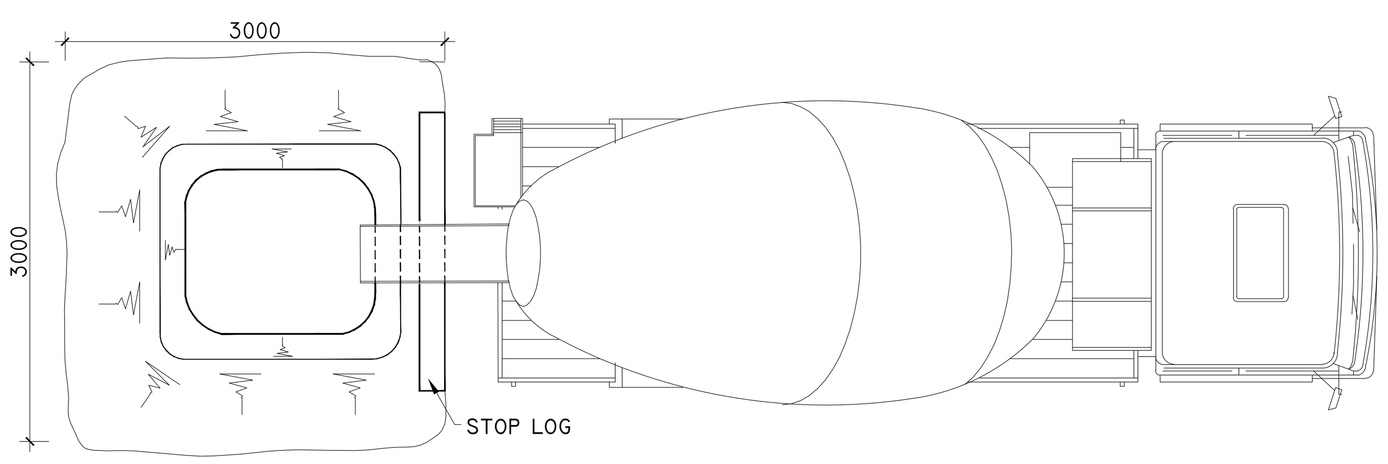
SCALE 1:25

DETAIL I

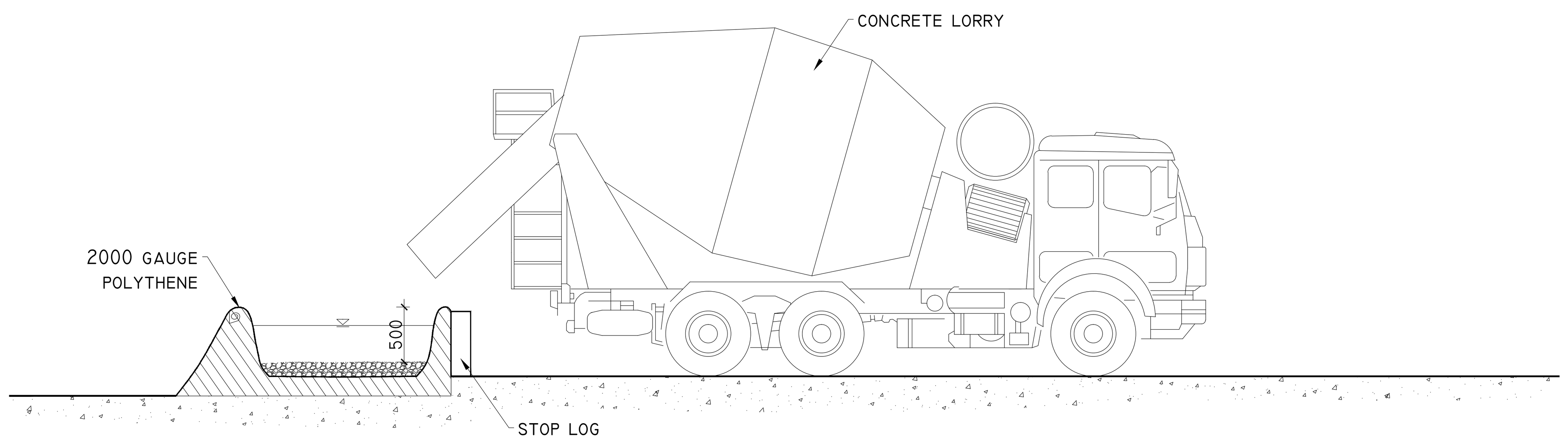
TEMPORARY CONCRETE WASH OUT PIT

SCALE 1:25

PLAN



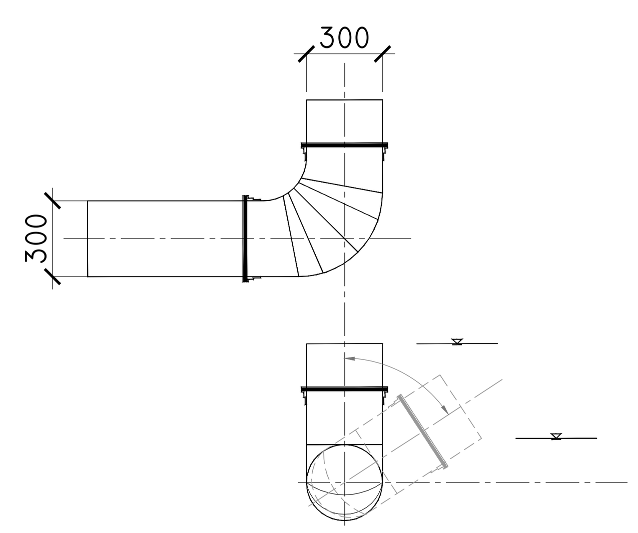
ELEVATION



DETAIL H

90° U BEND AND WATER LEVEL CONTROL MECHANISM

SCALE 1:25



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7. DRAINAGE SYSTEMS ARE OFFSET AT A DISTANCE APPROPRIATE TO THE SCALE OF THIS DRAWING. ALL DRAINAGE WILL BE LOCATED ADJACENT TO INFRASTRUCTURE, AS APPROPRIATE ACROSS THE SITE.

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, SETTLEMENT PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR SETTLEMENT POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE <6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. SETTLEMENT PONDS TO BE SIZED ACCORDING TO THE CATCHMENT AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WILL BE INSTALLED AS CLOSE TO ACCESS TRACKS/ROADS AS POSSIBLE.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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Job: COLLE WF, CO. WESTMEATH

Title: DRAINAGE DETAILS 2

Figure No: 502

Drawing No: P1320-2-0221-A1-502-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/21	Checked By: M.G.

APPENDIX 5

BEST PRACTICE GUIDELINES FOR THE CONTROL OF INVASIVE SPECIES

Best Practice Management Guidelines

Rhododendron
(*Rhododendron ponticum*)

and

Cherry Laurel
(*Prunus laurocerasus*)

1. Aim of this advice

This document provides best practice management guidelines on the control of *Rhododendron ponticum* and Cherry Laurel (*Prunus laurocerus*) on the island of Ireland.

2. Introduction

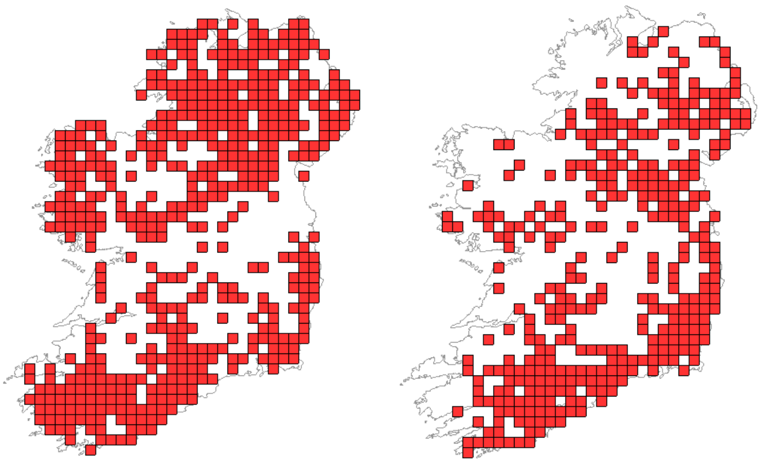
2.1. *Rhododendron*

Rhododendron is a large evergreen shrub (growing up to 8m tall) that was introduced to Ireland as an ornamental plant in the 18th Century from Asia and north-west China. There are more than 900 species of *Rhododendron*, but only one type, *Rhododendron ponticum* is invasive in Ireland. It has dark green waxy, oblong leaves and conspicuous pinkish purple or lilac flowers on 2-4cm stalks although hybrids and cultivated varieties can vary in colour. Flowering occurs in spring and summer with plants capable of producing large quantities of viable seed, which can persist to create a seed-bank in the soil. *Rhododendron* can also propagate itself by vegetative means, both by suckering from roots and by layering wherever branches touch the ground.

Rhododendron thrives on peaty, sandy and acidic soils and is extremely hardy. It is a very popular garden ornamental plant and has been extensively planted as game cover along the edges of fields and within woodlands. Its popularity, adaptability to Irish climate and soils along with its highly successful and multiple methods of reproduction and dispersal means that it has become naturalised and widespread. As *Rhododendron* is very shade tolerant, it has become widely established in several habitats, notably heathlands and woodlands from adjacent gardens.

2.2. Cherry Laurel

Cherry Laurel is a dense thicket forming invasive ever-green shrub of gardens, parks and woodlands from South West Asia. The leaves are thick and laurel-like, poisonous with cyanide, the white flowers are produced on upright spikes and are succeeded in autumn by blackish cherry-like fruits which should not be eaten.



Distribution of *Rhododendron ponticum* in Ireland (right) and Cherry Laurel (left). Source of data: National Biodiversity Network; accessed 07 April 2008.

2. Impacts

Rhododendron and Cherry Laurel are extremely invasive plant species, particularly in the more humid western parts of Ireland forming dense impenetrable thickets. Both species are unpalatable and likely toxic to mammals and probably invertebrates due to the presence of 'free' phenols and diterpenes in *Rhododendron* and cyanide in Cherry Laurel. They are both avoided by grazing animals, thus giving them significant advantages over native species. The deep shadow cast by the plants and toxic leaf litter accumulating underneath *Rhododendron* produces a dark sterile environment, which suppresses regeneration of native species and supports little wildlife. Changes in soil chemistry induced by *Rhododendron* have also been reported. Animal populations can also be negatively influenced by *Rhododendron* e.g. bird numbers are lower in mature oak woodlands dominated by *Rhododendron*.

In Ireland, *Rhododendron* has invaded three habitats of international importance under the EC Habitats Directive: upland oak woods, bogs and heath. For example, it is now a widespread invasive species in Killarney, where >650 acres of the Killarney National Park are completely infested.

Rhododendron in Ireland hosts a serious plant health pathogen *Phytophthora ramorum.* This is a fungus that has the potential to attack a wide variety of native woody plants and is the causative agent of 'Sudden Oak Death'. On *Rhododendron*, the first indication of the disease is wilting of shoots. These develop a brown/black colour that spreads along the twig and can move onto the leaves, where the leaf bases and tips blacken. The fungus has been recorded in Northern Ireland and DARD has identified this species as likely to cause significant damage to trees and landscapes if it establishes widely. Consequently, *Rhododendron* is one of the biggest conservation issues facing Irish woodlands today.

There are reported cases of human poisoning by 'toxic' honey from *Rhododendron*. The severity of the reaction probably relates to the amount of affected honey digested and the health and susceptibility of the individual concerned.

3. Legal status

There are no specific legal provisions associated with growing of *Rhododendron* or Cherry Laurel on the island of Ireland. However, all management methods described here should be carried out with due care and attention, with particular consideration to health and safety requirements and, where necessary, by trained and competent personnel. All waste not dealt with on site should be taken to a licensed landfill site.

Under the EU Plant Health Directive, emergency legislation was introduced in 2002 to prevent the introduction and spread of *Phytophthora ramorum* within the EU. If suspicious symptoms are observed on *Rhododendron* or any other tree species, the Forest Service (ROI) / DARD (NI) should be informed.

4. Managing *Rhododendron* and Cherry Laurel

The management and eradication of *Rhododendron* and Cherry Laurel is challenging. Understanding the ecology of the species and carefully planning clearance work will ensure success. Clearance can be expensive and time consuming, and should be well planned before any action is taken.

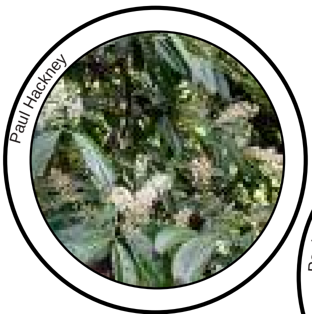
5. Control and eradication

Three main issues must be considered when planning management/control. These are:

• *Rhododendron* in Ireland is a prolific seed producer. However, a naturally seeded plant does not flower and produce seed until at least 10-12 years old. This provides a window of opportunity to prevent serious infestation, through the immediate removal of young plants.

• *Rhododendron* regrows vigorously when cut. As a result, some method of stump killing or removal is always necessary. Any untreated cut stump will regrow and in most cases flower within 3-4 years.

• The scale and nature of the site infestation. Adjacent garden/land owners should be encouraged to control *Rhododendron* at the same time as clearance on your site.



6. Rhododendron and Cherry Laurel on adjacent sites

It is important to consider populations in the wider environment around the site. If *Rhododendron* is growing profusely on adjacent land, or upstream, then recolonisation of recently cleared sites is possible. Discussion with neighbouring land owners on the issues involved and your intended actions, may help encourage them to remove or not plant *Rhododendron* and Cherry Laurel as ornamental or hedging species.

For all sites, the following six steps may be usefull to ensure success:

1. Find out how much *Rhododendron* and/or Cherry Laurel there is on the property and map it if possible.

2. Note the age, condition and previous treatments at your site. Use this information to guide your control programme.

3. Areas should be prioritised. It may be easier to clear less heavily infested areas to begin with or sites where seed production has not yet occurred. Also, ideally work with prevailing wind direction, rather than against it, to help minimise seed dispersal into recently cleared areas.

4. Create suitable conditions for the recovery of native ground flora. This will reduce open areas for recolonisation.

5. Write a Management Plan to guide your work. Including timeframes for planned clearance and repeated treatments.

6. Follow-up work will be necessary to ensure that any small plants and seedlings have not been missed.

7. Treatment options

Treatment programmes can be divided into 3 main stages: initial removal, control of stems and roots, and follow up. The following treatment options have been widely tested and measured for effectiveness across Ireland. In almost all cases, failures can be accredited to poor application of a particular technique and/or logistical difficulties, rather than the control method itself. Care should be taken when embarking on a control programme and resources should be identified and allocated for repeated treatments.

8. Successfully managing *Rhododendron*

Cut and remove stems by hand or chainsaw, cutting as close to the ground as possible to remove above ground growth. Chip or remove the cut material from the area to allow for effective follow-up work and prevent regrowth. Chipped material can provide good weed barrier around ornamental garden areas. Flailing has also been effectively used in Ireland to treat young or immature growth. Although not suitable on all sites and locations, especially steeply sloping or wet sites, it is very effective as it breaks up woody stems upon contact.

The removal of above ground growth will not prevent regrowth as *Rhododendron* will regrow from cut stems and stumps. There are four recommended methods to achieve successful management after the initial cut and removal:

1. Digging the stumps out. The effectiveness of this technique is increased by removing all viable roots. This can be done manually or with a tractor and plough. To avoid regrowth, stumps should be turned upside down and soil should be brushed off roots.

2. Direct stump treatment by painting or spot spraying freshly cut low stumps with a herbicide immediately after been cut. Glyphosate (20% solution), tryclopyr (8% solution) or ammonium sulphate (40% solution) are known to be effective during suitable weather conditions i.e. dry weather. The herbicide concentrations used and timings of applications vary according to which chemical is used. Use of a vegetable dye is recommended to mark treated stumps and all stumps should be targeted. A handheld applicator will help avoid spray drift onto surrounding non-target species. Always read the label and follow the manufacturers guidelines when using herbicides. Remember that using

3. A variation on the stump treatment method is stem injection, using a ‘drill and drop’ methodology, whereby, if the main stem is cut and is large enough for a hole to be drilled into it, the hole can be used to facilitate the targeted application of glyphosate (25% solution). The main drawback is that the dead *Rhododendron* may persist in situ for 10-15 years.

4. Stump regrowth and seedlings can be effectively killed by spraying regrowth with a suitable herbicide, usually glyphosate. Best practice spraying protocols should be carefully followed. General broadcast spraying is not as effective as stump spot treatment and has the potential to impact on surrounding non-target species. Rhododendron leaves are thick and waxy. For herbicide treatment to be effective **each individual leaf needs be thoroughly wetted with herbicide to kill the plant**.

Remember: If the initial infestation was of flowering age or a seed source is nearby, then follow-up seedling removal work will be necessary. The intensity of this work will vary according to the severity and duration of infestation.

See also: Higgins, G.T. (2006) *Rhododendron ponticum*: A guide to management on nature conservation sites. Irish Wildlife Manuals, No. XX. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

9. *Rhododendron*/Cherry Laurel Management Plan Template

Use this template to help formulate your own management plan outlining how you are going to proceed and what you will need.

Site Name: ____

Site Manager/Owner: ____

Site details

Address:	
Telephone:	
Email:	
Agencies/persons involved:	
Date:	

Date of introduction:	
Total site area:	
Total area colonised:	
Previous site management:	

Designation	**On site**	**Near site**	**None present**
Details: Establish if there is a requirement to apply for a license/notify before proceeding with plan.			

Actions and resources

Management options	**Responsibility**	**Date to undertake**

Resources needed	**Responsibility**	**Date to undertake**

Monitoring and evaluation

Name of person/s	**Date to undertake**	**Report to**	**Additional treatments date (if required)**

10. Summary of actions needed for effective management

1. Confirm *Rhododendron*/Cherry laurel identification.

2. Carry out a survey and produce a distribution map indicating the location across the site.

3. Consider surrounding properties and potential for reintroduction. Talk to adjacent land owners. Identify potential contamination routes to your site and mitigate against these.

4. Decide should the programme aim for continuous control on a yearly basis or eradication from the site. Base your decision on an understanding of the biology, size of infestation, potential for reintroduction and other relevant sensitivities in the area. Once management has begun, do not allow any plant to flower and set seed within areas that have undergone initial clearance.

5. Consider if you can successfully and safely carry out the work or if professional practitioners, with relevant training and certificates should undertake the work.

6. Identify if sufficient resources are/will be available to complete the work within the planned timescale. If work will take more than 1 year to complete, ensure you have sufficient funds to complete the work.

7. Ensure disposal options for plant material are in place prior to work commencing.

8. Develop and produce a site specific control/management plan. Use the template provided in this document to guide you.

9. Monitor for regrowth and/or reintroduction during site visits. If applicable, ensure new members of staff are aware of your *Rhododendron*/Cherry Laurel plan and report sightings.

12. *Rhododendron* and Cherry Laurel treatment times

Cutting	J	F	M	A	M	J	J	A	S	O	N	D
Glyphosate	J	F	M	A	M	J	J	A	S	O	N	D
Tryclopyr*	J*	F*	M*	A*	M*	J*	J*	A*	S*	O*	N*	D*
Ammonium sulphate	J	F	M	A	M	J	J	A	S	O	N	D

■ Optimum treatment time. Remember to consider breeding birds before embarking on a programme.

■ Suboptimum treatment time but can be effective. In the case of glyphosate based herbicides consider higher concentrations 25--100% during this time period.

* Suitable for treatment any time after cutting and appearance of new growth.

Please consider sharing your experience undertaking a management plan with others. The Invasive Species Ireland website will feature case studies to help guide others under taking similar work.

The Invasive Species Ireland Project is undertaken, in partnership, by EnviroCentre and Quercus.

www.envirocentre.co.uk

www.quercus.ac.uk

and is funded by the National Parks and Wildlife Service and the Northern Ireland Environment Agency.

www.ni-environment.gov.uk

www.npws.ie

For more information on the Invasive Species Ireland Project please see the website at www.invasivespeciesireland.com

Recommended citation: Maguire, C.M., Kelly, J. and Cosgrove, P.J. (2008). Best Practice Management Guidelines Rhododendron *Rhododendron ponticum* and Cherry Laurel *Prunus laurocerasus.* Prepared for NIEA and NPWS as part of Invasive Species Ireland.

APPENDIX 6

INLAND FISHERIES IRELAND BIOSECURITY PROTOCOL FOR FIELD SURVEY WORK

IFI Biosecurity Protocol for Field Survey Work

December 2010

Iascach Intíre Éireann
Inland Fisheries Ireland

Biosecurity Protocol for Field Survey Work

Invasive species are an ever present threat in our aquatic and riparian systems and it is imperative that none of our field operations exacerbate the risks to the environment and to the economy that are posed by these species. Fish parasites, pathogens and diseases also represent a significant threat to the health status of our watercourses. The introduction or transfer of such pathogens or diseases has the potential to wipe out large populations of fish in affected waters or catchments. Vigilance is required if we are to stop the spread of invasive species and fish diseases, and it is imperative that we in IFI lead by example in the ongoing struggle against these significant threats to our fishery watercourses.

The need for basic biosecurity in our fisheries operations must become ingrained in the psyche of our staff if we are to do our part to stop the spread of hazardous invasive species and fish pathogens. Much to do with biosecurity involves awareness, common sense and agreed procedures. Listed below are some basic procedures that must be implemented when conducting field survey work.

Each field vehicle must carry a ‘disinfection box’. This should contain Virkon Aquatic or another proprietary disinfectant, a spray bottle, cloths or sponges, a scrubbing brush and protective gloves.

On completion of any field operation, all equipment used must be treated according to the procedures listed below. Equipment in this respect includes the following:
boats, trailers, outboard motors, anchors and rope, weights, tanks, buckets and bins, all PPE (including boots, wellingtons, waders, wetsuits, dry suits, waterproof clothing, life jackets, diving apparatus, etc.) and any technical or sampling apparatus used as part of the survey. Protective gloves must be worn when using any disinfectant solution in any of the procedures listed below.

- Visually inspect all equipment that has come into contact with the water for evidence of attached plant or animal material, or adherent mud or debris. This should be done before leaving the site.

- Remove any attached or adherent material (fish, fish scales, vegetation and debris) before leaving the site of operation.

- Ensure that all water is drained from boats, live wells and other water retaining compartments, outboard motors, tanks and other equipment before transportation elsewhere.

- High-pressure steam cleaning, with water > 40 degrees C, is recommended for boats (including oars, row locks, attachment ropes, anchors and buoys), trailers and outboard motors that are being moved from one watercourse to another. Many roadside garages provide these facilities. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning visually inspect the equipment to ensure that all adherent material and debris has been removed.

- It is recommended to apply disinfectant, using the spray bottle from the ‘disinfection box’, to the undercarriage and wheels of the vehicle and trailer after steam cleaning or power hosing.

- Wet or live wells and other water retaining compartments in survey boats must be cleaned, rinsed or flushed with a 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Rinse thoroughly with clean water.

- Tanks that are used to stock or transfer live fish should be thoroughly washed with a 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. All disinfected equipment must be thoroughly rinsed with clean water.

- Outboard motors should be flushed with a 1% solution of Virkon Aquatic or another proprietary disinfection product, or with water > 40 degrees C. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Facilities will be provided at IFI stores countrywide to accommodate this operation.

- Nets (to include monofilament and braided gill nets, fyke nets and seine nets) must be cleaned of all vegetation and debris before returning to base. The clean nets must then be placed in a freezer for a period of four days (3 days will suffice for monofilament nets). Following this treatment the nets must be soaked in a 1% solution of Virkon Aquatic or a proprietary disinfectant for a period of not less than 15 minutes and thoroughly rinsed thereafter. Where these proprietary disinfectants are not available the nets must be soaked in a 5% solution (100 ml / 20 litre solution) of chlorine bleach for 1 hour and thoroughly rinsed after.
  An SOP on ‘Management and Disinfection of Survey Nets’ is available on request from IFI Swords.

- Footwear should be dipped in or scrubbed with a disinfectant solution (e.g. 1% solution of Virkon Aquatic or another proprietary disinfection product) and thoroughly dried afterwards.

- All PPE should be visually inspected and any attached vegetation or debris removed. Where appropriate, the gear should be wiped down with a cloth soaked in 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Rubber gloves must be worn when undertaking this procedure.

- Sampling equipment (e.g. electrofishing electrodes and cable, grab samplers, meter sticks, buckets and bins, etc.) must be cleaned, rinsed or wiped down with or dipped in a suitable disinfectant solution.

- Landing nets and hand nets must be dipped in disinfectant solution and rinsed in clean water.

- All field equipment must be suitably disinfected before being returned to the IFI Swords warehouse for storage. Staff will be requested to sign a prepared form detailing the nature of the disinfection process carried out and the date on which this was conducted.

Note
Disinfectants must be used with care and in strict accordance with the manufacturer’s instructions. They must be disposed of safely and never in close proximity to open waters,

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APPENDIX 3

AQUATIC SURVEYS

Coole Wind Farm

Aquatic Ecology Assessment

July 2016

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1 AQUATIC ECOLOGY AND FISHERIES

1.1 Introduction

This chapter addresses the potential impact of the proposed Coole Wind Farm project on aquatic ecology and fisheries. This document provides an appraisal of the impact of the proposed development on aquatic habitats, aquatic ecological communities, individual aquatic species, and recreational fisheries. The aims of the aquatic ecology and fisheries assessment are: -

- To carry out a desktop study in order to determine the surface water features affected by the proposed development and surrounding area;
- To carry out a fisheries and aquatic ecological assessment of the affected aquatic areas;
- To predict the potential direct, indirect and cumulative impacts of the proposed development on aquatic species and habitats.
- To propose mitigation measures in the construction and operation of the wind farm so as to minimise potential impacts on fisheries and aquatic ecology receptors.

Field survey work to inform the current appraisal was undertaken during June 2016. Survey work was also carried out during August 2013 in relation to a larger windfarm development. Electrical fishing results from the 2013 survey were used in the current appraisal, since the current proposal is located within the area of the larger development. Figure 1 gives the location of the proposed Coole Wind Farm with respect to water regions (Hydrometric Area and catchment). This report has been prepared by ECOFACT Environmental Consultants Ltd.

1.2 Methodology

1.2.1 Relevant Guidance

The current appraisal has been prepared taking account of relevant guidance published by the Environmental Protection Agency (EPA) including '*Guidelines on the Information to be contained in Environmental Impact Statements*' (EPA, 2002) and '*Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*' (EPA, 2001). In addition, the impact appraisal also takes account of the '*Guidelines for Ecological Impact Assessment*' (Institute of Ecology and Environmental Management, 2005). The Heritage Council publication '*Best Practice Guidance for Habitat Survey & Mapping*' (Smith *et al*., 2010) is also referenced.

Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland was also followed, including '*Guidelines for the Assessment of Ecological Impacts of National Road Schemes – Revision 2*' (NRA 2009a), '*Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2*' (NRA 2009b), '*Environmental Impact Assessment of National Road Schemes – A practical guide*' (NRA 2008) and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (NRA 2005). IFI (2016) *'Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*' was also consulted in relation to mitigation.

1.2.2 Legislative context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000; which includes the Flora Protection Order (1999). The Habitats Directive 1992 has been transposed into Irish legislation as the European Union (Natural Habitats) Regulations SI 94/1997 and amended in 1998 and 2005. The Habitat Regulations have been updated in 2011 as the European Communities (Birds and Natural Habitats) Regulations (2011) to bring the Irish transposition of these regulations into line with the requirements of the EU Habitats Directive (1992).

Under the Fisheries (Consolidation) Act, 1959, it is an offence to disturb the bed of a river; therefore, it will be necessary to get written permission from Inland Fisheries Ireland to proceed with the works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys will occur as a result of the proposed development. Salmon, all lamprey species and their habitats are further protected under the EU Habitats Directive, 1992.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

These European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) and (Amendment) Regulations 2012 (S.I. No. 327 of 2012) establish legally binding quality objectives for all surface waters and environmental quality standards for pollutants for purposes of implementing provisions of E.U. legislation on protection of surface waters. These regulations clarify the role of public authorities in the protection of surface waters also concern the protection of designated habitats.

1.2.3 Selection of watercourses for appraisal

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. lie within 500 m of the site boundary) were considered as part of the current appraisal. Generally only streams and other watercourses shown on the 1:50,000 Discovery Series Maps were examined, as watercourses smaller than this are not normally of fisheries or aquatic ecological significance. The River Inny is the largest and most important watercourse in the study area. This river was assessed at several locations within the study area.

The watercourses selected for appraisal are given in Table 1 and are shown in Figure 2.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare / protected / notable aquatic species at each site. Surveying was carried out on the 9th June 2016.

1.2.4 Desktop review

A desktop review was carried out to collate information on fish and protected aquatic species in and to identify features of aquatic ecological importance within the study area. Natura 2000 sites and records of protected species in the vicinity of the proposed development were identified. This information was obtained by accessing the website of the National Parks & Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government. The database of the National Biodiversity Data Centre (NBDC) was also consulted to assess the presence of rare plant and faunal species and records of protected species from records of the study area. The websites of the Environmental Protection Agency (EPA) and Inland Fisheries Ireland (IFI) were accessed to collate information on surface water quality and fish respectively.

1.2.5 Aquatic habitat appraisals

Habitat appraisal was carried out at the selected watercourses on the site using the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000). In June 2016, all the affected watercourses were assessed in terms of:

- Stream width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside;
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

Table 1: Location of the aquatic sites assessed for the proposed Coole wind farm site during June 2016.

Site	EPA code	River	Tributary	Segment code	Location
1	26I01	Inny	-	26_892	Bridge near Shrubbywood
2			-	26_625 13281	Float Bridge
3			-	26_1160	Camagh Bridge
4	26M92	Inny	Mayne	26_2450	Ballin
5	26G02	Inny	Glore	26_2976	Doon (d/s Monktown Stream confluence)
6			Glore	26_13411	Newcastle (u/s Monktown Stream confluence)
7			Glore	26_3579	Bridge at Rockbrook
8	26M78	Inny, Glore	Monktown	26_2975	Newcastle

1.2.5.1 Aquatic invertebrates

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at survey sites using kick-sampling (Toner *et al.*, 2005) in 2013. All samples of invertebrates were combined for each site and live sorted on the river bank and fixed in ethanol for subsequent laboratory identification. The relative abundance of macroinvertebrates was recorded on-site at each site. This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. Where possible, this procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected.

An appraisal of the occurrence of rare protected species (e.g. white-clawed crayfish) and of non-native invasive species was assessed at sampling sites using underwater visual observation (bathyscopes and snorkeling - see section 1.2.6.3). Methodology for White-clawed Crayfish surveying followed recognised procedures given in the manual 'A technical manual for monitoring white-clawed crayfish *Austropotamobius pallipes* in Irish lakes' by Reynolds *et al.* (2010).

1.2.6 Fish appraisals

Habitat and watercourse size has a key influence on fish communities. Electrical fishing results (Ecofact, 2013) were used in combination with physical habitat appraisals to evaluate the watercourses affected by the proposed development.

1.2.6.1 Visual surveys

Habitat suitability for salmonids was assessed in 2016 with reference to the leaflet 'The Evaluation of habitat for Salmon and Trout' (DANI Advisory Leaflet No. 1) and 'Ecology of the Atlantic Salmon' (Hendry & Cragg-Hine, 2003). An opinion of lamprey habitats was formed at survey sites and at Salmon Point with reference to Ecology of the River, Brook and Sea Lamprey by Maitland (2003).

1.2.6.2 Electrical fishing surveys

An electrical fishing survey was undertaken in 2013 at all selected sites under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act (1980). It is noted that some of the watercourses were too small to complete a full survey, but all were checked for presence / absence of fish. Sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive - Electric fishing in wadable reaches*". A portable electrical fishing unit (Smith Root-LR 24 backpack or Marine Electrics Safari Researcher 660D) was used during the assessments. Fishing was carried out continuously for 20 minutes at each of the sites located on the larger watercourses, and for at least 5 minutes at the smaller stream sites. Stop nets were used at suitable sites. Captured fish were collected into a container of river water using dip nets. On completion of the survey fish were then anaesthetised using a solution of 2-phenoxyethanol, identified, and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water and were the released alive and spread evenly over the sampling area. No mortalities were recorded.

Electrical fishing for juvenile lampreys was carried out in the most suitable juvenile lamprey habitats that could be found habitat taking cognisance of habitat suitability outlined in O'Connor (2006). Identification followed the manual 'Identifying Lamprey. A Field key for Sea, River and Brook Lamprey' by Gardiner (2003).

1.2.6.3 Snorkeling surveys

Snorkel surveys are widely used to monitor fish populations in streams and to estimate both relative and total abundance (Slaney and Martin, 1987). Snorkeling was carried out in June 2016 with the aid of a snorkel and face mask to qualitatively assess fish and macroinvertebrate distribution, presence/absence, species assemblages (i.e., diversity) and habitat use. A wet suit and diving boots were worn during this survey to provide insulation. A waterproof camera was used to capture underwater images.

Snorkeling is often feasible in places where other methods are not; for example, deep clear water with low conductivity makes electrofishing prohibitive (Johnson *et al*., 2007). In the current assessment, snorkeling was suitable in the River Inny and River Glore with respect to depth and soft substrates. Snorkeling was not feasible in the remainder of the watercourses due to poor visibility (peat stained water) and extent of shading.

Fish were identified with reference to the 'Key to British Freshwater Fish with notes on their ecology and distribution' by Maitland (2004).

1.2.7 Biological Water Quality

Benthic macroinvertebrates, or aquatic insects were used as an indicator of water quality at the study sites using the Quality Rating (Q) System (Toner *et al*, 2005). This is the standard biotic index which is used by the Environmental Protection Agency. This method categorises invertebrates into one of five groups, depending on their sensitivity to pollution. Where possible, Q-ratings were derived for sites. Further details on the Q-rating system and its relationship to the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) are provided in Table 2.

Table 2: Relationship between Q-Value and ecological status for macroinvertebrates.

Q Value*	WFD Status	Pollution Status	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

** These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.*

*** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses*

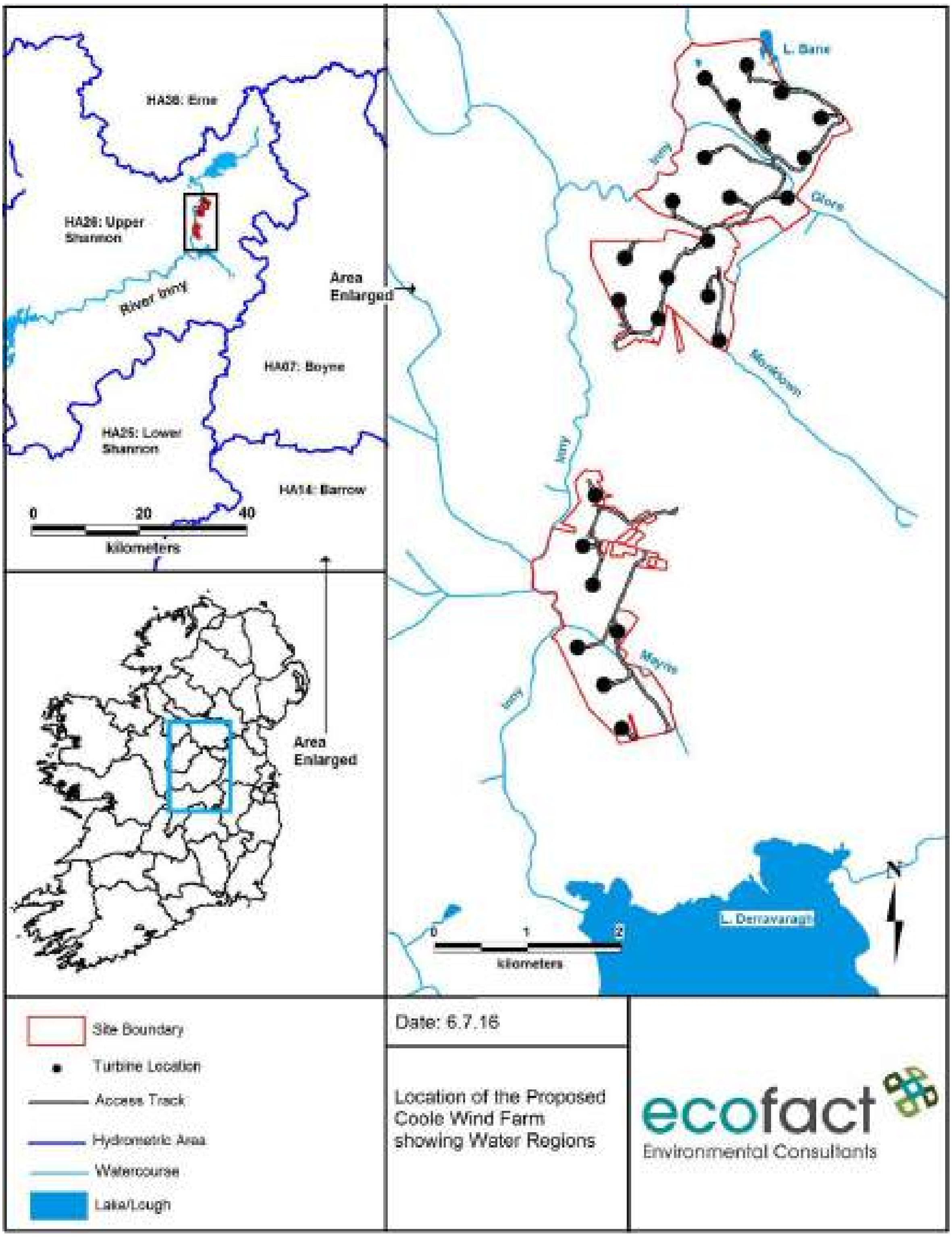

Figure 1 Location of the proposed Coole Wind Farm showing water regions.

1.2.8 Evaluation Criteria

The evaluation criteria used in the current appraisal follows the '*Guidelines for the Assessment of Ecological Impacts of National Realignments – Revision 2*' (NRA, 2009). The evaluation of impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is therefore necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts.

Following the guidance set out by the NRA (2009) the study area has been evaluated based on an identified zone of influence with regard to the potential for pathways for impacts affecting aquatic ecological features of interest (habitats, flora and fauna).

Ecological features are assessed on a scale ranging from international-national-county-local (see Table 3). The local scale is taken as corresponding to the zone of influence of the development and extending to a parish area. The evaluation criteria are presented below. Watercourses, evaluated following the NRA (2009) criteria were evaluated on the basis of a number of characteristics and features defined as follows:

- Aquatic habitat refers to the in-water conditions of any watercourse; including substrate and stream structure (i.e. proportion of riffles, runs and pools).
- The fisheries value of a watercourse refers to its suitability for fish, primarily salmonids (salmon and trout), and to the associated value for recreational angling purposes.
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC).
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats.
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

Table 3: Criteria used to determine the value of ecological resources (NRA 2009)

Importance	Criteria
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. Proposed Special Protection Area (SPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). Biosphere Reserve (UNESCO Man & The Biosphere Programme) Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).

Importance	Criteria
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (higher value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (lower value)	Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

- *SAC = Special Area of Conservation; SPA = Special Protection Area; NHA = Natural Heritage Area.
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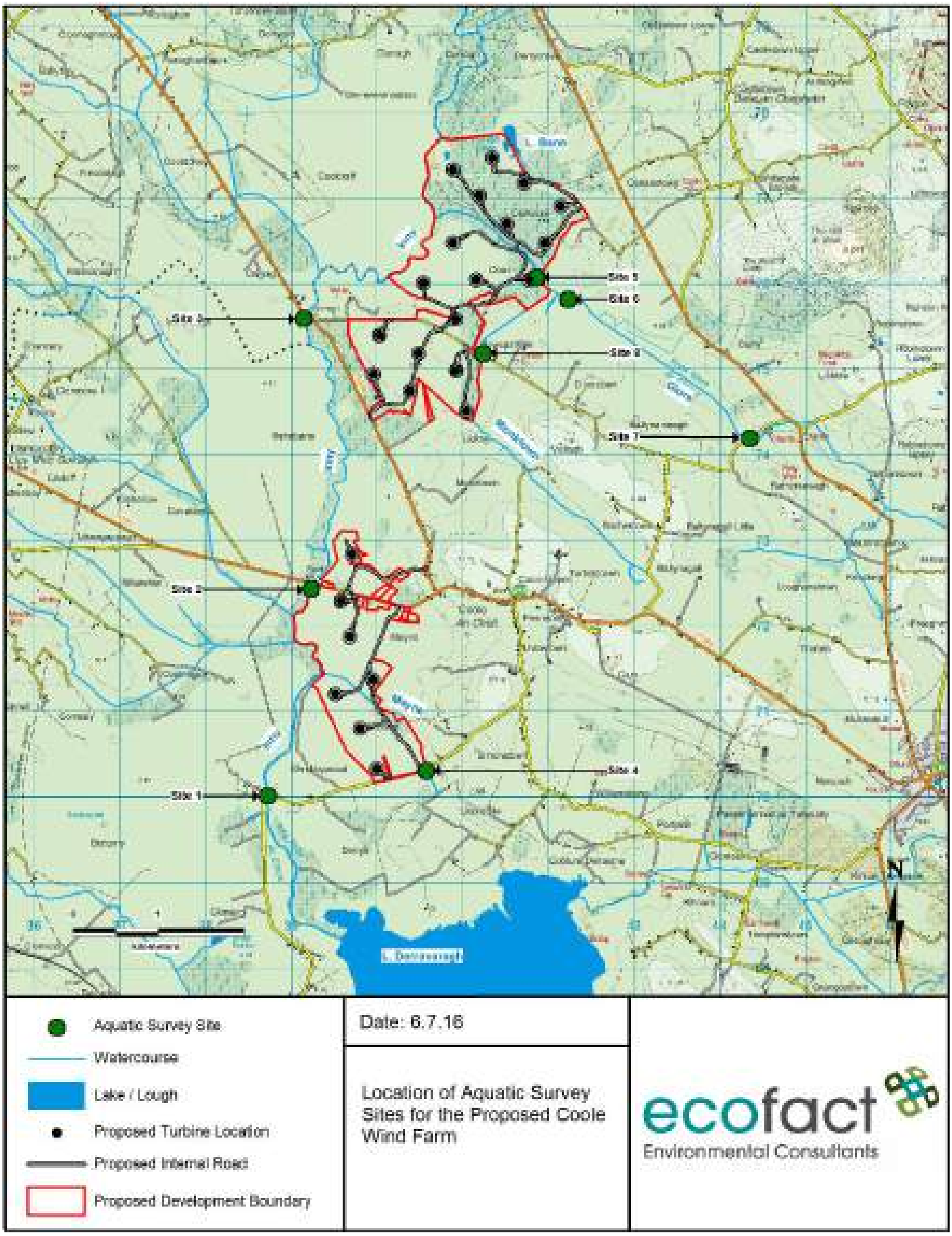

Figure 2 Coole aquatic ecology and fish survey sites.

1.3 Existing Environment

A variety of sites were evaluated with regard to their potential to support protected aquatic species, fish and macroinvertebrates using a combination of visual surveys and instream surveying. Table 3 presents the results of the physical habitat appraisals at survey sites, Table 4 presents the results of the River Corridor Survey appraisals, Table 5 presents the results of the fisheries habitat appraisals and Table 6 presents the biological water quality and WFD status at the survey sites. The results of the aquatic ecology and fisheries survey are also presented on Figure 4.

The study area is described below in section 1.3.1 and 1.3.2 in terms of surface water hydrology, designated sites with aquatic dependant key conservation interests, waterbody types in the study area, protected aquatic flora and fauna, fish communities and fisheries, biological water quality.

1.3.1 Overview of watercourses in the study area

The proposed development is located in Hydrometric Area 26 - the upper Shannon catchment.

Only one sub-catchment, the Inny sub-catchment, is affected by the current proposal. This major tributary of the River Shannon flows from Lough Sheelin to join the Shannon at Lough Ree. The catchment is generally underlain by calcareous limestone and also drains large areas of midlands peat bogs, many of which are still being worked commercially.

The Inny River itself is almost 90km long and drains a catchment area of 782 km^2. It rises near Oldcastle. Co Meath, and drains several important midland lakes, including Lough Sheelin. It has a number of tributaries including the Tang which joins the Inny downstream of Ballymahon, Co. Westmeath; the Rath River, which joins it upstream of Ballymahon; and its largest tributary is the River Glore which feeds the River Inny upstream of Lough Derravaragh.

As with many other Irish river catchments, the Inny catchment was also subjected to a major arterial drainage programme in the 1960s. This scheme resulted in the channelisation of the main channels such as the Inny and Glore, and the lowering of water levels in the lakes in the catchment.

1.3.2 Description of watercourses in the study area

Figures 1-3 show the principal watercourses in the study area. These water features correspond with rivers and streams shown on the EPA map viewer and OSI mapping. The 4^{th} order River Inny is the largest and most important watercourse in the study area. Much of the western boundary of the proposed development site is formed by the River Inny and all components of the proposed development are within the Inny catchment (to the east of the main channel of the Inny). The Inny catchment includes numerous lakes. From upstream to downstream, these include Lough Sheelin, Lough Kinale, Lough Derragh, Lough Derravaragh and Lough Iron. The River Inny discharges into Lough Ree (River Shannon).

The southern extent of the proposed development is drained by the Mayne Stream. The Mayne Stream is a minor 1^{st} order low gradient watercourse. It is a highly modified channel with a bed consisting almost entirely of peat silt. It has a channel length of ca. 2km and flows into the River Inny ca. 3.5km upstream of Lough Derravaragh.

The 3^{rd} order River Glore drains part of the northern extent of the proposed development. The River Glore rises ca. 6km east of Castlepollard in Co. Westmeath and flows northwest over a distance of ca. 12.3km. Lough Glore is a small waterbody of ca. 0.24km^2 that occurs in the upper part of the Glore sub-catchment. It is noted that only the lower reach of the River Glore, a stretch of ca. 1.8km downstream of the Monktown Stream confluence could be affected by the proposed development. The River Glore has been drained and channelised. It has a medium gradient with the exception of the lower reach where gradient is low.

The Monktown Stream is a 2^{nd} order watercourse with a channel length of ca. 4.6km. The Monktown Stream drains a portion of the proposed development. It flows into the River Glore from the south ca. 1.8km upstream of the River Inny - Glore confluence.

The Mayne and Monktown Streams are highly modified waterbodies corresponding to the habitat 'Drainage ditch' (FW4) and/or 'Depositing river' (FW2). These channels have been subjected to severe modifications in part as a result of arterial drainage schemes and some stretches appear to be regularly maintained and entirely artificial. A long stretch of the River Glore has been channelised upstream of the proposed Coole Wind Farm, as evident by deepening and straightening.

Lough Bane and its feeder stream occurs at the northern extent of the proposed development. This waterbody has no efferent stream.

Table 3: Results of the physical habitat appraisals of the aquatic ecology and fisheries survey sites at proposed Coole wind farm site.

Site	Watercourse Name	Wetted width (m)	Mean Depth (cm)	Max Depth (cm)	Instream vegetation (%)	Bank Height (m)	Bank slope (°)	Bank Cover (%)	Canopy Cover (%)	Riffle (%)	Glide (%)	Pool (%)	Flow Velocity (m/s)	Rock (%)	Cobble (%)	Gravel (%)	Fine (%)	Shade (%)
1-3	Inny	28	1	2.5	40	1	75	95	0	0	20	80	0.2	0	0	20	80	10
4	Mayne	1.5	20	25	10	0.7	90	100	70	0	100	0	0.01	0	0	0	100	90
5	Glore	3	20	60	50	3	45	80	10	40	30	30	0.4	0	10	70	20	10
6	Glore	2.5	20	25	90	0.5	80	100	0	10	90	0	0.05	0	0	20	80	0
7	Glore	2.5	35	50	40	0.9	55	100	5	30	40	30	0.1	20	30	25	25	0
8	Monktown	1.5	10	30	15	1	80	80	45	25	25	50	0.2	0	0	0	100	45

1.3.3 Designated sites

1.3.3.1 SACs designated for aquatic organisms

The location of the proposed development in relation to water quality dependent Natura 2000 sites is indicated in Figure 3. The proposed development is located in the surface water catchment of the Inny sub-catchment within the upper Shannon catchment. The only Natura 2000 sites with aquatic interests potentially affected are those within the Inny sub-catchment. There is no Natura 2000 river system in the study area. Lough Derravaragh SPA (4043) is located approximately 1.3km to the south of the proposed development. Lough Derravaragh is connected to the proposed development via the River Inny and its tributaries within and bordering the proposed development.

Lough Derravaragh SPA is located ca. 3.4km and 11.3km downstream of the Mayne Stream and River Glore confluence with the River Inny respectively. The River Inny is the main inflowing and outflowing river. Lough Derravaragh is a medium to large-sized lake of relatively shallow water (maximum depth 23 m). It extends along a SE-NW axis for approximately 8 km. It is a typical limestone lake with water of high hardness and alkaline pH. It is classified as a mesotrophic system. A notable feature is the range of charophytes that occur in the lake. The features of interest of Lough Derravaragh are: Whooper Swan *Cygnus cygnus* [A038], Pochard *Aythya ferina* [A059], Tufted Duck *Aythya fuligula* [A061], Coot *Fulica atra* [A125] as well as Wetland and Waterbirds [A999] (NPWS, 2015).

Enrichment of the lake, mainly by agricultural run-off, is listed as a threat and could affect the bird populations and especially diving ducks.

Lough Iron SPA is another waterbody on the Inny located downstream of the proposed development where the features of interest are dependent on water quality. This site is located ca. 8.2km downstream of Lough Derravaragh, or ca. 13.5km downstream of the proposed development.

Lough Ree SAC (00440) is located over 40km southwest of the proposed development and a considerably longer distance via the surface water pathway i.e. via the River Inny and its lakes. Lough Ree is an excellent example of a natural eutrophic system. The Otter *Lutra lutra* is the only species listed as a conservation interest of this site. There are no designated salmonid waters within 40km downstream of the proposed development.

Table 4: Results of the River Corridor Survey appraisals of survey sites at proposed Coole wind farm site.

Site	River	Tributary	Segment code	EPA code	Order	Wetted width (m)	Drained (Y/N)	Gradient (Low/Med/High)	Siltation (Heavy/Moderate/Normal/Free)	Filamentous algae (Y/N)	Eroding banks (Y/N)	Braided channel (Y/N)
1-3	Inny	-	07_1712	07M03	4	28	Y	L	H	Y	N	N
4	Inny	Mayne	26_2450	26M92	1	1.5	Y	L	H	Y	N	N
5	Inny	Glore	26_2976	26G02	3	3	Y	L	M	Y	Y	N
6	Inny	Glore	26_13411	26G02	3	2.5	Y	M	M	Y	Y	N
7	Inny	Glore	26_3579	26G02	3	2.5	Y	M	N	Y	Y	N
8	Inny	Glore, Monktown	26_2975	26M78	2	1.5	Y	L	H	Y	N	N

Table 5: Results of the aquatic ecological appraisals of survey sites for proposed Coole wind farm site (P=present, L=likely, A=absent).

Site	Watercourse Name	Salmonid nursery (Y/N)	Salmonid fishery (Y/N)	Coarse nursery (Y/N)	Coarse fishery (Y/N)	Salmon (P/A)	Trout (P/A/L)	Coarse fish (P/A)	Eel (P/A/L)	Juvenile lamprey habitat (P/A)	Lamprey (P/A)	Crayfish (P/A)	FPM (P/A)	Floating river vegetation (Y/N)
1-3	Inny	A	A	Y	Y	A	A	A	A	P	A	A	A	A
4	Mayne	A	A	N	A	A	L	L	P	P	P	A	A	A
5	Glore	A	A	Y	A	A	P	A	P	P	L	A	A	A
6	Glore	Y	A	Y	A	A	P	P	P	P	P	A	A	Y
7	Glore	Y	A	Y	A	A	P	P	P	P	P	A	A	A
8	Monktown	A	A	A	A	A	L	L	A	A	A	A	A	A

Table 6: Biological water quality and WFD status at survey sites (<u>H</u>igh / <u>G</u>ood / <u>M</u>oderate / <u>P</u>oor / <u>B</u>ad).

Site	Watercourse Name	Q-value	Biological Status (Macroinvertebrates)	Morphological Status	Fish Status
1-3	Inny	Q4/Q3-4	G/M	P	P/B
4	Mayne	Q3	P	P	B
5	Glore	Q3-4	M	P	P/B
6	Glore	Q3-4	M	M	P/B
7	Glore	Q3-4	M	M/P	P
8	Monktown	Q3	P	P/B	B

1.3.4 Protected aquatic flora and fauna

1.3.4.1 Atlantic salmon

The Atlantic salmon (*Salmo salar*) is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It an economically important species and salmon recreational and commercial fisheries occur throughout Ireland. Atlantic salmon are an anadromous species, meaning they are spawned in freshwater habitats and then migrate to the sea. Salmon habitats are usually fast flowing riffle and glide habitats with cobble or gravel substrates. The gravels at these sites must be clean and well oxygenated for successful hatching. Crisp (2000) notes that salmon spawning site selection is governed by a complex of environmental factors including intra-gravel flow, gravel size, water depth as well as stream velocity and cover, which are all essential for successful spawning, egg survival and hatching. One of the most important factors for salmon egg survival is oxygen supply, which is dependent upon dissolved oxygen concentration and inter-gravel flow. High concentrations of suspended solids in the river are undesirable as they are likely to result in infilling of the gravel pores with fine material (Cowx and Fraser, 2003). Juvenile salmon require fast flowing clean water and the cover of instream rocks, plants and banks to thrive. Adult salmon require pool habitat to rest before in the interval between entering the river and reaching spawning grounds and the act of spawning. Salmon angling areas are usually located on main river channels or small rivers in deep glides of 1.5m depth or more.

The dams on the lower reaches of the River Shannon (Ardnacrusha hydroelectric station, Parteen Weir) represent obstacles for upstream migrating adult salmon. In McGinnity *et al.* (2005), which gives the distribution of salmon in Ireland, the reaches of the River Shannon and its tributaries above the aforementioned barriers, including the River Inny, are indicated as non-self sustaining with regard to salmon. This is because salmon cannot negotiate the dams on the river downstream of Lough Derg. Salmon populations in the River Inny, Brosna and Little Brosna catchments are supported primarily by stocking of juvenile salmon produced in the ESB's Parteen salmon hatchery. The Inny catchment was formerly an important salmon fishery, but currently very few salmon occur. Any salmon populations in this catchment are now the progeny of stocking programmes. Up to the early 1990's naturally spawned salmon did occur on the River Inny and its tributary the Rath River (ESB, 1994). During the most recent Inland Fisheries Ireland survey of the main Inny channel at Shrule Bridge (IFI Code 26I011350) no 0+ (young of the year) salmon were recorded and 1+ and older salmon were recorded at a very low density (0.001/m^2) (Kelly *et al.* 2015).

With the exception of the River Glore, the watercourses in the study area of the proposed Coole Wind Farm are unsuitable / marginal with regard to the requirements of the early life stages of salmon due to the peaty nature of their substrates and low gradient. Parts of the River Glore upstream of the proposed development site are considered suitable for salmon spawning and as salmonid nursery areas.

Atlantic salmon populations in Ireland have been recently assessed as being 'unfavourable - inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

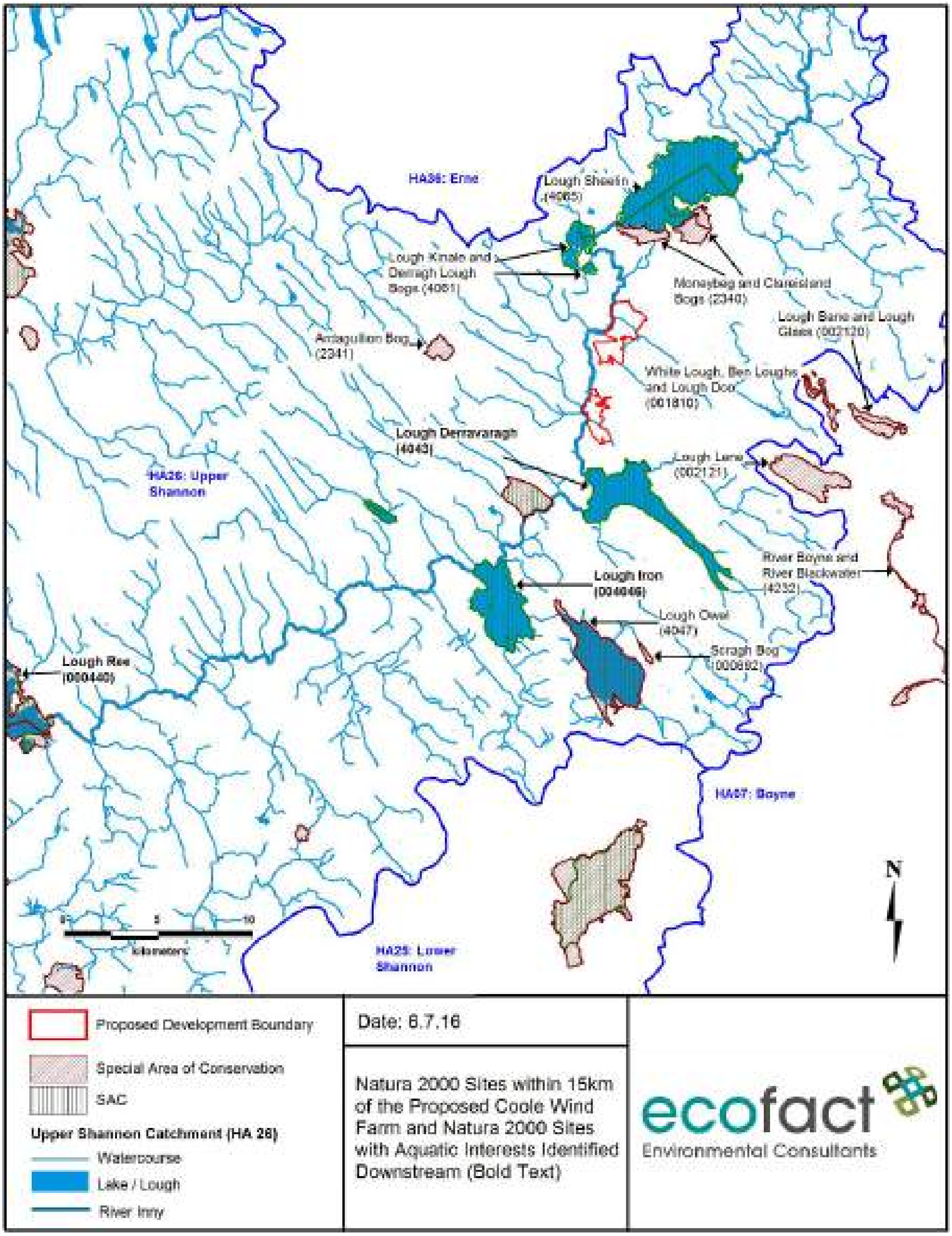

Figure 3 Special Areas of Conservation with aquatic interests within the study area of the proposed Coole Wind Farm.

1.3.4.2 Freshwater Pearl Mussel

The freshwater pearl mussel (*Margaritifera margaritifera* (L.)) is a large bivalve species found in oligotrophic, soft to neutral waters of rivers and, occasionally, in lakes. In Ireland, the species is concentrated along the western sea-board, but also occurs in the south and east where geology allows. The biology and ecology of the species are particularly notable in that individuals can grow to very large sizes relative to other freshwater molluscs, building up thick calcareous valves, in rivers with relatively soft water and low levels of calcium. Their shell building is consequently very slow, and individuals in natural conditions live to over a hundred years of age.

The Freshwater Pearl Mussel does not occur in the study area and there are no previous records from Hydrometric Area 26 (Upper Shannon). The nearest freshwater pearl mussel catchment is the Erne -Annalee catchment located in excess of 20km northeast of the proposed development.

Freshwater Pearl Mussel populations in Ireland have been recently assessed as being 'unfavourable - bad' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.3 White-clawed crayfish

The white-clawed crayfish is the only freshwater crayfish recorded in Ireland. Populations of the species in the rest of Europe have declined dramatically and Ireland is seen as a unique stronghold for this species in a European context (Reynolds 1998).

The white-clawed crayfish is protected under both European and Irish legislation. It is protected by the Wildlife Act, 1976 and has been classified as endangered in the IUCN Red List. It is also listed under Appendix III of the Bern Convention and Annexes II and V of the EU Habitats Directive (1992). The white-clawed crayfish is Ireland's only crayfish species. Ireland is understood to hold some of the best European stocks of this species, under least threat from external factors. Irish stocks are therefore of substantial conservation importance (Reynolds, 1998). Throughout its natural range across Western Europe, the distribution and abundance of white-clawed crayfish has been dramatically reduced in the last 150 years due to human disturbances such as overfishing, habitat destruction, pollution and the introduction of foreign crayfish species (Reynolds, 1998). In Britain, the North American signal crayfish (*Pacifastacus leniusculus*) was introduced for aquaculture and subsequently escaped into the wild, where it has had a devastating effect on white-clawed crayfish populations. While this species has not been recorded in Ireland, there is a real threat that this alien crayfish species will reach this country. The crayfish plague, which was transmitted by introduced crayfish species and is caused by the fungus *Aphanomyces astaci*, has been found in Ireland since the late 1980s.

White-clawed crayfish is widespread in areas which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998). It is generally considered to be widespread in lowland rivers such as the Kells, Blackwater, Boyne, and tributaries. Demers *et al.* (2005) reported that white-clawed crayfish are still widespread in the rivers of the Irish midlands, where the geology is predominantly limestone. However, these authors also report that the distribution of white-clawed crayfish in rivers has been restricted since the mid-1980s. This was attributed in part to an outbreak of the crayfish plague. Demers *et al*. (2005) also reported that crayfish populations in the lakes and rivers of the Boyne catchment were likely to have been affected by crayfish plague. However, this effect is geographically isolated (Gallagher *et al*., 2006). Large unexplained mortalities of crayfish have occurred in waterbodies including Lough Owel (Demers *et al*., 2005). Recent data from the EPA suggests a decline in crayfish populations in the north midlands (Reynolds, 2006).

According to Reynolds (1998), the main threats to the White-clawed Crayfish in Ireland are stream drainage, pollution and the introduction of predators, competitors or diseases. Ongoing drainage maintenance on arterially drained rivers in Ireland has also been identified as having a significant adverse effect of this species (O'Connor & McDonnell, 2008).

White-clawed crayfish were recorded in the study area during (Ecofact, 2013) when it was concluded that this species occurs in the River Glore in low densities. This species was not recorded in the River Glore adjacent to the proposed development site during hand searching carried out in 2016. White-clawed Crayfish is considered likely to occur in the River Inny.

White-clawed crayfish populations in Ireland have been recently assessed as being 'inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.4 Brook lamprey

The brook lamprey is the smallest of the three lampreys native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992). Brook lamprey is listed in Annex II of the EU Habitats Directive (92:43: EEC) and in Appendix III of the Bern Convention. Brook lampreys are the most common and widespread of the three Irish lamprey species (Kurtz & Costello, 1999). Brook Lampreys live for up to five years burrowed into silt deposits in rivers. They metamorphose into adults and spawn in the early spring in fast flowing streams with gravel substrates. Unlike the other two Irish lamprey species they are not parasitic as adults, and undertake only localised migrations.

Although still common in Ireland they are under significant threat from drainage and navigation maintenance works and also from water quality deterioration. Brook lampreys are also doing less well across the rest of the European Union. In this regard Irish populations of Brook Lampreys are of International Importance in Ireland. Ireland has failed to protect lampreys with a close season for instream works during their spawning season so they are vulnerable due to the lack of this type of protection. Responsibility for protecting lampreys in Ireland falls within the remit of Inland Fisheries Ireland; although there are none and never have been any fisheries for this species in Ireland.

Brook Lamprey occurs in the River Inny and River Glore as well as in the Mayne Stream as observed in 2013 (Ecofact, 2013). Based on recent visual observations, habitat for juvenile lampreys in these watercourses is considered to support the species in these watercourses. The general lack of suitable spawning areas in the subject watercourses is considered a limiting factor with regard to Brook Lamprey populations in the study area.

Brook lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.5 River and Sea Lamprey

The River Lamprey *Lampetra fluviatilis* and Sea Lamprey *Petromyzon marinus* are larger in size than the brook lamprey and exhibit an anadromous life cycle. Both species are listed in Annex II and IV of the Habitats Directive (92:43: EEC), and also in Appendix III of the Bern Convention. Lampreys are poor swimmers and cannot jump or climb (Reinhardt *et al.*, 2009), so are considered limited to the lower reaches of the River Shannon - well downstream of the study area of the currently proposed wind energy development.

River lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013). However, this has been based on the fact that they have been grouped together with Brook lamprey populations due to identification difficulties. Sea Lamprey populations in Ireland have been recently assessed as being 'unfavourable' by NPWS in the 2013 Article 17 Conservation Status Assessments.

1.3.4.6 Floating river vegetation

The plants characteristic of this habitat includes a number of *Ranunculus* species and all *Callitriche* species, including other submerged aquatic plants. The community Callitricho–Batrachion includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species. There are few published records for descriptions of this habitat in Ireland and no comprehensive island-wide descriptions.

According to NPWS (2013) the EU definition of this habitat is very broad, especially when the presence of aquatic mosses is taken into account. Using this broad definition, the habitat will be found in most watercourses in Ireland. There is to date no satisfactory definition of the habitat and its sub-types or their distribution in Ireland. Consequently, there is a lack of relevant monitoring data concerning the habitat. What is clear is that the habitat can occur over a wide range of physical conditions, from acid, oligotrophic, flashy upland streams dominated by bryophytes to more eutrophic, slow flowing streams dominated by *Ranunculus* and *Callitriche* species. While the former will be sensitive to diffuse pollution the latter, especially in shallow streams, will be relatively more resistant.

Flora associated with the Annex I habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' (3260) includes *Ranunculus saniculifolius, Ranunculus trichophyllus, Ranunculus fluitans, Ranunculus penicillatus ssp. penicillatus, Ranunculus penicillatus* ssp. *Pseudofluitantis, Ranunculus aquatilis, Myriophyllum* spp., *Callitriche* spp., *Sium erectum* (or *Berula erecta*), *Zannichellia palustris, Potamogeton* spp., and the moss *Fontinalis antipyretica*. *Groenlandia densa* (Opposite leaved pondweed) is also included in the list.

The plant communities in the watercourses within the proposed development mainly comprises of low diversity emergent vegetation which limits instream growth during the growing season owing to its luxuriant growth, driven by eutrophication. No plants characteristic of the habitat floating river vegetation were recorded during the current study. Channel maintenance, siltation and competition from higher plants reduces the chances of such plants establishing in these watercourses.

The habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' in Ireland has been recently assessed as being 'inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.5 Fish communities

Two sites on the River Inny were surveyed by Inland Fisheries Ireland (IFI) as part of Water Framework Directive (WFD) fish surveillance monitoring in 2014 (Kelley *et al.*, 2015). One site was located on the upper reach of the river at Oldcastle (upstream of Lough Sheelin) and the other was located at Shrule Bridge near Ballymahon on a lower reach of the river.

The Oldcastle survey site was located close to its source, on the downstream side of Tubride Bridge, just south of Oldcastle, Co. Meath. Three electric-fishing passes were conducted using one bank-based electric fishing unit on the 9th of September 2014, along a 40m length of channel. Glide and riffle dominated the habitat, over a mixed substrate largely composed of cobble, gravel and boulder. Brown trout density fluctuated over the three sampling occasions; the 0+ age class was dominant in 2008 and 2011, while 1+ & older fish dominated in 2014. Juvenile lamprey and Three-spined Stickleback *Gasterosteus aculeatus* were also present at the site. Table 7 and Table 8 gives the results of the IFI investigations at Oldcastle and Shrule Bridge respectively.

Table 7: Density of fish (no./m^2), River Inny (Bridge 1 km S of Oldcastle). From Kelly *et al.,* (2015).

Species	Total minimum density		
	2008	2011	2014
Brown Trout	0.492	0.346	0.468
0+ Brown Trout	0.331	0.208	0.190
1+ & older Brown Trout	0.161	0.138	0.278
Lamprey sp.	-	0.023	-
3-spined Stickleback	0.018	0.154	0.008
All fish	0.510	0.523	0.476

The Shrule Bridge survey site was located downstream of Shrule Br., about 3km upstream of Ballymahon, Co. Longford. One electric-fishing pass was conducted using four boat-based electric fishing units (two boats electric fished parallel to each bank separately) on the 8th of September 2014, along a 380m length of channel. Glide dominated the habitat, over a mixed substrate of sand, cobble and gravel. Minnow and perch were the two most abundant species encountered. Perch density was higher in 2014 than in 2008, with a wide range of length classes present. Brown trout were also recorded across a wide range of length classes but their density was lower in 2014. Roach x bream hybrids and chub were absent from the latest survey.

This site was located at Boyne Bridge, close to the river’s source, approximately 1.5km north of Edenderry. Three fish species were recorded in the River Boyne at Boyne Bridge: Brown Trout (0.0089/m^2), Three-spined Stickleback (0.004/m^2) and Stone Loach (0.002/m^2). It is noted that the stretch of the River Boyne surveyed during 2014 (Kelley *et al.*, 2015) was drained, corresponding to channel characteristics of some watercourses in the current survey area. The growth category of Brown Trout at this site was rated 'Moderate' based on a new classification scheme developed using length at age data (Matson and Kelly, in prep). With respect to fish, the ecological status of the sites at Oldcaslte and Shrule Bridge were rated 'Good and Moderate' based on the results obtained by IFI, in that order.

The drained nature of all watercourses within and adjoining the proposed Coole Wind Farm site has significantly reduced the ecological and fisheries value of these watercourses, with deepening and channelisation leading to reduced cover for young fish, excessive instream vegetation growth and deposition of fine material.

A number of watercourses in the study area were investigated during 2013 by Ecofact (Ecofact, 2013). At this time, the Glore River was surveyed at two locations upstream of the proposed development site, the River Inny was surveyed at two locations within the study area (Float Bridge and Camagh Bridge) while the upper reach of the Mayne Stream was surveyed. These locations and the fish species recorded are illustrated in Figure 4 and listed in Table 9.

Fish species recorded at both locations were Brown Trout and Brook Lamprey, with European Eel *Anguilla anguilla* and Salmon *S. salar* also recorded at the upstream location. During the 2016 study, Three-spined Stickleback *Gasterosteus aculeatus* were recorded in all watercourses with the exception of the Rossmeen Stream and the Drakerath Stream. Stone Loach *Barbatula barbatula* were also recorded during the 2016 survey (Site 1, 2, 7, 16).

The Inny River is evaluated as being of county importance with regard to its fisheries value and presence of European eel. It is noted that European eel is listed as 'Critically endangered' and is now 'Red Listed' according to the recently published '*Red List No. 5: Amphibians, Reptiles & Freshwater Fish*' (King *et al*., 2011). The River Glore is evaluated as being of local importance (higher value) due to the presence of salmonid spawning and nursery areas.

The minor watercourses within the study area (Mayne and Monktown Streams) are first and second order channels found to be modified and generally evaluated as being of poor ecological and hydrogeomorphological status; these are evaluated as being of local importance (lower - value).

Table 8: Density of fish (no./m²), River Inny (Shrule Bridge). From Kelly *et al.*, (2015).

Species	Total minimum density	
	2008	2014
Brown Trout	0.014	0.006
0+ Brown Trout	0.009	0.001
1+ & older brown trout	0.006	0.005
Chub	0.0001	-
European Eel	0.001	-
Gudgeon	0.007	0.003
Minnow	0.011	0.007
Perch	0.002	0.007
Pike	0.001	0.001
Roach	0.004	0.004
Roach x bream hybrid	0.0001	-
Salmon	-	0.001
+ salmon	-	-
1+ & older salmon	-	0.001
Stone loach	0.001	0.0004
All Fish	0.041	0.029

Table 9: Fish and notable macroinvertebrate species recorded during surveys carried out on watercourses draining the proposed Coole Wind Farm. Based on electrical fishing assessments from Ecofact (2013) and snorkeling surveys (2016).

Species		**Watercourse**			
		River Inny	**River Glore**	**Monktown Stream**	**Mayne Stream**
Fish	Brown trout	✓	✓	✓	✓
	European eel	✓	✓		✓
	Brook lamprey	✓	✓		✓
	Pike	✓	✓		
	Perch	✓			
	Roach	✓			
Macro-invertebrate	*Anodonta* sp.	✓			
	Zebra Mussel	✓			
	White-clawed Crayfish	✓	✓		

1.3.5.1 Salmonid habitats and fisheries

Atlantic salmon are discussed in detail in Section 1.3.4.1. As well as salmon, brown trout also occur in the study area. Brown trout occur in virtually every catchment in Ireland with suitable water quality and spawning grounds, and are one of the most common and recognisable fish species in Ireland. Indeed, they have less protection in Ireland from anglers than non-native invasive cyprinid fish species such as the dace and roach, presumably due to their abundance.

Brown trout occur as resident 'brown trout' and also as an anadromous form, the 'sea trout'. In many catchments throughout Ireland trout make extensive migrations between spawning grounds in streams and feeding grounds in lakes or larger rivers.

The Inny catchment and its major tributaries were severely affected by drainage which degraded habitats for species such as trout. In many cases trout populations were more affected than salmon, with the removal of features such as undercut banks and large woody debris etc. from these channels. Ongoing peat harvesting in the study area is considered a persistent impact on salmonid habitats due to accumulations of peat silt in watercourse beds and thereby reducing available spawning areas and habitats for the macroinvertebrates upon which juvenile salmoids feed.

The River Inny is still considered an important trout fishery, especially the lower reaches of the river and the lakes it flows through, e.g. Lough Sheelin is still noted for the quality and size of brown trout that it produces. As for salmon, the habitats for Brown trout in the study area are limited by lack of suitable habitat (low gradient), water quality problems and drainage maintenance.

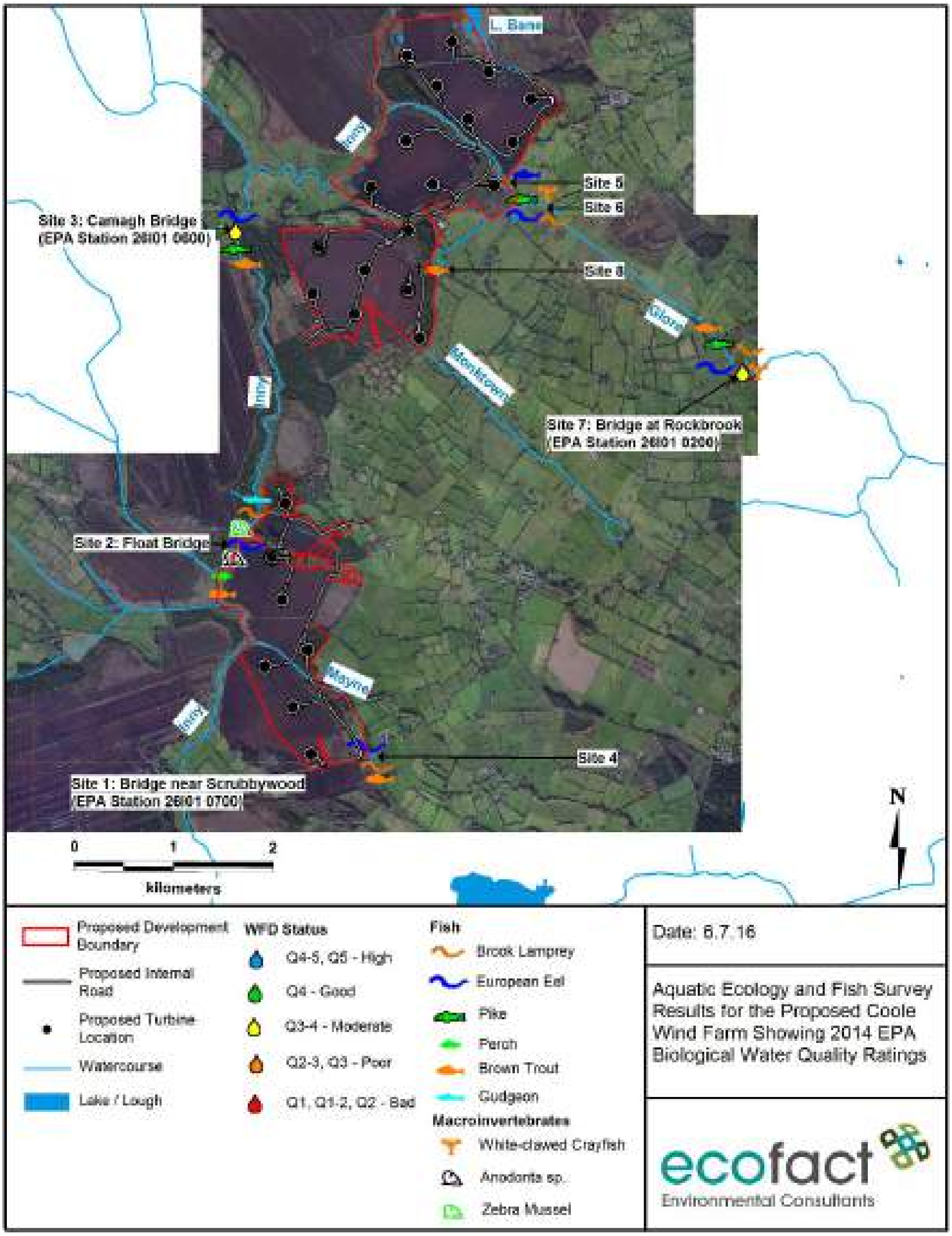

Figure 4 Coole Wind Farm aquatic ecology and fisheries survey results.

1.3.5.2 Coarse fish habitats and fisheries

Coarse fish are essentially any freshwater fish other than salmon and trout and generally include members of the cyprinidae family (i.e. roach, dace, rudd, bream, and tench), pike and perch. The term coarse fishing originated in the United Kingdom in the early 19th century. Prior to that time, recreational fishing was a sport of the gentry, who fished for salmon and trout which they called game fish. Other fish were disdained as coarse fish.

Almost all coarse fish in Ireland are considered to be non-native species. However, there is recent evidence that pike may be native to Ireland (Pedreschi *et al.*, 2013). Coarse fish in Ireland are afforded a higher level of protection in Ireland than native brown trout, with strict limits on the number and sizes of these fish that can be killed by anglers.

Coarse fisheries are of significant economic value in Ireland, particularly for tourist angers. Coarse fisheries and coarse fish spawning areas are generally located in large lowland rivers and lakes. The main channel of Inny is important in this regard. From upstream of Lough Derravaragh to Lough Ree, IFI note that the river varies in depth from approximately 1.5 metres to over 3 metres in normal water levels. The best fishing stretches are at Coolnagun, Inny Bridge and Ballycorkey Bridge. Lough Iron is fringed with dense weed beds and holds large Pike. Angling access is provided at the bridges and in most cases extensive bank fishing is available upstream and downstream from the bridges. There is a large stock of Pike in many locations throughout the length of the River with numerous hot spots.

Lough Derraravagh is regarded as a mixed fishery - it supports brown trout population but is better known for its very good pike fishing.

1.3.5.3 Eel habitats

The European eel *Anguilla anguilla* is a native fish of significant ecological importance. In recent decades, this species has undergone a dramatic decline throughout its range. In response to the decline in European eel populations European Council Regulation 1100/2007 "Establishing measures for the recovery of the stock of European eel" has now been adopted in member states. European eel is listed as 'Critically endangered' and is now 'Red Listed' according to the recently published 'Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King *et al*., 2011).

Eels are considered present throughout the study area, but are generally only found in larger watercourses, rivers and lakes. Eels have a catadromous life cycle, which means they spawn in the sea and migrate into freshwater to feed and grow. This is opposite of the life cycle of the salmon, for example. The upstream migration of eels in rivers is restricted by weirs and their obstacles. However unlike lampreys they are able to climb over weirs. Despite the international decline in this species, they occur in the Inny and Glore Rivers in the study area.

1.3.5.4 Lamprey habitats

Lampreys are discussed above in Sections 1.3.4.4, 1.3.4.5, and 1.3.4.6. The study area is considered to support only Brook lamprey. This species is generally common throughout Ireland.

1.3.5.5 Others

The majority of the watercourses within the proposed wind farm site are small fish populations dominated by species such as the Three-spined stickleback and Gudgeon. These small fish communities are not of significant ecological or economic importance. These small fish populations, and particularly ones dominated by sticklebacks, can be present in even small drains that have permanent water.

1.3.6 Aquatic macroinvertebrates

The River Inny and the River Glore are evaluated as being of local value (higher importance) with regard to macroinvertebrates, due to the presence of *Anodonta* sp. and White-clawed Crayfish, respectively.

Based on the physical characteristics of the watercourses in the study area, the habitat suitability for macroinvertebrates is by and large suboptimal in the case of the Inny and Glore Rivers and marginal with respect to the Monktown and Mayne Streams. All watercourses within / adjacent to the proposed development site score low on the range of physical attributes that contribute to favourable conditions for macroinvertebrate diversity and abundance, including bottom substrate (substrates dominated by silt), habitat complexity (monotonous habitat with little diversity), pool quality (pools small/shallow and/or absent), bank stability (banks unstable and contributing sediment to the stream/denuded areas eroded during high floods) and shading.

Biological/kick sampling carried out on watercourses in the study area and the results are discussed hereunder. The mayflies *Baetis* spp., *Ephemerella ignita*, and *Caenis* spp. were found to be generally common. The Trichopterans were a well represented group with cased caddisfly larvae of. and *Agapetus* spp. inhabiting faster flowing areas with stony substrates in the River Glore. Case building families (classified as Group B, less tolerant) such as Limnephilidae, Lepidostomatidae, and Sericostomatidae along with *Phryganea bipunctata* were mostly confined to the slower parts of rivers in the study area (River Inny). Caseless caddisfly larvae (Group C, pollution tolerant) of *Hydropsyche* spp., *Rhyacophila* spp., and *Polycentropus* spp. were also found in the study area.

The most common Coleopterans in the study area were *Haliplus* spp., whirligig beetle *Gyrinus* sp., *Ilybius quadriguttatus* and *Brychius elevatus*. Hemipterans such as water boatman (*Notonecta* sp., *Sigara* sp.), bugs *(Hydrometra stagnorum*, *Velia caprai, Nepa cinerea, Notonecta* sp. *Gerris sp.*) were found in slow areas, particularly at the margins of the River Inny. Other slow-flowing fauna in the study area included dragonflies such as *Aeshna* spp. and damselfly larvae of *Calopteryx* spp.

The macroinvertebrates communities in the study area were dominated by pollution tolerant taxa. Other macroinvertebrates signifying polluted conditions that were recorded included Bloodworm *Chironomous sp*., Freshwater shrimp *Gammarus duebeni, Asellus aquaticus* and *Erpobdella testacea.*

The only large bivalve recorded was *Anodonta* sp*.* This species was recorded in the River Inny at Float Bridge. *A. anatina* is typically a lowland species (Kerney, 1999). Its habitat in Ireland is lowland lake, slow moving rivers and canals. Microhabitat for this species in Ireland comprises muddy or silty beds in areas of still or slow flow. There are a total of 31 Irish non-marine molluscan species that either have a threat status or are important Irish populations (Moorkens, 2006), including *Anodonta*. The IUCN status of *Anodonta* is 'Vulnerable' (Byrne *et al*., 2009) and its threat status is 'Vulnerable' (Moorkens, 2006).

1.3.7 Biological water quality

The River Inny (28I01) and its tributaries were most recently surveyed by the EPA in 2014. Good ecological condition was found at four out of eleven sites surveyed on the Inny in 2014. Sites in the upper reaches (0060-0600) are not reaching their ecological potential, with sensitive macroinvertebrate taxa noticeably absent. Ballinrink Bridge (0300) returned to unsatisfactory condition after an improvement in 2011. The lower reaches exhibited high macroinvertebrate diversity and were of satisfactory ecological condition in 2014 with the exception of site 0800 which had deteriorated to moderate ecological condition.

The Glore (Westmeath) was once again found to be slightly polluted/eutrophic below Glore lake (0100), as characterised by a paucity of sensitive macroinvertebrate fauna. The lower reaches (0200) were in moderate condition in 2014 after previously returning to highly satisfactory ecological condition in 2011.

1.3.8 Aquatic plant communities

Plants recorded during the current surveys consisted of *Sparganium erectum*, *Apium nodiflorum*, *Rorippa nasturtium-aquaticum*, *Glyceria maxima*, *Phragmites australis, Phalaris arundinacea, Mentha aquatica*, *Myosotis scorpioides, Iris pseudacorus, Schloenoplectus lacustris, Nuphar lutea, Callitriche* spp., *Lemna* spp. and *Potamegeton* sp. The filamentous green algae *Cladophora glomerata* was common in the enriched lower reaches of the Glore River and also in the River Inny.

1.3.9 Amphibians

The Mayne and Monktown Streams as well as Lough Bane and its feeder stream may support a small population of frog and/or newt.

Aquatic baseline report for Coole wind farm, Co. Westmeath

Prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan

October 2022

Please cite as:

Triturus (2022). Aquatic baseline report for Coole wind farm, Co. Westmeath. Report prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan. October 2022.

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by McCarthy Keville O'Sullivan Ltd. to prepare a baseline assessment of the aquatic ecology in the vicinity of Coole wind farm, located in the lands between Carnagh, Coolcraff, Derragh, Monktown, Clonsura, Doon, Derrycrave, Newcastle, Mullagh, Carlanstown, Clonrobert, Co. Westmeath. The report includes an assessment of fisheries, biological water quality, protected aquatic species and habitats.

The surveys were undertaken to inform a Further Information request issued by An Bord Pleanála dated the 21st April 2022 (ABP ref: 309110-21) and is in respect of the submission made by the Development Applications Unit (DAU), presented in the FI request as item 2.5. In their FI request, the Board (referencing the DAU submission on the application) have requested that the Aquatic Surveys for the site be updated. In this respect the previous aquatic surveys that were completed by Ecofact (2016) inclusive of all previously surveyed sites were repeated and updated.

Surveys focused on aquatic habitats in relation to fisheries potential (including all fish of high conservation value), white-clawed crayfish (*Austropotamobious pallipes*), macro-invertebrates, macrophytes, aquatic bryophytes and aquatic invasive species which may be present in the watercourses in the vicinity of the proposed project.

1.2 Project description

A full description of the proposed project is provided in the accompanying Environmental Impact Assessment Report (EIAR). The proposed Coole wind farm project comprises the following elements:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the
viii. townland of Irishtown;
ix. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
x. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
xi. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on lands along the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;

xii. Site drainage;
xiii. Forestry felling;
xiv. Signage, and;
xv. All associated site development works.

2. Methodology

2.1 Selection of watercourses for assessment

The current survey was undertaken at the same 8 no. survey sites as per Ecofact (2016) (**Table 2.1, Figure 2.1**). Furthermore, to reflect the addition of a proposed grid connection route (GCR) to the project design, an additional 6 no. sites were included in the current survey (i.e. watercourse crossings). This resulted in a total of *n*=14 aquatic survey sites. The nomenclature for the watercourses surveyed is per the Environmental Protection Agency (EPA).

Aquatic survey sites were present on the River Inny (EPA code: 26I01), Mayne Stream (26M92), Glore River (26G02), Monktown River (26M78), Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (**Table 2.1**). The *n*=14 aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments. The proposed wind farm and associated infrastructure were not located within a European site.

Please note this aquatic report should be read in conjunction with the final EIAR prepared for the proposed project by McCarthy Keville O'Sullivan.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on Thursday 18th and Friday 19th August 2022. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 2.1 & Figure 2.1**). Surveys at each of these sites included a fisheries habitat appraisal, electro-fishing survey (where possible), white-clawed crayfish survey, macrophyte & aquatic bryophyte survey and biological water quality sampling (Q-sampling) or macro-invertebrate sweep sampling. The survey approach ensured that any habitats and species of high conservation value would be detected to best inform mitigation for the wind farm project.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of *n*=14 aquatic survey sites in the vicinity of Coole wind farm, Co. Westmeath

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	River Inny	26I01	Coolnagun Bridge	638678	770052
2	River Inny	26I01	Float Bridge	639188	772506
3	River Inny	26I01	Carnagh Bridge	639122	775632
4	Mayne Stream	26M92	Ballin	640517	770359
5	Glore River	26G02	Doon	641798	776069
6	Glore River	26G02	Newcastle	642220	775848
7	Glore River	26G02	Bridge at Rockbrook	644300	774205
8	Monktown River	26M78	Newcastle	641180	775185
B1	Unnamed stream	n/a	GCR crossing, Clonava	638616	769821
B2	Drainage channel	n/a	GCR crossing, Clonava	638615	769557
B3	River Inny	21I01	Inny Bridge	638805	766735
B4	Froghanstown Stream	26F41	GCR crossing, L1819	640562	763362
B5	Ballynafid Stream	26B36	GCR crossing, N4	641296	760577
B6	Brosna North River	26B28	GCR crossing, L1773	642540	756035

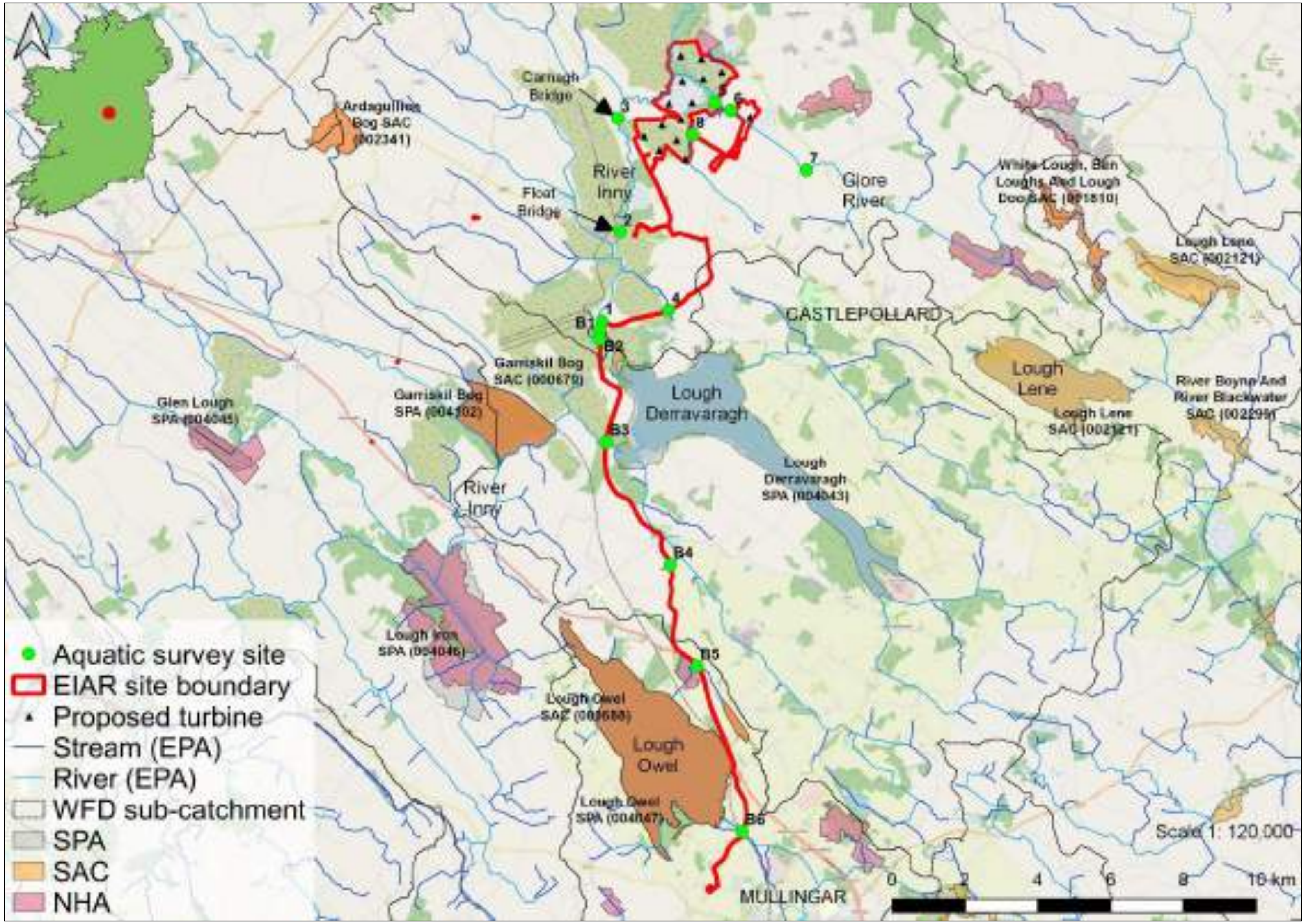

Figure 2.1 Overview of the *n*=14 aquatic survey site locations for Coole wind farm, Co. Westmeath

2.3 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Coole wind farm in August 2022, following notification to Inland Fisheries Ireland and the National Parks and Wildlife Service, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Electro-fishing was undertaken at all aquatic survey sites with the exception of sites 1, 2 and 3 on the River Inny and site 5 on the Glore River due to prohibitive depths of >1.5m. Therefore, a total of *n*=10 sites were surveyed via electro-fishing (**Table 2.1, Figure 2.1**). The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the aquatic survey sites (**Figure 2.1**) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites.

2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in August 2022 under a National Parks and Wildlife (NPWS) open licence (no. C31/2022), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Coole wind farm survey area was completed.

2.5 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs, if encountered incidentally during surveys. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, molluscs etc.).

2.6 Biological water quality (Q-sampling)

The 14 no. aquatic survey sites were assessed for biological water quality through Q-sampling in August 2022 (**Figure 2.1).** All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.4 Reference categories for EPA Q-ratings (Q1 to Q5)

Q Value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.7 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.8 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) given the known distribution of white-clawed crayfish (*Austropotamobius pallipes*) in the wider survey area. Equipment was also thoroughly dried (through UV exposure) between survey areas by using duplicate equipment. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

3. Receiving environment

3.1 Coole wind farm catchment and survey area description

The proposed Coole wind farm is located in an area of cutover blanket bog approximately 8km north-west of Castlepollard, Co. Westmeath (**Figure 2.1**), whilst the proposed grid connection route (GCR) runs from the site along the R396, a number of local roads and the N4 to the Mullingar 110kV substation. The proposed wind farm site is within the Shannon River Basin District and within hydrometric area 26 (Inny). The aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments (**Figure 2.1**). The proposed wind farm site is drained by the River Inny (26I01), Monktown River (26M78) and Glore River (26G02), with the proposed GCR crossing the River Inny, Mayne Stream (26M92) Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (**Figure 2.1**).

The watercourses and aquatic surveys sites in the vicinity of Coole wind farm are typically small, lowland depositing channels (FW2; Fossitt, 2000) which have been historically modified as part of drainage works (see **section 4** for more details). The Inny catchment, including the Inny and Glore rivers, was arterially drained in the 1960-68 period (OPW data). Predominantly, the watercourses flow over areas of Visean limestone & calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area are peat bogs (CORINE 412), transitional woodland scrub (CORINE 324), land principally occupied by agriculture with significant areas of natural vegetation (CORINE 243), coniferous forests (CORINE 312) and pastures (CORINE 231).

3.2 Fisheries asset of the survey area

The River Inny flows for some 90km from Oldcastle, Co. Meath, through Loughs Sheelin, Kinale, Derragh, Derravaragh and Ree, draining an area of 782km^2 (Caffrey et al., 2018). The upper reaches are known to support brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.) and three-spined stickleback (*Gasterosteus aculeatus*) (Kelly et al., 2012, 2015). The lower reaches, which are deeper, wider and more depositing habitat (having been arterially drained) support a community dominated by coarse fish species including bream (*Abramis brama*), roach (*Rutilus rutilus*), roach x bream hybrid, perch (*Perca fluviatilis*), gudgeon (*Gobio gobio*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and European eel (*Anguilla anguilla*), in addition to brown trout (Delanty et al., 2016; Kelly et al., 2010). Atlantic salmon (*Salmo salar*) are also known occasionally from the Inny (Kelly et al., 2015; Maguire et al., 2011). Lamprey (*Lampetra* sp.) are known to be present from the River Inny at Coolnagun Bridge (survey site 1) according to Inland Fisheries Ireland (OES, 2020). Chub (*Squalius cephalus*), a non-native cyprinid, are also known from the River Inny (Caffrey et al., 2008, 2018: Maguire et al., 2011; IFI, 2020).

The Glore River rises 6km east of Castlepollard. Co. Westmeath and flows north-west for a distance of approx. 12km before joining the River Inny along the proposed wind farm site boundary. The Glore is known to support brown trout, *Lampetra* sp., European eel and pike (Ecofact, 2016).

The Mayne Stream, a short tributary of the River Inny, is known to support brown trout (Ecofact, 2016). The Monktown River, a tributary of the Glore River, is known to support brown trout, European eel and *Lampetra* sp. (Ecofact, 2016)

Fisheries data for the other watercourses within the survey area (i.e. Froghanstown Stream, Ballynafid Stream, Brosna North River and unnamed stream) was not available at the time of survey.

3.3 Protected aquatic species

A comprehensive desktop review of available data (NPWS, NBDC & BSBI data) for 10km grid squares adjoining the project (i.e. N36, N37, N45, N46 and N47) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed wind farm.

A low number of records for Annex II white-clawed crayfish (*Austropotamobius pallipes*) were available for the Glore River, ≥2km upstream of the proposed wind farm (**Figure 3.1**). These records were from the 1977-2011 period. Crayfish were also recorded from the Glore River at survey site 7 in 2013 (Ecofact, 2016). A low number of records were also available for the Gaine River, Lough Sheever Stream, Brosna North River and River Brosna in the vicinity of Mullingar (Figure 3.1). Available records on the River Inny were confined to upstream of the proposed wind farm (i.e. near Loughs Sheelin and Kinale). Whilst not hydrologically linked to the proposed wind farm project, Lough Owel is known to support a very large population of white-clawed crayfish (Gammell et al., 2021; pers. obs.).

A low number of Annex II otter (*Lutra lutra*) records were available in the vicinity of the proposed wind farm on the River Inny and River Glore, with scattered records from the respective 10km grid squares (NPWS & NBDC data).

A single brook lamprey (*Lampetra planeri*) record was available for the Lough Owel outflow (aka. canal feeder or Brosna North River) (NPWS data, no date), approximately 0.7km upstream of survey site B6 (**Figure 3.1**). Brook lamprey were also recorded on the River Inny (survey site 2), Mayne Stream (site 4) and River Glore (sites 6 & 7) in 2013 (Ecofact, 2016).

Common frog (*Rana temporaria*) records were widespread in the wider N36, N37, N45, N46 and N47 10km grid squares, including in the vicinity of Rathangan (not within study area, however). A single historical record for smooth newt (*Lissotriton vulgaris*) was available in the vicinity of Crokedwood.

3.4 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed wind farm project. Only recent water quality is summarised below. There was no existing EPA biological monitoring data available for the Mayne Stream, Monktown River, Froghanstown Stream or Ballynafid Stream.

Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 4** and **Appendix A** of this report.

3.4.1 River Inny

A number of contemporary EPA biological monitoring stations were located on the River Inny in the vicinity of the survey area. The River Inny achieved **Q3-4 (moderate status)** at Carnagh Bridge (station RS26I010600, survey site 3) in 2020. Downstream, the river achieved **Q3 (poor status)** at Inny Bridge (station RS26I010700, survey site 1). At Ballinalack Bridge (station RS26I010800), approx. 6.8km downstream of survey site B3, the Inny achieved **Q3-4 (moderate status)** in 2020.

Upstream of and adjoining the proposed wind farm boundary, the River Inny (Inny_050 river waterbody) achieved moderate status in the 2013-2018 period and was considered ‘at risk’ of not achieving target good status water quality. Between Carnagh Bridge and Coolnagun Bridge, the Inny_060 river waterbody achieved good status in the same period and was considered ‘not at risk’ of achieving good status water quality. Downstream of Coolnagun Brudge, the Inny_070 river waterbody (as far as Ballinalack Bridge) was also of good status in the 2013-2018 period, but the river waterbodies risk was under review at the time of reporting. The primary risk to water quality within these river water bodies is peat extraction (EPA, 2019).

3.4.2 Glore River

The Glore River achieved Q4 (good status) at survey site 7 (station RS26G020200) in 2020. This monitoring station is located c.2km upstream of the wind farm boundary. The Glore receives large volumes of spring flow derived from Lough Lene and White Lough in the Boyne catchment and is a good example of a karst inter-catchment water transfer (EPA, 2018).

Upstream of and within the proposed wind farm boundary, the Glore River (Inny_050 river waterbody) achieved moderate status in the 2013-2018 period and was considered ‘at risk’ of not achieving target good status water quality. This is due to hydromorphological issues (channelisation) caused by peat harvesting (EPA, 2019).

3.4.3 Brosna North River (Royal Canal feeder)

There is a single contemporary EPA biological water quality monitoring station on the Brosna North River. The stream achieved **Q2-3 (poor status)** at station RS25B280390 in 2021, approx. 1.4km downstream of survey site B6.

The Brosna North River is located within the Brosna_010 river waterbody, which achieved ‘poor status’ in the 2013-2018 period and was considered ‘at risk’ of not achieving target good status water quality.

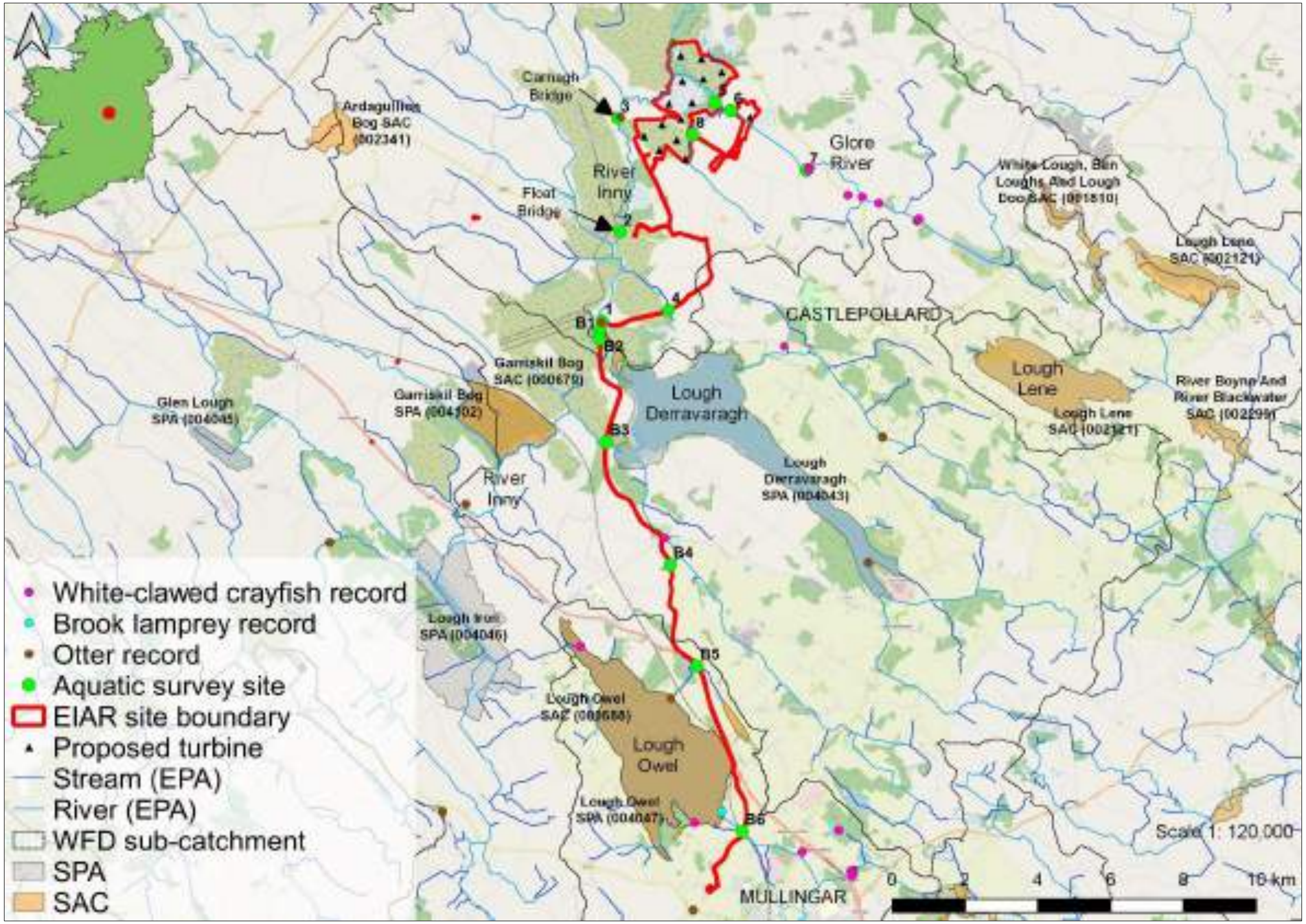

Figure 3.1 Distribution of white-clawed crayfish, otter and brook lamprey in the vicinity of the proposed Coole wind farm (source: NPWS & NBDC data)

4. Results of aquatic surveys

The following section summarises each of the *n*=14 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, white-clawed crayfish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are also summarised for each sampling site (*n*=7) and in **Appendix A**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in August 2022. Site numbering for sites 1-8 is as per Ecofact (2016). An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.1**.

4.1 Aquatic survey site results

4.1.1 Site 1 – River Inny, Coolnagun Bridge

Site 1 was located on the River Inny (EPA code: 26I01) at Coolnagun Bridge at a local road crossing, approx. 1.7km upstream of Lough Derravaragh. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterial drainage), with a deep U-shaped channel and bankfull heights of 3-4m. Old embankments were evident on the east bank. The canalised channel averaged a homogenous 15-20m wide and 1.8-2.5m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. The bed was comprised of silt over compacted cobble and gravels with occasional boulder (mostly near the bridge). Given the site profile and low flow rates, the site was heavily vegetated with a diverse range of macrophytes. Heterophyllus[1] arrowhead (*Sagittaria sagittifolia*) was abundant instream, with frequent branched bur-reed (*Sparganium erectum*) and yellow lily (*Nuphar lutea*). Non-native Canadian pondweed (*Elodea canadenis*) was also frequent. Frogbit (*Hydrocharis morsus-ranae*) and curled pondweed (*Potamogeton crispus*) were occasional along channel margins. Water forget-me-not (*Myosotis scorpioides*), floating sweet-grass (*Glyceria fluitans*), water starwort (*Callitriche* spp.) and amphibious bistort (*Persicaria amphibia*) were occasional along the river margins. Water plantain (*Alisma plantago-aquatica*), river water dropwort (*Oenanthe fluviatilis*) and common clubrush (*Schoenoplectus lacustris*) were present but rare. Stands of common reed (*Phragmites australis*) were occasional, being more frequent upstream of the bridge. Filamentous algal mats were present, indicating enrichment (more prevalent than at upstream sites). The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and occasional marginal structure, with *Leptodictyum riparium* frequent on marginal cobble and boulder. The riparian zone supported mature treelines of grey willow (*Salix cinerea*) with a nitrophilous community dominated by reed canary grass (*Phalaris arundinacea*), nettle (*Urtica dioica*) and hedge bindweed (*Calystegia sepium*), with scattered iris (*Iris psuedacorus*). The site was bordered by improved (intensive) pasture (GA1).

Electro-fishing was not undertaken at site 1 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Coolnagun Bridge was of high coarse fish value, with suitability for a range of species including pike (*Esox lucius*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), bream (*Abramis brama*) and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots). Juvenile roach, for example, were visible abundant during the site visit. The River Inny is also known

[1] heterophyllus refers to the presence of foliage leaves of more than one form on the same plant or stem

to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. However, *Lampetra* sp. are known from the site according to Inland Fisheries Ireland (OES, 2020). White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 1 was of **local importance (higher value) (Table 4.1).**

Plate 4.1 Representative image of site 1 on the River Inny at Coolnagun Bridge, August 2022 (facing upstream from bridge)

4.1.2 Site 2 – River Inny, Float Bridge

Site 2 was located on the River Inny at Float Bridge, approx. 3km upstream of site 1. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterially drained), with a deep U-shaped channel and bankfull heights of 2-3m. The canalised channel averaged a homogenous 25-30m wide and 2-3m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. With the exception of an artificial slipway (gravels) and occasional boulder near the bridge, the bed was comprised of silt atop compacted cobble and gravels. As per site 1, given the site profile the river at this location was heavily vegetated. Heterophyllus arrowhead was abundant instream, with frequent branched bur-reed, yellow lily and frogbit. Canadian pondweed (*Elodea canadensis*) and river water dropwort were locally frequent instream. Water forget-me-not, water mint, water starwort (*Callitriche* sp.) and amphibious bistort were occasional along the river margins. Mare's-tail (*Hippurus vulgaris*) was also occasional. Flowering rush (*Butomus umbellatus*) grew amongst branched bur-reed beds. The river margins were fringed with common reed and reed canary grass. Filamentous algae was frequent, indicating enrichment. The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and occasional marginal structure. Freshwater sponge (likely *Porifera* sp.) was present on boulder and cobble near the bridge. The riparian zone supported intermittent mature treelines of alder (*Alnus glutinosa*) and willow species (*Salix* spp.) with a nitrophilous community dominated by reed canary grass and hedge bindweed. The site was bordered by cutover bog (PB4) and coniferous afforestation (WD3).

Electro-fishing was not undertaken at site 2 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Float Bridge was of high coarse fish value, with suitability for a range of species including pike, perch, roach, bream and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots) downstream. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the survey site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.2 Representative image of site 2 on the River Inny at Float Bridge, August 2022 (facing upstream from bridge)

4.1.3 Site 3 – River Inny, Carnagh Bridge

Site 3 was located on the River Inny at Carnagh Bridge, approx. 3.7km upstream of site 2 and 1.7km downstream of the proposed site boundary. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterially drained), with a deep trapezoidal channel and bankfull heights of up to 8m (with old embankments present). The canalised channel averaged a homogenous 18-20m wide and 1.8-≥3m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. With the exception of an artificial slipway (gravels) and occasional boulder underneath the bridge arch, the bed was comprised of silt and clay atop compacted cobble and gravels. Excavated clay banks were present along the channel. As per site 1 and 2 downstream, given the site profile the river at this location was heavily vegetated. Heterophyllus arrowhead was abundant instream, with frequent submerged lesser water parsnip (*Berula erecta*) in addition to frogbit and heterophyllus yellow lily. Water starwort (*Callitriche* sp.), river water dropwort and amphibious bistort were occasional along the river margins. Extensive marginal stands of reed canary grass were present along the margins (deeply undercut), with common reed locally frequent upstream of the bridge. The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and marginal structure. Freshwater sponge (likely *Porifera* sp.) was also present on the bridge abutments. Filamentous algae (*Vaucheria* sp.) was frequent, indicating enrichment. The riparian zone supported mature treelines of alder, willow species (*Salix* spp.), hawthorn (*Crataegus monoygna*) and ash (*Fraxinus excelsior*) with a nitrophilous community dominated by reed canary grass, hedge bindweed and bramble (*Rubus fruticosus* agg.). The site was bordered by improved pasture (GA1) and coniferous plantations (WD3).

Electro-fishing was not undertaken at site 3 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Carnagh Bridge was of high coarse fish value, with suitability for a range of species including pike, perch, roach, bream and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots) downstream. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the survey site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.3 Representative image of site 3 on the River Inny at Carnagh Bridge, August 2022 (facing downstream from bridge)

4.1.4 Site 4 – Mayne Stream, Ballin

Site 4 was located on the uppermost reaches of the Mayne Stream (26M92) at a local road crossing, approx. 1.8km upstream of the River Inny confluence. The lowland depositing watercourse (FW2) had been extensively straightened and deepened historically and suffered from very low flows at the time of survey (i.e. a semi-dry channel with an imperceptible flow). The stream was contained in a shallow U-shaped channel that averaged 2.5-3m wide and <0.05m deep. The profile was of stagnant glide and pool (ponding of water). The stream at this location featured a bed of deep anoxic silt (peat-derived) up to 1m in depth with no hard substrata. Macrophyte coverage was very high (>75%) with abundant fool's watercress (*Apium nodiflorum*) and frequent branched bur-reed. Bryophytes were not recorded. The channel was heavily shaded in the vicinity of the road crossing with mature grey willow and downy birch (*Betula pubescens*) growing from peat banks. An area of nitrophilous herb vegetation was present in the vicinity of the bridge, with abundant hedge bindweed, nettle, marsh woundwort (*Stachys palustris*) and bramble.

With the exception of three-spined stickleback (*Gasterosteus aculeatus*) (low density recorded via electro-fishing), site 4 was not of fisheries value given gross siltation and poor seasonal flows. Furthermore, the location of the site in the uppermost reaches of the river and poor connectivity with downstream-connecting habitats (due to gross siltation and poor flows) reduced the fisheries potential of the channel. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site and suitability was very poor.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given Q2 (bad status) water quality and the poor-quality fisheries habitat present, the aquatic ecological evaluation of site 4 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.4 Representative image of site 4 on the Mayne Stream, August 2022

4.1.5 Site 5 – Glore River, Doon

Site 5 was located on the Glore River approx. 0.2km downstream of the Monktown River confluence and 0.5km downstream of site 6. As per upstream, the river had been extensively straightened and deepened (arterial drainage) and featured a trapezoidal channel with 3-4m bankfull heights. The significant hydromorphological modifications resulted in poor flows and a depositing habitat dominated by very slow-flowing glide and occasional pool (no riffle). The substrata were dominated by deep silt with only localised mixed gravels in shaded areas (also heavily silted). The site was very heavily vegetated, with abundant broad-leaved pondweed (*Potamogeton natans*) (>50% cover). River water dropwort, water cress (*Nasturtium officinale*), common duckweed (*Lemna minor*), water mint and water forget-me-not were frequent. Branched bur-reed was occasional. Bryophytes were not recorded. The river margins supported abundant nitrophilous community dominated by reed canary grass, nettle and hedge bindweed with angelica (*Angelica sylvestris*) and meadowsweet (*Filipendula ulmaria*). Mature, overhanging grey willow were frequent along the channel, providing high shading locally. The site was bordered by improved agricultural grassland (GA1) to the north and coniferous afforestation (WD3) to the south.

Electro-fishing was not undertaken at site 5 given prohibitive depths (i.e. fisheries appraisal only). Site 5 was considered a poor-quality salmonid and lamprey habitat due to evident siltation and historical drainage pressures, including low flows. However, some good quality holding habitat for adult salmonids was present. The heavily vegetated, depositional habitat was of highest value for a range of coarse fish species, with abundant nursery and spawning habitat throughout. Suitability for European eel and white-clawed crayfish was also high given the presence of amble instream refugia. Despite good suitability for otter, no signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via Q-sampling.

Given suitability for salmonids, European eel, white-clawed crayfish and otter, the aquatic ecological evaluation of site 5 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.5 Representative image of site 5 on the Glore River, August 2022

4.1.6 Site 6 – Glore River, Newcastle

Site 6 was located on the Glore River approx. 0.3km upstream of the Monktown River confluence and 0.5km upstream of site 5. The river had been arterially drained (straightened and deepened) historically, with a typical trapezoidal channel and bankfull heights of 3-4m (old embankments present). However, some good instream recovery was evident. The open water width of the fast-flowing lowland depositing watercourse (FW2) averaged 3m wide but often featured a channel of up to 6m wide, with up to 50% covered by floating aquatic vegetation. The depth varied from 0.3-0.8m in fast glide areas to 1.2-1.8m in deeper glide and pool. The profile was dominated by glide habitat with very localised riffle and frequent pool. The substrata comprised cobble and coarse gravels with occasional boulder. These were compacted due to high flow rates and also partially calcified. Siltation was high overall although much was deposited in association with instream macrophyte beds (likely mobilises during winter). The clear-water site supported a high diversity of aquatic vegetation. Narrow-fruited watercress (*Nasturtium microphyllum*) was abundant along channel margins and formed extensive floating mats, with the abundant submerged form also present. Water mint was also abundant with frequent water forget-me-not and occasional pink water speedwell (*Veronica catenata*), water starwort (*Callitriche* spp.) and branched bur-reed. Ivy-leaved duckweed (*Lemna trisulca*) was also locally frequent. The pondweed species *Potamogeton crispus* and *Stuckenia pectinata,* in addition to mare's-tail and floating sweet-grass were present but localised. The moss species *Fontinalis antipyretica* was present occasionally. Filamentous algal cover (*Vaucheria* sp.) was high (20%), indicating significant enrichment. The sloping banks supported lush herbaceous vegetation comprising abundant reed canary grass with iris, great willowherb (*Epilobium hirsutum*), lesser water parsnip, angelica, water mint, pink water speedwell and water forget-me-not. Given the presence of numerous indicator species (EC, 2013; Devaney et al., 2013), this community was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. The bank top supported scattered hawthorn and bramble scrub (much of which had been cleared historically). The site was bordered by improved pasture (GA1) with frequent livestock access and considerable poaching.

Brown trout (*Salmo trutta*), gudgeon (*Gobio gobio*) and stone loach (*Barbatula barbatula*) were recorded via electro-fishing at site 6. Site 6 was of good value for salmonids, despite evident hydromorphological and siltation pressures. However, the site supported only a low density of brown trout. Primarily, this was considered to reflect considerable siltation pressures which reduced the quality of available spawning habitat. The site was, however, of excellent value as a holding habitat for large adults with abundant undercut banks/overhanging vegetation providing valuable cover in an otherwise open channel. Excellent quality nursery habitat was also present given abundant instream refugia. The high-energy site provided moderate (at best) lamprey ammocoete and spawning habitat - none were recorded via targeted electro-fishing. The site was of high suitability for European eel and white-clawed crayfish but neither species was recorded. No otter signs were recorded in the vicinity of the survey site, despite high foraging suitability.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and excellent quality nursery habitat, in addition to the presence of Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', the aquatic ecological evaluation of site 6 was of **local importance (higher value) (Table 4.1).**

Plate 4.6 Representative image of site 6 on the Glore River, August 2022

4.1.7 Site 7 – Glore River, bridge at Rockbrook

Site 7 was located on the Glore River at a local road crossing approx. 2.7km upstream of site 6. The river had been straightened historically but not deepened with low-lying banks of 1-1.5m height. The fast-flowing, spring-fed (EPA, 2018) alkaline river (FW2) averaged 3m wide and 0.2-0.4m deep. The profile was of very fast flowing glide with occasional small pool and localised riffle. A shallow farm ford crossing was present immediately upstream of the bridge (riffle habitat). The substrata were dominated by cobble but this was compacted given high flow rates and featured high levels of calcification (cementation). Boulder was occasional. Sands were present in pool slacks. Soft sediment deposits were present in association with instream macrophyte beds and adjoining pool areas. Macrophyte coverage was relatively high with abundant heterophyllus narrow-fruited watercress and fool's watercress along the channel margins and submerged instream. Water mint was frequent along the margins. The site also supported localised water starwort (*Callitriche* sp.), ivy-leaved duckweed and common duckweed. Branched bur-reed was present but rare. The site was dominated by the calcicolous liverwort *Pellia endiviifolia* (>30% cover) (a result of the highly calcified/compacted bed). The moss species *Rhynchostegium riparioides* and *Fissidens crassipes* were also present locally. The riparian zone supported a mature ash, sycamore (*Acer psuedoplatanus*) and hawthorn treeline along the south bank with a bramble and ivy (*Hedera* sp.) understorey. The north bank was open and supported a herbaceous community of abundant reed canary grass, frequent great willowherb and occasional bittersweet (*Solanum dulcamara*) and meadowsweet. The site was bordered by amenity grassland (GA2, lawns) and improved pasture (GA1).

Brown trout and *Lampetra* sp. were the only two fish species recorded via electro-fishing at site 7 (**Appendix B**). Site 7 was of high value to salmonids, supporting a high density of mixed-cohort brown trout. The site was of most value as a nursery habitat, with high numbers of juvenile trout amongst abundant instream vegetation in fast glide. Scoured banks and, more importantly, overhanging macrophyte vegetation (e.g. watercress) provided valuable holding habitat for adult salmonids. Deeper holding pools were absent. Good quality spawning habitat was present by way of fine and medium gravels but such areas were small in extent and of reduced value due to calcification. These areas also provided suitability for lamprey spawning. Good quality larval lamprey habitat was present adjoining the ford crossing and supported a low density of ammocoetes (1.5 per m^2 targeted habitat). Despite some good suitability for European eel and white-clawed crayfish, none were recorded (poorly accessible refugia with the exception of macrophyte beds). However, crayfish remains were identified in two otter spraint sites recorded on boulders adjoining the bridge abutments (ITM 644297, 774199 and 644301, 774202).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Annex II *Lampetra* sp. and white-clawed crayfish (identified in otter spraint), in addition to utilisation by otter, the aquatic ecological evaluation of site 7 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.7 Representative image of site 7 on the Glore River, August 2022 (upstream of bridge) showing high riverbed cover of *Pellia endiviifolia*

4.1.8 Site 8 – Monktown River

Site 8 was located on the Monktown River (26M78) at a local road crossing approx. 0.25km south-east of proposed turbine T9. The river had been extensively straightened and deepened historically in vicinity of the road crossing. The river crossed under the local road via a masonry arch bridge with a rendered apron. The river suffered from near imperceptible flows at the time of survey and averaged 2-2.5m wide and 0.2m deep. The profile comprised near-stagnant glide with no riffle areas in a shallow U-shaped channel. The site suffered from gross siltation upstream of the road crossing, with flocculent anoxic (peat-dominated) deposits of up to 0.5m deep on top of heavily compacted cobble and mixed gravels (none of which were exposed). Downstream of the bridge, a short section of channel was exposed to heavy livestock poaching which had created a small area of over-widened cobble and boulder habitat. This also supported very limited and heavily silted beds of fine gravels and sand. Macrophyte growth was limited to marginal stands of fool's watercress with more occasional lesser water parsnip and common duckweed. Bryophytes were not recorded. The riparian zone supported scattered mature sycamore, hawthorn, elder (*Sambucus nigra*) and ash with abundant great willowherb, reed canary grass, nettle and bramble. A mature beech (*Fagus sylvatica*) treeline lined the channel downstream. The site was bordered by improved pasture (GA1).

Three-spined stickleback and *Lampetra* sp. were the only species recorded via electro-fishing at site 8. Despite gross siltation and very low seasonal flows, site 8 was of moderate value for lamprey (*Lampetra* sp.), with flocculent silt deposits supporting a low density of relatively large ammocoetes (c.2 per m^2). The site was unsuitable for salmonids given siltation and flow pressures. However, very low densities of brown trout were observed in the lower reaches of the stream during the survey period, c. 0.5km downstream. Three-spined stickleback, a species highly tolerant of poor water quality and low dissolved oxygen, were abundant. A debris dam located at the downstream side of the culvert/bridge was a significant barrier to flow and fish passage. Suitability for white-clawed crayfish was low and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex II *Lampetra* sp., the aquatic ecological evaluation of site 8 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.8 Representative image of site 8 on the Monktown River, August 2022 (facing upstream from bridge)

4.1.9 Site B1 – unnamed stream

Site B1 was located on a drainage channel at a local road and proposed GCR crossing, approx. 0.2km south-west of site 1. The drainage channel (FW4) emanated from a coniferous block and had been recently excavated prior to the survey as part of road resurfacing works (new pipe culvert installed). The trapezoidal shaped channel featured bankfull heights of 2-2.5m and contained localised pools of <0.05m deep stagnant water only, i.e. no flow, rainwater fed. There was no connectivity with the adjacent River Inny given an earthen berm of 0.75m high at the end of the channel. However, the channel would hold water during periods of high water levels in the adjacent River Inny, i.e. a back-channel. The substrata comprised excavated sand and clay (marl). Despite evident recent clearance works, the margins supported occasional watercress, water forget-me-not, brooklime (*Veronica* beccabunga) and very occasional water starwort (*Callitriche* sp.). Common duckweed was present locally. Common reed also grew in the lower reaches of the channel with a dense stand fringing the River Inny. Whilst the south bank had been recently cleared of vegetation, the north bank supported flailed grey willow, sycamore and hawthorn. The site was bordered by improved pasture (GA1).

Site B1 was not of fisheries value given its evident ephemeral nature (rainwater fed) and extensive modifications. No fish were recorded via electro-fishing (**Appendix B**). However, given the proximity to the River Inny, the channel likely conveys flood water and thus may serve as a very low value coarse fish habitat, seasonally. No otter signs were recorded in vicinity of the survey site.

Biological water quality, based on Q-sampling, was calculated as **Q1-2 (bad status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of fisheries value and absence of species or habitats of high conservation value in the ephemeral channel, in addition to Q1-2 (bad status) water quality, the aquatic ecological evaluation of site B1 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.9 Representative image of site B1 on a drainage channel, May 2022 (facing downstream from road crossing)

4.1.10 Site B2 – drainage channel

Site B2 was located on an unmapped drainage channel (FW4) at a local road and proposed GCR crossing approx. 0.1km upstream of the River Inny confluence. The drainage channel (FW4) emanated from an adjacent coniferous plantation (WD3) and had been straightened and deepened historically. The deep trapezoidal channel featured bankfull heights of 2m and averaged 2m wide and 0.5-0.7m deep. There was no flow in the channel at the time of survey, i.e. stagnant channel. The substrata comprised compacted (excavated) cobble and boulder which were heavily silted. The drain was heavily encroached by common reed on both banks and instream. Ivy-leaved duckweed and common duckweed were abundant instream. Greater bladderwort (*Utricularia vulgaris*) was present but rare. Yellow lily was present at the River Inny confluence. Aquatic bryophytes were not recorded. The narrow riparian zones supported abundant common reed with frequent meadowsweet, reed canary grass and occasional common valerian. The site was bordered by wet improved grassland (GA1) and coniferous plantation (WD3) with downy birch borders.

With the exception of three-spined stickleback (recorded via electro-fishing; **Appendix B**), site B2 was not of fisheries value given gross siltation and poor hydromorphology. However, the confluence with the River Inny provided some suitability for European eel and as a coarse fish nursery, particularly during periods of high-water levels. Suitability for white-clawed crayfish was poor and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the low fisheries value and absence of species or habitats of high conservation value, in addition to Q3 (poor status) water quality, the aquatic ecological evaluation of site B2 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.10 Representative image of site B2 on an unmapped drainage channel, August 2022 (facing downstream from road crossing to River Inny confluence)

4.1.11 Site B3 – River Inny, Inny Bridge

Site B3 was located on the River Inny at Inny Bridge, a proposed GCR crossing, approx. 0.5km downstream of the Lough Derravaragh outflow. The lowland depositing river (FW2) had not been historically modified in the vicinity of the bridge, with mature banks, meandering profile and an adjoining flood plain. The river averaged 20m wide and 2.5-3m deep, with a centrally deeper channel and steeply sloping margins. The profile was of slow-flowing depositional glide with a bed dominated by silt and localised silted cobble and boulder. Some exposed gravels and cobble were present in the vicinity of the bridge abutments, which supported the invasive zebra mussel (*Dreissena polymorpha*). The depositional glide was heavily vegetated with abundant long-leaved pondweed (*Potamogeton x angustifolius*) and heterophyllus arrowhead. Beds of yellow lily and frogbit were frequent. Common duckweed (*Lemna minuta*) and greater duckweed (*Spirodela polyrhiza*) were both frequent. Non-native Canadian pondweed was occasional. The moss *Fontinalis antipyretica* and *Leptodictyum riparium* were both locally frequent on hard substrata near the bridge and submerged structure. The margins were lined by mature linear stands of common reed and branched bur-reed with frequent water mint and occasional lesser water parsnip, amphibious bistort, water forget-me-not and bog bean (*Menyanthes trifoliata*). These stands graded into reed swamp (FS1) habitat along the south bank, particularly downstream of the bridge. Great yellow cress (*Rorippa amphibia*) was present but rare. Floating filamentous algal mats were frequent with *Cladophora* sp. abundant instream. The river was lined by a mature overhanging willow (*Salix* spp.) treeline on the north bank. The site was bordered by reed swamp habitat and wet grassland (GS4).

Electro-fishing was not undertaken at site B3 given prohibitive depths (i.e. fisheries appraisal only). Site B3 was of high coarse fish value, known to support a range of species including pike, perch, roach, bream and European eel. Mature overhanging willows on the north bank provided especially valuable holding habitat for a range of fish species. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots). Juvenile roach, for example, were visible abundant during the site visit. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the site. An old otter spraint site was recorded on an old stanchion under the southernmost arch of the bridge (ITM 638807, 766724). The undercut bridge structure also had some suitability as an otter resting (couch) area although none were identified.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.11 Representative image of site B3 on the River Inny at Inny Bridge, August 2022 (facing downstream from bridge)

4.1.12 Site B4 – Froghanstown Stream, L1819 road crossing

Site B4 was located on the Froghanstown Stream (26F41) at a local road and proposed GCR crossing. The stream had been extensively straightened and deepened downstream of the road crossing, where it had been realigned to emanate from a twin culvert headwall (Plate 4.12). Bank revetment was present in the vicinity of the culverts. The original channel was still present at the road crossing but this was dry and evidently did not convey water except perhaps after rainfall events. The trapezoidal channel featured bankfull heights of 2m. The realigned stream averaged 1.5m wide and <0.1m deep. The stream suffered from low seasonal flows at the time of survey. The profile comprised slow flowing, very shallow glide and riffle with a low frequency of small pools. The substrata were dominated by compacted mixed gravels and small cobble, with only occasional boulder. These were heavily calcified (tufa-like formations on culvert outfall) and also heavily silted given very low flow rates and historical modifications. The site was very heavily vegetated with abundant cover of narrow-fruited watercress and fool's watercress (>90% cover). Common duckweed was also present in stagnant areas. Aquatic bryophytes were limited to *Rhynchostegium riparoides* and the liverwort *Chiloscyphus polyanthos*. The liverwort *Lunularia cruciata* grew on bank revetment and the culvert structure. The modified channel was lined on the south bank by a mature treeline of sycamore and hawthorn with bramble scrub. The north bank was open with a very narrow scrubby riparian zone. The site was bordered by improved agricultural grassland (GA1).

With the exception of ten-spined stickleback (*Pungitius pungitius*), site B4 was not of fisheries value given poor seasonal flows, poor hydromorphology and siltation pressures. Furthermore, the location of the site in the uppermost reaches of the stream and poor connectivity with downstream-connecting habitats (e.g. Gaine River) reduced the fisheries potential of the channel. There was no suitability for white-clawed crayfish at this location and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the low fisheries value and absence of species or habitats of high conservation value, in addition to Q3 (poor status) water quality, the aquatic ecological evaluation of site B4 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.12 Representative image of site B4 on the Froghanstown Stream, August 2022

4.1.13 Site B5 – Ballynafid Stream, N4 road crossing

Site B5 was located on the Ballynafid Stream (26B36) at the N4 road and proposed GCR crossing, approx. 120m upstream of the confluence with Ballynafid (Ballinafid) Lake. The lower reaches of the stream are located within Ballynafid Lake And Fen pNHA (000673), a calcareous fen site noted as very important for rare invertebrates and insects some of which are internationally rare (NPWS, 2009). The stream (FW2) had been realigned and modified historically in vicinity of the N4 road crossing, being straightened from the road culvert to the lake. The stream suffered from very low water levels at the time of survey, with no flow present in a semi-dry trapezoidal channel that averaged 2m wide and <0.05m deep. The substrata were dominated by cobble with occasional boulder and some localised mixed gravels but these were heavily silted. Water was restricted to stagnant pools. Due to heavy tunnelling, no aquatic macrophytes were recorded although fool's watercress was present within the channel upstream of the road crossing. Aquatic bryophytes were not recorded. The stream channel was heavily tunnelled by dense treelines of sycamore, ash, holly (*Ilex aquifolium*), elder and hawthorn with bramble and ivy understories.

Site B1 was not of fisheries value given its evident ephemeral nature and poor connectivity with the downstream Ballynafid Lake. No fish were recorded via electro-fishing (**Appendix B**). However, given the proximity to the lake, the channel likely conveys flood water and thus may serve as a very low value coarse fish and European eel habitat in its lower reaches, seasonally. No otter signs were recorded in vicinity of the survey site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Despite its ephemeral nature and low aquatic value, given the location of the lower reaches of the stream within Ballynafid Lake And Fen pNHA (000673), the aquatic ecological evaluation of site B5 was of **national importance** (**Table 4.1**).

Plate 4.13 Representative image of site B5 on the Ballynafid Stream, August 2022 (downstream of N5 road crossing)

4.1.14 Site B6 – Brosna North River, L1173 road crossing

Site B6 was located on the Brosna North River (26B28) (aka Lough Owel outflow) at a local road and proposed GCR crossing near Levington railway crossing. The artificial channel was dug in 1806 to supply the Royal Canal and had a straightened and deepened profile. The swift-flowing lowland depositing watercourse (FW2) averaged 2.5-3m wide and 0.4-0.8m deep, with locally deeper pool to 1.2m. The profile comprised deep glide habitat with only occasional pool (this was the same upstream of the bridge also). The substrata were dominated by mixed gravels and small cobble, with only localised boulder. Shells of deceased zebra mussels (*Dreissena polymorpha*) were abundant on the bed. Soft sediment deposits were frequent along the channel margins (east bank) and were largely flocculent in nature. Siltation was light overall although livestock poaching of the narrow riparian zone on the eastern bank was excessive and contributing to sedimentation. Macrophytes were limited to very occasional spiked water-milfoil (*Myriophyllum spicatum*) and Canadian pondweed (*Elodea canadensis*) with water mint and yellow iris. More extensive beds of macrophytes were observed further upstream near Lough Owel. Aquatic bryophytes were absent. Freshwater sponges were frequent on the bed. The river was heavily shaded by scattered mature ash, hawthorn, dog rose (*Rosa canina*) and fuchsia (*Fuchsia magellanica*) with scrubby understories dominated by ivy, bramble and hedge bindweed. The invasive Himalayan knotweed (*Persicaria wallichii*) was present c.5m downstream of the bridge. The site was bordered by a rail line and improved pasture (GA1).

Despite some good physical suitability for salmonids and other fish species, site B6 supported a very low density of fish, with only a single brown trout and a single juvenile roach recorded via electro-fishing. This unusually low density was at odds with the presence of good quality suitable spawning, nursery and holding habitat for salmonids. The presence of invasive zebra mussels and calcification of the bed reduced the availability and quality of salmonid and lamprey spawning habitat but suitable areas were nevertheless present. Similarly, despite some apparent suitability for lamprey in terms of both spawning and nursery habitat, none were recorded during targeted electro-fishing. Habitat for European eel was considered of good quality given ample accessible hard refugia and an abundant prey resource. In more open glide areas upstream (near Lough Owel), low densities of roach (*Rutilus rutilus*) and perch (*Perca fluviatilis*) were observed instream during the survey period. A high density of white-clawed crayfish (*Austropotamobius pallipes*) were recorded via sweep netting and hand-searching, with a total of 42 crayfish recorded from 45 refugia (very high density; Peay, 2003). No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the Royal Canal NHA (002103), the aquatic ecological evaluation of site B5 was of **national importance** (**Table 4.1**). The site (and wider channel) supported abundant Annex II white-clawed crayfish, in addition to a low density of salmonids.

Plate 4.14 Representative image of site B6 on the Brosna North River, August 2022 (facing downstream from bridge)

Plate 4.15 White-clawed crayfish recorded from site B6, August 2022

4.2 Fisheries assessments & habitat appraisals

Electro-fishing surveys were undertaken at 9 no. sites in August 2022, with fisheries appraisals completed at the remining 5 no. sites on the River Inny and Glore River (due to prohibitive depths for electro-fishing). A summary of these results is presented in **Table 4.1** below.

Salmonids were recorded (via electro-fishing) from sites 6 and 7 on the Glore River and B6 on the Brosna North River (Lough Owel outflow). Site 7 was of especially high value to salmonids, supporting a high number of mixed-cohort brown trout (*n*=83). The site was of most value as a nursery habitat, with high numbers of juvenile trout amongst abundant instream vegetation in fast glide. Site 6 (located downstream of site 7) also provided some excellent quality salmonid habitat but supported much lower fish numbers (*n*=11; **Table 4.1**). Only a single adult trout was recorded from site B6. Deeper, more depositional survey sites such as those on the River Inny (sites 1, 2, 3, & B3) and Glore River (5) provided some low suitability for adult salmonids (holding habitat) but were not suitable as spawning or nursery areas.

Lamprey ammocoetes *(Lampetra* sp.) were recorded in low densities from site 7 on the Glore River (1.5 per m^2) and, despite poor suitability, site 8 on the Monktown River (2 per m^2). Larval lamprey were known from this location on the Glore River but not from the Monktown Stream (Ecofact, 2016). Whilst previously recorded from the Mayne Stream at site 4 (Ecofact, 2016), no lamprey ammocoetes were recorded via targeted electro-fishing at this site in 2022. Inland Fisheries Ireland data indicates that brook lamprey (*L. planeri*) are known from the River Inny at Coolnagun Bridge (site 1) (OES, 2020).

Despite some good suitability across numerous survey sites (e.g. on the River Inny, Glore River and Brosna North River), no European eel were recorded via electro-fishing in August 2022.

Table 4.1 Summary of fisheries assessments (electro-fishing) and fisheries habitat appraisals for sites in the vicinity of Coole wind farm, August 2022

			Recorded via electro-fishing				
Site	**Watercourse**	**Assessment**	**Salmonids**	***Lampetra* sp.**	**European eel**	**Other fish species**	**Fisheries summary**
1	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat. *Lampetra* sp. recorded at this site previously (IFI data in OES, 2020)
2	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
3	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
4	Mayne Stream	Electro-fishing	x	x	x	Three-spined stickleback (*n*=5)	Very heavily silted, modified channel with poor flows. Only of value for three-spined stickleback
5	Glore River	Fisheries appraisal	n/a	n/a	n/a	n/a	Deep, modified river channel with high value as coarse fish & European eel habitat, some value as adult salmonid holding habitat given nearby superior salmonid habitat upstream
6	Glore River	Electro-fishing	Brown trout (*n*=11)	x	x	Gudgeon (*n*=7), stone loach (*n*=3)	Modified, swift-flowing channel with good value for salmonids including excellent quality nursery & holding habitats.
7	Glore River	Electro-fishing	Brown trout (*n*=83)	*Lampetra* sp. (*n*=3; 1.5 per m^2)	x	x	Swift-flowing channel with good value for salmonids, lamprey & European eel
8	Monktown River	Electro-fishing	x	*Lampetra* sp. (*n*=11; 2 per m^2)	x	Three-spined stickleback (*n*=4)	Very heavily silted, modified channel with poor flows supporting a low density of ammocoetes in sub-optimal habitat
B1	Unnamed stream	Electro-fishing	x	x	x	x	Heavily modified ephemeral drainage channel with no fisheries value. No fish recorded via electro-fishing
B2	Drainage channel	Electro-fishing	x	x	x	Three-spined stickleback (*n*=16)	Modified drainage channel with low fisheries value for three-spined stickleback. Some low European eel & coarse fish potential near Inny confluence under higher flows
B3	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
B4	Froghanstown Stream	Electro-fishing	x	x	x	Ten-spined stickleback (*n*=6)	Small, heavily vegetated, modified stream with poor seasonal flows, only of value for ten-spined stickleback
B5	Ballynafid Stream	Electro-fishing	x	x	x	x	Small, modified ephemeral stream with perhaps some low seasonal suitability as coarse fish & European eel habitat in its lower reaches. No fish recorded via electro-fishing
B6	Brosna North River	Electro-fishing	Brown trout (*n*=1)	x	x	Roach (*n*=1)	Artificial, mature channel with some good local suitability for salmonids, lamprey, European eel & coarse fish but supported vey low fish densities. Of very high value for white-clawed crayfish (abundant)

4.3 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=14 sites in August 2022 based on a full taxonomic list (**Appendix A; Tables 7.1 & 7.2**).

None of the survey sites achieved target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). A comparison of biological water quality for sites 1-8 in 2016 and 2022 is provided in **Table 4.2** below.

Site 3 on the River Inny and sites 6 and 7 on the Glore River achieved **Q3-4 (moderate status)** water quality. This was given the low numbers (<5%) of group A species and a dominance of group C species such as the mayflies *Baetis rhodani* and *Serratella ignita*, the caseless caddis *Hydropsyche instabilis*, freshwater shrimp (*Gammarus duebeni*) and several molluscan species. Sites 6 and 7 were the only sites to support the group A mayfly *Ecdyonurus dispar*.

Sites 1, 2 and B3 (River Inny), 5 (Glore River), 8 (Monktown Stream), B2 (unnamed stream), B3 (drainage channel), B4 (Froghanstown Stream), B5 (Ballynafid Stream) and B6 (Brosna North River) all achieved **Q3 (poor status)** based on an absence of group A species, low numbers of group B species such as the caddis *Halesus radiatus* and the damselfly *Calopteryx splendens*, and a dominance of group C species, particularly the freshwater shrimp *Gammarus duebeni*. Group D species, chiefly *Asellus aquaticus*, were also common at most of these sites. It should be noted that due to poor flows and an absence of suitable riffle areas for sampling, the Q-ratings for sites 8, B2 and B5 are tentative.

Site 4 on the Froghanstown Stream and B1 on an unnamed stream adjacent to the River Inny achieved **Q2 (bad status)** and **Q1-2 (bad status),** respectively. This was given a dominance of highly pollution tolerant group D and E species such as *Asellus aquaticus* and *Chironomus* spp. However, the ratings for both these sites are tentative due to poor flows and an absence of suitable riffle areas for sampling.

Table 4.2 Comparison of biological water quality at sites 1-8 in 2016 and 2022

Site	Watercourse	Q-rating June2016	Q-rating Aug 2022	WFD status 2022	Pollution status
1	River Inny	Q3-4 / Q4	Q3	Poor status	Moderately polluted
2	River Inny	Q3-4 / Q4	Q3	Poor status	Moderately polluted
3	River Inny	Q3-4 / Q4	Q3-4	Moderate status	Slightly polluted
4	Mayne Stream	Q3	Q2*	Bad status	Seriously polluted
5	Glore River	Q3-4	Q3	Poor status	Moderately polluted
6	Glore River	Q3-4	Q3-4	Moderate status	Slightly polluted
7	Glore River	Q3-4	Q3-4	Moderate status	Slightly polluted
8	Monktown River	Q3	Q2-3*	Poor status	Moderately polluted

4.4 White-clawed crayfish

Annex II white-clawed crayfish were recorded from site B6 on the Brosna North River. A high density were recorded via sweep netting and hand-searching, with a total of 42 crayfish recorded from 45 refugia (very high density; Peay, 2003).

Whilst no crayfish were recorded via sweep netting or hand searching at site 7 on the Glore River, crayfish remains were identified in otter spraint recorded in vicinity of the bridge. This indicated the presence of a low density of crayfish at this site, a supposition also noted by Ecofact (2016).

Despite suitability at sites 1, 2, 3, 5, 6 and B3, crayfish were not recorded from any other survey sites via sweep netting or hand searching in August 2022.

4.5 Otter signs

The presence of otter (*Lutra lutra*) within 150m each aquatic survey site was determined through the recording of otter signs, including holts (breeding areas), couches (resting areas), spraint, latrine, prints and slides with (ITM co-ordinates) for each sign type. Two regular spraint sites (inferring frequent visitation) were identified at site 7 on the Glore River, with an old spraint site also recorded underneath Inny Bridge at site B3 (River Inny). Despite some high suitability within the survey area, otter signs were not recorded from other sites. No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in August 2022.

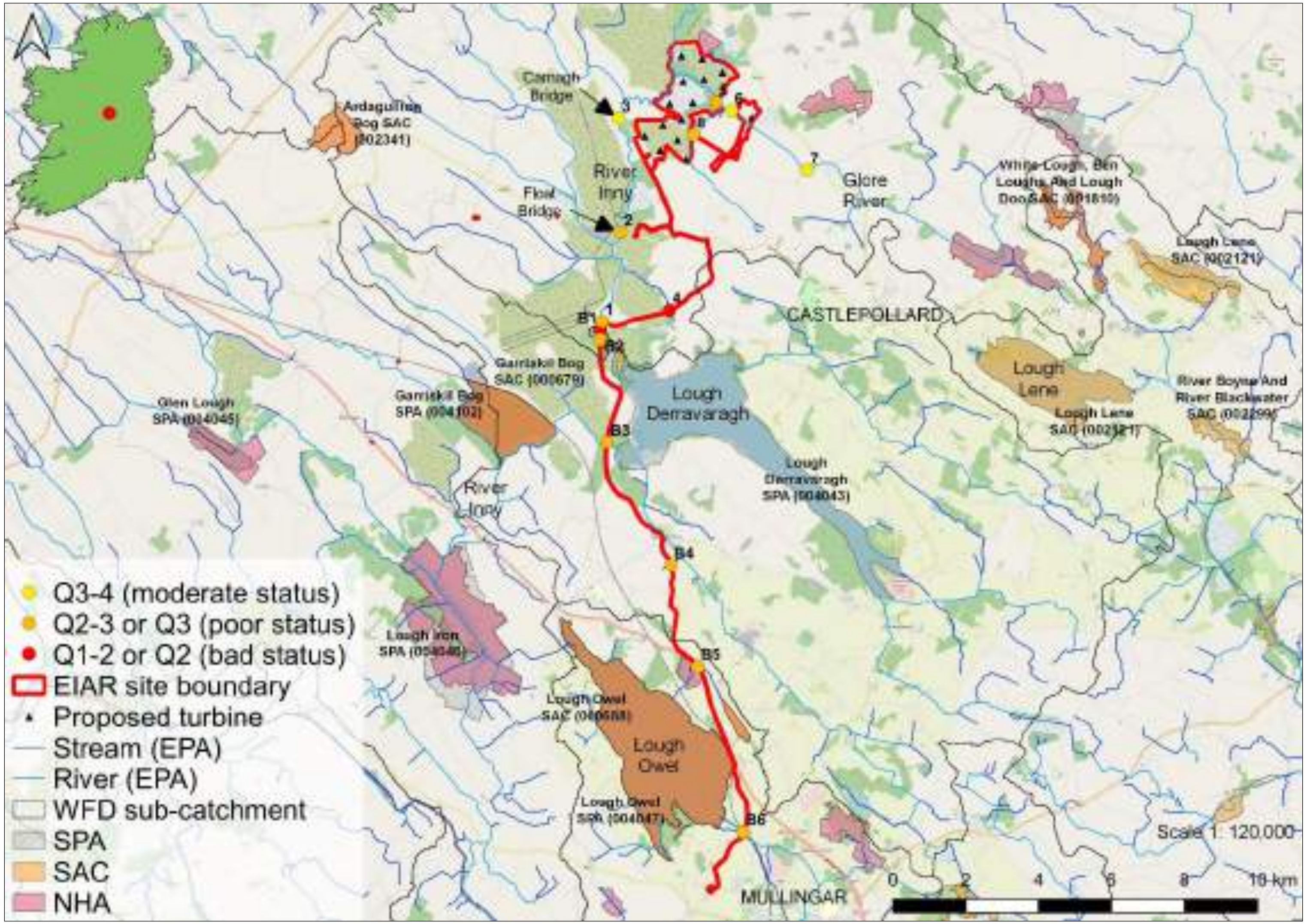

Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Coole wind farm project, Co. Westmeath, August 2022

4.6 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of desktop review (i.e., presence of fish of conservation value), fisheries habitat assessments, the presence of protected or rare invertebrates (e.g. white-clawed crayfish), the presence of rare macrophytes and aquatic bryophytes and or associated representations of Annex I habitats. Furthermore, biological water quality status also informed the aquatic evaluation (**Table 4.2**).

Site B5 on the Ballynafid Stream and site B6 on the Brosna North River were evaluated as **national importance** given their locations within Ballynafid Lake and Fen pNHA (000673) and Royal Canal NHA (002103), respectively.

None of the remaining 12 no. aquatic survey sites were evaluated as greater than **local importance (higher value)**. The higher value sites were present on the River Inny (sites 1, 2, 3 & B3), Glore River (sites 5, 6 & 7) and the Monktown River (site 8). Primarily, this evaluation was due to the presence of salmonids, *Lampetra* sp. and or other aquatic species or habitats of conservation value.

The remaining sites on the Mayne Stream (site 4), unnamed stream (B1), Inny drainage channel (B2) and Froghanstown Stream (B4) were evaluated as **local importance (lower value)** in terms of their aquatic ecology given an absence of species or habitats of high conservation value.

Table 4.2 Aquatic ecological evaluation summary of the Coole wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
1	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat (although lamprey known from the site - see OES, 2020), good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
2	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat, good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
3	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat, good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
4	Mayne Stream	26M92	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, gross siltation & poor seasonal flows, only of value for three-spined stickleback; no suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q2 (bad status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value
5	Glore River	26G02	**Local importance (higher value)**	Poor quality salmonid and lamprey habitat given poor hydromorphology & siltation pressures but of high value as European eel & coarse fish habitat; high suitability for white-clawed crayfish but none recorded; good suitability for otter but no signs recorded; Q3 (poor status) water quality (tentative rating); no other aquatic species or habitats of high conservation value
6	Glore River	26G02	**Local importance (higher value)**	Brown trout, gudgeon & stone loach recorded via electro-fishing; good quality salmonid habitat with excellent nursery & holding

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				habitat, moderate quality lamprey habitat; high suitability for European eel and white-clawed crayfish, but none recorded; high suitability fir otter but no signs recorded; Q3-4 (moderate status) water quality; site supported the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'; no other aquatic species or habitats of high conservation value
7	Glore River	26G02	**Local importance (higher value)**	Brown trout and Annex II *Lampetra* sp. recorded via electro-fishing; of good value for salmonids with high quality holding and nursery habitat; good quality lamprey spawning & nursery habitat; good suitability for European eel & white-clawed crayfish but none recorded (however, Annex II crayfish remains recorded in otter spraint, inferring likely presence); two otter spraint sites recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
8	Monktown River	26M78	**Local importance (higher value)**	Three-spined stickleback and Annex II *Lampetra* sp. recorded via electro-fishing; site not of value as a salmonid habitat given gross siltation, poor hydromorphology & very low seasonal flows; moderate quality lamprey habitat with low density of ammocoetes present; low suitability for European eel & white-clawed crayfish, with none recorded; poor suitability for otter with no signs recorded; Q2-3 (poor status) water quality (tentative rating); no other aquatic species or habitats of high conservation value
B1	Unnamed stream	n/a	Local importance (lower value)	No fish recorded via electro-fishing; ephemeral, heavily modified artificial channel with no fisheries value & poor aquatic value; Q1-2 (bad status) water quality (tentative rating); no suitability for white-clawed crayfish or otter; no aquatic species or habitats of high conservation value
B2	Drainage channel	n/a	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, gross siltation & poor seasonal flows, only of value for three-spined stickleback; very poor suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q3 (poor status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
B3	River Inny	21I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat but good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability with spraint site recorded under bridge; invasive zebra mussel abundant; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
B4	Froghanstown Stream	26F41	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, siltation & poor seasonal flows, only of value for ten-spined stickleback; very poor suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q3 (poor status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value
B5	Ballynafid Stream	26B36	**National importance**	Site not of fisheries value and of poor aquatic value but lower reaches (including survey site) located within Ballynafid Lake And Fen pNHA (000673); Q3 (poor status) water quality (tentative rating)
B6	Brosna North River	26B28	**National importance**	Located within Royal Canal NHA (002103); brown trout and roach (Rutilus rutilus) recorded via electro-fishing; good quality salmonid and lamprey & European eel habitat but only very low densities of brown trout & no lamprey or eel recorded; abundant Annex II white-clawed crayfish; invasive zebra mussel abundant; Q3 (poor status) water quality (tentative Q-rating); no other aquatic species or habitats of high conservation value

Conservation value: Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*), white-clawed crayfish (*Austropotamobius pallipes*) and otter (*Lutra lutra*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon, river lamprey, freshwater pearl mussel, white-clawed crayfish and otter are also listed under Annex V of the Habitats Directive [92/42/EEC]. Freshwater pearl mussel and otters (along with their breeding and resting places) are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout have no legal protection in Ireland.

5. Discussion

5.1 Most valuable areas for aquatic ecology

Site B5 on the Ballynafid Stream and site B6 on the Brosna North River were evaluated as **national importance** given their locations within Ballynafid Lake and Fen pNHA (000673) and Royal Canal NHA (002103), respectively. Whilst the Ballynafid Stream at this location was of very poor fisheries or aquatic value given its ephemeral nature, the Brosna North River at site B6 supported abundant Annex II white-clawed crayfish. Crayfish were visibly abundant at the time of survey throughout the river channel from site B6 as far as the Lough Owel confluence, approx. 0.6km upstream (pers. obs.). In light of ongoing national outbreaks of crayfish plague (*Aphanomyces astaci*) and resulting declines in the species (Swords, 2021), the site is of even greater importance in terms of white-clawed crayfish conservation.

None of the remaining 12 no. aquatic survey sites were evaluated as greater than **local importance (higher value)**. The higher value sites were present on the River Inny (sites 1, 2, 3 & B3), Glore River (sites 5, 6 & 7) and the Monktown River (site 8). Despite historical modifications (arterial drainage), the River Inny is an important ecological corridor and of high ecological (and recreational) value for coarse fish, in addition to Red-listed European eel. The four River Inny survey sites were also of high value for Annex II otter although signs (spraint) were only recorded at site B3. Similarly, despite extensive historical straightening and deepening (arterial drainage), the Glore River survey sites were of value for a range of species and habitats of high conservation value. Site 7 supported a high abundance of salmonids in addition to Annex II *Lampetra* sp., Annex II otter and (by proxy of remains in otter spraint), Annex II white-clawed crayfish at site 7, with high suitability for salmonids, Annex II otter and Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' present (downstream) at site 6. Site 5 was also of value to Annex II otter. The Monktown River at site 8, whilst heavily modified, exposed to gross siltation pressures and suffering from low seasonal flows, was of value to Annex II *Lampetra* sp., supporting a low density of lamprey ammocoetes (**Table 4.1**).

The sites on the Mayne Stream (site 4), unnamed stream (B1), Inny drainage channel (B2) and Froghanstown Stream (B4) were evaluated as **local importance (lower value)** in terms of their aquatic ecology given an absence of species or habitats of high conservation value. The unnamed stream at site B1 was evidently ephemeral and had been extensively modified in the recent past, resulting in an absence of fisheries habitat and very poor aquatic value. Sites B2 and B4 also provided poor quality aquatic and fisheries habitats given poor hydromorphology, historical modifications and or siltation pressures. In contrast to previous surveys (Ecofact, 2016), no lamprey ammocoetes were recorded from site 4 on the Mayne Stream and no suitability was identified in the grossly silted peat channel.

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from n=14 riverine sites (**Appendix A**). None of the survey sites achieved target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Siltation (via peat escapement) and alterations to hydromorphology are known to be the major pressures within the survey area (EPA, 2018, 2019) and this was supported by observations made during the aquatic surveys.

No examples of the Annex I habitat ‘Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] (‘floating river vegetation’) were recorded in August 2022. Whilst not corresponding to Annex I habitat classifications, the River Inny and River Glore survey sites (i.e. 1, 2, 3, 5, 6, 7 & B3) supported valuable macrophyte-rich habitats of particular value to salmonids and macro-invertebrates.

5.2 Aquatic invasive species

The invasive bivalve zebra mussel (*Dreissena polymorpha*) was recorded on the River Inny at site B3 and Brosna North River at site B6. This invasive bivalve is well-established in the Shannon and Erne catchments (including the River Inny), having proliferated in the mid to late 1990’s (Minchin et al., 2002). Zebra mussel is considered a high-risk impact species in Ireland (O’ Flynn et al., 2014) and is subject to restrictions under Regulations 49 and 50 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011).

The invasive (albeit naturalised) macrophyte Canadian pondweed (*Elodea canadenis*) was recorded at all survey sites on the River Inny (i.e. 1, 2, 3, & B3) in addition to site B6 on the Brosna North River. This very widespread invasive pondweed is also listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011) and is considered a high-risk invasive species in Ireland (O’ Flynn et al., 2014).

5.3 Aquatic ecology summary

In summary, the majority of watercourses in the vicinity of the proposed Coole wind farm were of at least **local importance (higher value)** in terms of their aquatic ecology. However, historical drainage pressures and or siltation have significantly reduced the quality of aquatic habitats on the Mayne Stream, Glore River, Monktown River, Froghanstown Stream, Ballynafid Stream and the Brosna North River.

Typically, larger watercourses with higher flow rates, greater water volumes and better connectivity, such as the River Inny and Glore River, are better able to buffer against such impacts and these watercourses supported the best quality aquatic habitats within the vicinity of the proposed wind farm for aquatic receptors of conservation value, such as salmonids, *Lampetra* sp., otter and or white-clawed crayfish.

With the exception of sites 3 on the River Inny and sites 6 & 7 on the Glore River (Q3-4), biological water quality was of **≤Q3 (poor status)** across all survey sites.

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7. Appendix A – Q-sample results (biological water quality)

Table 7.1 Macro-invertebrate Q-sampling results for sites 1 to 8, August 2022

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*						1	3		A
Ephemeroptera	Heptageniidae	Unidentified species			3			1			A
Ephemeroptera	Baetidae	*Alainites muticus*						2			B
Ephemeroptera	Leptophlebiidae	*Paraleptoplebia cincta*						1			B
Plecoptera	Leuctridae	*Leuctra hippopus*						4	3		B
Trichoptera	Beraeidae	*Beraeodes minutus*								2	B
Trichoptera	Goeridae	*Goera pilosa*									B
Trichoptera	Hydroptilidae	*Oxyethira* sp.			1			3			B
Trichoptera	Limnephilidae	*Halesus radiatus*	4	8	4			7			B
Trichoptera	Limnephilidae	*Limnephilus flavicornis*									B
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*									B
Trichoptera	Sericostomatidae	*Sericostoma personatum*									B
Hemiptera	Aphelochiridae	*Aphelocheirus aestivalis*	1		7			81	1		B
Odonata	Calopterygidae	*Calopteryx splendens*	4	2	8		19		1		B
Odonata	Coenagrionidae	*Coenagrion* sp.	2	8							B
Ephemeroptera	Baetidae	*Baetis rhodani*	8	17	21		86	33	42		C
Ephemeroptera	Ephemerellidae	*Serratella ignita*					1	32	48		C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*					2	66	31		C
Trichoptera	Polycentropodidae	*Neureclipsis bimaculata*									C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*	1		1						C
Trichoptera	Polycentropodidae	*Polycentropus kingi*									C
Crustacea	Gammaridae	*Gammarus duebeni*	25	18	23	2	112	61	98	1	C
Arachnida	Hydrachnidiae	Unidentified species	1	11	15					8	C
Coleoptera	Dytiscidae	*Agabus paludosus*									C
Coleoptera	Dytiscidae	*Dytiscus marginalis*	1	3	2						C

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Coleoptera	Dytiscidae	*Dytiscidae* larva	1	3	7						C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*				6					C
Coleoptera	Dytiscidae	*Ilybius ater*									C
Coleoptera	Dytiscidae	*Ilybius fuliginosus*				3					C
Coleoptera	Dytiscidae	*Nebrioporus depressus*	1								C
Coleoptera	Dytiscidae	*Rhantus exsoletus*			1						C
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*								1	C
Coleoptera	Elmidae	*Elmis aenea*						18	2		C
Coleoptera	Gyrinidae	*Gyrinidae larva*	1	2	8						C
Coleoptera	Gyrinidae	*Gyrinus substriatus*									C
Coleoptera	Halipliidae	*Haliplus ruficollis* group	11	12	16					1	C
Coleoptera	Halipliidae	*Haliplidae nymph*		1							C
Coleoptera	Noteridae	*Noterus crassicornis*									C
Diptera	Chironomidae	non-*Chironomus* spp.			9				2		C
Diptera	Culicidae	Unidentified species		1							C
Diptera	Pediciidae	*Dicranota* sp.						1			C
Diptera		Unidentified species									C
Diptera	Simuliidae	Unidentified species			1			44			C
Diptera	Thaumaleidea	Unidentified species					1				C
Diptera	Tipuliidae	Unidentified species									C
Hemiptera	Corixidae	Corixidae nymph	6	2	1						C
Hemiptera	Corixidae	*Siagara sp.*	13	28							C
Hemiptera	Gerridae	Gerridae nymph		2						2	C
Hemiptera	Gerridae	*Gerris sp.*	1				1			1	C
Hemiptera	Nepidae	*Nepa cinerea*					2				C
Hemiptera	Notonectidae	*Notonecta marmorea viridis*	1	1	1						C

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Hemiptera	Veliidae	*Velia caprai*				1					C
Mollusca	Bithnyiidae	*Bithynia tentaculata*	29	41	68						C
Mollusca	Dreissenidae	*Dreissena polymorpha*									C
Mollusca	Lymnaeidae	*Galba truncatula*								1	C
Mollusca	Lymnaeidae	*Lymnaea stagnalis*	1	8	12						C
Mollusca	Neritidae	*Theodoxus fluviatilis*						26	8		C
Mollusca	Planorbidae	*Bathyomphalus contortum*						1			C
Mollusca	Planorbidae	*Ancylus fluviatilis*						8			C
Mollusca	Planorbidae	*Gyraulus albus*	4	11	12			1			C
Mollusca	Planorbidae	*Planorbis carinatus*	1	1							C
Mollusca	Planorbidae	*Planorbis planorbis*	1	1	10				4	15	C
Mollusca	Tateidae	*Potamopyrgus antipodarum*						112	143		C
Mollusca	Valvatidae	*Valvata piscinalis*								1	C
Hirudinidae	Piscicolidae	*Piscicola sp.*		1							C
Tricladida	Planariidae	*Polycelis* sp.	2	4	2	6					C
Crustacea	Asellidae	*Asellus aquaticus*	16	21	18	56	31	14			D
Mollusca	Lymnaeidae	*Ampullacaena balthica*	6	1							D
Mollusca	Physidae	*Physa fontinalis*								2	D
Mollusca	Sphaeriidae	Unidentified species	2		11				1	16	D
Hirudinidae	Glossiphoniidae	Unidentified species									D
Megaloptera	Sialidae	*Sialis lutaria*				1				2	D
Diptera	Chironomidae	*Chironomus* spp.		1	1	35				16	E
Annelidae	Oligochaeta	Unidentified species	2		1						n/a
Annelidae	Naididae	Unidentified species				22					n/a
Crustacea	Argulidae	*Argulus* sp.									n/a
Arachnida	Dictynidae	*Argyroneta aquatica*		1	1						n/a
Abundance			**146**	**210**	**265**	**132**	**255**	**517**	**387**	**69**	

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Q-rating			Q3	Q3	Q3-4	Q2*	Q3	Q3-4	Q3-4	Q2-3*	
WFD status			Poor	Poor	Mod	Bad	Poor	Mod	Mod	Poor	

Table 7.2 Macro-invertebrate Q-sampling results for sites B1-B6, August 2022

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*							A
Ephemeroptera	Heptageniidae	Unidentified species							A
Ephemeroptera	Baetidae	*Alainites muticus*							B
Ephemeroptera	Leptophlebiidae	*Paraleptoplebia cincta*							B
Plecoptera	Leuctridae	*Leuctra hippopus*							B
Trichoptera	Beraeidae	*Beraeodes minutus*							B
Trichoptera	Goeridae	*Goera pilosa*						1	B
Trichoptera	Hydroptilidae	*Oxyethira* sp.							B
Trichoptera	Limnephilidae	*Halesus radiatus*			14				B
Trichoptera	Limnephilidae	*Limnephilus flavicornis*			2				B
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*			4				B
Trichoptera	Sericostomatidae	*Sericostoma personatum*				5			B
Hemiptera	Aphelochiridae	*Aphelocheirus aestivalis*			1				B
Odonata	Calopterygidae	*Calopteryx splendens*			7			5	B
Odonata	Coenagrionidae	*Coenagrion* sp.			4				B
Ephemeroptera	Baetidae	*Baetis rhodani*			16		1	97	C
Ephemeroptera	Ephemerellidae	*Serratella ignita*							C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*							C
Trichoptera	Polycentropodidae	*Neureclipsis bimaculata*						1	C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*							C

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Trichoptera	Polycentropodidae	*Polycentropus kingi*						1	C
Crustacea	Gammaridae	*Gammarus duebeni*	2			123	6	28	C
Arachnida	Hydrachnidiae	Unidentified species			17				C
Coleoptera	Dytiscidae	*Agabus paludosus*				3			C
Coleoptera	Dytiscidae	*Dytiscus marginalis*							C
Coleoptera	Dytiscidae	*Dytiscidae* larva		1	1	2			C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*							C
Coleoptera	Dytiscidae	*Ilybius ater*				2			C
Coleoptera	Dytiscidae	*Ilybius fuliginosus*	7						C
Coleoptera	Dytiscidae	*Nebrioporus depressus*							C
Coleoptera	Dytiscidae	*Rhantus exsoletus*							C
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*							C
Coleoptera	Elmidae	*Elmis aenea*							C
Coleoptera	Gyrinidae	*Gyrinidae larva*							C
Coleoptera	Gyrinidae	*Gyrinus substriatus*		2					C
Coleoptera	Haliplidae	*Haliplus ruficollis* group							C
Coleoptera	Haliplidae	*Haliplidae nymph*							C
Coleoptera	Noteridae	*Noterus crassicornis*			1				C
Diptera	Chironomidae	non-*Chironomus* spp.			1	8			C
Diptera	Culicidae	Unidentified species							C
Diptera	Pediciidae	*Dicranota* sp.							C
Diptera		Unidentified species			2				C
Diptera	Simuliidae	Unidentified species						24	C
Diptera	Thaumaleidea	Unidentified species							C
Diptera	Tipuliidae	Unidentified species				1			C
Hemiptera	Corixidae	Corixidae nymph	11		1				C

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Hemiptera	Corixidae	*Siagara sp.*			10				C
Hemiptera	Gerridae	Gerridae nymph							C
Hemiptera	Gerridae	*Gerris sp.*				1		1	C
Hemiptera	Nepidae	*Nepa cinerea*			1				C
Hemiptera	Notonectidae	*Notonecta marmorea viridis*			5				C
Hemiptera	Veliidae	*Velia caprai*							C
Mollusca	Bithnyiidae	*Bithynia tentaculata*		1	4				C
Mollusca	Dreissenidae	*Dreissena polymorpha*			7			14	C
Mollusca	Lymnaeidae	*Galba truncatula*			1				C
Mollusca	Lymnaeidae	*Lymnaea stagnalis*		2	11				C
Mollusca	Neritidae	*Theodoxus fluviatilis*			2			8	C
Mollusca	Planorbidae	*Bathyomphalus contortum*							C
Mollusca	Planorbidae	*Ancylus fluviatilis*							C
Mollusca	Planorbidae	*Gyraulus albus*							C
Mollusca	Planorbidae	*Planorbis carinatus*							C
Mollusca	Planorbidae	*Planorbis planorbis*		21	17				C
Mollusca	Tateidae	*Potamopyrgus antipodarum*		4				30	C
Mollusca	Valvatidae	*Valvata piscinalis*							C
Hirudinidae	Piscicolidae	*Piscicola sp.*			3				C
Tricladida	Planariidae	*Polycelis* sp.			5	32	5		C
Crustacea	Asellidae	*Asellus aquaticus*	17	37	21	9		7	D
Mollusca	Lymnaeidae	*Ampullacaena balthica*				57	3		D
Mollusca	Physidae	*Physa fontinalis*			1	1		1	D
Mollusca	Sphaeriidae	Unidentified species		2					D
Hirudinidae	Glossiphoniidae	Unidentified species			1				D
Megaloptera	Sialidae	*Sialis lutaria*		1					D
Diptera	Chironomidae	*Chironomus* spp.	53	3	3	2	6	1	E

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Annelidae	Oligochaeta	Unidentified species					2		n/a
Annelidae	Naididae	Unidentified species							n/a
Crustacea	Argulidae	*Argulus* sp.						10	n/a
Arachnida	Dictynidae	*Argyroneta aquatica*			8				n/a
Abundance			**90**	**74**	**171**	**246**	**23**	**229**	
Q-rating			**Q1-2***	**Q3***	**Q3**	**Q3**	**Q3***	**Q3**	
WFD status			**Bad**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	

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APPENDIX 4

2021-2022 BIRD SURVEY REPORTS

Bird Survey Report: March 2021 – March 2022

Coole Wind Farm

DOCUMENT DETAILS

Client:	**Statkraft**
Project Title:	**Coole Wind Farm**
Project Number:	**200445g**
Document Title:	**Bird Survey Report: March 2021 – March 2022**
Document File Name:	**200445g– F – Bird Report Mar21-Mar22 2022.10.27**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	21/10/2022	PM	PC
02	Final	27/10/2022	PM	PC

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1. INTRODUCTION

McCarthy Keville O'Sullivan (MKO) was appointed to carry out bird survey works at Coole Wind Farm during the period from March 2021 to March 2022 inclusive. This report also includes discussion of the key observations from the 2022 breeding season. It is further noted that surveys will continue this winter 2022/23, this data was not available at the time of writing this response but can be collated and made available on request. The site is located north of Coole Village in County Westmeath (53.734193, -7.3807204). The dominant habitat onsite is cutover bog, conifer plantation and improved agricultural grassland with accompanying smaller areas of wet grassland. The wider surroundings are predominantly cutover bog, to the west and north, and improved agricultural grassland, to the east and south. The total area of the wind farm site is approximately 495ha.

This report describes the ornithological survey methods employed and survey data collected at Coole for the period from March 2021 to March 2022 inclusive. The key observations from the 2022 breeding season are included in Section 3.2.9. This report also contains information compiled during desktop studies. Particular attention has been paid to species of conservation importance and identified target species.

The report is supported by Technical Appendix 1 (Survey Effort), Appendix 2 (Survey Data) and Appendix 3 (Confidential Data) which contains the raw data from the breeding bird surveys undertaken during the survey period. This includes detail on survey times, weather conditions, surveyors, survey results and other additional information. Flight line figures from surveys are included in Appendix 4. Appendix 5 contains the collision risk assessment.

The report is structured as follows:

- An introduction providing a description of the background and statement of authority regarding ornithological works.
- An update to the desktop study that was carried out as part of the EIAR.
- A comprehensive description of the ornithological surveys carried out.
- A full description of results for all ornithological surveys carried out.
- An updated impact assessment incorporating the data contained within the EIAR and this report.
- Conclusion

The following defines terms used in this report:

- "Zones of Influence" (ZOI) for potential ornithological receptors refer to the zone within which potential effects are anticipated. ZOIs were assigned following the best available guidance (SNH 2016 and McGuinness et.al 2015).

1.1 Statement of Authority

This report has been prepared by Patrick Manley (B.Sc.) Project Ornithologist with MKO. The field surveys were undertaken by Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Patrick Manley, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

2. DESK STUDY & CONSULTATION

2.1 Desk Study Methods

A comprehensive desk study was undertaken to search for any changes in the relevant information on species of conservation concern which may potentially make use of the study area since the EIAR was submitted. The assessment included a thorough review of the latest ornithological data not available at the time of EIAR submission. These include:

- Review of online web-mappers with more up to date available data: Irish Wetland Bird Survey (I-WeBS).
- Review of Birds of Conservation Concern (BoCCI) in Ireland 2020-2026 (Gilbert et al., 2021)
- Review of the 2020 International Swan Census data (Burke et al., 2021).

2.2 Desk Study Results

2.2.1 Bird of Conservation Concern (BoCCI) in Ireland 2020-2026

As per Bird of Conservation Concern (BoCCI) in Ireland 2020-2026, the following key ornithological receptors from the EIAR have been added to the BoCCI red-list:

- Kestrel
- Snipe

The following key ornithological receptors from the EIAR have been moved from the BoCCI red-list to the BoCCI Amber-list:

- Black-headed Gull
- Teal
- Wigeon

2.2.2 Irish Wetland Bird Surveys (I-WeBS)

The I-WeBS data presented in the EIAR was the county population estimate based on the five year mean from 2011/12 to 2015/16. The most up to date I-WeBS data currently available is the five year mean from 2015/16 to 2019/20. It is noted that this is an estimate, based on the best available information for water bird species. The table below shows the change in county population size for each species discussed in the EIAR, where I-WeBS data was used to evaluate county importance thresholds.

Table 1 I-WeBS updated county population sizes

Species	2011/12-2015/16 Mean	2015/16-2019/20 Mean
Greenland White-fronted Goose	291	235
Golden Plover	2,610	264
Wigeon	632	248
Teal	450	221

2.2.3 2020 International Swan Census

At the time of submission of the EIAR the Swan Census 2015 (Crowe et al., 2015) was the latest available data for whooper swan. In 2021, the 2020 International Swan Census data was published (Burke et al., 2021). The EIAR referenced the Westmeath county population to be 389 whooper swan. The 2020 Swan Census estimated the Westmeath whooper swan population to be 982 birds.

2.2.4 EPA Guidelines

The Environmental Protection Agency guidelines on the information to be contained in Environmental Impact Assessment Reports were updated in May 2022 (EPA, 2022). This document was reviewed for changes compared to the EPA (2017) guidelines and the new guidelines were adhered to in this report.

3. FIELD SURVEYS

3.1 Field Survey Methods

This section of the report describes the various field survey methods employed. Field surveys were undertaken from March 2021 to March 2022 inclusive[1]. The data provided in this report is robust and allows clear, precise and definitive conclusions to be made with regard to the likely significant effects on avian receptors identified within the subject site. Field survey methodologies have been devised to survey for the bird species composition and assemblages that occur within the study area.

3.1.1 Initial Site Assessment

The likely importance of the study area for bird species was determined, based on the results of the previous surveys as reported in the EIAR, the desk study and reconnaissance site visits. Based on the collated information available from the above preliminary assessment and adopting a precautionary approach, a site-specific scope for the ornithological surveys was developed.

3.1.2 Vantage Point Surveys

Vantage point (VP) surveys were undertaken in accordance with SNH guidance (SNH, 2017) from two vantage point locations from March 2021 to September 2021 (VP4 & VP6) and from four vantage point locations from October 2021 to March 2022 (VP3, VP4, VP5 & VP6). Data on bird observations and flight activity was collected from a scanning arc of 180° and a two-kilometre radius by an observer at each fixed location for six hours per month. Surveys were timed to provide a spread over the full daylight period including at dawn and dusk to coincide with the highest peaks of bird activity.

Details on the vantage point watch survey effort are presented in Appendix 1 of this report. This appendix includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Appendix 4, Figure 1 shows the locations of vantage points and technical data is provided in Appendix 2.

Flight activity was assigned to distinct height bands. The flight bands were chosen with reference to the dimensions of likely turbine models for the site and the resulting potential collision height. Bands are split into 0-15m, 15-25m, 25m-200m and 200m+. Taking a precautionary approach 15-200m is considered potential collision height (PCH), i.e. the height of the rotating turbine blade.

3.1.2.1 Viewshed Analysis

Viewshed analysis was carried out to confirm the sufficiency of the selected fixed vantage point locations (VP3, VP4, VP5 & VP6) prior to the commencement of surveys in March 2021(or September 2022 where relevant). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional and precautionary layer suspended at 20m, which represents the lowest swept height of the turbine blades. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance emphasises the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a view shed point two metres in height (to represent the height of the observer) on a map using 10 metre contours terrain data. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 20

[1] *In addition, the key observations from the 2022 breeding season are included in Section 3.2.9 below.*

metres from ground level up to a two-kilometre radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the likely maximum viable area of the site for a wind energy development in line with SNH's recommendation to conduct surveys to 500m from the outermost turbines of a proposed wind farm site (2017). The viewshed analysis offers maximum views of the study area with adequate coverage of the proposed turbine layout. As described above, the predicted collision risk height band that was used in the current assessment is considered to be precautionary and in line with previous recommended height bands advocated in SNH (2005) guidance documents. Appendix 4, Figure 1a, 1b and 1c show the viewshed analysis of the four vantage point locations at 20m, 26m and 25m, respectively.

3.1.3 Breeding Walkover Surveys

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable, or confirmed breeding territories for bird species observed within the study area. The survey methodology followed the O'Brien and Smith method for lowland sites as outlined in Gilbert et al. (1998). The study area for these surveys was the wind farm site and a 500m survey radius of the wind farm site.

Transects were selected in order to survey all areas of suitable breeding/ foraging habitat to within 100m, where access allowed. Target species included waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out during daylight hours, during the core breeding season months of April, May, June and July (2021), with the wind farm site being visited three days per month on each occasion. Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 2 in Appendix 3 shows the survey area.

3.1.4 Breeding Raptor Surveys

Breeding raptor surveys (*i.e.,* birds of prey and owls) were undertaken within the study area and its immediate surroundings. These surveys aimed to identify occupied territories and ascertain whether breeding was successful. Methodology followed Hardey *et al.* (2013). Raptor surveys were undertaken onsite and to a 2km radius from the wind farm site every month during the core breeding season period (April to July 2021).

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 3 in Appendix 4 shows the study area extending 2km from the wind farm site.

3.1.5 Woodcock Surveys

Breeding season surveys for woodcock were undertaken in accordance with Gilbert et. al (1998). The survey area extended 500m beyond the wind farm site. All surveys were undertaken in areas of suitable breeding habitat during May and June 2021. Surveys commenced one hour before sunset and continue for an hour after sunset/ until it was too dark to see. The survey aimed to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area. This survey method also allowed the observer to survey for owls, i.e., barn owls and long-eared owls.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 4 in Appendix 4 shows survey area and technical data is provided in Appendix 2.

3.1.6 Winter Walkover Surveys

Winter walkover surveys were undertaken to record the presence of bird species of high conservation concern within areas of potentially suitable habitat in the wind farm site and a 500m survey radius of the wind farm site.

Transect routes, devised to ensure coverage of different habitat complexes, were visited within the study area during the winter months. Methodology was broadly based on adapted Brown and Shepherd methods. Target species included raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 5 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.7 Wildfowl Distribution Surveys

Significant wetland sites and waterbodies within eight kilometres of the study area were surveyed for waterbird populations between September 2021 and March 2022. The area surveyed exceeded the requirements of SNH (SNH, 2017), i.e., 500m for foraging wildfowl and one kilometre for roosting wildfowl. In addition, the Lough Iron waterbird population situated approximately 12.8km to the south-west of the wind farm site was monitored one day per month during the same period, with a particular focus on Greenland white-fronted goose. The count methodology was in line with survey guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours from suitable vantage points at the wetland sites.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 6 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.8 Survey Justification

A comprehensive suite of bird surveys was undertaken at the site between March 2021 and March 2022, as detailed in this report. Results in this report are derived from a continuous thirteen months of surveying undertaken in accordance with SNH Guidance.

The surveys undertaken provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the wind farm site on avian receptors. The survey duration and scope are considered entirely satisfactory.

3.2 Field survey results

3.2.1 Introduction

The following target species were recorded between March 2021 and March 2022 and observations are described in detail in subsequent sections below. The list is ordered in accordance with conservation significance: Annex I species, SCIs of designated sites, Red listed species and raptors:

- Common Tern (Annex I)
- Golden Plover (Annex I; SCI species of nearby SPA)
- Greenland White-fronted Goose (Annex I; SCI species of nearby SPAs)
- Hen harrier (Annex I)
- Kingfisher (Annex I)
- Little Egret (Annex I)
- Merlin (Annex I; Schedule IV of the Wildlife Act; 1976)
- Peregrine Falcon (Annex I; Schedule IV of the Wildlife Act; 1976)
- Ruff (Annex I)
- White-tailed Eagle (Annex I; Schedule IV of the Wildlife Act; 1976)
- Whooper Swan (Annex I; SCI species of nearby SPA)
- Coot (SCI species of nearby SPA)
- Shoveler (SCI species of nearby SPAs)
- Teal (SCI species of nearby SPA)
- Tufted Duck (SCI species of nearby SPAs)
- Wigeon (SCI species of nearby SPA)
- Curlew (BoCCI Red listed)
- Goldeneye (BoCCI Red listed)
- Kestrel (BoCCI Red listed)
- Lapwing (BoCCI Red listed)
- Pochard (BoCCI Red listed)
- Snipe (BoCCI Red listed)
- Woodcock (BoCCI Red listed)
- Buzzard
- Long-eared Owl
- Sparrowhawk

The following sections describe the observations of each target species under the individual survey headings. Raw data and maps are provided in Appendix 2 and Appendix 4, respectively.

3.2.2 Vantage Point Survey Results

Vantage point surveys were undertaken at the site between March 2021 and March 2022 inclusive. Summary results from vantage point surveys are presented below in Table 3-1 and discussed in further detail in Section 4 of this report.

Table 3-1 Vantage Point Survey Results

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	9	126,830	8	Flocks of between six and 175 birds commuting or circling over the wind farm site.	Appendix 4, Figure 1.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1,400	1	One observation of a flock of 14 birds commuting.	Appendix 4, Figure 1.2
Annex I; BoCCI Red Listed	Hen Harrier	8	0	7	There were eight observations of hen harrier at the wind farm site. All of which were of birds commuting or landing in scrub near the River Inny.	Appendix 4, Figure 1.3
Annex I	Kingfisher	2	0	2	One observation of a bird flying from a drain and one of a bird heard calling.	Appendix 4, Figure 1.4
Annex I; Schedule IV of the Wildlife Act	Merlin	5	0	5	Four observations of an individual hunting and one observation of an individual commuting.	Appendix 4, Figure 1.5
Annex I; Schedule IV of the Wildlife Act	Peregrine	2	12	1	One observation of an individual hunting and one of an individual commuting.	Appendix 4, Figure 1.6
Annex I; SCI of nearby SPAs	Whooper Swan	25	13,704	19	All observations were of birds commuting. Flocks ranged from two to sixteen birds.	Appendix 4, Figure 1.7
SCI of nearby SPAs	Coot	4	317	4	All observations were of one or two birds commuting.	Appendix 4, Figure 1.8

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
BoCCI Red Listed	Curlew	2	590	2	There were two observations of birds commuting/soaring, ranging from one to three birds.	Appendix 4, Figure 1.9
BoCCI Red Listed	Kestrel	30	5,655	25	Most observations were of birds hunting or commuting. There was one observation of a kestrel being chased by a buzzard. All observations were of individuals.	Appendix 4, Figure 1.10
BoCCI Red Listed	Lapwing	1	2,025	1	There was one observation of a flock of 25 birds commuting.	Appendix 4, Figure 1.11
BoCCI Red Listed	Snipe	18	130	15	There were four observations of one or two birds commuting. There was one observation of a bird being flushed. Additionally, there were four birds heard drumming and nine calling.	Appendix 4, Figure 1.12
BoCCI Red Listed	Woodcock	2	0	2	Two observations of birds roding in March.	Appendix 4, Figure 1.13
Schedule IV of the Wildlife Act	Buzzard	62	8,452	49	Most observations were of birds soaring, travelling or hunting. There was one observation of a buzzard chasing a kestrel in August. There were six observations of buzzards displaying between January and March 2022.	Appendix 4, Figure 1.14
Schedule IV of the Wildlife Act	Long-eared Owl	1	0	0	One observation of a bird perched in a tree and being mobbed by corvids.	Not Mapped
Schedule IV of the Wildlife Act	Sparrowhawk	7	166	7	There were three observations of sparrowhawk in April. Flying and perching at the known nest site. The remaining flights were of birds hunting or commuting.	Appendix 4, Figure 1.15

3.2.3 Breeding Walkover Survey Results

Breeding walkover surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding walkover surveys are presented below in Table 3-2 and discussed in more detail in Section 4 of this report.

Table 3-2 Breeding Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Breeding Status	Figure
Annex I; SCI of nearby SPA	Golden Plover	1	1	One observation of three birds travelling at the beginning of April 2021. Likely remnant wintering birds on route north to summer breeding grounds.	**Non-breeding**	Appendix 4, Figure 2.1
BoCCI Red Listed	Lapwing	6	3	Four observations of territorial behaviour. There were three territories identified, two to the north of the wind farm site (one immediately adjacent to the wind farm site and one approx. 400m from the wind farm site). The third territory was at the historical territory, approximately 3.8km south of the wind farm site	**Confirmed – Three breeding territories**	Appendix 4, Figure 2.2
BoCCI Red Listed	Snipe	8	4	There were six observations of flushed birds, one of a bird flying and one of a bird displaying, approximately 3.8km south of the wind farm site	**Probable – One breeding territory**	Appendix 4, Figure 2.3
Schedule IV of the Wildlife Act	Buzzard	4	4	There were three observations of birds calling, and one observation of a bird flying from trees and circling	**Non-breeding**	Appendix 4, Figure 2.4
Schedule IV of the Wildlife Act	Sparrowhawk	1	1	One observation of a bird carrying nesting material to a nest site	**Confirmed – One breeding territory**	Appendix 4, Figure 2.5

3.2.4 Breeding Raptor Survey Results

Breeding raptor surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding raptor surveys are presented in Table 3-3 below and discussed in more detail in Section 4 of this report.

Table 3-3 Breeding Raptor Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/within 500m	Activity of note	Breeding Status	Figure
Annex I	Peregrine	2	0	Two observations of birds travelling/soaring	**Non-breeding**	Appendix 4, Figure 3.1
Annex I	White-tailed Eagle	1	0	One observation of a bird travelling, and being mobbed by buzzard	**Non-breeding**	Appendix 4, Figure 3.2
BoCCI Red Listed	Kestrel	8	1	All observations were of birds travelling or hunting	**Non-breeding**	Appendix 4, Figure 3.3
Schedule IV of the Wildlife Act	Buzzard	31	0	Most observations were of birds travelling, soaring or hunting. There was one observation of two buzzards mobbing a white-tailed eagle in July	**Non-breeding**	Appendix 4, Figure 3.4
Schedule IV of the Wildlife Act	Sparrowhawk	3	1	All observations were of birds travelling	**Non-breeding**	Appendix 4, Figure 3.5

3.2.5 Breeding Woodcock Survey Results

A number of woodcock observations were recorded during targeted breeding woodcock surveys. All observations are detailed in Table 3-4 below and discussed in further detail in Section 4 of this report.

Table 3-4 Breeding Woodcock Observations

Conservation Status	Species	Observations recorded during surveys	Number of birds within 500m of site	Activity of note	Breeding Status	Figure
BoCCI Red List (Breeding populations only)	Woodcock	30	30	All observations were of birds roding	**Probable – Seven breeding territories**	Appendix 4, Figure 4.1

3.2.6 Winter Walkover Survey Results

Winter walkover surveys were carried out during the 2021/2022 winter season: October to March. Summary results from winter walkover surveys are presented below in Table 3-5 and discussed in more detail in Section 4 of this report.

Table 3-5 Winter Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	4	4	Observations ranged from four to sixteen birds. There were two observations of birds commuting and two of birds roosting on the bog.	Appendix 4, Figure 5.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1	One observation of five birds commuting over the wind farm site.	Appendix 4, Figure 5.2
Annex I	Kingfisher	1	1	One observation of an individual flying along the River Inny.	Appendix 4, Figure 5.3
SCI of nearby SPA	Teal	3	3	There was one observation of two birds commuting, one of two birds roosting and one of a flock of 22 birds foraging.	Appendix 4, Figure 5.4
SCI of nearby SPA	Wigeon	1	1	There was one observation of a flock of eight birds foraging.	Appendix 4, Figure 5.5
BoCCI Red Listed	Kestrel	1	1	One observation of an individual perched.	Appendix 4, Figure 5.6
BoCCI Red Listed	Lapwing	1	1	One observation of 4 pairs of lapwing nest building in mid-March.	Appendix 4, Figure 5.7
BoCCI Red Listed	Snipe	8	8	All observations were of birds being flushed by the observer. Numbers ranged from one to four birds.	Appendix 4, Figure 5.8

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	7	7	All observations were of one or two birds commuting.	Appendix 4, Figure 5.9

3.2.7 Wildfowl Distribution Surveys

Wildfowl distribution surveys were carried out during the 2021/22 winter season: September to March. Summary results from wildfowl distribution surveys are presented below in Table 3-6 and discussed in more detail in Section 4 of this report.

Table 3-6 Wildfowl Distribution Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
Annex I	Common Tern	1	2	0	Two birds seen flying at Lough Derravaragh.	Appendix 4, Figure 6.1
Annex I; SCI of nearby SPA	Golden Plover	4	5 – 160	1	All observations were of birds commuting or circling.	Appendix 4, Figure 6.2
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	4	4 – 24	0	All observations were of birds foraging at Piercefield, near Lough Iron.	Appendix 4, Figure 6.3
Annex I	Kingfisher	1	1	0	One observation of a bird foraging along the River Inny.	Appendix 4, Figure 6.4
Annex I	Little Egret	16	1 – 2	2	All observations were of birds commuting, foraging or roosting. Birds were observed at Lough Iron, Lough Bane, Lough Sheelin, Derragh Lough and Brackragh Lough.	Appendix 4, Figure 6.5
Annex I	Ruff	1	2	1	One observation of two birds perched on peat at the wetland west of Lough Bane.	Appendix 4, Figure 6.6
Annex I	Whooper Swan	36	1 – 77	3	Birds observed at Lough Iron, Derragh Lough, River Inny, Lough Bane and Lough Sheelin.	Appendix 4, Figure 6.7

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
SCI of nearby SPA	Coot	167	1 – 890	0	Birds observed on Deragh Lough, Lough Iron Lough Kinale, Lough Sheelin, Lough Derravaragh, Bracklagh Lough and along the River Inny.	Appendix 4, Figure 6.8
SCI of nearby SPAs	Pochard	18	1 – 182	0	Birds observed on Lough Kinale, Lough Sheelin, Lough Derravaragh and Bracklagh Lough.	Appendix 4, Figure 6.9
SCI of nearby SPAs	Shoveler	11	5 – 36	0	Birds observed at Derragh Lough, Lough Iron, And Lough Sheelin.	Appendix 4, Figure 6.10
SCI of nearby SPA	Teal	41	3 – 240	7	Birds observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown.	Appendix 4, Figure 6.11
SCI of nearby SPAs	Tufted Duck	48	2 – 190	0	Birds observed at Lough Kinale, Bracklagh Lough, Lough Sheelin, Lough Derravaragh, Deragh Lough, Lough Iron and Robinstown.	Appendix 4, Figure 6.12
SCI of nearby SPA	Wigeon	37	2 – 263	8	Birds observed at Derragh Lough, Lough Derravaragh, Lough Sheelin, Lough Iron, Lough Kinale and Lough Bane.	Appendix 4, Figure 6.13
BoCCI Red Listed	Curlew	3	2 – 57	1	All observations were of birds commuting.	Appendix 4, Figure 6.14
BoCCI Red Listed	Goldeneye	9	5 – 24	0	Birds observed on Lough Derravaragh and Lough Sheelin.	Appendix 4, Figure 6.15
BoCCI Red Listed	Lapwing	28	1 – 245	6	All observations were of birds commuting, foraging or roosting.	Appendix 4, Figure 6.16

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
BoCCI Red Listed	Snipe	13	1 – 4	5	All observations were of birds being flushed by the observer.	Appendix 4, Figure 6.17

3.2.8 Incidentals

A number of incidental observations of target species were recorded during the survey period. The most significant of these observations are detailed in Table 3-7 below and discussed in further detail in Section 4 of this report.

Table 3-7 Incidental Observations

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Annex I	Kingfisher	Wildfowl distribution surveys	8	Birds observed along the River Inny.	Appendix 4, Figure 7.1
Annex I	Peregrine	Vantage point survey	1	One bird commuting at Doon.	Appendix 4, Figure 7.2
Annex I	White-tailed Eagle	Wildfowl distribution surveys	1	One observation of a birds soaring over Lough Derravaragh.	Appendix 4, Figure 7.3
BoCCI Red Listed	Kestrel	Wildfowl distribution surveys & winter walkover surveys	18	All observations were of birds commuting, hunting or perched.	Appendix 4, Figure 7.4
BoCCI Red Listed	Lapwing	Breeding raptor surveys	10	Two breeding territories identified to the north of the wind farm site.	Appendix 4, Figure 7.5
BoCCI Red Listed	Snipe	Breeding woodcock & vantage point surveys	10	Five observations of birds drumming and five observations of birds being flushed by the observer.	Appendix 4, Figure 7.6

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	32	All observations were of birds commuting, soaring or perched.	Appendix 4, Figure 7.7
Schedule IV of the Wildlife Act	Sparrowhawk	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	6	All observations were of birds commuting.	Appendix 4, Figure 7.8

3.2.9 Target Species Status Summary

While breeding/roosting status is assigned according to the evidence obtained during individual breeding bird surveys as reported in Tables 3-1 to 3-7 above, Table 3-8 below provides the status of target species observed during surveys between March 2021 and March 2022 at Coole Wind Farm. In addition, the key observations from the 2022 breeding bird surveys are also summarised in the below table.

Table 3-8 Target Species Status Summary

Species	Overall breeding status	Overall roosting status
Greenland White-fronted Goose	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Golden Plover	**No breeding site identified.**	**No regularly used roosts identified.**
Hen Harrier	**No breeding site identified.**	**No regularly used roosts identified.**
Kingfisher	**No breeding site identified.**	**No regularly used roosts identified.**
Peregrine	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** Peregrine occupied the known breeding territory, approximately 1.3km from the wind farm site, during the 2022 breeding season. This site was last occupied in 2016. Please refer to Confidential Appendix 3 for location details.	**No regularly used roosts identified.**
White-tailed Eagle	**No breeding site identified.**	**No regularly used roosts identified.**
Whooper Swan	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Kestrel	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** One observation of a bird being agitated and one of a bird carrying prey, within the wind farm site. It is assumed both of these observations relate to one confirmed breeding territory, within the wind farm site.	**No regularly used roosts identified.**
Lapwing	**Confirmed breeding** **March 2021 to March 2022:** Three breeding territories, one presumed successful and two failed to fledge young. Two within 500m of the wind farm site, and one approximately 3.8km from the wind farm site. Please refer to Confidential Appendix 3 for location details. **Summer 2022:** There was an estimated 4 – 10 pairs of lapwing breeding in this area c. 441m from the nearest proposed infrastructure. This is discussed further in Section 4.4.7.	**No regularly used roosts identified.**

Species	Overall breeding status	Overall roosting status
Snipe	**Probable breeding** – Nine breeding territories identified, six within, or partially within, the wind farm site, to the north. Two within 500m of the wind farm site to the north. One approximately 3.8km south of the wind farm site. **Summer 2022** – Snipe were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Woodcock	**Probable breeding** – Seven breeding territories identified. Five within, or partially within, the wind farm site. **Summer 2022** – Woodcock were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Buzzard	**No breeding site identified.**	**No regularly used roosts identified.**
Sparrowhawk	**Confirmed breeding** – One territory, within the wind farm site. Sparrowhawk were also confirmed to have bred successfully within the wind farm site during the 2022 breeding season.	**No regularly used roosts identified.**

4. IMPACT ASSESSMENT

The ornithological evaluation criteria and impact assessment methods are outlined in Section 7.2.5 of the EIAR.

4.1 Identification of Key Ornithological Receptors

The identification of KOR species is outlined in Section 7.6 of the EIAR. Given the observations between March 2021 and March 2022 are in keeping with those outlined in the EIAR, the identified KOR species remains the same.

The following species were not discussed in the EIAR but were observed during surveys between March 2021 and March 2022:

- Common Tern
- Kingfisher
- Little Egret
- Ruff
- White-tailed Eagle
- Goldeneye

Of these, only kingfisher was observed at, or within 500m of, the wind farm site. This species was recorded infrequently and in low numbers. Therefore, kingfisher is not considered a KOR. The remaining species were only observed during the wildfowl distribution surveys, up to 8km from the wind farm site and are therefore not considered a KOR.

The following species have been moved from the BoCCI red list to the BoCCI amber list and were only recorded infrequently and in low numbers during surveys at, or near, the wind farm site between March 2021 and March 2022. Therefore, an updated impact assessment for these species is not required:

- Black-headed gull
- Teal
- Wigeon

Furthermore, osprey, barn owl and red kite were not recorded during these surveys, therefore, an updated impact assessment for these species is not required.

Please refer to the EIAR as lodged for the impact assessment.

4.2 KOR Sensitivity Determination

Criteria developed by Percival (2003) is presented in **Error! Reference source not found.** (Section **Error! Reference source not found.**) of the EIAR for assessing bird sensitivity within the study area. The sensitivity of KOR as per Percival are listed below and includes the rationale for their respective sensitivity classification included in brackets.

Very High Sensitivity KORs include:

- Greenland White-fronted Goose (Annex I; EU Birds Directive, SCI of nearby SPAs)

Medium Sensitivity KORs include:

- Golden Plover (Annex I; EU Birds Directive)

- Merlin (Annex I; EU Birds Directive)
- Peregrine Falcon (Annex I; EU Birds Directive)
- Whooper Swan (Annex I; EU Birds Directive)
- Kestrel (BoCCI Red-listed)
- Lapwing (BoCCI Red-listed)
- Snipe (BoCCI Red-listed)
- Woodcock (BoCCI Red-listed)

The remaining KORs identified in the study area were classified as **Low Sensitivity**:

- Buzzard
- Long-eared Owl
- Sparrowhawk

Please note since the lodging of the planning application for the proposed development the conservation status of several species has changed due to the recent update of the BoCCI red-list (Gilbert et al. 2021), this change is reflected in the classification of sensitivity for those species. The following updates have been made:

- Kestrel was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.
- Snipe was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.

4.3 Potential Effects Associated with the Proposed Development

As per SNH Guidance, wind farms present three potential risks to birds (Drewitt & Langston 2006, 2008; Band et al. 2007):

- **Direct habitat loss** through construction of wind farm infrastructure;
- **Displacement** (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds;
- Death through **Collision** or interaction with turbine blades and other infrastructure.

4.4 Effects on Key Ornithological Receptors during Construction and Operation

4.4.1 Greenland White-fronted Goose (*Wintering*)

As outlined in Section 7.8.2.2 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.2 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.2 of the EIAR, the vast majority of observations were of flocks recorded at Lough Iron, approximately 12.8km from the wind farm site. During surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). There was no evidence of roosting or foraging within 1km of the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.2 of the EIAR, this species was not recorded utilising habitats on, or within 500m of, the wind farm site. The species was observed flying over the site on only one occasion between March 2021 and March 2022.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
	Given the low numbers recorded and the abundance of suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. Significant effects with regard to displacement are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	*Negligible* Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Similar to the data outlined in Section 7.8.2.2 of the EIAR, there was only one observation of birds commuting over the wind farm site between March 2021 and March 2022. Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind site. There was no foraging birds recorded on, or within 500m of, the wind farm site. Similarly, there was no evidence of roosting birds on, or within 1km of, the wind farm site. No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.04 collisions per year, or one bird every 25 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.2 Golden Plover (*Wintering*)

As outlined in Section 7.8.2.3 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.3 of the EIAR for further details on the impact assessment for golden plover. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	In contrast to the data presented in Section 7.8.2.3 of the EIAR, there were no observations of golden plover utilizing habitats on, or within 500m of, the wind farm site between March 2021 and March 2022. Significant effects with regard to direct habitat loss are not predicted, given the development infrastructure is confined to a narrow corridor, therefore direct habitat loss will be minimal. Furthermore, the habitats within the Site are not of particularly high quality and there is an abundance of similar habitat in the surrounding area. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As per McGuinness et al. (2015) the zone of sensitivity for the species is 800m during the breeding season only. The species is not identified as being particularly sensitive to wind farm developments during the wintering period. This species was recorded commuting or circling over the bog on, or within 500m of, the wind farm site during the winter season. Numbers of county importance were observed on six occasions on, or within 500m of, the wind farm site.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	This is a marked reduction in the use of the Site compared to the regular use of the Site as reported in the EIAR. Given the abundance of similar suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	A review of 29 studies suggests golden plover will approach wind turbines to an average distance of 175m in non-breeding season (Hötker et al., 2006). There were 10 observations of golden plover within 200m of the proposed turbine layout during surveys between March 2021 and March 2022. In the event of displacement, there are sufficient areas of suitable habitat in the wider area to render such an effect inconsequential. Furthermore, habitats within the wind farm site (e.g. cutover bog) are not of particularly high quality. There is no evidence to suggest that the wind farm site lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (EIAR Appendix 7-5). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. Please see Appendix 5 for further discussion.	Impact corresponds to a ***Low*** effect significance. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.3 Merlin (All Seasons)

As outlined in Section 7.8.2.4 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.4 of the EIAR for further details on the impact assessment for merlin. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	A similar abundance and rate of occurrence was recorded between March 2021 and March 2022 as reported in Section 7.8.2.4 of the EIAR. This species was not recorded utilising habitats within the wind farm site for roosting or breeding. Significant effects are not anticipated particularly given the low levels of activity recorded. The species was recorded hunting onsite on only four occasions between March 2021 and March 2022. This is not significantly different from the seven observations over four years as outlined in Section 7.8.2.4 of the EIAR. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.4 of the EIAR, there was no breeding activity recorded within the study area during the 2021 breeding season. Significant displacement effects are not anticipated, given how infrequently the wind farm site was visited by this species. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated particularly given the low levels of activity recorded throughout surveys. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was infrequently recorded flying with the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken on a precautionary basis and full details are provided in Appendix 5. The collision risk has been calculated to be 0.011 collisions per year, or approximately one bird every 92 years. The results of this analysis are not significantly different from the collision risk report in the EIAR as lodged. The predicted collision risk is insignificant.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.4 Peregrine (*All Seasons*)

As outlined in Section 7.8.2.5 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.5 of the EIAR for further details on the impact assessment for peregrine. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented in Section 7.8.2.5 of the EIAR, this species was only occasionally recorded commuting/hunting at the wind farm site. There is no significant difference in the rate of occurrence of peregrine between these surveys and those discussed in Section 7.8.2.5 of the EIAR. There is no suitable breeding habitat for this species within the wind farm site. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	No breeding territories or roost sites were recorded within the wind farm site. Breeding activity was recorded at the historic nest site (please see Confidential Appendix 3 for further details), approximately 1.3km from the wind farm site, during the 2022 breeding season. Peregrine were recorded foraging on one occasion within the wind farm site between March 2021 and March 2022. However, the wind farm site does not contain habitats that are of particularly high quality or unique to the local area. Therefore, if displacement was to occur it would not result in the loss of a scarce resource for the local population.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement or barrier effects are not predicted, particularly given the separation distance between the wind farm site and the nest site. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Disturbance impacts are not predicted for the nest, given the significant separation distance involved, i.e. 1.6km from the nearest proposed turbine. As previously discussed, this species was only recorded foraging within the wind farm site on one occasion between March 2021 and March 2022, which is less frequent that the data presented in the EIAR shows. Furthermore, the wind farm site does not contain habitats that are of particularly high quality for this species or unique to the local area. Therefore, if displacement were to occur it would not result in the loss of a scarce resource for the local population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at 0.196 collisions per year or one bird every 5 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. Significant effects are not predicted for a rate of one potential collision every eight years.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.5 Whooper Swan (*Wintering*)

As outlined in Section 7.8.2.1 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.1 of the EIAR for further details on the impact assessment for whooper swan. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	The wind farm site is dominated by cutover bog, this is not considered suitable for wintering whooper swan. There were no whooper swans observed utilising the habitats within the wind farm site. The unfavourable nature of this habitat limits the potential for construction activities to result in ecologically significant habitat loss for whooper swan. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data presented in Section 7.8.2.1 of the EIAR, most observations were of flocks recorded during the wildfowl distribution surveys, with the majority of these being at Lough Iron, approximately 12.8km from the wind farm site. In contrast to the data presented in Section 7.8.2.1 of the EIAR, the frequency of whooper swan commuting flights over the wind farm site increased during surveys between March 2021 and March 2022. There were 25 observations of whooper swan commuting during this period, compared to an average of three flights per winter presented in Section 7.4.1 of the EIAR (twelve flights total over a four-year period). The number of birds per flock remained similar to	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	those presented in Section 7.4.1 of the EIAR, with between two and sixteen birds being observed. However, the number of flights over the wind farm site remains low and given that the habitats on site are unlikely to attract whooper swan significant disturbance impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	No foraging areas were recorded on, or within 500m of, the wind farm site and there was no evidence of roosting on, or within 1km of, the wind farm site. Whooper swan were rarely recorded flying over the wind farm site during surveys presented in the EIAR. The frequency of flights increased slightly between March 2021 and March 2022 compared to data presented in Section 7.4.2 of the EIAR, but whooper swans were still infrequently observed. Survey results indicate that the wind farm site does not lie on a migratory corridor for this species. Therefore, no barrier effect is predicted. Based on the complete dataset there is no potential for significant displacement effects given that whooper swans were not dependent on the habitats of the whooper swan for roosting or feeding. Furthermore, it is unlikely that any significant displacement impact will result during the operational phase, given the low level of flight activity and particularly the low numbers recorded per flight.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.79 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.6 Kestrel (All Seasons)

As outlined in Section 7.8.2.17 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.17 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented Section 7.8.2.17 in the EIAR, this species was frequently recorded hunting, potentially breeding and commuting on, or within 500m of, the wind farm site. Direct loss of foraging habitat relative to its availability onsite and within the surrounding area, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[2] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded on, or within 500m of, the wind farm site. The majority of observations involve hunting or commuting birds. The proposed development area does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local kestrel population.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

[2] Note that kestrel is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Studies on raptors have generally found only low levels of turbine avoidance (Hötker et al., 2006; Madders & Whitfield, 2006), with some species, such as kestrels, known to continue foraging activity close to turbines (Pearce Higgins et al., 2009). Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 2.5 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore negligible in the context of the county population.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.7 Lapwing (All Seasons)

As outlined in Section 7.8.2.11 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.11 of the EIAR for further details on the impact assessment for lapwing. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.11 of the EIAR, lapwing nested within 500m of the wind farm site (Please see Confidential Appendix 3 for details). In 2021, there were two breeding pairs in this area, with one nest fledging young and the second nest was presumed to have failed (furthermore, these breeding territories remained active in 2022 breeding season). Additionally, there was one breeding territory located approximately 3.8km from the wind farm site and adjacent to the grid connection. This pair was presumed to have hatched chicks but was predated before fledging. Lapwing were observed utilising habitats on, or within 500m of, the wind farm site on seven occasions during the winter season (October 2021 to March 2022). The majority of observations were near Lough Bane. No development infrastructure is proposed in the areas of bog where breeding was recorded and lapwing were recorded infrequently and in low numbers within the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Disturbance	Construction works can result in disturbance impacts within 350m of lapwing breeding habitat (Hotker et al. 2006). The species was rarely encountered within the wind farm site. This species was recorded breeding adjacent to the wind farm site. As reported in Section 7.8.2.11 of the EIAR birds were previously recorded breeding 380m from the nearest infrastructure. More recently, in 2021 and 2022, the closest breeding territories within this same approx. area were c. 441m from the nearest proposed infrastructure. Taking a highly precautionary approach, if it is assumed that construction works could occur anywhere within the EIAR Site boundary. In which case, construction works adjacent (within 350m) to this nesting area have the potential to cause disturbance of breeding lapwing. Additionally, breeding activity was recorded c. 3.8km from the wind farm site, adjacent to the grid connection route. There is little similar suitable habitat available locally (i.e. a mosaic of revegetating bog, with exposed shale and pools). Construction works adjacent to this nesting area associated with the grid connection route has the potential to cause disturbance of breeding lapwing. The majority of winter season (October 2021 to March 2022) observations were recorded at Lough Bane. Wintering birds are unlikely to be significantly impacted.	The magnitude of the effect is assessed as *Medium.* The cross tablature of *Medium* sensitivity species and *Medium* Impact corresponds to a ***Low*** effect significance.	**Short-term Moderate Negative Effect** **Please see Section 4.6 below for proposed mitigation.**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Hotker et al. (2006) undertook a meta-analysis of existing literature on disturbance distances from turbines. This review reported from the 13 studies examined the disturbance distance could occur up to 350m for breeding	The magnitude of the effect is assessed as *Low.*	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lapwing. This species was recorded breeding: the nearest proposed infrastructure is between 380-441m from the closest territory to the wind farm site. Based on the separation distance, significant disturbance displacement of these breeding birds is not predicted. The majority of winter season (October 2021 to March 2022) observations were at Lough Bane. No significant operational phase displacement impacts are predicted for the identified nesting habitat along the grid connection route. As previously discussed, this species was infrequently recorded within the wind farm site. Significant effects are not predicted particularly given the low levels of activity recorded within the wind farm site. Significant displacement or barrier effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.38 collisions per winter season and there were no collisions predicted for the breeding season[3]. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore insignificant.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

[3] *There were no breeding season flights recorded at possible collision height.*

4.4.8 Snipe (*All Seasons*)

As outlined in Section 7.8.2.18 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.18 of the EIAR for further details on the impact assessment for snipe. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.18 of the EIAR, snipe were recorded regularly during surveys, during both the summer and winter months. Snipe favour open habitats for foraging and breeding. There will likely be the loss of some suitable habitat within the wind farm site as a result of construction works. However, the (direct) loss of breeding and foraging habitat will be minimal as the infrastructure is confined to a narrow corridor. Significant effects are not anticipated at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[4] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Snipe were regularly recorded during surveys between March 2021 and March 2022. Disturbance from construction activities could result in the loss of snipe breeding and wintering habitat locally. Pearce Higgins et. al (2009), found a c. 50% reduction in breeding density of snipe within 500m of turbines. The majority of the open habitat onsite is located within 500m of turbines. There is therefore potential for a measurable reduction in breeding density of snipe due	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low*	**Short-term Slight Negative Effect**

[4] *Note that snipe is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).*

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	to disturbance associated with construction works. However, the wind farm site does not contain habitats that are of particularly high quality to this species or unique to the local area. Therefore, were disturbance to occur it would not result in the loss of a scarce resource for the local snipe population. Significant displacement effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Snipe were regularly recorded during surveys between March 2021 and March 2022. As previously discussed, Pearce Higgins et. al (2009), found a 50% reduction in breeding density of snipe within 500m of turbines. A 500m buffer around the turbines would cover the majority of the open habitat onsite, therefore it is likely that there will be a measurable reduction in breeding density of snipe within the development and its immediate surroundings. However, the Proposed Development Site does not contain habitats that are unique to the local area nor are cutover bogs of particularly high-quality breeding habitat for this species. If displacement were to occur, it would not result in the loss of a scarce resource for the local snipe population Significant displacement or barrier effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	It is acknowledged that the predicted number of transits, and hence the predicted rate of collision for common snipe may be underestimated, as flight	The magnitude of the effect is assessed as *Low.*	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	activity for this species is predominantly crepuscular in nature while the Vantage Point surveys are largely diurnal (Table 1.4, SNH (2017)). The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.18 collisions per year, or one bird every 5.6 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is low in the context of the county, national and international population.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	

4.4.9 Woodcock (*Breeding*)

As outlined in Section 7.8.2.12 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.12 of the EIAR for further details on the impact assessment for woodcock. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct loss of habitat will be minimal. The majority of the wind farm site is bare peat which does not provide optimal habitat for the species. The felling of forestry may temporarily reduce the distribution and availability of suitable habitat. However significant areas of forestry will remain within the wind farm site and surrounding area. Significant effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.12 of the EIAR, this species was frequently recorded during breeding woodcock surveys. Disturbance from construction activities could result in the disturbance of woodcock from suitable breeding habitat locally. However, habitat loss will be restricted to the small areas of forestry onsite. It is noted that the majority of proposed development infrastructure will be sited in cutover bog, a habitat of very limited ecological value to this species. Should any potential displacement effect occur, there are extensive areas of suitable habitat in the wider area, to render this potential impact inconsequential. Significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	There is potential for displacement of breeding woodcock in areas of forestry adjacent to proposed turbines. The wind farm site does not contain habitats that are unique to the local area nor are commercial forestry plantations of particularly high-quality breeding habitat for this species. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.009 collisions per year or one bird every 106 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.10 Buzzard (All Seasons)

As outlined in Section 7.8.2.15 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.15 of the EIAR for further details on the impact assessment for buzzard. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. Direct loss of foraging habitat relative to its availability onsite, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involve foraging or commuting birds. The wind farm site does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local buzzard population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not anticipated at any geographical scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 3.7 collisions per year. A separate collision risk was run relating to breeding buzzard specifically. The collision risk for breeding buzzard was calculated as 2.4 birds per breeding season. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The favourable conservation status of this species (Green-listed BoCCI) limits the potential for ecologically significant effects to result. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.11 Long-eared Owl (All Seasons)

As outlined in Section 7.8.2.14 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.14 of the EIAR for further details on the impact assessment for long-eared owl. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	This species was observed perched in a tree on one occasion, within the wind farm site (along the internal road route) and 1.2km from the closest turbine. This is the same location where birds were observed during surveys outlined in the EIAR. The habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. However, habitat loss in this area is likely to be insignificant given the availability of similar habitat in the wider surroundings. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As previously discussed, the habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. Therefore, disturbance from construction works is unlikely to be significant as birds would not be foraging in habitats where the majority of these works will be taking place.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant disturbance effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant displacement is not predicted given the area of grassland (i.e. long-eared owl foraging habitat) within the wind farm site is confined to a small marginal area and there is an abundance of similar suitable habitat in the wider surroundings. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was not recorded flying at Potential Collision Height during Vantage Point Surveys. Collision related mortality is not likely to significantly impact this species.	**No Effect**	**No Effect**

4.4.12 Sparrowhawk (*All Seasons*)

As outlined in Section 7.8.2.16 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.16 of the EIAR for further details on the impact assessment for sparrowhawk. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data discussed in Section 7.8.2.16 the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. There was one confirmed breeding territory within the wind farm site. Direct loss of foraging and breeding habitat relative to its availability onsite will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted at the county or national level. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involved foraging and commuting birds, with one confirmed breeding territory within the wind farm site during the 2021 breeding season. Construction adjacent to these nest sites could potentially cause displacement of breeding and foraging sparrowhawk. The disturbance associated with construction works will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. However, these	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lands (e.g. cutover bog and scrub) are not considered unique to the wind farm site or rare in the wider surroundings. Significant displacement effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As previously discussed, the wind farm site hosts breeding and foraging sparrowhawk. Displacement from turbines is not reported for sparrowhawk, however, it is assumed for the purposes of the assessment that sparrowhawk show avoidance to a distance of 500m from turbines as with other raptors (Pearce-Higgins et al., 2009). There was one breeding territory within 500m of the proposed turbine layout in 2021. The disturbance associated with operational turbines will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. Notwithstanding this, extensive areas of suitable foraging habitat exist and will remain in the wider area (i.e. outside 500m from the proposed turbine layout). Moreover, onsite habitats are not considered unique to the wind farm site. Significant displacement or barrier effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5.	The magnitude of the effect is assessed as *Negligible*.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	The collision risk has been calculated to be 0.09 collisions per year, equating to one bird every 10.9 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The cross tablature of *Low* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	

4.5 Effects on Key Ornithological Receptors during Decommissioning

4.5.1 All Species

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	As above for construction phase for each species listed as a KOR.	As above for construction phase for each KOR	As above for construction phase for each KOR

4.6 Mitigation

Lapwing continues to breed locally the potential for the construction works to impact breeding lapwing persists and requires mitigation (as per Section 4.4.7 above). This further corroborates the results of the impact assessment as reported the EIAR as lodged. Please refer to Section 7.9.2.1 of the EIAR for the prescriptive mitigation measures that have been designed to ensure significant impacts are avoided.

4.7 Cumulative Effects

There has been no significant changes to the bird communities observed at the wind farm site during surveys between March 2021 and March 2022 when compared to those outlined in the EIAR. Furthermore, there have been no significant changes to the effects of the wind farm site on key ornithological receptors to those outlined in the EIAR. Therefore, the cumulative effects as described in the EIAR remain unchanged, and no additional information is required.

5. CONCLUSION

Following consideration of the residual effects (post-mitigation), it is concluded that the proposed development will not result in any significant effects on any of the identified KORs. No significant effects on receptors of International, National or County Importance were identified.

Provided that the proposed development is constructed, operated and decommissioned in accordance with the design, best practice and mitigation that is described within the EIAR, significant individual or cumulative effects on ornithology are not anticipated at the international, national or county scales or on any of the identified KORs.

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APPENDIX 1

SURVEY EFFORT

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1. APPENDIX 1 (SURVEY EFFORT)

Table 1-1 Vantage Point Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/04/2021	Vantage Point Survey	VP6	3:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	1:00 starting at 18:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	2:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 15:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 04:20	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 07:50	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 04:15	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 07:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No target species	PM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 13:00	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 08:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 09:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 10:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 09:30	Visibility: limited; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Fog for at beginning limited visibility	TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 10:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 18:05	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 19:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 20:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 18:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 19:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 20:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 06:50	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none	Sunrise - 07:45. Persistent lights and drizzly showers throughout which reduced visibility a great deal (especially at a distance). Occasional clear and brighter spells but drizzle was always threatening. Very mild with fresh S breeze (14 - 17°C).	NM
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NM
19/10/2021	Vantage Point Survey	VP4	6:30 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	Sunrise - 08:05	

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 07:15	Visibility: moderate; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Sunrise - 08:06. Cool with moderate W breeze (which was especially apparent in open areas). Largely overcast early on with thin sheets of cloud being blown across. 90% cover. Frequent drizzly and misty showers moving across early in the survey which produced sporadic decreases in visibility. (6 - 12°C)	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Became a lot brighter by mid-morning with prolonged periods of sunny and clearer conditions stretching into lunchtime. Cloud cover reduced but the threat of showers remained. Wind increased to fresh W which made it feel cold despite the sun. Very occasional drizzly shower	NM
23/10/2021	Vantage Point Survey	VP3	6:10 starting at 07:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunrise - 08:06. Cool and moderate S breeze (5 - 13°C). Patchy cloud and partly overcast with some clearer spots. Continued to be largely cloudy with moderate breeze (+ fresher gusts).	
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 11:17	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 14:47	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 11:05	Visibility: good; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		CR

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 14:35	Visibility: moderate; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility until 15:26 pm.	CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 11:04	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 14:34	Visibility: moderate; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility from 16:23 pm.	CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 11:02	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 14:32	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: ; Snow:		CR
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 07:33	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 11:03	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 07:39	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 11:10	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 07:44	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 11:14	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 07:45	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none		KB
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZE

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/01/2022	Vantage Point Survey	VP3	3:00 starting at 11:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 15:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 16:00	Visibility: moderate; Wind speed and direction: fresh breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 17:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Occasional light drizzle for few minutes	ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 11:40	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 15:10	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:00	Visibility: none; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:30	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 08:00	Visibility: poor; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Very misty, visibility reduced greatly	NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 09:00	Visibility: ; Wind speed and direction: SW; Cloud cover and height: ; Rain: ; Frost: ; Snow:		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 10:30	Visibility: good; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 11:30	Visibility: moderate; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:30 starting at 12:00	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	0:30 starting at 06:45	Visibility: none; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	2:30 starting at 07:15	Visibility: good; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: light breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 06:45	Visibility: poor; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:15 starting at 08:30	Visibility: moderate; Wind speed and direction: fresh breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none	visibility low, very misty	NS
16/02/2022	Vantage Point Survey	VP4	0:45 starting at 10:15	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	0:30 starting at 11:00	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 11:30	Visibility: limited; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:50 starting at 06:40	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:30 starting at 07:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:40 starting at 09:00	Visibility: poor; Wind speed and direction: SW; Cloud cover and height: ; Rain: heavy showers; Frost: none; Snow: none		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
17/02/2022	Vantage Point Survey	VP6	2:00 starting at 10:10	Visibility: poor; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:00 starting at 12:10	Visibility: moderate; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 13:20	Visibility: moderate; Wind speed and direction: near gale SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 16:50	Visibility: good; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 13:25	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 16:55	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 13:10	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 16:40	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 13:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 0-33% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 16:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC

Table 1-2 Breeding Bird Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
07/04/2021	Breeding Walkover Survey	500m Survey Radius	6:00 starting at 07:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 05:30	Visibility: poor; Wind speed and direction: light air S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Foggy	PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
18/06/2021	Breeding Walkover Survey	500M Survey Radius	6:00 starting at 05:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
21/06/2021	Breeding Walkover Survey	500M Survey Radius	9:00 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: light; Snow: none	Cool, bright and clear with almost no clouds early on and some light frost in places (2 - 11˚C). No apparent breeze to start with but gentle - moderate W wind emerged (in open areas). Remaining clear and bright for the majority of the survey (cool in wind but warm in shade). Cloud cover gradually increasing towards evening with very light passing showers - but continued to be clear and cloud cover never went above 30%.	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
23/07/2021	Breeding Walkover Survey	500M Survey Radius	5:00 starting at 05:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2022	Breeding Walkover Survey	VP3	3:00 starting at 10:00	Visibility: poor; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
09/05/2022	Breeding Walkover Survey	VP6	3:30 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
09/05/2022	Breeding Walkover Survey	VP4	3:30 starting at 13:30	Visibility: moderate; Wind speed and direction: strong breeze NE; Cloud cover and height: 66-100% <150m; Rain: ; Frost: none; Snow: none		NS
10/05/2022	Breeding Walkover Survey	VP5	3:00 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
24/05/2022	Breeding Walkover Survey	500M Survey Radius	11:00 starting at 06:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Primarily clear throughout with widespread sunny spells. Occasional showers with some heavier ones emerging later in the day. 9 - 14°C	NM
25/05/2022	Breeding Walkover Survey	500M Survey Radius	12:00 starting at 06:00	Visibility: good; Wind speed and direction: fresh breeze WSW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Largely clear throughout with bright spells. Occasional light showers but they were seldom and short-lived. 9 - 13°C. Fresh WSW breeze with some stronger gusts.	NM

Table 1-3 Breeding Raptor Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/04/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
29/04/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 07:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 16:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none	No Raptors Observed	PM
24/05/2021	Breeding Raptor Survey	BRVP2a	3:00 starting at 17:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 17:45	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
04/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:20	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		PM
28/06/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
29/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 10:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 11:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	No target species observed	Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 13:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 12:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 13:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 14:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea

Table 1-4 Winter Transect Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
20/10/2021	Winter Walkover Survey	500M Survey Radius	7:25 starting at 08:35	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Grey and dark with persistent heavy showers to start with but cleared considerably by mid-morning - leading to relatively bright conditions and occasional sunny spells. Occasional heavy showers and drizzly outbursts. (10 - 17°C).	NM
27/01/2022	Winter Walkover Survey	T1	6:00 starting at 11:30	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		AOD
28/01/2022	Winter Walkover Survey	T1,T2	6:00 starting at 11:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		AOD
22/02/2022	Winter Walkover Survey	T1	6:00 starting at 11:50	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		AOD
23/02/2022	Winter Walkover Survey	T1,T2	6:00 starting at 12:00	Visibility: good; Wind speed and direction: fresh breeze SE; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		AOD
15/03/2022	Winter Walkover Survey	VP3&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/03/2022	Winter Walkover Survey	VP6&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS

Table 1-5 Wildfowl Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/09/2021	Waterfowl Distribution Survey	8km buffer	9:10 starting at 08:00	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Overcast with some patchy clearences peeking through at times. Quite calm with light SE breeze, mild (10 - 18˚C). Some lights showers emerging by mid-morning - mixture of random showers and hazy sunshine for the remainder of survey	NM
17/09/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 12:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Warm and humid throughout (16 - 18˚C) with largely cloudy sky but with clearer spells on occasion. Occasional sporadic lights showers. Moderate SW breeze.	NM
17/09/2021	Waterfowl Distribution Survey	L. Iron Roost	11:30 starting at 18:00	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild conditions continued along with a reduction in cloud cover leading to a bright a largely clear evening. Wind dropped considerably - light air from SW. 14 - 17˚C. Sunset - 19:40	NM

29/09/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 07:45	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Relatively mild (6 - 14°C) and entirely overcast. Moderate SW breeze. Grey and drear throughout. Blustery showers at dawn followed by sporadic drizzly showers throughout the morning - some heavier and more persistent showers towards evening.	NM
30/09/2021	Waterfowl Distribution Survey	L. Iron Roost	2:45 starting at 17:30	Visibility: good; Wind speed and direction: fresh breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Breezy with fresh SW breeze. Sunny spells and scattered showers blowing across. Relatively mild (10 - 14°C) but wind made it feel colder	NM
11/10/2021	Waterfowl Distribution Survey	L. Iron Roost	3:15 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 18:56. Cool and bright evening with bright sunny patches. Almost no breeze whatsoever with light movement of air on occasion. Cool with the temperature dropping towards dusk (4 - 10°C). Mist gathering low of fields and wetlands at dusk also.	NM

12/10/2021	Waterfowl Distribution Survey	8km buffer (point survey on water bodies)	9:15 starting at 08:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none	Grey and overcast but with thinner and brighter patches at times (remaining largely overcast throughout). Patches of sunny spells emerging towards mid afternoon but continued to remain rather cloudy. (8 - 13˚C).	NM
25/10/2021	Waterfowl Distribution Survey	L. Iron roost	2:30 starting at 16:45	Visibility: moderate; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Sunset - 18:10	NM
26/10/2021	Waterfowl Distribution Survey	8km buffer	8:45 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Very mild and humid (12 - 15˚C) with overcast sky and sporadic light SW breeze. Occasional drizzly showers. Brightening up as morniong progressed with some patchy brighter spots but remaining largely overcast. Prolonged clear spells in afternoon.	NM

08/11/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Mild with moderate SW breeze (10 - 13°C). Damp with rain in the morning - but when survey started it had cleared significantly. Extensive clearer spells throughout the day with drifting lines of stratus clouds. Becoming cloudier and darker in afternoon.	NM
09/11/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	9:10 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 16:40. L. Iron roost: 15:15 - 17:30	NM
22/11/2021	Waterfowl Distribution Survey	L. Iron Roost	2:30 starting at 15:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Cool (3 - 8°C) with light S breeze. Bright and clear with no cloud. Sunset - 16:21	NM

23/11/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Cool (4 - 6°C) with light SW breeze. Almost entirely overcast with occasional thinner and brighter areas but these were fleeting. Still and quiet for the most part with breeze apparent in open areas. L. Bane - almost inaccesible, perimter of tangled and boggy birch woodland and scrub + very wet and boggy shores (with Sphagnum) - fully saturated (quaking bog??).	NM
09/12/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	4:20 starting at 13:00	Visibility: limited; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Constant drizzle and rain throughout made survey unpleasent. Very poor visibility throughout. Cold with moderate W breeze (4 - 6°C). The weather during this survey was very bad and the visibility very poor. The lake was seen to be full of wildfowl but ID was nearly impossible.	NM

10/12/2021	Waterfowl Distribution Survey	8km buffer	8:05 starting at 08:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: drizzle; Frost: light; Snow: none	Cold and crisp throughout the day with light NW breeze (3 - 7°C). Cold and sleety showers to start with but by mid-morning it had tunred into a clear and bright day.	NM
22/12/2021	Waterfowl Distribution Survey	8km buffer	7:50 starting at 08:30	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Cool with gentle SE breeze throuough (2 - 7°C). Grey and entirely overcast	NM
23/12/2021	Waterfowl Distribution Survey	L. Iron roost	2:15 starting at 14:45	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild and calm with clear bright skies (9 - 12°C). No wind. Good visibility.	NM

04/01/2022	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost	8:20 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze SE; Cloud cover and height: 33-66% 150-500m; Rain: drizzle; Frost: heavy; Snow: falling	Cold all day (-1 - 3˚C). Light snow on ground along with heavy frost which stayed put all day. Predominantly overcast througout with snow showers up until 13:00 - visibility greatly reduced during snow. Turning clear and bright very abruptly in the afternoon with clear and sunny conditions - but remained very cold. Clouding over once again in evening but remaining high and bright. L. Iron roost: 15:00 - 17:20. Numbers of WF recorded were likely to be understimates due to high numbers and distance away from lake by surveyor. Sunset: 16:22	NM

05/01/2022	Waterfowl Distribution Survey	8km buffer	7:45 starting at 08:45	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: light; Snow: none	Predominantly bright and clear with prolonged sunny spells which persisted for the survey duration. Cold and crisp (-2 - 4°C) and remained so throughout.	NM

17/01/2022	Waterfowl Distribution Survey	8km buffer	8:30 starting at 08:30	Visibility: good; Wind speed and direction: calm W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: heavy; Snow: none	Cold and crisp early in the morning (-3 - 7°C) with heavy frost on ground. No wind, very calm all day. Patchy mist and haze early on which hampered visibility but it was quickly burned off. Clear and bright all day, never a cloud to be seen. Warming up gradually with frost disappearing mostly by mid-morning (except in shaded areas). Remaining clear and calm throughout. Large numbers of wildfowl on L. Sheelin, with CO & TU being notable numerous - underestimation of numbers likely. Large RE & SG flocks flying over site at dusk.	NM

18/01/2022	Waterfowl Distribution Survey	8km buffer	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Largely clear and bright early on with with prolonged sunny spells (5 - 8°C). Relatively calm with light S breeze. Becoming gradually cloudier and greyer towards lunchtime with rain showers blowing in - turning entirely overcast and wet by mid-afternoon.	NM
18/01/2022	Waterfowl Distribution Survey	L. Iron roost	2:00 starting at 15:30	Visibility: poor; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none	Entirely overcast with mid-height cloud (5 - 9°C). Consistent heavy rain and very wet conditions - some occasional but short-lived clearences. Rain hampered visibility greatly. Sunset - 16:43	NM
14/02/2022	Waterfowl Distribution Survey	5km buffer	4:40 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
15/02/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		KB
26/02/2022	Waterfowl Distribution Survey	5km buffer	5:00 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		KB
28/02/2022	Waterfowl Distribution Survey	5km buffer	3:50 starting at 11:40	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		KB
07/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB

08/03/2022	Waterfowl Distribution Survey	5km buffer	4:30 starting at 11:30	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 08:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	3:30 starting at 13:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
17/04/2022	Waterfowl Distribution Survey	5km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none		KB
04/05/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
20/05/2022	Waterfowl Distribution Survey	8km buffer	11:00 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze WSW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Consistent rain for the first half of the day - light showers. Clearing gradually towards the evening with the onset of clearer and sunny spells. Moderate WSW breeze, 11 - 15°C	NM
27/05/2022	Waterfowl Distribution Survey	5km buffer	10:15 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Moderate SW breeze , 10 - 16°C. Largely clear and bright and remained so throughout - some darker and cloudier spells came and went. Brightening significantly (and warming) from 1pm onwards with a decrease in cloud cover	NM

Table 1-6 Woodcock Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/05/2021	Breeding Woodcock Survey	T1	2:30 starting at 20:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Woodcock Survey	T4	2:00 starting at 20:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	No WK Observed	PM
24/05/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		Trea
04/06/2021	Breeding Woodcock Survey	T4	3:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
04/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
28/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
28/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/06/2021	Breeding Woodcock Survey	T4	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
29/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK Observed	Trea
16/05/2022	Breeding Woodcock Survey	T4	2:10 starting at 20:30	Visibility: moderate; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
20/05/2022	Breeding Woodcock Survey	T2	2:20 starting at 20:30	Visibility: moderate; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
24/05/2022	Breeding Woodcock Survey	T1	2:10 starting at 20:40	Visibility: moderate; Wind speed and direction: light air NE; Cloud cover and height: 33-66% <150m; Rain: none; Frost: none; Snow: none		NS

APPENDIX 2

SURVEY DATA

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1. APPENDIX 2 (SURVEY DATA)

Table 1-1 Common Tern Wildfowl Distribution Survey Data

Vantage Point Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CN001	L. D'varagh	17/09/2021	13:48	Common Tern	2	mesotrophic lakes; appeared to be doing laps around lake shore	NM

Table 1-2 Golden Plover Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
GP001	VP5	08/10/2021	12:43	Golden Plover	175	330	0	0	0	330	improved agricultural grassland, semi-natural grassland and scrub; flying high over and back far to the s of vp	NM
GP002	VP4	19/10/2021	09:13	Golden Plover	65	170	0	0	170	0	cutover bog; flying w across site	NM
GP003	VP6	22/10/2021	13:05	Golden Plover	54	245	0	40	205	0	cutover bog and scrub; flying and swirling over bog in flock	NM
GP004	VP3	23/10/2021	10:10	Golden Plover	6	65	0	65	0	0	cutover bog; flying s	NM
GP005	VP3	23/10/2021	10:18	Golden Plover	6	60	25	35	0	0	cutover bog; flying across bog + rapidly low across ground	NM
GP006	VP3	23/10/2021	10:21	Golden Plover	148	650	0	60	590	0	cutover bog, improved agricultural grassland and hedgerows; flying and swirling in group over bog and farmland	NM
GP007	VP3	23/10/2021	10:27	Golden Plover	46	125	0	0	125	0	cutover bog, improved agricultural grassland and scrub; flying across s of site	NM
GP008	VP3	23/12/2021	08:47	Golden Plover	11	5	5	0	0	0	cutover bog; travelling	KB
GP009	VP3	23/12/2021	09:14	Golden Plover	10	8	8	0	0	0	cutover bog; travelling	KB

Table 1-3 Golden Plover Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	07/04/2021	08:47	Golden Plover	3	cutover bog; travelling (flyover; non-breeding)	PM

Table 1-4 Golden Plover Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP002	20/10/2021	10:56	Golden Plover	6	cutover bog; flying and swirling across bog (wintering)	NM
GP003	20/10/2021	16:13	Golden Plover	6	improved agricultural grassland and scattered tress and parkland; flying and calling (wintering)	NM
GP004	20/10/2021	10:56	Golden Plover	16	cutover bog; on bog and calling (wintering)	NM
GP005	27/01/2022	16:27	Golden Plover	14	cutover bog; roosting, roosting on bog (wintering)	AOD

Table 1-5 Golden Plover Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	L. D'varagh	12/10/2021	16:16	Golden Plover	6	lakes and ponds; flying low and rapidly across lake - heading w	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP002		26/10/2021	12:47	Golden Plover	5	cutover bog; flying low across bog wetland	NM
GP003		23/11/2021	15:40	Golden Plover	160	lakes and ponds; flying over farmland to n of lake	NM
GP004	L. D'varagh	04/01/2022	09:14	Golden Plover	19	improved agricultural grassland and hedgerows; swirling low over fields	NM

Table 1-6 Greenland White-fronted Goose Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WG001	VP6	06/04/2021	19:54	Greenland White-fronted Goose	14	100	0	0	100	0	cutover bog and wet grassland; travelling	PM

Table 1-7 Greenland White-fronted Goose Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	21/10/2021	10:14	Greenland White-fronted Goose	5	cutover bog and scrub; flying sw across site (wintering)	NM

Table 1-8 Greenland White-fronted Goose Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	24	wet grassland; foraging, rest of the flock was unseen through vegetation/trees but more birds heard calling	KB
WG002	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	4	wet grassland; foraging, more birds likely present but unseen through hedgerow	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WG003	Lough Iron - piercefield fields	28/02/2022	15:30	Greenland White-fronted Goose	9	wet grassland; foraging, more birds present but not visible through the vegetation/trees - calling heard indicating larger flock	KB
WG004	Lough Iron - piercefield	08/03/2022	11:42	Greenland White-fronted Goose	12	wet grassland; foraging, whole flock not visible through the vegetation/trees - more birds likely present	KB

Table 1-9 Hen Harrier Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
HH001	VP6	06/04/2021	19:53	Hen Harrier	1	110	110	0	0	0	wet grassland, cutover bog and conifer plantation; travelling, 2cy male	PM
HH002	VP6	06/09/2021	17:30	Hen Harrier	1	6	6	0	0	0	cutover bog; flying, ringtail, glided in and landed out of site in scrub near river	TRea
HH003	VP6	06/09/2021	18:13	Hen Harrier	1	27	27	0	0	0	cutover bog; travelling, ringtail, flew low over bog and landed by stream	TRea
HH004	VP6	22/10/2021	12:14	Hen Harrier	1	95	95	0	0	0	semi-natural grassland, scrub and cutover bog; flying low with acrobatics across grassland and scrub along river, diving at passerines	NM
HH005	VP6	17/02/2022	09:48	Hen Harrier	1	20	20	0	0	0	lowland blanket bog; flying, male	NS
HH006	VP6	17/02/2022	12:35	Hen Harrier	1	150	150	0	0	0	lowland blanket bog; flying, male	NS
HH008	VP6	17/02/2022	10:17	Hen Harrier	1	15	15	0	0	0	improved agricultural grassland; flying, male	NS
HH008	VP6	17/02/2022	12:13	Hen Harrier	1	25	25	0	0	0	improved agricultural grassland; flying, same male in the area seen 4 times	NS

Table 1-10 Kingfisher Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
KF001	VP4	27/07/2021	12:38	Kingfisher	1	40	40	0	0	0	cutover bog; flew from drain	PM
KF002	VP6	22/11/2021	16:03	Kingfisher	1	21	21	0	0	0	eroding/upland rivers; flying	CR

Table 1-11 Kingfisher Vantage Point Survey Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
KF003	VP6	22/11/2021	16:07	Kingfisher	1	depositing/lowland rivers; calling/flying, kingfisher heard calling whilst travelling downstream.	CR

Table 1-12 Kingfisher Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	28/01/2022	13:04	Kingfisher	1	depositing/lowland rivers; fly, along inny (wintering)	AOD

Table 1-13 Kingfisher Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Kingfisher	1	watercourses; foraging	KB

Table 1-14 Kingfisher Incidental Observations Data

Incidental Records							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
KF001	Wildfowl Distribution Survey, r. inny	16/09/2021	16:24	Kingfisher	1	depositing/lowland rivers; flying over river, perching on riverbank willow before flying low and rapidly upstream, appeared to be hunting	NM
KF002	Wildfowl Distribution Survey,	12/10/2021	09:45	Kingfisher	1	depositing/lowland rivers; flying rapidly along wooded river	NM
KF003	Wildfowl Distribution Survey, r. inny	12/10/2021	15:10	Kingfisher	1	depositing/lowland rivers; flying low and rapidly over river	NM
KF004	Wildfowl Distribution Survey,	26/10/2021	10:37	Kingfisher	1	depositing/lowland rivers; flying rapidly along river, perched	NM
KF005	Wildfowl Distribution Survey, r. inny	23/11/2021	13:10	Kingfisher	1	depositing/lowland rivers; flying low downstream along river edge	NM
KF006	Wildfowl Distribution Survey, r. inny	10/12/2021	13:08	Kingfisher	1	depositing/lowland rivers; flushed from perch at bridge, flying low and rapidly along river	NM
KF007	Wildfowl Distribution Survey,	22/12/2021	11:32	Kingfisher	1	lakes and ponds; flying rapidly along vegetated river channel	NM
KF008	Wildfowl Distribution Survey, r. inny	05/01/2022	11:18	Kingfisher	1	depositing/lowland rivers; flying low and rapidly along river, perching in willow	NM

Table 1-15 Little Egret Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
ET001		12/10/2021	10:18	Little Egret	1	lakes and ponds and scrub; flying over scrubby lake shore	NM
ET002		12/10/2021	15:41	Little Egret	1	lakes and ponds and semi-natural grassland; flying over lake fringes	NM
ET003	L. Iron	22/11/2021	16:06	Little Egret	1	lakes and ponds; flying across lake	NM
ET004		10/12/2021	08:35	Little Egret	2	scrub; flying over bog and scrubland near to lake	NM
ET005	L. Iron	23/12/2021	15:43	Little Egret	2	lakes and ponds; flying low along lake edge	NM
ET006	L. Sheelin	17/01/2022	08:34	Little Egret	2	scrub, semi-natural grassland and lakes and ponds; perched on scrubby lake shore	NM
ET007		17/01/2022	11:28	Little Egret	1	depositing/lowland rivers and semi-natural grassland; perched on grassy bank of river	NM
ET008		17/01/2022	12:30	Little Egret	1	improved agricultural grassland; grazing on farmland	NM
ET009	BN2	17/01/2022	16:08	Little Egret	2	cutover bog; flying low across bog wetland + landing and foraging sporadically at different locations on wetland, consistently in area for over an hour	NM
ET010	BN2	17/01/2022	16:16	Little Egret	1	cutover bog; flying across bog wetland + landing within	NM
ET011	Derragh Lough	14/02/2022	13:26	Little Egret	1	lakes and ponds; foraging	KB
ET012	Bracklagh Lough	26/02/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB

ET013	Lough Derravaragh north	28/02/2022	13:31	Little Egret	1	lakes and ponds; foraging	KB
ET014	Brackagh Lough	07/03/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB
ET015	Derragh Lough	07/03/2022	10:51	Little Egret	1	lakes and ponds; foraging	KB
ET016	Derragh Lough	31/03/2022	09:32	Little Egret	1	lakes and ponds; foraging	KB

Table 1-16 Merlin Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ML001	VP4	09/12/2021	10:21	Merlin	1	5	5	0	0	0	cutover bog; foraging, adult male	KB
ML002	VP6	15/12/2021	09:31	Merlin	1	6	6	0	0	0	cutover bog; foraging - landed on ground, female	KB
ML003	VP6	15/12/2021	09:42	Merlin	1	8	8	0	0	0	cutover bog and semi-natural grassland; foraging, female	KB
ML004	VP6	15/12/2021	14:01	Merlin	1	6	6	0	0	0	scrub and semi-natural grassland; foraging, male	KB
ML005	VP4	10/03/2022	15:12	Merlin	1	18	18	0	0	0	cutover bog; flying	NS

Table 1-17 Peregrine Falcon Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
PE001	VP5	03/01/2022	09:17	Peregrine Falcon	1	12	0	12	0	0	improved agricultural grassland and hedgerows; foraging	KB
PE002	VP3	26/01/2022	15:05	Peregrine Falcon	1	25	25	0	0	0	cutover bog; flying	ZE

Table 1-18 Peregrine Falcon Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
PE001	BRVP6	29/06/2021	17:46	Peregrine Falcon	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring/travelling	flyover; non-breeding	PM
PE002	BRVP6	13/07/2021	15:13	Peregrine Falcon	1	highly modified/non-native woodland and bogs, travelling	suitable nesting habitat; possible breeder	TRea

Table 1-19 Peregrine Falcon Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PE001	Vantage Point Survey, doon	31/01/2022	14:55	Peregrine Falcon	1	lowland blanket bog and improved agricultural grassland; flying	ZE

Table 1-20 Ruff Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
RU001	BN2	16/09/2021	14:13	Ruff	2	cutover bog; perched on bare peat at edge of shallow bog pool	NM

Table 1-21 White-tailed Eagle Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
WE001	BRVP2	19/07/2021	14:20	White-tailed Eagle	1	highly modified/non-native woodland and improved grassland, fighting buzzards, buzzards soaring above and diving down, eagle flipped to repel with talons.	flyover; non-breeding	TRea

Table 1-22 White-tailed Eagle Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WE001	Wildfowl Distribution Survey,	12/10/2021	16:33	White-Tailed Eagle	1	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; soaring over lake and adjacent sloping ground - appeared to descend and land within scrub	NM

Table 1-23 Whooper Swan Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS001	VP4	19/10/2021	08:12	Whooper Swan	7	100	0	100	0	0	cutover bog; flying across bog and calling, descending towards bn2	NM
WS002	VP4	19/10/2021	12:34	Whooper Swan	4	210	0	0	210	0	cutover bog; flying w across bog	NM
WS003	VP6	22/10/2021	09:05	Whooper Swan	7	120	105	15	0	0	cutover bog, scrub and improved agricultural grassland; flying sw across site	NM
WS004	VP6	22/10/2021	08:53	Whooper Swan	2	85	40	45	0	0	cutover bog and depositing/lowland rivers; flying along river and adjacent bog	NM
WS005	VP6	22/10/2021	09:02	Whooper Swan	9	150	0	130	20	0	improved agricultural grassland, hedgerows and semi-natural grassland; flying ne across farmland	NM
WS006	VP6	22/10/2021	10:27	Whooper Swan	8	130	0	0	130	0	cutover bog and improved agricultural grassland; flying and calling to w of site	NM
WS007	VP6	22/10/2021	10:56	Whooper Swan	16	140	0	125	15	0	improved agricultural grassland and bogs; flying ne and calling	NM
WS008	VP6	22/10/2021	10:58	Whooper Swan	3	65	0	65	0	0	cutover bog, improved agricultural grassland and semi-natural grassland; flying n	NM
WS009	VP6	22/10/2021	11:24	Whooper Swan	3	65	0	40	25	0	watercourses and cutover bog; flying ne along river and bog fringes	NM
WS010	VP6	22/10/2021	11:32	Whooper Swan	12	170	0	0	170	0	cutover bog, scrub and improved agricultural grassland; flying w across bog to nw of site	NM
WS011	VP3	23/10/2021	08:22	Whooper Swan	5	180	25	155	0	0	cutover bog, scrub and hedgerows; flying along s boundary of site	NM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS012	VP3	23/10/2021	08:16	Whooper Swan	7	90	0	90	0	0	treelines, improved agricultural grassland and cutover bog; flying n	NM
WS013	VP3	23/10/2021	09:23	Whooper Swan	8	125	0	125	0	0	cutover bog, scrub and improved agricultural grassland; flying s across bog	NM
WS014	VP3	23/10/2021	09:28	Whooper Swan	15	95	25	70	0	0	cutover bog and scrub; flying n across bog	NM
WS015	VP3	23/10/2021	10:25	Whooper Swan	12	95	95	0	0	0	depositing/lowland rivers and cutover bog; flying and calling along river	NM
WS016	VP3	23/10/2021	11:00	Whooper Swan	7	240	210	30	0	0	cutover bog and scrub; flying low across bog	NM
WS017	VP5	03/01/2022	08:24	Whooper Swan	5	8	0	0	8	0	improved agricultural grassland; travelling	KB
WS018	VP5	03/01/2022	08:31	Whooper Swan	5	30	0	0	30	0	improved agricultural grassland; travelling	KB
WS019	VP5	03/01/2022	08:32	Whooper Swan	9	10	0	0	10	0	improved agricultural grassland; travelling	KB
WS020	VP5	03/01/2022	08:46	Whooper Swan	10	50	0	0	50	0	improved agricultural grassland; travelling	KB
WS021	VP5	03/01/2022	09:05	Whooper Swan	3	70	0	20	50	0	improved agricultural grassland; travelling	KB
WS022	VP5	03/01/2022	09:09	Whooper Swan	2	25	0	0	25	0	improved agricultural grassland; travelling	KB
WS023	VP5	03/01/2022	09:12	Whooper Swan	2	20	0	0	20	0	improved agricultural grassland; travelling	KB
WS024	VP4	27/01/2022	17:54	Whooper Swan	8	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
WS025	VP5	08/02/2022	09:08	Whooper Swan	2	30	0	30	0	0	improved agricultural grassland; flying	NS

Table 1-24 Whooper Swan Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	L. Iron	30/09/2021	18:30	Whooper Swan	3	lakes and ponds; swimming on lake	NM
WS002	L. Iron	11/10/2021	18:00	Whooper Swan	3	improved agricultural grassland and scrub; flying in from s and descending onto lake, roost	NM
WS003	L. Iron	25/10/2021	17:20	Whooper Swan	26	lakes and ponds; swimming on lake	NM
WS004	L. Iron	25/10/2021	17:47	Whooper Swan	5	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; flying onto lake from w/sw, roost	NM
WS005	L. Iron	25/10/2021	18:29	Whooper Swan	9	semi-natural grassland and reed and large sedge swamps; flying in and landing on lake - coming from n, roost	NM
WS008		26/10/2021	10:21	Whooper Swan	18	lakes and ponds; swimming on lake, some individuals grazing on banks	NM
WS007		26/10/2021	09:40	Whooper Swan	49	improved agricultural grassland; foraging on grassy edge of lake	NM
WS009		26/10/2021	14:58	Whooper Swan	11	lakes and ponds and highly modified/non-native woodland; flying sw along lake shore	NM
WS006		26/10/2021	09:46	Whooper Swan	16	lakes and ponds; flying e across lake	NM
WS010	Derragh Lough	09/11/2021	11:34	Whooper Swan	25	lakes and ponds; swimming on lake	NM
WS012	L. Iron	09/11/2021	16:24	Whooper Swan	21	lakes and ponds; swimming on lake, roost	NM
WS011	Lough Iron	09/11/2021	16:53	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; commuting towards and landing on lake - arriving in group from farmland to w	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS015	L. Iron	22/11/2021	16:00	Whooper Swan	24	lakes and ponds; swimming on lake, roost	NM
WS013	Lough Iron	22/11/2021	16:30	Whooper Swan	5	semi-natural grassland, scrub and lakes and ponds; flying in from s and landing on lake	NM
WS014	Lough Iron	22/11/2021	16:46	Whooper Swan	7	improved agricultural grassland and lakes and ponds; flying from farmland to sw of lake, roost	NM
WS016		23/11/2021	10:47	Whooper Swan	7	improved agricultural grassland and highly modified/non-native woodland; flying sw across farmland	NM
WS017		10/12/2021	14:10	Whooper Swan	4	lakes and ponds and semi-natural grassland; feeding on reedy grassland adjacent to lake	NM
WS019	R. Inny	22/12/2021	10:16	Whooper Swan	2	depositing/lowland rivers; swimming on river	NM
WS021	L. Bane	22/12/2021	15:45	Whooper Swan	39	lakes and ponds; swimming and foraging on lake, calling	NM
WS018		22/12/2021	10:10	Whooper Swan	8	lakes and ponds; swimming and feeding within reedy lake margins	NM
WS020		22/12/2021	10:34	Whooper Swan	16	cutover bog and scrub; flying sw across bog	NM
WS024	L. Iron	23/12/2021	15:32	Whooper Swan	16	lakes and ponds; swimming on lake, roost	NM
WS022	Lough Iron	23/12/2021	16:16	Whooper Swan	5	semi-natural grassland and scrub; flying in from fields to n	NM
WS023	Lough Iron	23/12/2021	16:35	Whooper Swan	16	semi-natural grassland, reed and large sedge swamps and scrub; flying in from fields and wetland to the n, calling profusely, roost	NM
WS025	L. Iron	04/01/2022	15:40	Whooper Swan	12	lakes and ponds; swimming on lake	NM
WS026	L. Bane	05/01/2022	09:02	Whooper Swan	16	lakes and ponds; swimming on lake	NM
WS029	L. Sheelin	17/01/2022	08:47	Whooper Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS028	R. Inny	17/01/2022	14:00	Whooper Swan	7	improved agricultural grassland; grazing on grassland adjacent to river	NM
WS027	L. Sheelin	17/01/2022	09:55	Whooper Swan	6	lakes and ponds; flying low across lake	NM
WS030	L. Iron	18/01/2022	15:43	Whooper Swan	45	lakes and ponds, reed and large sedge swamps and scrub; swimming on lake and within swollen edges	NM
WS031	Lough Iron	18/01/2022	16:56	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; flying in from lands to sw and landing on lake - calling. numbers unclear due to poor visibility, roost	NM
WS032	Piercefield	15/02/2022	09:40	Whooper Swan	77	improved agricultural grassland; foraging	KB
WS033	Piercefield	15/02/2022	10:10	Whooper Swan	1	wet grassland; foraging	KB
WS034	Lough Iron - piercefield fields	28/02/2022	15:20	Whooper Swan	31	improved agricultural grassland; foraging	KB
WS035	Lough Iron - piercefield fields	28/02/2022	15:30	Whooper Swan	2	wet grassland; foraging	KB
WS036	Flooded bog on site	08/03/2022	15:24	Whooper Swan	4	cutover bog; foraging	KB

Table 1-25 Coot Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CO001	VP6	31/01/2022	15:37	Coot	1	111	0	0	111	0	improved agricultural grassland and conifer plantation; flying	ZE
CO002	VP6	31/01/2022	16:19	Coot	1	121	0	0	121	0	cutover bog and conifer plantation; flying	ZE
CO003	VP6	17/02/2022	07:30	Coot	2	30	0	30	0	0	lowland blanket bog; flying west	NS
CO004	VP6	17/02/2022	11:56	Coot	1	25	0	25	0	0	lowland blanket bog and improved agricultural grassland; flying	NS

Table 1-26 Coot Waterfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO001	Derragh Lough	16/09/2021	12:16	Coot	96	mesotrophic lakes; swimming on lake - in groups and frequently within reed boundaries + diving, throughout lake	NM
CO002		16/09/2021	17:00	Coot	5	mesotrophic lakes; swimming on lake	NM
CO003	L. Kinale	16/09/2021	10:56	Coot	9	mesotrophic lakes; swimming on lake	NM
CO004	L. Kinale	16/09/2021	11:05	Coot	13	mesotrophic lakes; swimming on lake	NM
CO005	L. Sheelin	16/09/2021	10:03	Coot	16	mesotrophic lakes; swimming and diving on lake near reed beds - forming group with lg	NM
CO006	L. D'varagh	17/09/2021	14:40	Coot	25	mesotrophic lakes; swimming on lake - n section	NM
CO007	Bracklagh Lough	17/09/2021	12:30	Coot	10	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO008	L. D'varagh	17/09/2021	12:59	Coot	9	mesotrophic lakes; swimming on lake	NM
CO009	L. D'varagh	17/09/2021	13:06	Coot	3	mesotrophic lakes; swimming on lake	NM
CO010	L. D'varagh	17/09/2021	13:10	Coot	13	mesotrophic lakes; swimming on lake	NM
CO011	L. D'varagh	17/09/2021	14:01	Coot	3	mesotrophic lakes; swimming on lake	NM
CO012	L. D'varagh	17/09/2021	13:08	Coot	6	mesotrophic lakes; swimming in reedy fringes	NM
CO013	L. Iron	17/09/2021	19:00	Coot	78	mesotrophic lakes; swimming and foraging on lake	NM
CO014	L. D'varagh	17/09/2021	13:05	Coot	7	mesotrophic lakes; swimming and diving on lake	NM
CO015	L. D'varagh	17/09/2021	13:49	Coot	8	mesotrophic lakes; swimming and diving on lake	NM
CO016	L. D'varagh	17/09/2021	16:16	Coot	9	mesotrophic lakes; swimming and diving along lake fringes	NM
CO017	L. D'varagh	17/09/2021	16:07	Coot	18	mesotrophic lakes; swimming and calling on lake and within reeds	NM
CO018	L. D'varagh	17/09/2021	15:45	Coot	37	mesotrophic lakes; swimming and calling on lake (+ foraging within reeds)	NM
CO019	L. D'varagh	17/09/2021	13:06	Coot	8	mesotrophic lakes; swimming along edge of lake	NM
CO020	Bracklagh Lough	29/09/2021	09:25	Coot	16	mesotrophic lakes; swimming on lake	NM
CO021	L. D'varagh	29/09/2021	16:15	Coot	31	mesotrophic lakes; swimming on lake	NM
CO022	L. Sheelin	29/09/2021	08:07	Coot	6	lakes and ponds; swimming on lake	NM
CO023	L. Sheelin	29/09/2021	08:45	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO024	Derragh Lough	29/09/2021	10:53	Coot	180	mesotrophic lakes; swimming and foraging on lake, approx. count	NM
CO025	L. D'varagh	29/09/2021	16:00	Coot	47	mesotrophic lakes; swimming and foraging in and around reed islets	NM
CO026	L. Kinale	29/09/2021	12:15	Coot	16	mesotrophic lakes; swimming along lake edge	NM
CO027	L. D'varagh	29/09/2021	16:15	Coot	58	mesotrophic lakes; swimming along lake edge	NM
CO028	L. D'varagh	12/10/2021	16:07	Coot	12	lakes and ponds; swimming within reedy islets	NM
CO029	L. Kinale	12/10/2021	12:05	Coot	19	lakes and ponds; swimming on lake	NM
CO030	L. D'varagh	12/10/2021	16:02	Coot	53	lakes and ponds; swimming on lake	NM
CO031	L. Sheelin	12/10/2021	08:18	Coot	287	lakes and ponds; swimming in large group in open water	NM
CO032	Derragh Lough	12/10/2021	11:10	Coot	91	lakes and ponds; swimming and diving on lake	NM
CO033	L. D'varagh	12/10/2021	15:37	Coot	13	lakes and ponds; swimming and diving on lake	NM
CO034	L. D'varagh	12/10/2021	16:31	Coot	14	lakes and ponds; swimming and diving on lake	NM
CO035	L. D'varagh	12/10/2021	16:14	Coot	10	lakes and ponds; swimming and calling within complex of reedy islets	NM
CO036	L. Sheelin	26/10/2021	15:04	Coot	265	lakes and ponds; swimming on lake in large dense flock	NM
CO037	L. Sheelin	26/10/2021	15:00	Coot	129	lakes and ponds; swimming on lake in dense flock	NM
CO038	Derragh Lough	26/10/2021	11:24	Coot	58	lakes and ponds; swimming on lake and foraging around fringes	NM
CO039		26/10/2021	09:12	Coot	6	lakes and ponds; swimming on lake	NM
CO040		26/10/2021	09:12	Coot	15	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO041		26/10/2021	09:34	Coot	156	lakes and ponds; swimming on lake	NM
CO042		26/10/2021	09:38	Coot	24	lakes and ponds; swimming on lake	NM
CO043		26/10/2021	10:22	Coot	9	lakes and ponds; swimming on lake	NM
CO044	L. Sheelin	26/10/2021	14:06	Coot	6	lakes and ponds; swimming on lake	NM
CO045	L. Sheelin	26/10/2021	15:00	Coot	34	lakes and ponds; swimming on lake	NM
CO046		26/10/2021	09:06	Coot	39	lakes and ponds; swimming and calling on lake	NM
CO047		26/10/2021	09:21	Coot	2	lakes and ponds; flying w across lake	NM
CO048	L. D'varagh	26/10/2021	08:36	Coot	5	lakes and ponds; calling within reedy fringes of lake	NM
CO049		26/10/2021	10:18	Coot	6	reed and large sedge swamps and dystrophic lakes; calling within reeds	NM
CO050	L. D'varagh	08/11/2021	12:26	Coot	6	lakes and ponds; swimming on lake	NM
CO051	L. Sheelin	09/11/2021	09:28	Coot	87	lakes and ponds; swimming on lake - large group in open water	NM
CO052	L. Sheelin	09/11/2021	10:02	Coot	8	lakes and ponds; swimming on lake	NM
CO053	Derragh Lough	09/11/2021	11:34	Coot	46	lakes and ponds; swimming and diving on lake	NM
CO054	L. Iron	22/11/2021	16:02	Coot	56	lakes and ponds; swimming on lake	NM
CO055	Derragh Lough	23/11/2021	11:10	Coot	56	lakes and ponds; swimming on lake + calling within reedy margins	NM
CO056	L. Sheelin	23/11/2021	09:13	Coot	70	lakes and ponds; swimming on lake - large 'raft' in open water	NM
CO057	L. D'varagh	23/11/2021	15:40	Coot	11	lakes and ponds; swimming on lake	NM
CO058	L. D'varagh	23/11/2021	15:41	Coot	26	lakes and ponds; swimming on lake	NM
CO059	L. D'varagh	23/11/2021	15:45	Coot	149	lakes and ponds; swimming on lake	NM
CO060		23/11/2021	15:45	Coot	7	lakes and ponds; swimming on lake	NM
CO061	L. D'varagh	23/11/2021	15:46	Coot	61	lakes and ponds; swimming on lake	NM
CO062	L. D'varagh	23/11/2021	15:49	Coot	23	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO063	L. Sheelin	23/11/2021	08:46	Coot	6	lakes and ponds; swimming on lake	NM
CO064	L. Sheelin	23/11/2021	08:53	Coot	4	lakes and ponds; swimming and diving on lake	NM
CO065	Derragh Lough	10/12/2021	10:48	Coot	37	lakes and ponds; swimming on lake and around reedy margins	NM
CO066	L. Sheelin	10/12/2021	09:05	Coot	13	lakes and ponds; swimming on lake	NM
CO067	L. Sheelin	10/12/2021	08:40	Coot	54	lakes and ponds; swimming in large raft on lake	NM
CO068	L. Sheelin	22/12/2021	13:40	Coot	890	lakes and ponds; swimming on lake - 3 large rafts of birds floating in open water	NM
CO069	L. D'varagh	22/12/2021	08:34	Coot	13	lakes and ponds; swimming on lake	NM
CO070	L. D'varagh	22/12/2021	08:40	Coot	64	lakes and ponds; swimming on lake	NM
CO071	L. D'varagh	22/12/2021	08:50	Coot	14	lakes and ponds; swimming on lake	NM
CO072	L. D'varagh	22/12/2021	08:43	Coot	5	lakes and ponds; swimming on lake	NM
CO073	L. Kinale	22/12/2021	11:27	Coot	6	lakes and ponds; swimming on lake	NM
CO074	L. Sheelin	22/12/2021	13:53	Coot	170	lakes and ponds; swimming on lake	NM
CO075	L. Kinale	22/12/2021	12:24	Coot	43	lakes and ponds; swimming and diving on lake	NM
CO076	Deragh Lough	22/12/2021	11:01	Coot	68	lakes and ponds; swimming and calling on lake	NM
CO077	L. Kinale	22/12/2021	12:22	Coot	5	lakes and ponds; swimming and calling on lake	NM
CO078	L. Kinale	22/12/2021	11:23	Coot	4	lakes and ponds; calling within reedy margins	NM
CO079		22/12/2021	09:30	Coot	46	lakes and ponds; calling and swimming on lake	NM
CO080	L. Iron	23/12/2021	15:30	Coot	36	lakes and ponds; swimming on lake	NM
CO081	L. D'varagh	04/01/2022	09:10	Coot	5	lakes and ponds; swimming on lake	NM
CO082	L. D'varagh	04/01/2022	10:00	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO083	L. D'varagh	04/01/2022	13:30	Coot	5	lakes and ponds; swimming on lake	NM
CO084	L. D'varagh	04/01/2022	14:45	Coot	11	lakes and ponds; swimming and calling on lake	NM
CO085	L. D'varagh	04/01/2022	14:16	Coot	6	lakes and ponds; calling from lake edge	NM
CO086	L. D'varagh	05/01/2022	13:20	Coot	77	lakes and ponds; swimming on lake	NM
CO087	Derragh Lough	05/01/2022	10:34	Coot	80	lakes and ponds; swimming and calling on lake	NM
CO088	R. Inny	17/01/2022	11:28	Coot	7	depositing/lowland rivers; swimming on river	NM
CO089	L. Kinale N	17/01/2022	10:40	Coot	146	lakes and ponds; swimming on lake	NM
CO090	Derragh Lough	17/01/2022	11:20	Coot	81	lakes and ponds; swimming on lake	NM
CO091	L. Kinale S	17/01/2022	11:46	Coot	9	lakes and ponds; swimming on lake	NM
CO092	L. D'varagh	17/01/2022	13:05	Coot	16	lakes and ponds; swimming on lake	NM
CO093	L. D'varagh	17/01/2022	13:08	Coot	16	lakes and ponds; swimming on lake	NM
CO094	L. Sheelin	17/01/2022	08:32	Coot	4	lakes and ponds; swimming on lake	NM
CO095	L. Sheelin	17/01/2022	08:35	Coot	13	lakes and ponds; swimming on lake	NM
CO096	L. Sheelin	17/01/2022	08:38	Coot	6	lakes and ponds; swimming on lake	NM
CO097	L. Sheelin	17/01/2022	09:30	Coot	37	lakes and ponds; swimming on lake	NM
CO098	L. Sheelin	17/01/2022	08:49	Coot	340	lakes and ponds; swimming on lake	NM
CO099	L. Sheelin	17/01/2022	08:46	Coot	130	lakes and ponds; swimming on lake	NM
CO100	L. D'varagh	17/01/2022	13:10	Coot	196	lakes and ponds; swimming in large group within sw corner of lake	NM
CO101	L. D'varagh	17/01/2022	13:04	Coot	8	lakes and ponds; swimming and diving on lake	NM
CO102	L. D'varagh	17/01/2022	13:12	Coot	5	lakes and ponds; swimming and calling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO103	L. Sheelin	17/01/2022	08:55	Coot	15	lakes and ponds; swimming and calling on lake	NM
CO104	L. D'varagh	17/01/2022	13:05	Coot	7	lakes and ponds; swimming and calling close to lake fringes	NM
CO105	L. D'varagh	17/01/2022	13:52	Coot	32	lakes and ponds; swimming all over lake	NM
CO106	L. Sheelin	17/01/2022	08:52	Coot	3	lakes and ponds; calling within reedy margins of lake	NM
CO107	L. D'varagh	18/01/2022	13:03	Coot	9	lakes and ponds; swimming on lake	NM
CO108	Lough Sheelin west	14/02/2022	11:45	Coot	8	lakes and ponds; foraging	KB
CO109	Lough Kinale	14/02/2022	12:50	Coot	153	lakes and ponds; foraging	KB
CO110	Derragh Lough	14/02/2022	13:26	Coot	27	lakes and ponds; foraging	KB
CO111	Lough Kinale south	14/02/2022	13:40	Coot	7	lakes and ponds; foraging	KB
CO112	Lough Iron	15/02/2022	09:40	Coot	70	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	KB
CO113	lake off Lough Derravaragh	15/02/2022	11:47	Coot	9	lakes and ponds; foraging	KB
CO114	Lough Derravaragh south	15/02/2022	12:20	Coot	347	lakes and ponds; foraging	KB
CO115	Lough Derravaragh north	15/02/2022	13:13	Coot	13	lakes and ponds; foraging	KB
CO116	Bracklagh Lough	26/02/2022	09:00	Coot	3	lakes and ponds; foraging	KB
CO117	Lough Sheelin west	26/02/2022	09:20	Coot	151	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO118	Lough Sheelin centre	26/02/2022	09:53	Coot	1	lakes and ponds; foraging	KB
CO119	Lough Kinale	26/02/2022	10:26	Coot	266	lakes and ponds; foraging	KB
CO120	Derragh Lough	26/02/2022	11:04	Coot	29	lakes and ponds; foraging	KB
CO121	Lough Kinale south	26/02/2022	11:28	Coot	1	lakes and ponds; foraging	KB
CO122	Robinstown flooded fields	26/02/2022	13:46	Coot	4	wet grassland; foraging	KB
CO123	Lough Derravaragh south	28/02/2022	11:45	Coot	272	lakes and ponds; foraging	KB
CO124	lake off Lough Derravaragh	28/02/2022	12:28	Coot	16	lakes and ponds; foraging	KB
CO125	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Coot	10	lakes and ponds and watercourses; foraging	KB
CO126	Lough Derravaragh north	28/02/2022	13:31	Coot	10	lakes and ponds; foraging	KB
CO127	Lough Sheelin west	07/03/2022	09:16	Coot	1	lakes and ponds; foraging	KB
CO128	Lough Kinale	07/03/2022	10:20	Coot	53	lakes and ponds; foraging	KB
CO129	Derragh Lough	07/03/2022	10:51	Coot	22	lakes and ponds; foraging	KB
CO130	Lough Kinale south	07/03/2022	11:08	Coot	13	lakes and ponds; foraging	KB
CO131	Lough Derravaragh south	08/03/2022	12:01	Coot	137	lakes and ponds; foraging	KB
CO132	Lake off Lough Derravaragh	08/03/2022	12:37	Coot	17	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO133	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Coot	14	lakes and ponds and watercourses; foraging	KB
CO134	Lough Derravaragh north	08/03/2022	13:32	Coot	7	lakes and ponds; foraging	KB
CO135	Lough Kinale	31/03/2022	09:07	Coot	7	lakes and ponds; foraging	KB
CO136	Derragh Lough	31/03/2022	09:32	Coot	22	lakes and ponds; foraging	KB
CO137	Lough Kinale south	31/03/2022	09:50	Coot	3	lakes and ponds; foraging	KB
CO138	Robinstown flooded fields	31/03/2022	13:16	Coot	5	lakes and ponds; foraging	KB
CO139	Lough Derravaragh north	31/03/2022	13:41	Coot	16	lakes and ponds; foraging	KB
CO140	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Coot	1	lakes and ponds; foraging	KB
CO141	Lake off Lough Derravaragh	31/03/2022	15:00	Coot	5	lakes and ponds; foraging	KB
CO142	Lough Derravaragh south	31/03/2022	15:27	Coot	34	lakes and ponds; foraging	KB

Table 1-27 Shoveler Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
SV001	Derragh Lough	16/09/2021	12:18	Shoveler	12	mesotrophic lakes; foraging on lake + a few resting	NM
SV002	L. Iron	17/09/2021	18:56	Shoveler	13	mesotrophic lakes; swimming and foraging on lake	NM
SV003	Derragh Lough	29/09/2021	11:04	Shoveler	6	mesotrophic lakes; swimming and foraging on lake	NM
SV004	L. Iron	25/10/2021	17:40	Shoveler	36	lakes and ponds; swimming and dabbling on lake	NM
SV005		26/10/2021	10:21	Shoveler	5	lakes and ponds; swimming on lake	NM
SV006	L. Iron	09/11/2021	16:32	Shoveler	14	lakes and ponds; swimming on lake	NM
SV007	L. Iron	22/11/2021	16:05	Shoveler	27	lakes and ponds; swimming on lake	NM
SV008	L. Sheelin	23/11/2021	08:46	Shoveler	5	lakes and ponds; flying low across lake	NM
SV009	Derragh lough	10/12/2021	10:52	Shoveler	6	lakes and ponds; swimming and feeding on lake	NM
SV010	L. Iron	23/12/2021	15:35	Shoveler	19	lakes and ponds; swimming on lake	NM
SV011	L. Sheelin	17/01/2022	08:54	Shoveler	7	lakes and ponds; flying low across lake	NM

Table 1-28 Teal Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	27/01/2022	16:07	Teal	2	cutover bog; fly, m and f pair (wintering)	AOD
T002	28/01/2022	16:55	Teal	22	lakes and ponds; foraging (wintering)	AOD
T003	22/02/2022	17:11	Teal	2	cutover bog; roosting (wintering)	AOD

Table 1-29 Teal Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	BN2	16/09/2021	14:10	Teal	31	cutover bog; roosting in shallow water and on bare peat with flooded area of bog	NM
T004	L. Iron	17/09/2021	19:28	Teal	14	reed and large sedge swamps and mesotrophic lakes; wading within reedy pool at se end of lake	NM
T002	L. D'varagh	17/09/2021	13:37	Teal	3	mesotrophic lakes and reed and large sedge swamps; wading within reedbeds at edge of lake	NM
T003	L. Iron	17/09/2021	19:04	Teal	94	mesotrophic lakes; swimming and foraging on lake	NM
T005		29/09/2021	12:36	Teal	145	raised bog, immature woodland and mesotrophic lakes; swimming in large frantic flock over s of l. kinale	NM
T006		29/09/2021	12:40	Teal	23	mesotrophic lakes and mixed conifer woodland; flying s across woodland and lake fringes	NM
T008	L. Sheelin	29/09/2021	08:29	Teal	16	lakes and ponds; flying ne across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T007		29/09/2021	12:49	Teal	33	mixed broadleaved woodland, raised bog and mesotrophic lakes; flying in wide random circles	NM
T009	L. Iron	30/09/2021	18:30	Teal	57	lakes and ponds; swimming on lake	NM
T010	L. Sheelin	12/10/2021	08:12	Teal	6	lakes and ponds; flying low across lake	NM
T011	L. Iron	25/10/2021	17:48	Teal	134	lakes and ponds; swimming on lake and around wetland fringes	NM
T012		26/10/2021	14:54	Teal	16	lakes and ponds; calling within reedy fringes	NM
T013	L. Sheelin	09/11/2021	10:01	Teal	16	lakes and ponds; swimming on lake	NM
T014		09/11/2021	11:54	Teal	6	improved agricultural grassland; swimming and feeding on pond within field	NM
T015	L. Iron	22/11/2021	16:04	Teal	95	lakes and ponds; swimming on lake	NM
T016	L. Kinale	23/11/2021	10:56	Teal	26	lakes and ponds; calling within reedy & flooded margins	NM
T017	L. Bane	10/12/2021	15:57	Teal	34	lakes and ponds and semi-natural grassland; swimming on lake and foraging on wet boggy margins	NM
T020		22/12/2021	14:24	Teal	4	lakes and ponds; swimming on pool within field hollow	NM
T018	Deragh Lough	22/12/2021	11:04	Teal	13	lakes and ponds; swimming on lake	NM
T019	L. Sheelin	22/12/2021	13:45	Teal	7	lakes and ponds; swimming on lake	NM
T021	L. Bane	22/12/2021	15:45	Teal	26	lakes and ponds; swimming and calling on lake	NM
T022		22/12/2021	15:57	Teal	23	bogs and scrub; flying in wide circles over lake area	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T023	L. Iron	23/12/2021	15:37	Teal	52	lakes and ponds; swimming and calling on lake	NM
T024	L. Iron	04/01/2022	15:40	Teal	240	lakes and ponds; swimming and calling on lake and within reedy fringes	NM
T025	L. D'varagh	04/01/2022	09:10	Teal	12	lakes and ponds; calling within flooded reedy margins of lake	NM
T026	L. D'varagh	04/01/2022	12:40	Teal	15	semi-natural grassland, highly modified/non-native woodland and lakes and ponds; calling within flooded birch / willow woodland along lake perimeter	NM
T027	L. Bane	05/01/2022	09:06	Teal	6	lakes and ponds; swimming on lake	NM
T030	L. Bane	17/01/2022	15:50	Teal	28	lakes and ponds, semi-natural grassland and transition mire and quaking bog; swimming on lake and within saturated margins	NM
T028	L. Kinale N	17/01/2022	10:40	Teal	67	lakes and ponds; swimming on lake	NM
T033	L. Sheelin	17/01/2022	08:58	Teal	13	lakes and ponds; swimming and calling within reedy margins	NM
T029		17/01/2022	13:54	Teal	16	improved agricultural grassland and reed and large sedge swamps; swimming and calling on flooding adjacent to lake	NM
T032	L. Sheelin	17/01/2022	08:50	Teal	16	lakes and ponds; flying across lake	NM
T031		17/01/2022	13:13	Teal	7	reed and large sedge swamps, scrub and lakes and ponds; bursting from wetland surrounding lake, flying	NM
T034	L. Iron	18/01/2022	16:00	Teal	45	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T035		18/01/2022	10:33	Teal	4	turloughs, lakes and ponds and improved agricultural grassland; calling within flooded reeds	NM
T036	Robinstown flooded fields	14/02/2022	14:50	Teal	12	wet grassland; foraging	KB
T038	Lough Bane	26/02/2022	12:50	Teal	4	lakes and ponds; roosting	KB
T037	Derragh Lough	26/02/2022	11:04	Teal	4	lakes and ponds; foraging	KB
T039	Robinstown flooded fields	07/03/2022	12:50	Teal	5	wet grassland; foraging	KB
T040	Robinstown pond	31/03/2022	13:10	Teal	12	lakes and ponds; foraging	KB
T041	Lough Derravaragh north	31/03/2022	13:41	Teal	6	lakes and ponds; foraging	KB

Table 1-30 Tufted Duck Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU001	L. Kinale	16/09/2021	10:52	Tufted Duck	2	mesotrophic lakes; swimming on lake	NM
TU002	Bracklagh Lough	29/09/2021	09:26	Tufted Duck	57	mesotrophic lakes; swimming and diving on lake	NM
TU003	L. Kinale	29/09/2021	10:12	Tufted Duck	6	mesotrophic lakes; swimming and diving on lake	NM
TU004	L. Sheelin	29/09/2021	08:43	Tufted Duck	6	lakes and ponds; swimming and diving on lake	NM
TU005	Bracklagh Lough	12/10/2021	08:55	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU006	L. Sheelin	12/10/2021	08:07	Tufted Duck	4	lakes and ponds; swimming on lake	NM
TU007		26/10/2021	15:12	Tufted Duck	5	lakes and ponds; swimming on lake	NM
TU008	Bracklagh Lough	28/10/2021	16:18	Tufted Duck	14	lakes and ponds; swimming and diving on lake	NM
TU010	L. Sheelin	23/11/2021	09:00	Tufted Duck	7	lakes and ponds; swimming and diving on lake	NM
TU009	L. Kinale	23/11/2021	09:55	Tufted Duck	3	lakes and ponds; diving on lake	NM
TU011	Bracklagh Lough	10/12/2021	09:26	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU013	Deragh Lough	22/12/2021	11:02	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU016	L. Sheelin	22/12/2021	13:47	Tufted Duck	12	lakes and ponds; swimming on lake	NM
TU012	L. D'varagh	22/12/2021	08:32	Tufted Duck	10	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU014	Bracklagh Lough	22/12/2021	12:03	Tufted Duck	9	lakes and ponds; swimming and diving on lake	NM
TU015	L. Sheelin	22/12/2021	13:40	Tufted Duck	5	lakes and ponds; swimming and diving on lake	NM
TU017	L. D'varagh	04/01/2022	13:34	Tufted Duck	2	lakes and ponds; swimming and diving on lake	NM
TU018	L. Sheelin	17/01/2022	09:46	Tufted Duck	38	lakes and ponds; swimming on lake	NM
TU020	L. Sheelin	17/01/2022	09:49	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU022	L. Sheelin	17/01/2022	08:37	Tufted Duck	13	lakes and ponds; swimming on lake	NM
TU023	L. Sheelin	17/01/2022	08:48	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU024	L. Sheelin	17/01/2022	08:46	Tufted Duck	19	lakes and ponds; swimming on lake	NM
TU025	L. Sheelin	17/01/2022	08:47	Tufted Duck	78	lakes and ponds; swimming on lake	NM
TU026	L. Sheelin	17/01/2022	08:47	Tufted Duck	190	lakes and ponds; swimming on lake	NM
TU027	L. Sheelin	17/01/2022	09:25	Tufted Duck	49	lakes and ponds; swimming on lake	NM
TU021	L. Kinale N	17/01/2022	10:40	Tufted Duck	36	lakes and ponds; swimming and diving on lake	NM
TU019	L. Sheelin	17/01/2022	09:57	Tufted Duck	16	lakes and ponds; flying across sw of lake	NM
TU028	Bracklagh Lough	18/01/2022	10:00	Tufted Duck	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU029	Lough Sheelin west	14/02/2022	11:45	Tufted Duck	183	lakes and ponds; foraging	KB
TU030	Bracklagh Lough	14/02/2022	12:20	Tufted Duck	10	lakes and ponds; foraging	KB
TU031	Lough Kinale	14/02/2022	12:50	Tufted Duck	81	lakes and ponds; foraging	KB
TU032	Robinstown pond	14/02/2022	14:32	Tufted Duck	2	lakes and ponds; foraging	KB
TU033	Lough Iron	15/02/2022	09:40	Tufted Duck	20	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	
TU034	Lough Derravaragh south	15/02/2022	12:20	Tufted Duck	174	lakes and ponds; foraging	KB
TU035	Bracklagh Lough	26/02/2022	09:00	Tufted Duck	11	lakes and ponds; foraging	KB
TU036	Lough Sheelin west	26/02/2022	09:20	Tufted Duck	74	lakes and ponds; foraging	KB
TU037	Lough Sheelin centre	26/02/2022	09:53	Tufted Duck	76	lakes and ponds; foraging	KB
TU038	Lough Kinale	26/02/2022	10:26	Tufted Duck	98	lakes and ponds; foraging	KB
TU039	Derragh Lough	26/02/2022	11:04	Tufted Duck	7	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU040	Lough Derravaragh south	28/02/2022	11:45	Tufted Duck	96	lakes and ponds; foraging	KB
TU041	Lough Derravaragh north	28/02/2022	13:31	Tufted Duck	7	lakes and ponds; foraging	KB
TU042	Brackagh Lough	07/03/2022	09:00	Tufted Duck	43	lakes and ponds; foraging	KB
TU043	Lough Sheelin west	07/03/2022	09:16	Tufted Duck	8	lakes and ponds; foraging	KB
TU044	Lough Kinale	07/03/2022	10:20	Tufted Duck	33	lakes and ponds; foraging	KB
TU045	Lough Derravaragh south	08/03/2022	12:01	Tufted Duck	49	lakes and ponds; foraging	KB
TU046	Brackagh Lough	31/03/2022	08:00	Tufted Duck	23	lakes and ponds; foraging	KB
TU047	Lough Sheelin west	31/03/2022	08:20	Tufted Duck	6	lakes and ponds; foraging	KB
TU048	Lough Kinale	31/03/2022	09:07	Tufted Duck	62	lakes and ponds; foraging	KB

Table 1-31 Wigeon Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	28/01/2022	16:55	Wigeon	8	lakes and ponds; foraging (wintering)	AOD

Table 1-32 Wigeon Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	Derragh Lough	16/09/2021	12:18	Wigeon	7	mesotrophic lakes; swimming on lake	NM
WN004		29/09/2021	12:36	Wigeon	243	mesotrophic lakes and immature woodland; swirling in large frantic flock over s of l. kinale	NM
WN005	L. Sheelin	29/09/2021	08:50	Wigeon	10	lakes and ponds; swimming on lake	NM
WN003	Derragh Lough	29/09/2021	11:00	Wigeon	15	mesotrophic lakes; swimming and foraging on lake	NM
WN002	L. D'varagh	29/09/2021	16:18	Wigeon	14	mesotrophic lakes; swimming and dabbling on lake	NM
WN006	L. Iron	30/09/2021	18:30	Wigeon	25	lakes and ponds; swimming on lake	NM
WN007	L. Iron	11/10/2021	17:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN008	L. Kinale	12/10/2021	10:11	Wigeon	16	lakes and ponds; swimming on lake	NM
WN009	Derragh Lough	12/10/2021	11:12	Wigeon	7	lakes and ponds; swimming and dabbling on lake	NM
WN010	L. Sheelin	12/10/2021	08:14	Wigeon	5	lakes and ponds; flying high across lake	NM
WN011		26/10/2021	09:49	Wigeon	7	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN015		09/11/2021	12:13	Wigeon	4	improved agricultural grassland; swimming on pond (flooding) within field	NM
WN014	Derragh Lough	09/11/2021	11:36	Wigeon	263	lakes and ponds; swimming on lake, flying around in vicinity, approximate numbers, numbers regulary cycling as individuals arrived and departed	NM
WN013	L. Sheelin	09/11/2021	09:27	Wigeon	5	lakes and ponds; swimming on lake	NM
WN016	L. Iron	09/11/2021	16:26	Wigeon	71	lakes and ponds; swimming on lake	NM
WN012	L. Sheelin	09/11/2021	09:29	Wigeon	13	lakes and ponds; flying low across lake, heading e	NM
WN017	L. Iron	22/11/2021	16:03	Wigeon	120	lakes and ponds; swimming on lake	NM
WN018	L. Bane	23/11/2021	14:20	Wigeon	39	lakes and ponds; swimming and dabbling on lake	NM
WN019	L. Sheelin	10/12/2021	09:03	Wigeon	5	lakes and ponds; swimming on lake	NM
WN021	L. Bane	10/12/2021	15:54	Wigeon	16	lakes and ponds; swimming on lake	NM
WN020	L. Kinale	10/12/2021	10:02	Wigeon	12	lakes and ponds; flying low across lake	NM
WN023		22/12/2021	14:24	Wigeon	3	lakes and ponds; swimming on pool within field hollow	NM
WN022	Deragh Lough	22/12/2021	11:00	Wigeon	22	lakes and ponds; swimming and calling on lake	NM
WN024	L. Bane	22/12/2021	15:44	Wigeon	34	lakes and ponds; swimming and calling on lake	NM
WN025		22/12/2021	15:46	Wigeon	9	lakes and ponds and bogs; flying in wide circles over lake area	NM
WN026	L. Iron	23/12/2021	15:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN027	L. Iron	04/01/2022	15:40	Wigeon	70	lakes and ponds; swimming on lake	NM
WN028	L. Bane	05/01/2022	09:05	Wigeon	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN030	L. Bane	17/01/2022	15:50	Wigeon	34	lakes and ponds, transition mire and quaking bog and semi-natural grassland; swimming on lake and within saturated edges	NM
WN029	L. Kinale N	17/01/2022	10:39	Wigeon	23	lakes and ponds; swimming on lake	NM
WN033	L. Sheelin	17/01/2022	08:42	Wigeon	11	lakes and ponds; swimming on lake	NM
WN032	L. D'varagh	17/01/2022	13:09	Wigeon	26	lakes and ponds; swimming and foraging on lake	NM
WN031	L. D'varagh	17/01/2022	13:13	Wigeon	6	reed and large sedge swamps and lakes and ponds; spooked and bursting from wetland, flying	NM
WN034	L. Iron	18/01/2022	16:00	Wigeon	46	lakes and ponds; swimming on lake	NM
WN035	Lough Sheelin west	26/02/2022	09:20	Wigeon	2	lakes and ponds; foraging	KB
WN036	Lough Bane	26/02/2022	12:50	Wigeon	2	lakes and ponds; foraging	KB
WN037	Lough Bane	31/03/2022	11:25	Wigeon	2	lakes and ponds; foraging	KB

Table 1-33 Curlew Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU001	VP5	08/10/2021	09:53	Curlew	3	80	0	80	0	0	improved agricultural grassland, semi-natural grassland and scrub; flying n along e 500m boundary + calling	NM
CU002	VP6	22/10/2021	09:32	Curlew	1	350	0	140	210	0	depositing/lowland rivers, cutover bog and semi-natural grassland; flying and soaring along river and adjacent areas, calling	NM

Table 1-34 Curlew Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001		16/09/2021	08:54	Curlew	2	mesotrophic lakes, immature woodland and raised bog; flying se across lake, bog and scrubby woodland	NM
CU002	BN2	22/12/2021	15:35	Curlew	6	cutover bog, scrub and mixed conifer woodland; flying high and calling, heading s	NM
CU003		23/12/2021	15:50	Curlew	57	improved agricultural grassland and hedgerows; flying low across farmland, heading sw	NM

Table 1-35 Goldeneye Wildfowl Distribution Survey Date

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB

Table 1-36 Kestrel Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K002	VP4	28/04/2021	17:09	Kestrel	1	212	0	100	112	0	mixed broadleaved/conifer woodland and improved agricultural grassland; hunting	PM
K003	VP4	21/05/2021	06:34	Kestrel	1	58	58	0	0	0	cutover bog; travelling low	PM
K004	VP4	21/05/2021	10:12	Kestrel	1	192	0	92	100	0	mixed broadleaved/conifer woodland; hunting	PM
K005	VP6	30/07/2021	13:23	Kestrel	1	175	0	0	175	0	cutover bog and mixed broadleaved/conifer woodland; hunting	PM
K006	VP4	26/08/2021	13:48	Kestrel	1	186	0	0	186	0	cutover bog; hunting	TRea
K007	VP4	26/08/2021	15:54	Kestrel	1	182	20	43	129	0	cutover bog and treelines; chased by bzto open bog, flew low to edged, soared, flew off	TRea
K008	VP5	08/10/2021	08:17	Kestrel	1	130	80	50	0	0	improved agricultural grassland and hedgerows; hunting and hovering along hedgerows within farmland	NM
K009	VP6	22/10/2021	08:15	Kestrel	1	75	35	40	0	0	scrub and cutover bog; flying over bog and fringes	NM
K010	VP6	22/10/2021	09:26	Kestrel	1	70	0	70	0	0	cutover bog; commuting s across bog	NM

Vantage Point Surveys

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K011	VP3	15/11/2021	13:00	Kestrel	1	53	13	40	0	0	cutover bog and conifer plantation; flying, male observed descending into conifer plantation.	CR
K012	VP3	15/11/2021	13:06	Kestrel	1	292	9	37	246	0	conifer plantation and cutover bog; hunting, male observed hunting before descending into conifer plantation.	CR
K013	VP4	16/11/2021	13:02	Kestrel	1	444	6	98	340	0	highly modified/non-native woodland and cutover bog; hunting, observed hunting before descending into woodland.	CR
K014	VP5	19/11/2021	13:22	Kestrel	1	40	40	0	0	0	improved grassland; flying, male observed heading south east.	CR
K015	VP5	19/11/2021	13:47	Kestrel	1	250	5	25	220	0	improved grassland and conifer plantation; hunting, observed hunting for four minutes before descending into conifer woodland to the west of the 500 buffer.	CR
K016	VP6	22/11/2021	13:16	Kestrel	1	133	133	0	0	0	improved grassland, cutover bog and highly modified/non-native woodland; flying, male observed heading east before descending into woodland.	CR
K017	VP6	15/12/2021	13:36	Kestrel	1	660	60	570	30	0	cutover bog, wet grassland and scrub; foraging	KB
K018	VP5	03/01/2022	08:20	Kestrel	1	480	30	200	250	0	immature woodland and wet grassland; foraging	KB
K019	VP4	27/01/2022	15:24	Kestrel	1	510	0	0	510	0	conifer plantation and cutover bog; flying, hovering	ZE
K020	VP6	31/01/2022	14:22	Kestrel	1	648	0	26	622	0	cutover bog and conifer plantation; flying, hovering	ZE

Vantage Point Surveys												
Map Ref.	**VP**	**Date**	**Time**	**Species**	**Number**	**Duration of flight (s)**	**Band 1 (0-15m)**	**Band 2 (15-25m)**	**PCH (25-200m)**	**Band 4 (>200m)**	**Habitat and activity**	**Surveyor**
K021	VP6	31/01/2022	14:32	Kestrel	1	370	0	0	370	0	improved agricultural grassland and conifer plantation; flying	ZE
K022	VP6	31/01/2022	16:04	Kestrel	1	38	10	28	0	0	lowland blanket bog and improved agricultural grassland; flying	ZE
K023	VP3	15/02/2022	10:51	Kestrel	1	240	0	60	180	0	cutover bog; flying	NS
K024	VP4	16/02/2022	10:11	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying	NS
K025	VP6	17/02/2022	13:05	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying, no hovering just flying	NS
K026	VP4	10/03/2022	15:22	Kestrel	1	86	0	0	86	0	cutover bog; flying	NS
K027	VP1	15/03/2022	15:49	Kestrel	1	420	0	0	420	0	cutover bog; flying	NS
K028	VP1	15/03/2022	17:03	Kestrel	1	20	0	20	0	0	cutover bog; flying	NS
K029	VP5	22/03/2022	14:04	Kestrel	1	120	0	20	100	0	improved agricultural grassland; hunting	ZOC

Table 1-37 Kestrel Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	**BRVP**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Breeding status**	**Surveyor**
K001	BRVP5	29/04/2021	09:07	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K002	BRVP2	30/04/2021	09:23	Kestrel	1	improved agricultural grassland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K003	BRVP1	30/04/2021	13:11	Kestrel	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
K004	BRVP6	04/06/2021	17:42	Kestrel	1	cutover bog, hunting	flyover; non-breeding	PM
K005	BRVP6	04/06/2021	18:25	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K006	BRVP6	13/07/2021	09:25	Kestrel	1	highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K007	BRVP6	13/07/2021	10:37	Kestrel	1	bogs and highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K008	BRVP1	19/07/2021	12:48	Kestrel	1	bogs and highly modified/non-native woodland, flying, hovering, soaring, perched on tree, flew off hovering and soaring over bog	suitable nesting habitat; possible breeder	TRea

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
	BRVP6	06/05/2022	15:39	Kestrel	1	scrub and bogs, hunting, female observed hunting before descending beyond row of trees heading north west.	suitable nesting habitat; possible breeder	CR
	BRVP6	06/05/2022	16:06	Kestrel	1	scrub, bogs and conifer plantation, hunting, female kestrel last seen heading west.	suitable nesting habitat; possible breeder	CR
	BRVP2	23/05/2022	14:05	Kestrel	1	cutover bog, hunting and hovering over bog	flyover; non-breeding	NM
	BRVP1	26/05/2022	10:40	Kestrel	1	highly modified/non-native woodland and cutover bog, flying over bog wetland	flyover; non-breeding	NM
	BRVP1	26/05/2022	11:21	Kestrel	1	mixed conifer woodland and scrub, hunting and hovering	suitable nesting habitat; possible breeder	NM
	BRVP6	26/05/2022	16:30	Kestrel	1	bogs, flying across bog	flyover; non-breeding	NM

Table 1-38 Kestrel Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	27/01/2022	14:55	Kestrel	1	cutover bog; fly/perch, k male (wintering)	AOD

Table 1-39 Kestrel Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	Wildfowl Distribution Survey, lough bane 2	16/09/2021	14:06	Kestrel	1	cutover bog, scrub and immature woodland; soaring high above scrubby bog wetland, moving n, hassled by sl & mp	NM
K002	Wildfowl Distribution Survey,	16/09/2021	14:19	Kestrel	2	cutover bog; flying low over bog, individuals then started chasing each other and flying rapidly low to w	NM
K003	Wildfowl Distribution Survey,	16/09/2021	15:39	Kestrel	1	improved agricultural grassland and hedgerows; flying low across farmland	NM
K004	Wildfowl Distribution Survey,	16/09/2021	16:17	Kestrel	1	scrub and dry meadows and grassy verges; perched on telephone wire along road	NM
K005	Wildfowl Distribution Survey,	17/09/2021	19:18	Kestrel	1	marsh and immature woodland; hunting and hovering over s marsh of lake	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K006	Wildfowl Distribution Survey,	12/10/2021	10:41	Kestrel	1	raised bog and scrub; hunting and hovering over scrubby bog fringes	NM
K007	Winter Walkover Survey,	20/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K008	Winter Walkover Survey,	21/10/2021	13:44	Kestrel	1	immature woodland and cutover bog; flying low over scrubby woodland / farmland near bog fringes	NM
K009	Winter Walkover Survey,	21/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K010	Winter Walkover Survey,	21/10/2021	15:25	Kestrel	1	semi-natural grassland, improved agricultural grassland and scrub; hunting and hovering over grassland	NM
K011	Wildfowl Distribution Survey,	26/10/2021	11:29	Kestrel	1	semi-natural grassland and mixed broadleaved woodland; flying across woodland	NM
K12	Wildfowl Distribution Survey,	26/10/2021	12:41	Kestrel	1	cutover bog and scrub; hunting and hovering over bog wetland and fringes	NM
K013	Wildfowl Distribution Survey, derragh lough	23/11/2021	10:40	Kestrel	1	improved agricultural grassland, semi-natural grassland and mixed broadleaved woodland; hunting and hovering over grassland	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K014	Wildfowl Distribution Survey,	10/12/2021	08:54	Kestrel	1	bogs and scrub; hunting and hovering over bog and scrubland	NM
K015	Wildfowl Distribution Survey,	22/12/2021	15:31	Kestrel	1	cutover bog and scrub; flying across bog and scrub fringes	NM
K016	Wildfowl Distribution Survey,	17/01/2022	15:20	Kestrel	1	cutover bog and scrub; flying across bog	NM
K017	Wildfowl Distribution Survey,	17/01/2022	16:30	Kestrel	1	cutover bog and scrub; commuting across bog and wetland	NM
K018	Wildfowl Distribution Survey,	18/01/2022	11:31	Kestrel	1	improved agricultural grassland and scrub; hunting and hovering over farmland	NM

Table 1-40 Lapwing Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
L001	VP6	22/11/2021	12:05	Lapwing	25	151	70	81	0	0	cutover bog; flying, flock of 25 birds observed flying in circles before heading east.	CR

Table 1-41 Lapwing Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
L007	15/03/2022	12:27	Lapwing	8	scrub; nest building (nest building; probable breeding)	NS

Table 1-42 Lapwing Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L002	L. D'varagh	17/09/2021	13:17	Lapwing	32	mesotrophic lakes; flying in v shaped flock low across water - heading nw up length of length	NM
L001		17/09/2021	13:09	Lapwing	81	mesotrophic lakes, mixed broadleaved woodland and improved agricultural grassland; flying in lare flock over narrow 'foot' of lake - heading ne across farmland	NM
L003		25/10/2021	16:36	Lapwing	43	improved agricultural grassland; grazing on grassland to s of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L006		26/10/2021	12:50	Lapwing	32	cutover bog; perched on bog wetland, dispersed across area	NM
L004		26/10/2021	09:34	Lapwing	79	lakes and ponds and improved agricultural grassland; flying and swirling low over lake edge, landing on grassy edge	NM
L005		26/10/2021	12:43	Lapwing	54	cutover bog and scrub; flying across bog wetland	NM
L007		09/11/2021	09:32	Lapwing	18	scrub and bogs; circling over bog / scrubland to w	NM
L011	L. Sheelin	23/11/2021	08:46	Lapwing	145	lakes and ponds and semi-natural grassland; roosting on grassy shore + occasionally smaller groups would fly low across lake and return to land	NM
L010		23/11/2021	12:45	Lapwing	23	improved agricultural grassland; roosting and foraging within rushy wetland area - turlough? wetland?, habitat??	NM
L008		23/11/2021	09:56	Lapwing	8	lakes and ponds, scrub and semi-natural grassland; flying over shore of lake	NM
L012	L. Sheelin	23/11/2021	09:15	Lapwing	34	lakes and ponds; flying e across lake	NM
L009	L. D'varagh	23/11/2021	15:39	Lapwing	86	lakes and ponds; flying across lake	NM
L013	L. Sheelin	10/12/2021	08:45	Lapwing	28	lakes and ponds and scrub; swirling over w shore area	NM
L014	BN2	10/12/2021	15:41	Lapwing	19	cutover bog; roosting and foraging on bare peat within bog wetland area	NM
L016		22/12/2021	14:34	Lapwing	31	lakes and ponds and improved agricultural grassland; foraging and roosting at edge of pool within field, turlough?	NM
L015	L. D'varagh	22/12/2021	08:43	Lapwing	78	lakes and ponds; flying low across lake - heading w	NM
L017		23/12/2021	15:35	Lapwing	245	semi-natural grassland and scrub; flying high across grassland and scrub to n of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L018		23/12/2021	15:37	Lapwing	87	improved agricultural grassland; flying across grassland to nw of lake	NM
L020		04/01/2022	14:15	Lapwing	38	improved agricultural grassland; grazing on field	NM
L019		04/01/2022	13:57	Lapwing	158	improved agricultural grassland, hedgerows and lakes and ponds; flock wheeling and flying high over farmland and lake edges	NM
L021	BN2	05/01/2022	09:43	Lapwing	23	cutover bog; roosting on bog wetland	NM
L023		17/01/2022	13:52	Lapwing	7	improved agricultural grassland and semi-natural grassland; roosting on flooding	NM
L024	L. Sheelin	17/01/2022	08:36	Lapwing	38	lakes and ponds; flying low across lake - heading se	NM
L022	L. Sheelin	17/01/2022	09:45	Lapwing	26	lakes and ponds; flying low across lake	NM
L025	Lough Sheelin centre	14/02/2022	11:00	Lapwing	76	lakes and ponds; flying over	KB
L027	Flooded cutaway bog on site	26/02/2022	12:58	Lapwing	6	cutover bog; foraging on ground and flying over	KB
L026	Derragh Lough	26/02/2022	11:04	Lapwing	1	wet grassland; foraging	KB
L028	Flooded bog on site	31/03/2022	11:20	Lapwing	2	cutover bog; foraging and alarm calling	KB

Table 1-43 Pochard Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PO001	L. Kinale	29/09/2021	10:23	Pochard	5	mesotrophic lakes; swimming and diving on lake	NM
PO002	L. Sheelin	26/10/2021	14:21	Pochard	5	lakes and ponds; swimming and diving on lake	NM
PO003	L. D'varagh	08/11/2021	12:23	Pochard	12	lakes and ponds; swimming on lake	NM
PO004	L. Sheelin	09/11/2021	09:15	Pochard	7	lakes and ponds; swimming and diving on lake	NM
PO005	L. Kinale	23/11/2021	09:52	Pochard	12	lakes and ponds; swimming on lake	NM
PO006	L. D'varagh	23/11/2021	15:42	Pochard	24	lakes and ponds; swimming on lake	NM
PO007	L. Sheelin	23/11/2021	09:10	Pochard	4	lakes and ponds; swimming and diving on lake	NM
PO008	L. Kinale	22/12/2021	12:20	Pochard	16	lakes and ponds; swimming on lake	NM
PO009	L. Sheelin	22/12/2021	13:52	Pochard	9	lakes and ponds; swimming and diving on lake	NM
PO010	L. D'varagh	04/01/2022	10:08	Pochard	5	lakes and ponds; swimming on lake	NM
PO011	L. Kinale	17/01/2022	10:41	Pochard	7	lakes and ponds; swimming on lake	NM
PO012	L. Sheelin	17/01/2022	08:59	Pochard	12	lakes and ponds; swimming and diving on lake	NM
PO013	Bracklagh Lough	14/02/2022	12:20	Pochard	1	lakes and ponds; foraging	KB
PO014	Lough Sheelin west	26/02/2022	09:20	Pochard	177	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PO015	Lough Sheelin centre	26/02/2022	09:53	Pochard	182	lakes and ponds; foraging	KB
PO016	Lough Derravaragh south	28/02/2022	11:45	Pochard	6	lakes and ponds; foraging	KB
PO017	Brackagh Lough	07/03/2022	09:00	Pochard	76	lakes and ponds; foraging	KB
PO018	Derragh Lough	31/03/2022	09:32	Pochard	4	lakes and ponds; foraging	KB

Table 1-44 Snipe Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SN001	VP6	06/04/2021	20:31	Snipe	1	10	10	0	0	0	cutover bog; flew from long grass	PM
SN002	VP6	26/05/2021	06:20	Snipe	1	15	15	0	0	0	cutover bog; travelling; landed in vegetation	PM
SN003	VP5	19/11/2021	12:03	Snipe	1	81	11	70	0	0	improved grassland; flying, landed in grassland to the north.	CR
SN004	VP6	31/01/2022	15:17	Snipe	1	10	10	0	0	0	improved agricultural grassland; flying, flushed	ZE
SN005	VP5	22/03/2022	19:25	Snipe	2	30	0	30	0	0	improved agricultural grassland; flying	ZOC

Table 1-45 Snipe Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN004	VP6	06/04/2021	20:44	Snipe	1	cutover bog; calling	PM
SN005	VP4	28/04/2021	21:29	Snipe	1	cutover bog; drumming, not seen	PM
SN007	VP4	28/04/2021	21:33	Snipe	1	cutover bog; drumming, second male; not seen	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN006	VP4	28/04/2021	21:39	Snipe	1	cutover bog; drumming, not seen; possibly same bird as earlier	PM
SN008	VP3	15/11/2021	17:07	Snipe	1	cutover bog; calling	CR
SN009	VP3	15/11/2021	17:15	Snipe	1	cutover bog; calling	CR
SN010	VP3	15/11/2021	17:19	Snipe	1	cutover bog; calling	CR
SN011	VP5	19/11/2021	17:07	Snipe	1	improved grassland; calling	CR
SN012	VP6	22/11/2021	15:54	Snipe	1	depositing/lowland rivers; calling	CR
SN013	VP6	22/11/2021	16:42	Snipe	1	improved grassland and depositing/lowland rivers; calling	CR
SN014	VP6	22/11/2021	17:12	Snipe	1	cutover bog; calling	CR
SN015	VP6	31/01/2022	17:47	Snipe	1	lowland blanket bog; calling	ZE

Table 1-46 Snipe Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	07/04/2021	07:23	Snipe	1	wet grassland; flushed (flyover; non-breeding)	PM
SN002	07/04/2021	11:32	Snipe	2	cutover bog; flushed (summering; non-breeding)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN003	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN004	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN005	18/06/2021	07:22	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN006	18/06/2021	07:49	Snipe	1	cutover bog; flying (flyover; non-breeding)	PM
SN007	18/06/2021	10:40	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN008	18/06/2021	10:40	Snipe	1	cutover bog; displaying (courtship and display; probable breeding)	PM

Table 1-47 Snipe Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN009	21/10/2021	11:52	Snipe	1	cutover bog, semi-natural grassland and depositing/lowland rivers; flushed from wet grassland along river (wintering)	NM
SN010	21/10/2021	11:57	Snipe	4	cutover bog; flushed from cutover bog fringes (wintering)	NM
SN011	28/01/2022	13:03	Snipe	2	raised bog; fly, flushed (wintering)	AOD
SN012	28/01/2022	16:56	Snipe	2	lakes and ponds; flushed (wintering)	AOD
SN013	22/02/2022	17:01	Snipe	4	lakes and ponds; flushed (wintering)	AOD
SN014	23/02/2022	17:08	Snipe	1	cutover bog; flushed (wintering)	AOD

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN015	23/02/2022	16:08	Snipe	1	cutover bog; flushed (wintering)	AOD
SN016	15/03/2022	15:10	Snipe	1	cutover bog; flying, flushed while walking (nest building; probable breeding)	NS

Table 1-48 Snipe Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001		29/09/2021	08:43	Snipe	1	raised bog; flushed from bog	NM
SN002		12/10/2021	13:27	Snipe	4	improved agricultural grassland and hedgerows; flying over farmland	NM
SN003		23/11/2021	14:18	Snipe	1	semi-natural grassland; flushed from wet grassland	NM
SN004		22/12/2021	15:46	Snipe	2	scrub and bogs; flushed from saturated fringes of lake, willow shrubs - wn7?	NM
SN005	L. D'varagh	04/01/2022	12:50	Snipe	2	highly modified/non-native woodland and semi-natural grassland; flushed from wet grass within woodland	NM
SN006	L. D'varagh	04/01/2022	13:30	Snipe	2	improved agricultural grassland; flushed from partially flooded field along lake edge	NM
SN008	BN1	17/01/2022	15:46	Snipe	1	scrub and semi-natural grassland; flushed from wet willow scrub	NM
SN009		17/01/2022	15:53	Snipe	1	transition mire and quaking bog and semi-natural grassland; flushed from saturated fringes	NM
SN007		17/01/2022	11:16	Snipe	1	improved agricultural grassland; flushed from disturbed farmland	NM
SN010	Lough Sheelin centre	14/02/2022	11:00	Snipe	1	raised bog; flushed	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN011	Lough Sheelin centre	26/02/2022	09:53	Snipe	1	raised bog; flushed	KB
SN012	Lough Bane	26/02/2022	12:50	Snipe	1	bogs and lakes and ponds; flushed	KB
SN013	Lough Derravaragh north	08/03/2022	13:32	Snipe	1	lakes and ponds; flushed	KB

Table 1-49 Snipe Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	Breeding Woodcock Survey, t1	06/05/2021	22:39	Snipe	1	cutover bog; drumming	PM
SN002	Breeding Woodcock Survey, t1	06/05/2021	22:10	Snipe	1	cutover bog; drumming	PM
SN003	Breeding Woodcock Survey, t1	06/05/2021	22:30	Snipe	1	cutover bog and conifer plantation; drumming	PM
SN004	Breeding Woodcock Survey, t1 coole	03/06/2021	22:37	Snipe	2	bogs and woodland and scrub; drumming, 2 individuals drumming	TRea
SN005	Breeding Woodcock Survey, wkt1	28/06/2021	23:28	Snipe	1	bogs; drumming	TRea
SN006	Vantage Point Survey, vp6	06/09/2021	17:28	Snipe	1	cutover bog; travelling, took off from scrub as hh passed over	TRea

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN007	Vantage Point Survey, walking to vp6	15/12/2021	07:37	Snipe	1	cutover bog; flushed	KB
SN008	Vantage Point Survey, walking from vp6	15/12/2021	14:13	Snipe	1	cutover bog; flushed	KB
SN009	Vantage Point Survey, doon	31/01/2022	11:37	Snipe	1	lowland blanket bog; flying - flushed	ZE
SN010	Vantage Point Survey, coole westmeath	17/02/2022	13:17	Snipe	1	lowland blanket bog; flying, flushed while walking back from vp	NS

Table 1-50 Woodcock Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WK001	VP4	31/03/2021	20:26	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland; roding, displaying bird	AOD
WK002	VP4	31/03/2021	20:36	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland and cutover bog; roding, displaying male	AOD

Table 1-51 Breeding Woodcock Survey Data

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK001	T1	06/05/2021	21:35	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK002	T1	06/05/2021	21:37	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK003	T1	06/05/2021	21:41	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK004	T1	06/05/2021	21:43	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK005	T1	06/05/2021	21:48	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK006	T1	06/05/2021	21:52	Woodcock	1	short rotation coppice, roding, t1 bird 3	PM
WK007	T1	06/05/2021	21:54	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM
WK008	T1	06/05/2021	21:58	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK009	T3	18/05/2021	21:50	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK010	T3	18/05/2021	21:53	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK011	T2	24/05/2021	22:22	Woodcock	1	mixed broadleaved/conifer woodland, roding, t2 bird 1	PM
WK012	T2	24/05/2021	22:30	Woodcock	1	mixed broadleaved/conifer woodland and cutover bog, roding, t2 bird 2	PM
WK013	T2	03/06/2021	21:42	Woodcock	2	mixed broadleaved/conifer woodland, chasing each other	PM
WK014	T2	03/06/2021	22:14	Woodcock	1	conifer plantation, roding	PM
WK015	T2	03/06/2021	22:34	Woodcock	1	conifer plantation, roding	PM
WK016	T1	03/06/2021	21:45	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK017	T1	03/06/2021	21:54	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK018	T1	03/06/2021	21:56	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK019	T1	03/06/2021	22:10	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK020	T1	03/06/2021	22:16	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK021	T1	03/06/2021	22:22	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK022	T1	03/06/2021	22:24	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK023	T1	03/06/2021	22:42	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK024	T1	03/06/2021	22:19	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK025	T1	03/06/2021	22:50	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK026	T3	04/06/2021	21:58	Woodcock	1	conifer plantation and bogs, roding	TRea
WK027	T3	04/06/2021	22:51	Woodcock	1	conifer plantation and bogs, roding	TRea
WK028	T3	04/06/2021	22:19	Woodcock	1	conifer plantation and bogs, roding	TRea
WK029	T3	04/06/2021	22:31	Woodcock	1	conifer plantation and bogs, roding	TRea
WK030	T1	28/06/2021	22:35	Woodcock	2	highly modified/non-native woodland and bogs, roding, 2 flying in loop aa individuals	TRea

Table 1-52 Buzzard Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ002	VP6	06/04/2021	15:00	Buzzard	1	117	0	0	117	0	cutover bog and conifer plantation; soaring	PM
BZ003	VP6	06/04/2021	15:31	Buzzard	1	244	0	0	244	0	conifer plantation and cutover bog; soaring before dropping down to land in tree	PM
BZ004	VP6	06/04/2021	16:17	Buzzard	1	155	0	0	155	0	conifer plantation and cutover bog; hunting/travelling	PM
BZ005	VP6	26/05/2021	10:18	Buzzard	1	20	20	0	0	0	improved agricultural grassland; travelling; being mobbed by hc	PM
BZ006	VP4	17/06/2021	15:03	Buzzard	2	200	0	0	100	100	conifer plantation and improved agricultural grassland; soaring	PM
BZ007	VP4	17/06/2021	15:32	Buzzard	1	450	0	0	400	50	cutover bog, conifer plantation and improved agricultural grassland; hunting; then soaring	PM
BZ008	VP4	17/06/2021	15:38	Buzzard	1	60	60	0	0	0	cutover bog; travelling	PM
BZ009	VP4	17/06/2021	15:42	Buzzard	1	23	23	0	0	0	cutover bog; travelling	PM
BZ010	VP4	17/06/2021	15:49	Buzzard	1	17	17	0	0	0	cutover bog; hunting	PM
BZ011	VP6	30/07/2021	12:48	Buzzard	1	19	0	19	0	0	cutover bog; hunting	PM
BZ012	VP6	30/07/2021	15:15	Buzzard	1	52	52	0	0	0	wet grassland; hunting	PM
BZ013	VP6	19/08/2021	11:00	Buzzard	1	787	0	127	660	0	cutover bog and semi-natural woodland; travelling, soaring	TRea
BZ014	VP6	19/08/2021	14:42	Buzzard	1	220	0	0	220	0	cutover bog; travelling	TRea
BZ015	VP6	19/08/2021	16:10	Buzzard	1	521	0	15	516	0	cutover bog; hunting	TRea
BZ016	VP4	26/08/2021	11:22	Buzzard	1	354	0	0	354	0	cutover bog; hunting	TRea
BZ017	VP4	26/08/2021	12:09	Buzzard	1	277	0	0	277	0	cutover bog and treelines; soaring	TRea
BZ018	VP4	26/08/2021	12:13	Buzzard	1	249	0	72	177	0	cutover bog and linear woodland/scrub; hunting	TRea

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ019	VP4	26/08/2021	12:47	Buzzard	1	77	0	77	0	0	cutover bog; travelling	TRea
BZ020	VP4	26/08/2021	14:46	Buzzard	2	360	0	41	319	0	cutover bog and treelines; hunting	TRea
BZ021	VP4	26/08/2021	14:59	Buzzard	1	208	0	0	208	0	cutover bog; soaring	TRea
BZ022	VP4	26/08/2021	15:58	Buzzard	1	5	5	0	0	0	cutover bog and treelines; fighting k.	TRea
BZ023	VP5	08/10/2021	11:01	Buzzard	1	240	0	0	60	180	improved agricultural grassland, mixed conifer woodland and cutover bog; soaring over forestry and bog fringes	NM
BZ024	VP4	19/10/2021	11:28	Buzzard	1	120	0	50	70	0	bogs and highly modified/non-native woodland; soaring over woodland on bog	NM
BZ025	VP6	22/10/2021	11:59	Buzzard	1	560	65	150	330	20	scrub, treelines and cutover bog; soaring and hunting over bog and scrub fringes, perched for period	NM
BZ026	VP3	23/10/2021	12:03	Buzzard	1	160	0	0	140	20	cutover bog and scrub; soaring over bog and fringes	NM
BZ027	VP3	23/10/2021	12:24	Buzzard	1	70	0	0	70	0	mixed broadleaved woodland, improved agricultural grassland and cutover bog; flying across hazel woodland and farmland	NM
BZ028	VP3	15/11/2021	12:06	Buzzard	1	465	0	0	115	350	highly modified/non-native woodland, improved grassland and cutover bog; soaring, observed heading north west.	CR
BZ029	VP6	22/11/2021	11:06	Buzzard	1	40	40	0	0	0	highly modified/non-native woodland and cutover bog; flying, observed heading north west before descending beyond line of trees.	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ030	VP6	22/11/2021	14:49	Buzzard	1	80	80	0	0	0	cutover bog, improved grassland and highly modified/non-native woodland; flying, adult buzzard observed heading south before landing on tree top.	CR
BZ031	VP6	22/11/2021	15:00	Buzzard	1	42	20	22	0	0	highly modified/non-native woodland and improved grassland; flying, last seen heading south west.	CR
BZ032	VP6	15/12/2021	08:53	Buzzard	1	30	10	20	0	0	mixed broadleaved woodland; foraging	KB
BZ033	VP6	15/12/2021	09:42	Buzzard	1	10	10	0	0	0	semi-natural grassland; foraging	KB
BZ034	VP5	25/01/2022	14:57	Buzzard	1	5	0	5	0	0	improved agricultural grassland; flying	ZE
BZ035	VP5	25/01/2022	15:25	Buzzard	1	3	0	5	0	0	improved agricultural grassland and treelines; flying	ZE
BZ036	VP5	25/01/2022	16:20	Buzzard	1	19	19	0	0	0	improved agricultural grassland and hedgerows; flying	ZE
BZ037	VP3	26/01/2022	11:50	Buzzard	1	50	40	10	0	0	conifer plantation and treelines; flying, circling	ZE
BZ038	VP3	26/01/2022	13:24	Buzzard	1	3	3	0	0	0	conifer plantation and treelines; flying, landed on the field	ZE
BZ039	VP3	26/01/2022	12:43	Buzzard	2	85	0	85	0	0	conifer plantation and treelines; flying, displaying	ZE
BZ040	VP4	27/01/2022	14:13	Buzzard	2	180	10	10	160	0	conifer plantation; flying, displaying, one flew south after two minutes	ZE
BZ041	VP6	31/01/2022	14:25	Buzzard	1	26	0	26	0	0	conifer plantation; flying	ZE
BZ042	VP4	10/03/2022	13:47	Buzzard	2	50	8	0	0	50	cutover bog; flying, soaring high. lost sight behind clouds	NS
BZ043	VP4	10/03/2022	13:57	Buzzard	1	319	0	0	0	319	cutover bog; flying	NS
BZ044	VP4	10/03/2022	14:23	Buzzard	1	78	0	0	78	0	cutover bog; flying	NS

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ045	VP4	10/03/2022	14:46	Buzzard	2	136	30	106	0	0	cutover bog; breeding behaviour	NS
BZ046	VP4	10/03/2022	15:15	Buzzard	2	500	0	200	300	0	cutover bog; flying	NS
BZ047	VP4	10/03/2022	17:30	Buzzard	1	30	0	30	0	0	cutover bog; flying	NS
BZ048	VP1	15/03/2022	15:46	Buzzard	2	68	0	68	0	0	cutover bog; flying	NS
BZ049	VP1	15/03/2022	15:53	Buzzard	1	8	8	0	0	0	cutover bog; flying	NS
BZ050	VP5	22/03/2022	13:47	Buzzard	1	60	0	10	50	0	oak-birch-holly woodland and improved agricultural grassland; soaring/ circling, soaring before dropping into woodland below	ZOC
BZ051	VP5	22/03/2022	14:00	Buzzard	1	190	0	0	190	0	dry calcareous and neutral grassland; travelling displaying, travelling and displaying briefly	ZOC
BZ052	VP5	22/03/2022	14:02	Buzzard	1	100	0	0	100	0	dry calcareous and neutral grassland; displaying, displaying	ZOC
BZ053	VP5	22/03/2022	16:55	Buzzard	1	50	5	10	35	0	improved agricultural grassland and oak-birch-holly woodland; travelling	ZOC
BZ054	VP3	23/03/2022	15:40	Buzzard	2	170	0	0	170	0	cutover bog and conifer plantation; flying, displaying	ZOC

Table 1-53 Buzzard Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ023	VP4	26/08/2021	14:07	Buzzard	1	improved agricultural grassland and treelines; calling	TRea
BZ061	VP4	07/09/2021	15:16	Buzzard	1	cutover bog and woodland and scrub; calling	TRea
BZ055	VP6	22/11/2021	11:37	Buzzard	1	highly modified/non-native woodland and cutover bog; calling, no visual	CR
BZ056	VP6	22/11/2021	14:50	Buzzard	1	highly modified/non-native woodland and improved grassland; roosting, remained perched on tree top until 15:00.	CR
BZ057	VP5	25/01/2022	15:01	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ058	VP5	25/01/2022	15:33	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ059	VP5	08/02/2022	13:14	Buzzard	1	improved agricultural grassland; calling	NS
BZ060	VP4	10/03/2022	18:16	Buzzard	2	cutover bog; perched, perched in tree	NS

Table 1-54 Buzzard Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ001	07/04/2021	10:16	Buzzard	1	mixed broadleaved/conifer woodland and cutover bog; flew from trees before circling (suitable nesting habitat; possible breeder)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ002	14/05/2021	11:30	Buzzard	1	mixed broadleaved/conifer woodland; calling (suitable nesting habitat; possible breeder)	PM
BZ003	18/06/2021	09:54	Buzzard	1	improved agricultural grassland; flying; calling (flyover; non-breeding)	PM
BZ004	23/07/2021	10:05	Buzzard	1	conifer plantation; calling, not seen (flyover; non-breeding)	PM

Table 1-55 Buzzard Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ005	27/01/2022	14:05	Buzzard	2	cutover bog; fly, soaring over bog (wintering)	AOD
BZ006	22/02/2022	13:04	Buzzard	2	mixed broadleaved/conifer woodland; flying over, calling (wintering)	AOD
BZ007	22/02/2022	15:12	Buzzard	1	improved agricultural grassland and cutover bog; flying over (wintering)	AOD
BZ008	15/03/2022	13:06	Buzzard	1	bog woodland; flying (nest building; probable breeding)	NS
BZ009	15/03/2022	13:23	Buzzard	1	wet willow-alder-ash woodland; flying (nest building; probable breeding)	NS
BZ010	15/03/2022	14:58	Buzzard	1	cutover bog; flying (nest building; probable breeding)	NS
BZ011	16/03/2022	12:51	Buzzard	2	cutover bog; flying (nest building; probable breeding)	NS

Table 1-56 Buzzard Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ001	BRVP5	29/04/2021	09:51	Buzzard	1	raised bog, travelling	flyover; non-breeding	PM
BZ002	BRVP5	29/04/2021	10:09	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ003	BRVP5	29/04/2021	10:29	Buzzard	2	improved agricultural grassland and conifer plantation, soaring, being mobbed by hc	flyover; non-breeding	PM
BZ004	BRVP5	29/04/2021	12:53	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ005	BRVP1	06/05/2021	17:07	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ006	BRVP1	06/05/2021	17:18	Buzzard	1	mixed broadleaved/conifer woodland, rising and travelling away from forestry	suitable nesting habitat; possible breeder	PM
BZ007	BRVP1	06/05/2021	17:33	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ008	BRVP1	06/05/2021	18:39	Buzzard	1	mixed broadleaved/conifer woodland, hunting/travelling	suitable nesting habitat; possible breeder	PM
BZ009	BRVP1	06/05/2021	19:06	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ010	BRVP1	06/05/2021	19:22	Buzzard	1	mixed broadleaved/conifer woodland, travelling	suitable nesting habitat; possible breeder	PM
BZ011	BRVP2	24/05/2021	18:22	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ012	BRVP2	24/05/2021	19:54	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ013	BRVP1	03/06/2021	19:43	Buzzard	1	conifer plantation, travelling; being mobbed by hc and bh	flyover; non-breeding	PM
BZ014	BRVP1	03/06/2021	19:48	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ015	BRVP6	04/06/2021	18:25	Buzzard	1	conifer plantation, travelling; mobbed by crows	flyover; non-breeding	PM
BZ016	BRVP2	28/06/2021	17:39	Buzzard	2	conifer plantation and improved agricultural grassland, circling	pair; probable breeding	PM
BZ017	BRVP2	28/06/2021	18:07	Buzzard	1	improved agricultural grassland, circling	flyover; non-breeding	PM
BZ018	BRVP6	29/06/2021	17:28	Buzzard	1	mixed broadleaved/conifer woodland, circling low	suitable nesting habitat; possible breeder	PM
BZ019	BRVP6	29/06/2021	18:05	Buzzard	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
BZ020	BRVP6	29/06/2021	18:15	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM
BZ021	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ022	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, travelling	flyover; non-breeding	PM
BZ023	BRVP6	29/06/2021	18:55	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring	flyover; non-breeding	PM
BZ024	BRVP6	13/07/2021	09:25	Buzzard	1	highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea
BZ025	BRVP5	13/07/2021	13:42	Buzzard	1	mixed broadleaved/conifer woodland and bogs, soaring, travelling	suitable nesting habitat; possible breeder	TRea
BZ026	BRVP6	13/07/2021	14:34	Buzzard	2	highly modified/non-native woodland and bogs, soaring	pair; probable breeding	TRea
BZ027	BRVP6	13/07/2021	14:34	Buzzard	1	highly modified/non-native woodland and bogs, soaring	suitable nesting habitat; possible breeder	TRea
BZ028	BRVP1	19/07/2021	10:27	Buzzard	1	bogs and highly modified/non-native woodland, soaring, divinng behind treeline	suitable nesting habitat; possible breeder	TRea
BZ029	BRVP1	19/07/2021	11:46	Buzzard	1	bogs and highly modified/non-native woodland, travelling	suitable nesting habitat; possible breeder	TRea
BZ030	BRVP2	19/07/2021	14:20	Buzzard	2	mixed broadleaved/conifer woodland and improved grassland, fighting white tailed eagle, calling and diving at eagle	agitated behaviour; probable breeding	TRea
BZ031	BRVP2	19/07/2021	15:16	Buzzard	1	improved grassland and highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea

Table 1-57 Buzzard Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ001	Wildfowl Distribution Survey,	16/09/2021	12:53	Buzzard	1	immature woodland, mixed broadleaved woodland and mesotrophic lakes; soaring over woodland	NM
BZ002	Wildfowl Distribution Survey,	16/09/2021	14:26	Buzzard	1	conifer plantation and cutover bog; soaring over forestry fringes of bog	NM
BZ003	Wildfowl Distribution Survey,	16/09/2021	16:49	Buzzard	1	scrub, immature woodland and mixed conifer woodland; perched in scrubby trees along track	NM
BZ004	Wildfowl Distribution Survey,	16/09/2021	16:58	Buzzard	1	mixed conifer woodland, mixed broadleaved woodland and mesotrophic lakes; flying and circling	NM
BZ005	Wildfowl Distribution Survey, s2	16/09/2021	09:14	Buzzard	1	raised bog, mixed conifer woodland and scrub; soaring over bog and forestry	NM
BZ006	Wildfowl Distribution Survey,	17/09/2021	15:00	Buzzard	1	improved agricultural grassland, scrub and hedgerows; soaring and circling over farmland	NM
BZ007	Wildfowl Distribution Survey,	29/09/2021	12:23	Buzzard	1	mesotrophic lakes, mixed conifer woodland and mixed broadleaved woodland; soaring over forestry and s fringes of derragh lough	NM
BZ008	Wildfowl Distribution Survey,	12/10/2021	12:43	Buzzard	1	improved agricultural grassland and hedgerows; soaring and circling over farmland + calling	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ009	Wildfowl Distribution Survey,	12/10/2021	16:33	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland - appeared to be harrying we for a time	NM
BZ010	Winter Walkover Survey,	20/10/2021	10:55	Buzzard	2	scrub and bogs; soaring over scrubby bog areas	NM
BZ011	Winter Walkover Survey,	21/10/2021	12:13	Buzzard	1	improved agricultural grassland, mixed broadleaved woodland and scrub; soaring over woodland and farmland	NM
BZ012	Winter Walkover Survey,	21/10/2021	14:56	Buzzard	1	treelines and improved agricultural grassland; perched low in ashe along road, flushed	NM
BZ013	Wildfowl Distribution Survey,	26/10/2021	10:31	Buzzard	1	improved agricultural grassland; perched in tree in farmland	NM
BZ014	Wildfowl Distribution Survey,	26/10/2021	13:08	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland	NM
BZ015	Wildfowl Distribution Survey,	26/10/2021	14:04	Buzzard	1	raised bog and immature woodland; soaring over bog and woody fringes	NM
BZ016	Wildfowl Distribution Survey,	22/12/2021	10:20	Buzzard	1	scrub, improved agricultural grassland and mixed conifer woodland; disturbed from perch along river, flew away low over farmland and woodland	NM
BZ017	Wildfowl Distribution Survey,	22/12/2021	12:18	Buzzard	1	lakes and ponds, scrub and improved agricultural grassland; soaring and circling over lake fringes	NM
BZ018	Wildfowl Distribution Survey,	22/12/2021	14:14	Buzzard	1	bogs and scrub; flying low across bog and scrub	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ019	Wildfowl Distribution Survey,	22/12/2021	14:30	Buzzard	1	improved agricultural grassland and hedgerows; flying across field	NM
BZ020	Wildfowl Distribution Survey,	23/12/2021	15:27	Buzzard	2	improved agricultural grassland and hedgerows; calling and flying low along hedgerows within farmland	NM
BZ021	Wildfowl Distribution Survey,	23/12/2021	16:11	Buzzard	1	improved agricultural grassland and hedgerows; flying low along hedgerows within farmland, perching briefly within tree	NM
BZ022	Wildfowl Distribution Survey,	04/01/2022	09:01	Buzzard	1	improved agricultural grassland and hedgerows; flying across farmland	NM
BZ023	Wildfowl Distribution Survey,	04/01/2022	13:20	Buzzard	1	improved agricultural grassland and hedgerows; perched on telephone line before flying away over farmland	NM
BZ024	Wildfowl Distribution Survey,	04/01/2022	14:05	Buzzard	1	improved agricultural grassland, hedgerows and mixed conifer woodland; flying across fields	NM
BZ025	Wildfowl Distribution Survey,	05/01/2022	09:28	Buzzard	2	cutover bog, mixed conifer woodland and scrub; soaring over bog	NM
BZ026	Wildfowl Distribution Survey,	17/01/2022	09:35	Buzzard	1	improved agricultural grassland; flying low across farmland	NM
BZ027	Wildfowl Distribution Survey, l. sheelin	17/01/2022	10:20	Buzzard	1	lakes and ponds; flying high and ne across lake	NM
BZ028	Wildfowl Distribution Survey,	17/01/2022	10:27	Buzzard	1	mixed conifer woodland and scrub; perched within forestry before flying off	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ029	Wildfowl Distribution Survey,	18/01/2022	10:23	Buzzard	1	improved agricultural grassland, hedgerows and scrub; soaring over farmland	NM
BZ030	Vantage Point Survey, coole vp4	16/02/2022	08:00	Buzzard	1	cutover bog; flying	NS
BZ031	Waterfowl Distribution Survey,	08/03/2022	15:24	Buzzard	1	cutover bog; foraging	KB
BZ032	Waterfowl Distribution Survey,	31/03/2022	11:25	Buzzard	1	lakes and ponds; foraging	KB

Table 1-58 Sparrowhawk Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SH001	VP4	28/04/2021	16:28	Sparrowhawk	1	12	12	0	0	0	mixed broadleaved/conifer woodland; flew to perch on tree; known nest site, flew from woods to perch on top of tree near nest site	PM
SH002	VP4	28/04/2021	16:34	Sparrowhawk	1	5	5	0	0	0	mixed broadleaved/conifer woodland; flew between perches at known nest site, male	PM
SH003	VP4	28/04/2021	16:39	Sparrowhawk	1	10	10	0	0	0	mixed broadleaved/conifer woodland; flew from perch at known nest site and flew off low, male	PM
SH004	VP4	09/12/2021	09:22	Sparrowhawk	1	10	10	0	0	0	cutover bog and immature woodland; foraging	KB
SH005	VP4	09/12/2021	09:22	Sparrowhawk	2	5	2	3	0	0	cutover bog and immature woodland; foraging	KB
SH006	VP4	09/12/2021	09:22	Sparrowhawk	1	8	8	0	0	0	cutover bog and immature woodland; foraging	KB
SH007	VP4	10/03/2022	13:41	Sparrowhawk	1	190	30	60	100	0	cutover bog; flying	NS

Table 1-59 Sparrowhawk Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	07/04/2021	08:50	Sparrowhawk	1	mixed broadleaved/conifer woodland; carrying nest material into trees (nest building; probable breeding)	PM

Table 1-60 Sparrowhawk Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
SH001	BRVP1	30/04/2021	13:15	Sparrowhawk	1	cutover bog, travelling; landed in tree	suitable nesting habitat; possible breeder	PM
SH002	BRVP1	06/05/2021	18:16	Sparrowhawk	1	mixed broadleaved/conifer woodland and cutover bog, travelling	flyover; non-breeding	PM
SH003	BRVP6	18/05/2021	18:52	Sparrowhawk	1	mixed broadleaved/conifer woodland, travelling, male	flyover; non-breeding	PM

Table 1-61 Sparrowhawk Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	Winter Walkover Survey,	21/10/2021	12:04	Sparrowhawk	1	improved agricultural grassland and semi-natural grassland; flying low across grassland	NM
SH002	Wildfowl Distribution Survey,	26/10/2021	12:38	Sparrowhawk	1	scrub and cutover bog; flying over scrubby bog fringes + perched	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH003	Wildfowl Distribution Survey,	08/11/2021	12:15	Sparrowhawk	1	improved agricultural grassland and hedgerows; flying low between hedgerows of farmland	NM
SH004	Vantage Point Survey, vp6	22/11/2021	14:03	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, female observed during lunch break. last seen heading north.	CR
SH005	Vantage Point Survey, vp6	22/11/2021	14:06	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, possibly same female bird observed three minutes earlier. last seen heading north.	CR
SH006	Wildfowl Distribution Survey,	17/01/2022	13:13	Sparrowhawk	1	lakes and ponds, scrub and reed and large sedge swamps; flying low and acrobatically across wetland - may have caused wn and t to be flushed	NM

Table 1-62 Vantage Point Non-target Species Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	21/05/2021	10:04	Black-headed Gull	1	50	0	50	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP5	08/10/2021	10:15	Black-headed Gull	6	125	15	80	30	0	improved agricultural grassland and hedgerows; flying and swirling across farmland - heading w	NM
	VP5	08/10/2021	08:47	Black-headed Gull	2	60	0	0	55	5	improved agricultural grassland and mixed conifer woodland; flying n and e across famrland	NM
	VP3	23/10/2021	08:15	Cormorant	2	55	15	40	0	0	mixed conifer woodland, depositing/lowland rivers and scrub; flying along sw boundary	NM
	VP4	16/11/2021	13:44	Cormorant	1	43	0	0	43	0	highly modified/non-native woodland and cutover bog; flying, heading north west	CR
	VP6	22/11/2021	15:34	Cormorant	1	291	0	0	214	77	improved grassland, depositing/lowland rivers and highly modified/non-native woodland; flying, last seen heading north at high altitude.	CR
	VP4	09/12/2021	11:38	Cormorant	1	12	0	12	0	0	cutover bog; travelling	KB
	VP6	15/12/2021	11:39	Cormorant	1	30	0	0	30	0	cutover bog and semi-natural grassland; travelling	KB
	VP6	15/12/2021	12:11	Cormorant	1	35	0	0	35	0	semi-natural grassland; travelling	KB

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	15/12/2021	12:31	Cormorant	1	25	10	15	0	0	semi-natural grassland; travelling - descended	KB
	VP6	15/12/2021	13:52	Cormorant	1	20	0	20	0	0	semi-natural grassland; travelling	KB
	VP1	15/03/2022	15:57	Cormorant	1	50	0	50	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:00	Cormorant	1	29	0	29	0	0	cutover bog; flying	NS
GE001	VP6	22/11/2021	15:04	Green Sandpiper	1	18	2	4	12	0	improved grassland and depositing/lowland rivers; flying/calling, observed descending into river.	CR
	VP6	22/10/2021	11:18	Grey Heron	1	80	0	80	0	0	improved agricultural grassland and cutover bog; flying across bog	NM
	VP6	22/10/2021	11:55	Grey Heron	1	25	25	0	0	0	depositing/lowland rivers and semi-natural grassland; flying low along river	NM
	VP4	16/11/2021	12:27	Grey Heron	1	60	60	0	0	0	cutover bog and highly modified/non-native woodland; flying, heading east	CR
	VP4	16/11/2021	14:51	Grey Heron	1	48	48	0	0	0	highly modified/non-native woodland; flying	CR
	VP4	16/11/2021	15:48	Grey Heron	1	27	27	0	0	0	highly modified/non-native woodland; flying	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/11/2021	16:33	Grey Heron	1	40	40	0	0	0	cutover bog and highly modified/non-native woodland; flying	CR
	VP1	15/03/2022	16:42	Grey Heron	1	46	9	37	0	0	cutover bog; flying	NS
	VP6	06/04/2021	16:47	Grey Heron	1	17	0	17	0	0	conifer plantation; travelling along river	PM
	VP6	06/04/2021	16:52	Grey Heron	1	57	0	57	0	0	cutover bog and conifer plantation; travelling; dropped into drain	PM
	VP4	28/04/2021	17:31	Grey Heron	1	25	25	0	0	0	cutover bog; travelling along large drain	PM
	VP4	17/06/2021	13:19	Grey Heron	1	30	30	0	0	0	depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP4	17/06/2021	13:24	Grey Heron	1	14	14	0	0	0	cutover bog; travelling; landed in drain	PM
	VP4	17/06/2021	13:26	Grey Heron	64	0	64	0	0	0	cutover bog; travelling; landed in drain	PM
	VP6	30/07/2021	09:24	Grey Heron	1	52	52	0	0	0	cutover bog; travelling	PM
	VP6	07/09/2021	15:14	Grey Heron	1	14	14	0	0	0	cutover bog and treelines; travelling, roosting	TRea
	VP6	31/01/2022	16:01	Grey Heron	1	61	20	41	0	0	improved agricultural grassland and bogs; flying, ze	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	31/01/2022	17:09	Grey Heron	1	34	34	0	0	0	improved agricultural grassland; flying	ZE
	VP4	21/05/2021	06:58	Lesser Black-backed Gull	1	32	0	32	0	0	cutover bog; travelling	PM
	VP6	26/05/2021	05:43	Lesser Black-backed Gull	1	100	0	100	0	0	cutover bog and wet grassland; travelling	PM
	VP6	26/05/2021	05:44	Lesser Black-backed Gull	1	577	0	577	0	0	cutover bog and wet grassland; travelling/circling bog	PM
	VP6	26/05/2021	08:05	Lesser Black-backed Gull	3	20	0	20	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP4	17/06/2021	17:00	Lesser Black-backed Gull	2	173	0	0	173	0	improved agricultural grassland; travelling/soaring	PM
	VP6	30/06/2021	15:26	Lesser Black-backed Gull	1	120	0	120	0	0	improved agricultural grassland; circling field where grass was being mown	PM
	VP4	27/07/2021	09:33	Lesser Black-backed Gull	1	51	0	0	61	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP6	06/04/2021	18:58	Mallard	3	20	5	15	0	0	conifer plantation; travelling; dropped behind trees toward river	PM
	VP4	28/04/2021	16:55	Mallard	1	47	27	20	0	0	cutover bog; travelling; landed in drain, male	PM
	VP4	28/04/2021	20:12	Mallard	1	25	0	5	20	0	cutover bog; travelling; landed in drain	PM
	VP4	28/04/2021	20:12	Mallard	2	36	0	0	36	0	cutover bog; travelling	PM
	VP4	28/04/2021	21:11	Mallard	2	30	30	0	0	0	cutover bog; travelling; landed in drain	PM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	26/05/2021	06:14	Mallard	2	27	27	0	0	0	cutover bog and depositing/lowland rivers; travelling; landed in river, 2 males	PM
	VP6	26/05/2021	06:41	Mallard	3	126	0	26	100	0	depositing/lowland rivers and cutover bog; travelling, 3 males	PM
	VP6	30/07/2021	09:50	Mallard	1	75	0	0	75	0	cutover bog and conifer plantation; travelling	PM
	VP6	30/07/2021	11:36	Mallard	2	80	0	80	0	0	cutover bog; travelling	PM
	VP5	08/10/2021	08:12	Mallard	3	85	0	25	60	0	cutover bog and mixed conifer woodland; flying in wide circle over cutover bog and adjacent area	NM
	VP5	08/10/2021	12:43	Mallard	2	45	0	45	0	0	improved agricultural grassland; flying s across farmalnd	NM
	VP4	09/12/2021	07:51	Mallard	2	10	10	0	0	0	cutover bog and immature woodland; travelling	KB
	VP4	09/12/2021	08:05	Mallard	10	14	14	0	0	0	cutover bog and immature woodland; travelling	KB
	VP1	08/03/2022	14:16	Mallard	2	120	0	120	0	0	cutover bog; flying	NS
	VP1	15/03/2022	18:49	Mallard	2	24	24	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	19:02	Mallard	2	15	15	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:07	Mallard	2	25	0	25	0	0	cutover bog; flying	NS
	VP4	27/01/2022	11:54	Meadow Pipit	1	41	41	0	0	0	cutover bog; flying, perching on top of a floodlight	ZE
	VP4	27/01/2022	13:50	Meadow Pipit	1	21	21	0	0	0	cutover bog; flying	ZE
	VP6	31/01/2022	12:15	Meadow Pipit	1	4	4	0	0	0	lowland blanket bog; flying	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/02/2022	11:17	Meadow Pipit	3	15	15	0	0	0	lowland blanket bog; flying	NS
	VP6	18/02/2022	12:25	Meadow Pipit	4	10	10	0	0	0	lowland blanket bog; flying, 6 flying around throughout the day	NS
	VP3	23/03/2022	15:10	Meadow Pipit	2	15	5	10	0	0	cutover bog; flying	ZOC
	VP3	23/03/2022	17:19	Meadow Pipit	3	20	20	0	0	0	cutover bog; flying	ZOC
	VP6	26/05/2021	06:37	Mute Swan	1	15	15	0	0	0	depositing/lowland rivers; flew along river before landing again	PM
	VP4	17/06/2021	16:16	Mute Swan	1	67	67	0	0	0	cutover bog, depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP5	08/10/2021	07:43	Mute Swan	16	65	0	65	0	0	improved agricultural grassland and hedgerows; flying e - low across farmalnd and hedgerows	NM
	VP4	27/01/2022	17:55	Mute Swan	5	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
	VP1	15/03/2022	18:57	Mute Swan	2	40	0	0	40	0	cutover bog; flying, not seen only heard	NS
	VP5	25/01/2022	13:58	Redwing	25	35	0	35	0	0	improved agricultural grassland; flying	ZE
	VP6	31/01/2022	12:32	Redwing	13	15	15	0	0	0	lowland blanket bog; flying	ZE
	VP6	31/01/2022	13:55	Redwing	12	20	0	20	0	0	lowland blanket bog; flying	ZE
	VP5	08/02/2022	10:18	Redwing	25	25	25	0	0	0	improved agricultural grassland; flying	NS
	VP4	16/02/2022	07:44	Redwing	30	20	0	20	0	0	lowland blanket bog; flying	NS
	VP5	22/03/2022	16:10	Redwing	2	10	10	0	0	0	hedgerows; flying	ZOC

Table 1-63 Vantage Point Survey Non-target Species Non-flight Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	22/11/2021	17:03	Grey Heron	1	depositing/lowland rivers, improved grassland and cutover bog; calling	CR
	VP6	06/04/2021	20:43	Grey Heron	1	depositing/lowland rivers; calling from river	PM
	VP6	26/05/2021	05:34	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	06:21	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	09:30	Grey Heron	1	depositing/lowland rivers; calling, not seen	PM
	VP3	15/11/2021	16:42	Mistle Thrush	4	cutover bog; flying	CR
	VP6	22/11/2021	12:18	Mistle Thrush	10	improved grassland, cutover bog and highly modified/non-native woodland; flying/calling, observed throughout survey	CR
	VP4	28/04/2021	21:39	Mallard	1	cutover bog; calling, not seen	PM
	VP6	22/10/2021	12:07	Mallard	4	depositing/lowland rivers; swimming on river	NM
	VP4	16/11/2021	17:09	Mallard	1	lakes and ponds and cutover bog; calling, no visual	CR
	VP4	16/11/2021	17:14	Mallard	1	lakes and ponds and cutover bog; calling	CR
	VP4	28/04/2021	20:57	Moorhen	1	lakes and ponds; calling	PM
	VP6	15/12/2021	12:05	Moorhen	1	watercourses; calling heard	KB
	VP6	06/04/2021		Meadow Pipit			PM
	VP6	26/05/2021	05:45	Meadow Pipit	1	cutover bog; displaying	PM
	VP4	17/06/2021	17:12	Meadow Pipit	1	cutover bog; singing intermittently throughout the survey	PM
	VP6	30/06/2021	15:27	Meadow Pipit	2	cutover bog; displaying periodically throughout survey	PM
	VP6	30/07/2021	15:16	Meadow Pipit	4	cutover bog; present throughout survey	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	06/09/2021		Meadow Pipit			TRea
	VP4	07/09/2021		Meadow Pipit			TRea
	VP6	22/10/2021		Meadow Pipit			NM
	VP3	23/10/2021		Meadow Pipit			NM
	VP3	15/11/2021	11:29	Meadow Pipit	11	cutover bog; flying/calling, observed throughout survey	CR
	VP4	16/11/2021	12:00	Meadow Pipit	9	cutover bog; flying/calling	CR
	VP5	19/11/2021	13:30	Meadow Pipit	5	improved grassland; flying/calling	CR
	VP6	22/11/2021	11:05	Meadow Pipit	21	cutover bog and improved grassland; flying/calling, observed throughout the survey.	CR
	VP6	15/12/2021	09:50	Meadow Pipit	2	cutover bog and scrub; foraging	KB
	VP4	16/02/2022	10:13	Meadow Pipit	2	cutover bog; calling	NS
	VP1	08/03/2022	14:28	Meadow Pipit	8	cutover bog; calling, some displaying activity	NS
	VP4	10/03/2022	14:18	Meadow Pipit	20	cutover bog; flying and calling, up to 20 seen flying and calling in the area	NS
	VP6	30/07/2021	10:49	Mute Swan	1	depositing/lowland rivers; call	PM
	VP3	23/10/2021	11:41	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	VP6	17/02/2022	11:08	Mute Swan	1	depositing/lowland rivers; feeding	NS
	VP6	22/10/2021		Redwing			NM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP3	15/11/2021		Redwing			CR
	VP4	16/11/2021		Redwing			CR
	VP5	19/11/2021		Redwing			CR
	VP6	22/11/2021		Redwing			CR
	VP3	23/12/2021	11:21	Redwing	22	hedgerows; foraging	KB
	VP5	03/01/2022	08:08	Redwing	270	hedgerows; foraging	KB
	VP6	22/11/2021	15:59	Water Rail	2	depositing/lowland rivers; calling, at least two water rails heard calling continuously until 16:30.	CR
	VP4	19/10/2021	10:06	Yellowhammer	1	scrub, highly modified/non-native woodland and cutover bog; calling within willow scrub on fringes of bog	NM

Table 1-64 Non-target species data (Vantage Point and Walkover survey Records)

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
06/04/2021	Vantage Point Survey, VP6	Skylark		PM
06/04/2021	Vantage Point Survey, VP6	Blackbird		PM
06/04/2021	Vantage Point Survey, VP6	Barn Swallow		PM
06/04/2021	Vantage Point Survey, VP6	Sand Martin		PM
06/04/2021	Vantage Point Survey, VP6	Hooded Crow		PM
06/04/2021	Vantage Point Survey, VP6	Magpie		PM
06/04/2021	Vantage Point Survey, VP6	Pheasant		PM
06/04/2021	Vantage Point Survey, VP6	Woodpigeon		PM
06/04/2021	Vantage Point Survey, VP6	Pied Wagtail		PM
06/04/2021	Vantage Point Survey, VP6	Raven		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Hooded Crow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jackdaw		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Wren		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Robin		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chaffinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Blackbird		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chiffchaff		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Raven		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Woodpigeon		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Song Thrush		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Linnet		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Skylark		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Starling		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Willow Warbler		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Bullfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jay		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Lesser Redpoll		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Barn Swallow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldcrest		PM
28/04/2021	Vantage Point Survey, VP4	Raven		PM
28/04/2021	Vantage Point Survey, VP4	Hooded Crow		PM
28/04/2021	Vantage Point Survey, VP4	Woodpigeon		PM
28/04/2021	Vantage Point Survey, VP4	Barn Swallow		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
28/04/2021	Vantage Point Survey, VP4	Sand Martin		PM
28/04/2021	Vantage Point Survey, VP4	Chaffinch		PM
28/04/2021	Vantage Point Survey, VP4	Robin		PM
28/04/2021	Vantage Point Survey, VP4	Blackbird		PM
28/04/2021	Vantage Point Survey, VP4	Cuckoo		PM
28/04/2021	Vantage Point Survey, VP4	Song Thrush		PM
28/04/2021	Vantage Point Survey, VP4	Great Tit		PM
28/04/2021	Vantage Point Survey, VP4	Chiffchaff		PM
28/04/2021	Vantage Point Survey, VP4	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Dunnock		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Pheasant		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Starling		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/05/2021	Vantage Point Survey, VP4	Woodpigeon		PM
21/05/2021	Vantage Point Survey, VP4	Raven		PM
21/05/2021	Vantage Point Survey, VP4	Hooded Crow		PM
21/05/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Song Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Blackbird		PM
21/05/2021	Vantage Point Survey, VP4	Willow Warbler		PM
21/05/2021	Vantage Point Survey, VP4	Robin		PM
21/05/2021	Vantage Point Survey, VP4	Wren		PM
21/05/2021	Vantage Point Survey, VP4	Chaffinch		PM
21/05/2021	Vantage Point Survey, VP4	Barn Swallow		PM
21/05/2021	Vantage Point Survey, VP4	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Blackbird		PM
26/05/2021	Vantage Point Survey, VP6	Robin		PM
26/05/2021	Vantage Point Survey, VP6	Barn Swallow		PM
26/05/2021	Vantage Point Survey, VP6	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Song Thrush		PM
26/05/2021	Vantage Point Survey, VP6	Skylark		PM
26/05/2021	Vantage Point Survey, VP6	Chaffinch		PM
26/05/2021	Vantage Point Survey, VP6	Chiffchaff		PM
26/05/2021	Vantage Point Survey, VP6	Goldfinch		PM
26/05/2021	Vantage Point Survey, VP6	Hooded Crow		PM
26/05/2021	Vantage Point Survey, VP6	Raven		PM
26/05/2021	Vantage Point Survey, VP6	Woodpigeon		PM
26/05/2021	Vantage Point Survey, VP6	Cuckoo		PM
17/06/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Song Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Robin		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
17/06/2021	Vantage Point Survey, VP4	Great Tit		PM
17/06/2021	Vantage Point Survey, VP4	Blue Tit		PM
17/06/2021	Vantage Point Survey, VP4	Sand Martin		PM
17/06/2021	Vantage Point Survey, VP4	Barn Swallow		PM
17/06/2021	Vantage Point Survey, VP4	House Martin		PM
17/06/2021	Vantage Point Survey, VP4	Hooded Crow		PM
17/06/2021	Vantage Point Survey, VP4	Raven		PM
17/06/2021	Vantage Point Survey, VP4	Woodpigeon		PM
17/06/2021	Vantage Point Survey, VP4	Starling		PM
17/06/2021	Vantage Point Survey, VP4	Chaffinch		PM
17/06/2021	Vantage Point Survey, VP4	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Whitethroat		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Mistle Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
30/06/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/06/2021	Vantage Point Survey, VP6	Barn Swallow		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
30/06/2021	Vantage Point Survey, VP6	House Martin		PM
30/06/2021	Vantage Point Survey, VP6	Skylark		PM
30/06/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/06/2021	Vantage Point Survey, VP6	Raven		PM
30/06/2021	Vantage Point Survey, VP6	Robin		PM
30/06/2021	Vantage Point Survey, VP6	Wren		PM
30/06/2021	Vantage Point Survey, VP6	Blackbird		PM
30/06/2021	Vantage Point Survey, VP6	Whitethroat		PM
30/06/2021	Vantage Point Survey, VP6	Dunnock		PM
30/06/2021	Vantage Point Survey, VP6	Starling		PM
30/06/2021	Vantage Point Survey, VP6	Willow Warbler		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jackdaw		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Linnet		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Raven		PM
27/07/2021	Vantage Point Survey, VP4	Woodpigeon		PM
27/07/2021	Vantage Point Survey, VP4	Jay		PM
27/07/2021	Vantage Point Survey, VP4	Sand Martin		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
27/07/2021	Vantage Point Survey, VP4	Barn Swallow		PM
27/07/2021	Vantage Point Survey, VP4	Song Thrush		PM
27/07/2021	Vantage Point Survey, VP4	Chaffinch		PM
27/07/2021	Vantage Point Survey, VP4	Wren		PM
27/07/2021	Vantage Point Survey, VP4	Pied Wagtail		PM
27/07/2021	Vantage Point Survey, VP4	Blackbird		PM
27/07/2021	Vantage Point Survey, VP4	Great Tit		PM
30/07/2021	Vantage Point Survey, VP6	Raven		PM
30/07/2021	Vantage Point Survey, VP6	Hooded Crow		PM
30/07/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/07/2021	Vantage Point Survey, VP6	Song Thrush		PM
30/07/2021	Vantage Point Survey, VP6	Barn Swallow		PM
30/07/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/07/2021	Vantage Point Survey, VP6	Goldfinch		PM
30/07/2021	Vantage Point Survey, VP6	Skylark		PM
19/08/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
19/08/2021	Vantage Point Survey, VP6	Raven		TRea
19/08/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
19/08/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
19/08/2021	Vantage Point Survey, VP6	Stonechat		TRea
19/08/2021	Vantage Point Survey, VP6	Whitethroat		TRea
19/08/2021	Vantage Point Survey, VP6	Sand Martin		TRea
19/08/2021	Vantage Point Survey, VP6	Willow Warbler		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
26/08/2021	Vantage Point Survey, VP4	Sand Martin		TRea
26/08/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
26/08/2021	Vantage Point Survey, VP4	Raven		TRea

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
26/08/2021	Vantage Point Survey, VP4	Dunnock		TRea
26/08/2021	Vantage Point Survey, VP4	Robin		TRea
26/08/2021	Vantage Point Survey, VP4	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
06/09/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
06/09/2021	Vantage Point Survey, VP6	Raven		TRea
06/09/2021	Vantage Point Survey, VP6	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Sand Martin		TRea
06/09/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
06/09/2021	Vantage Point Survey, VP6	Whitethroat		TRea
07/09/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
07/09/2021	Vantage Point Survey, VP4	Raven		TRea
07/09/2021	Vantage Point Survey, VP4	Robin		TRea
07/09/2021	Vantage Point Survey, VP4	Stonechat		TRea
07/09/2021	Vantage Point Survey, VP4	Wren		TRea
07/09/2021	Vantage Point Survey, VP4	Willow Warbler		TRea
07/09/2021	Vantage Point Survey, VP4	Goldfinch		TRea
07/09/2021	Vantage Point Survey, VP4	Sand Martin		TRea
07/09/2021	Vantage Point Survey, VP4	Goldcrest		TRea
07/09/2021	Vantage Point Survey, VP4	Great Tit		TRea
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jay		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Mistle Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Blue Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Long-tailed Tit		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Wren		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Magpie		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Linnet		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Robin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Raven		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Woodpigeon		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pheasant		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldcrest		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Great Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Hooded Crow		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Stonechat		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pied Wagtail		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Reed Bunting		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Dunnock		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Song Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Starling		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Skylark		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Bullfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Siskin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jackdaw		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Rook		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Collared Dove		NM
22/10/2021	Vantage Point Survey, VP6	Blackbird		NM
22/10/2021	Vantage Point Survey, VP6	Raven		NM
22/10/2021	Vantage Point Survey, VP6	Wren		NM
22/10/2021	Vantage Point Survey, VP6	Stonechat		NM
22/10/2021	Vantage Point Survey, VP6	Linnet		NM
22/10/2021	Vantage Point Survey, VP6	Chaffinch		NM
22/10/2021	Vantage Point Survey, VP6	Pied Wagtail		NM
22/10/2021	Vantage Point Survey, VP6	Rook		NM
22/10/2021	Vantage Point Survey, VP6	Jackdaw		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
22/10/2021	Vantage Point Survey, VP6	Pheasant		NM
22/10/2021	Vantage Point Survey, VP6	Starling		NM
22/10/2021	Vantage Point Survey, VP6	Goldfinch		NM
22/10/2021	Vantage Point Survey, VP6	Reed Bunting		NM
22/10/2021	Vantage Point Survey, VP6	Woodpigeon		NM
22/10/2021	Vantage Point Survey, VP6	Jay		NM
22/10/2021	Vantage Point Survey, VP6	Mistle Thrush		NM
22/10/2021	Vantage Point Survey, VP6	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Chaffinch		NM
23/10/2021	Vantage Point Survey, VP3	Raven		NM
23/10/2021	Vantage Point Survey, VP3	Pied Wagtail		NM
23/10/2021	Vantage Point Survey, VP3	Robin		NM
23/10/2021	Vantage Point Survey, VP3	Blackbird		NM
23/10/2021	Vantage Point Survey, VP3	Wren		NM
23/10/2021	Vantage Point Survey, VP3	Linnet		NM
23/10/2021	Vantage Point Survey, VP3	Hooded Crow		NM
23/10/2021	Vantage Point Survey, VP3	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Woodpigeon		NM
23/10/2021	Vantage Point Survey, VP3	Collared Dove		NM
23/10/2021	Vantage Point Survey, VP3	Rook		NM
15/11/2021	Vantage Point Survey, VP3	Magpie		CR
15/11/2021	Vantage Point Survey, VP3	Linnet		CR
15/11/2021	Vantage Point Survey, VP3	Jay		CR
15/11/2021	Vantage Point Survey, VP3	Great Tit		CR
15/11/2021	Vantage Point Survey, VP3	Blue Tit		CR
15/11/2021	Vantage Point Survey, VP3	Bullfinch		CR
15/11/2021	Vantage Point Survey, VP3	Dunnock		CR
15/11/2021	Vantage Point Survey, VP3	Woodpigeon		CR

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
15/11/2021	Vantage Point Survey, VP3	Jackdaw		CR
15/11/2021	Vantage Point Survey, VP3	Rook		CR
15/11/2021	Vantage Point Survey, VP3	Robin		CR
15/11/2021	Vantage Point Survey, VP3	Pied Wagtail		CR
15/11/2021	Vantage Point Survey, VP3	Wren		CR
15/11/2021	Vantage Point Survey, VP3	Blackbird		CR
15/11/2021	Vantage Point Survey, VP3	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Jackdaw		CR
16/11/2021	Vantage Point Survey, VP4	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Linnet		CR
16/11/2021	Vantage Point Survey, VP4	Raven		CR
16/11/2021	Vantage Point Survey, VP4	Wren		CR
16/11/2021	Vantage Point Survey, VP4	Magpie		CR
16/11/2021	Vantage Point Survey, VP4	Woodpigeon		CR
16/11/2021	Vantage Point Survey, VP4	Stonechat		CR
16/11/2021	Vantage Point Survey, VP4	Starling		CR
16/11/2021	Vantage Point Survey, VP4	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Chaffinch		CR
19/11/2021	Vantage Point Survey, VP5	Hooded Crow		CR
19/11/2021	Vantage Point Survey, VP5	Magpie		CR
19/11/2021	Vantage Point Survey, VP5	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Robin		CR
19/11/2021	Vantage Point Survey, VP5	Jackdaw		CR
19/11/2021	Vantage Point Survey, VP5	Woodpigeon		CR
19/11/2021	Vantage Point Survey, VP5	Dunnock		CR
19/11/2021	Vantage Point Survey, VP5	Wren		CR
19/11/2021	Vantage Point Survey, VP5	Blue Tit		CR
19/11/2021	Vantage Point Survey, VP5	Starling		CR

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
19/11/2021	Vantage Point Survey, VP5	Bullfinch		CR
19/11/2021	Vantage Point Survey, VP5	Rook		CR
19/11/2021	Vantage Point Survey, VP5	Jay		CR
19/11/2021	Vantage Point Survey, VP5	Raven		CR
19/11/2021	Vantage Point Survey, VP5	Great Tit		CR
19/11/2021	Vantage Point Survey, VP5	Pied Wagtail		CR
19/11/2021	Vantage Point Survey, VP5	Coal Tit		CR
22/11/2021	Vantage Point Survey, VP6	Starling		CR
22/11/2021	Vantage Point Survey, VP6	Song Thrush		CR
22/11/2021	Vantage Point Survey, VP6	Blackbird		CR
22/11/2021	Vantage Point Survey, VP6	Stonechat		CR
22/11/2021	Vantage Point Survey, VP6	Chaffinch		CR
22/11/2021	Vantage Point Survey, VP6	Raven		CR
22/11/2021	Vantage Point Survey, VP6	Woodpigeon		CR
22/11/2021	Vantage Point Survey, VP6	Dunnock		CR
22/11/2021	Vantage Point Survey, VP6	Wren		CR
22/11/2021	Vantage Point Survey, VP6	Long-tailed Tit		CR
22/11/2021	Vantage Point Survey, VP6	Hooded Crow		CR
22/11/2021	Vantage Point Survey, VP6	Blue Tit		CR
22/11/2021	Vantage Point Survey, VP6	Reed Bunting		CR
22/11/2021	Vantage Point Survey, VP6	Pheasant		CR
09/12/2021	Vantage Point Survey, VP4	Blue Tit		KB
09/12/2021	Vantage Point Survey, VP4	Robin		KB
09/12/2021	Vantage Point Survey, VP4	Blackbird		KB
09/12/2021	Vantage Point Survey, VP4	Woodpigeon		KB
09/12/2021	Vantage Point Survey, VP4	Starling		KB
09/12/2021	Vantage Point Survey, VP4	Wren		KB
09/12/2021	Vantage Point Survey, VP4	Long-tailed Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
09/12/2021	Vantage Point Survey, VP4	Hooded Crow		KB
09/12/2021	Vantage Point Survey, VP4	Raven		KB
09/12/2021	Vantage Point Survey, VP4	Great Tit		KB
09/12/2021	Vantage Point Survey, VP4	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Wren		KB
15/12/2021	Vantage Point Survey, VP6	Blackbird		KB
15/12/2021	Vantage Point Survey, VP6	Starling		KB
15/12/2021	Vantage Point Survey, VP6	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Hooded Crow		KB
15/12/2021	Vantage Point Survey, VP6	Raven		KB
15/12/2021	Vantage Point Survey, VP6	Reed Bunting		KB
15/12/2021	Vantage Point Survey, VP6	Lesser Redpoll		KB
15/12/2021	Vantage Point Survey, VP6	Fieldfare		KB
15/12/2021	Vantage Point Survey, VP6	Pheasant		KB
15/12/2021	Vantage Point Survey, VP6	Stonechat		KB
15/12/2021	Vantage Point Survey, VP6	Blue Tit		KB
15/12/2021	Vantage Point Survey, VP6	Song Thrush		KB
15/12/2021	Vantage Point Survey, VP6	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Robin		KB
23/12/2021	Vantage Point Survey, VP3	Wren		KB
23/12/2021	Vantage Point Survey, VP3	Starling		KB
23/12/2021	Vantage Point Survey, VP3	Pied Wagtail		KB
23/12/2021	Vantage Point Survey, VP3	Reed Bunting		KB
23/12/2021	Vantage Point Survey, VP3	Mistle Thrush		KB
23/12/2021	Vantage Point Survey, VP3	Blackbird		KB
23/12/2021	Vantage Point Survey, VP3	Lesser Redpoll		KB
23/12/2021	Vantage Point Survey, VP3	Raven		KB
23/12/2021	Vantage Point Survey, VP3	Blue Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
23/12/2021	Vantage Point Survey, VP3	Coal Tit		KB
23/12/2021	Vantage Point Survey, VP3	Bullfinch		KB
23/12/2021	Vantage Point Survey, VP3	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Blackbird		KB
03/01/2022	Vantage Point Survey, VP5	Robin		KB
03/01/2022	Vantage Point Survey, VP5	Wren		KB
03/01/2022	Vantage Point Survey, VP5	Magpie		KB
03/01/2022	Vantage Point Survey, VP5	Rook		KB
03/01/2022	Vantage Point Survey, VP5	Coal Tit		KB
03/01/2022	Vantage Point Survey, VP5	Long-tailed Tit		KB
03/01/2022	Vantage Point Survey, VP5	Starling		KB
03/01/2022	Vantage Point Survey, VP5	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Jackdaw		KB
03/01/2022	Vantage Point Survey, VP5	Raven		KB
03/01/2022	Vantage Point Survey, VP5	Hooded Crow		KB
03/01/2022	Vantage Point Survey, VP5	Fieldfare		KB
03/01/2022	Vantage Point Survey, VP5	Song Thrush		KB
03/01/2022	Vantage Point Survey, VP5	Chaffinch		KB
03/01/2022	Vantage Point Survey, VP5	Blue Tit		KB
03/01/2022	Vantage Point Survey, VP5	Great Tit		KB
03/01/2022	Vantage Point Survey, VP5	Dunnock		KB
25/01/2022	Vantage Point Survey, VP5	Raven		ZE
25/01/2022	Vantage Point Survey, VP5	Wren		ZE
25/01/2022	Vantage Point Survey, VP5	Robin		ZE
25/01/2022	Vantage Point Survey, VP5	Blackbird		ZE
25/01/2022	Vantage Point Survey, VP5	Rook		ZE
25/01/2022	Vantage Point Survey, VP5	House Sparrow		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
25/01/2022	Vantage Point Survey, VP5	Starling	large flocks over the fields	ZE
25/01/2022	Vantage Point Survey, VP5	Song Thrush		ZE
25/01/2022	Vantage Point Survey, VP5	Great Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Magpie		ZE
25/01/2022	Vantage Point Survey, VP5	Jackdaw		ZE
25/01/2022	Vantage Point Survey, VP5	Woodpigeon		ZE
25/01/2022	Vantage Point Survey, VP5	Hooded Crow		ZE
25/01/2022	Vantage Point Survey, VP5	Goldcrest		ZE
25/01/2022	Vantage Point Survey, VP5	Blue Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Dunnock		ZE
25/01/2022	Vantage Point Survey, VP5	Chiffchaff		ZE
25/01/2022	Vantage Point Survey, VP5	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Rook		ZE
26/01/2022	Vantage Point Survey, VP3	Raven		ZE
26/01/2022	Vantage Point Survey, VP3	Magpie		ZE
26/01/2022	Vantage Point Survey, VP3	Hooded Crow		ZE
26/01/2022	Vantage Point Survey, VP3	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Woodpigeon		ZE
26/01/2022	Vantage Point Survey, VP3	Starling	large flocks over the fields	ZE
27/01/2022	Vantage Point Survey, VP4	Raven		ZE
27/01/2022	Vantage Point Survey, VP4	Rook		ZE
27/01/2022	Vantage Point Survey, VP4	Woodpigeon		ZE
27/01/2022	Vantage Point Survey, VP4	Blackbird		ZE
27/01/2022	Vantage Point Survey, VP4	Wren		ZE
27/01/2022	Vantage Point Survey, VP4	Song Thrush		ZE
27/01/2022	Vantage Point Survey, VP4	Long-tailed Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Coal Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Magpie		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Dunnock		ZE
27/01/2022	Vantage Point Survey, VP4	Blue Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Hooded Crow		ZE
27/01/2022	Vantage Point Survey, VP4	Starling	large flocks flying north	ZE
27/01/2022	Vantage Point Survey, VP4	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Great Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Raven		ZE
31/01/2022	Vantage Point Survey, VP6	Rook		ZE
31/01/2022	Vantage Point Survey, VP6	Wren		ZE
31/01/2022	Vantage Point Survey, VP6	Fieldfare		ZE
31/01/2022	Vantage Point Survey, VP6	Woodpigeon		ZE
31/01/2022	Vantage Point Survey, VP6	Robin		ZE
31/01/2022	Vantage Point Survey, VP6	Magpie		ZE
31/01/2022	Vantage Point Survey, VP6	Starling		ZE
31/01/2022	Vantage Point Survey, VP6	Goldfinch		ZE
31/01/2022	Vantage Point Survey, VP6	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Blue Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Song Thrush		ZE
31/01/2022	Vantage Point Survey, VP6	Lesser Redpoll		ZE
08/02/2022	Vantage Point Survey, VP5	Blackbird	flying	NS
08/02/2022	Vantage Point Survey, VP5	Wren	calling	NS
08/02/2022	Vantage Point Survey, VP5	Raven	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Hooded Crow	flying	NS
08/02/2022	Vantage Point Survey, VP5	Magpie	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Bullfinch	perched in hedge	NS

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
08/02/2022	Vantage Point Survey, VP5	Blue Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Dunnock	calling, flying and in hedge	NS
08/02/2022	Vantage Point Survey, VP5	Great Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Pied Wagtail	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Jackdaw	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Mistle Thrush	flying	NS
08/02/2022	Vantage Point Survey, VP5	Robin	flying	NS
08/02/2022	Vantage Point Survey, VP5	Rook	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Starling	flying and in field	NS
15/02/2022	Vantage Point Survey, VP3	Robin	flying	NS
15/02/2022	Vantage Point Survey, VP3	Wren	calling and flying	NS
15/02/2022	Vantage Point Survey, VP3	Song Thrush	calling and perched in tree	NS
15/02/2022	Vantage Point Survey, VP3	Raven	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Hooded Crow	flying	NS
15/02/2022	Vantage Point Survey, VP3	Rook	flying	NS
15/02/2022	Vantage Point Survey, VP3	Woodpigeon	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Magpie	flying	NS
16/02/2022	Vantage Point Survey, VP4	Robin	flying	NS
16/02/2022	Vantage Point Survey, VP4	Hooded Crow	flying	NS
16/02/2022	Vantage Point Survey, VP4	Raven	flying and calling	NS
16/02/2022	Vantage Point Survey, VP4	Fieldfare	flying	NS
16/02/2022	Vantage Point Survey, VP4	Blackbird	flying	NS
16/02/2022	Vantage Point Survey, VP4	Siskin	flying, calling and perched in tree	NS
17/02/2022	Vantage Point Survey, VP6	Wren	calling	NS

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
17/02/2022	Vantage Point Survey, VP6	Raven	flying and calling	NS
17/02/2022	Vantage Point Survey, VP6	Rook	flying	NS
17/02/2022	Vantage Point Survey, VP6	Great Tit	flying	NS
17/02/2022	Vantage Point Survey, VP6	Reed Bunting	flying and perched on bush	NS
17/02/2022	Vantage Point Survey, VP6	Fieldfare	flying	NS
17/02/2022	Vantage Point Survey, VP6	Goldfinch	flying	NS
17/02/2022	Vantage Point Survey, VP6	Magpie	flying	NS
17/02/2022	Vantage Point Survey, VP6	Blackbird	flying	NS
17/02/2022	Vantage Point Survey, VP6	Woodpigeon	calling	NS
17/02/2022	Vantage Point Survey, VP6	Robin	flying	NS
17/02/2022	Vantage Point Survey, VP6	Starling	flying	NS
09/03/2022	Vantage Point Survey, VP6	Hooded Crow		NS
09/03/2022	Vantage Point Survey, VP6	Magpie		NS
09/03/2022	Vantage Point Survey, VP6	Woodpigeon		NS
09/03/2022	Vantage Point Survey, VP6	Blue Tit		NS
09/03/2022	Vantage Point Survey, VP6	Long-tailed Tit		NS
09/03/2022	Vantage Point Survey, VP6	Raven		NS
09/03/2022	Vantage Point Survey, VP6	Stonechat		NS
09/03/2022	Vantage Point Survey, VP6	Wren		NS
09/03/2022	Vantage Point Survey, VP6	Dunnock		NS
09/03/2022	Vantage Point Survey, VP6	Chaffinch		NS
09/03/2022	Vantage Point Survey, VP6	Robin		NS
10/03/2022	Vantage Point Survey, VP4	Rook		NS
10/03/2022	Vantage Point Survey, VP4	Lesser Redpoll		NS
10/03/2022	Vantage Point Survey, VP4	Siskin		NS
10/03/2022	Vantage Point Survey, VP4	Wren		NS
10/03/2022	Vantage Point Survey, VP4	Hooded Crow		NS

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
10/03/2022	Vantage Point Survey, VP4	Starling	large flock c1000	NS
10/03/2022	Vantage Point Survey, VP4	Song Thrush		NS
10/03/2022	Vantage Point Survey, VP4	Raven		NS
10/03/2022	Vantage Point Survey, VP4	Stonechat		NS
10/03/2022	Vantage Point Survey, VP4	Chaffinch		NS
22/03/2022	Vantage Point Survey, VP5	Raven		ZOC
22/03/2022	Vantage Point Survey, VP5	Robin		ZOC
22/03/2022	Vantage Point Survey, VP5	Hooded Crow		ZOC
22/03/2022	Vantage Point Survey, VP5	Dunnock		ZOC
22/03/2022	Vantage Point Survey, VP5	Great Tit		ZOC
22/03/2022	Vantage Point Survey, VP5	Rook		ZOC
22/03/2022	Vantage Point Survey, VP5	Woodpigeon		ZOC
22/03/2022	Vantage Point Survey, VP5	Wren		ZOC
22/03/2022	Vantage Point Survey, VP5	Starling		ZOC
22/03/2022	Vantage Point Survey, VP5	Magpie		ZOC
22/03/2022	Vantage Point Survey, VP5	Blackbird		ZOC
23/03/2022	Vantage Point Survey, VP3	Raven		ZOC
23/03/2022	Vantage Point Survey, VP3	Jay		ZOC
23/03/2022	Vantage Point Survey, VP3	Wren		ZOC
23/03/2022	Vantage Point Survey, VP3	Hooded Crow		ZOC
23/03/2022	Vantage Point Survey, VP3	Rook		ZOC

Table 1-65 Walkover Non-target Species Data

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	07/04/2021	07:11	Grey Heron	2	wet grassland; travelling (flyover; non-breeding)	PM
	07/04/2021	07:13	Mallard	1	wet grassland; circling/travelling (flyover; non-breeding)	PM
	07/04/2021	07:16	Mallard	2	wet grassland; circling (flyover; non-breeding)	PM
	07/04/2021	09:15	Mute Swan	1	lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Mute Swan	1	cutover bog and lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:32	Mallard	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:32	Grey Heron	1	cutover bog and immature woodland; travelling (flyover; non-breeding)	PM
	07/04/2021	09:36	Mute Swan	2	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:21	Moorhen	1	cutover bog and lakes and ponds; calling (suitable nesting habitat; possible breeder)	PM
	07/04/2021	10:33	Mute Swan	3	depositing/lowland rivers; feeding, one farmyard goose present also (summering; non-breeding)	PM
	07/04/2021	10:33	Mallard	2	cutover bog; flushed, 2 males (summering; non-breeding)	PM
	07/04/2021	10:33	Lesser Black-backed Gull	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	12:38	Mallard	1	cutover bog; flushed from reeds, female (suitable nesting habitat; possible breeder)	PM
	07/04/2021		Meadow Pipit			PM
	14/05/2021	07:41	Meadow Pipit	1	cutover bog; carrying food (adult carrying food/faecal sac; confirmed breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	14/05/2021	07:59	Grey Heron	1	recently-felled woodland; travelling (flyover; non-breeding)	PM
	14/05/2021	08:05	Black-headed Gull	2	cutover bog; being mobbed by l. (flyover; non-breeding)	PM
	14/05/2021	08:18	Meadow Pipit	1	raised bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	09:23	Mallard	1	depositing/lowland rivers; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mallard	2	cutover bog; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mute Swan	1	depositing/lowland rivers; preening on bank, 2cy; with a white farmyard goose (summering; non-breeding)	PM
	14/05/2021	09:28	Meadow Pipit	1	cutover bog; perched (suitable nesting habitat; possible breeder)	PM
	14/05/2021	10:05	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:13	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:22	Mallard	2	cutover bog; flushed from drain (summering; non-breeding)	PM
	18/06/2021	05:24	Meadow Pipit	1	wet grassland; singing (singing male; possible breeder)	PM
	18/06/2021	07:20	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	07:49	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	18/06/2021	07:49	Grey Heron	1	cutover bog; feeding (summering; non-breeding)	PM
	18/06/2021	07:49	Mallard	2	cutover bog; circling; calling, 2 males (summering; non-breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	18/06/2021	07:49	Black-headed Gull	1	cutover bog; calling (summering; non-breeding)	PM
	18/06/2021	09:09	Meadow Pipit	2	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	09:54	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	23/07/2021	08:01	Grey Heron	3	cutover bog; feeding (summering; non-breeding)	PM
	23/07/2021	08:01	Mallard	5	cutover bog; flew from flood (summering; non-breeding)	PM
	23/07/2021	08:01	Little Grebe	1	cutover bog; calling (suitable nesting habitat; possible breeder)	PM
	23/07/2021	08:01	Mallard	4	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:01	Grey Heron	1	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:27	Grey Heron	1	conifer plantation and cutover bog; travelling (flyover; non-breeding)	PM
	23/07/2021	09:10	Grey Heron	2	cutover bog and depositing/lowland rivers; travelling (flyover; non-breeding)	PM
	23/07/2021	09:14	Mute Swan	5	depositing/lowland rivers; feeding, 2ad & 3 juv (fledged young; confirmed breeding)	PM
	23/07/2021	09:41	Meadow Pipit	5	cutover bog; on bog, possibly a family flock (flyover; non-breeding)	PM
	20/10/2021	10:29	Grey Heron	1	scrub and cutover bog; flying across scrubby bog fringes and wetland (wintering)	NM
	21/10/2021	09:37	Mallard	5	lakes and ponds; swimming and calling on lake, fl (wintering)	NM
	21/10/2021	11:10	Mute Swan	1	depositing/lowland rivers; swimming on river (wintering)	NM
	21/10/2021		Meadow Pipit			NM
	27/01/2022	14:55	Redwing	8	conifer plantation; fly (wintering)	AOD
	27/01/2022	13:30	Meadow Pipit	6	cutover bog; fly (wintering)	AOD

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	27/01/2022	13:40	Grey Heron	1	depositing/lowland rivers; fly, flew from inny (wintering)	AOD
	27/01/2022	14:57	Mute Swan	2	depositing/lowland rivers; foraging, pair on inny (wintering)	AOD
	28/01/2022	13:12	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	28/01/2022	15:12	Little Grebe	5	lakes and ponds; flying (wintering)	AOD
	28/01/2022	15:12	Mute Swan	1	lakes and ponds; feeding (wintering)	AOD
	28/01/2022	16:56	Mute Swan	11	lakes and ponds; foraging (wintering)	AOD
	22/02/2022	16:11	Mute Swan	2	lakes and ponds; feeding (wintering)	AOD
	22/02/2022	17:11	Mute Swan	2	cutover bog; feeding (wintering)	AOD
	22/02/2022	14:13	Meadow Pipit	4	cutover bog and wet grassland; fly (wintering)	AOD
	22/02/2022	17:13	Meadow Pipit	3	cutover bog; fly (wintering)	AOD
	23/02/2022	14:22	Redwing	30	wet grassland; fly (wintering)	AOD
	23/02/2022	14:22	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	23/02/2022	17:09	Meadow Pipit	2	cutover bog; displaying, display (courtship and display; probable breeding)	AOD
	23/02/2022	17:28	Mute Swan	2	lakes and ponds; flying (wintering)	AOD
	23/02/2022	17:28	Little Grebe	2	lakes and ponds; flying (wintering)	AOD

Table 1-66 Wildfowl Distribution Non-target Species Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH001	L. Kinale	16/09/2021	10:49	Black-headed Gull	13	mesotrophic lakes; flying and swooping over lake	NM
CM002	L. Sheelin	16/09/2021	08:49	Common Gull	5	mesotrophic lakes; swirliong and circling over lake - often diving and landing briefly on lake surface	NM
CM004	L. Kinale	16/09/2021	10:57	Common Gull	2	mesotrophic lakes; flying over lake	NM
CM003	L. Sheelin	16/09/2021	10:05	Common Gull	3	mesotrophic lakes; flying and wheeling over lake	NM
CM001		16/09/2021	08:47	Common Gull	6	mesotrophic lakes; flying across lake - numerous flyovers near s3	NM
GA001	Derragh Lough	16/09/2021	12:15	Gadwall	24	mesotrophic lakes; swimming and dabbling along lake fringes, all along s shore	NM
GG007	L. Sheelin	16/09/2021	10:00	Great Crested Grebe	15	mesotrophic lakes; swimming on lake (with juveniles present)	NM
GG004	L. Sheelin	16/09/2021	08:50	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (including 2x juveniles)	NM
GG001		16/09/2021	16:26	Great Crested Grebe	5	mesotrophic lakes; swimming on lake	NM
GG002	L. Sheelin	16/09/2021	08:34	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG003	L. Sheelin	16/09/2021	08:37	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG005	L. Sheelin	16/09/2021	08:55	Great Crested Grebe	1	mesotrophic lakes; swimming on lake	NM
GG009	L. Kinale	16/09/2021	11:28	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with 1 juvenile present)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG006	S2	16/09/2021	09:16	Great Crested Grebe	8	mesotrophic lakes; swimming and diving on lake (+ 1 juvenile)	NM
GG008	L. Kinale	16/09/2021	10:52	Great Crested Grebe	13	mesotrophic lakes; swimming and diving on lake	NM
H001	L. Bracklagh	16/09/2021	10:40	Grey Heron	1	mesotrophic lakes; wading on edge of reedbed at lake fringe	NM
H002	BN2	16/09/2021	14:23	Grey Heron	1	cutover bog; perched within bog wetland	NM
H003	R. Inny	16/09/2021	15:25	Grey Heron	1	amenity grassland (improved) and depositing/lowland rivers; perched on grassy bank of river	NM
H004	Derragh Lough	16/09/2021	12:28	Grey Heron	1	mixed broadleaved woodland and mesotrophic lakes; flying s along w side of lake	NM
H005	L. Kinale	16/09/2021	11:12	Grey Heron	1	mesotrophic lakes; flying s across reedy lake fringes	NM
H006		16/09/2021	08:33	Grey Heron	2	mesotrophic lakes; flying n along lake shore	NM
H007	L. Sheelin	16/09/2021	08:47	Grey Heron	1	mesotrophic lakes; calling within reeds along lake shore	NM
LB001		16/09/2021	16:26	Lesser Black-backed Gull	1	mixed conifer woodland; flying w	NM
LB006	L. Kinale	16/09/2021	11:31	Lesser Black-backed Gull	2	mesotrophic lakes; flying sw across lake - swooping close to surface on occasion	NM
LB001		16/09/2021	09:39	Lesser Black-backed Gull	2	immature woodland and cutover bog; flying sw across bog and woodland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LB002		16/09/2021	09:27	Lesser Black-backed Gull	1	mixed conifer woodland, hedgerows and improved agricultural grassland; flying se	NM
LB005	L. Kinale	16/09/2021	10:08	Lesser Black-backed Gull	1	mesotrophic lakes and scrub; flying s along w lake shore	NM
LB003		16/09/2021	09:48	Lesser Black-backed Gull	5	raised bog and immature woodland; flying over land just to s of lake	NM
LB004	S1	16/09/2021	09:47	Lesser Black-backed Gull	2	mesotrophic lakes, immature woodland and mixed broadleaved woodland; flying e along lake shore	NM
LB002		16/09/2021	08:46	Lesser Black-backed Gull	3	mesotrophic lakes; flying across lake	NM
LG003		16/09/2021	13:24	Little Grebe	3	dystrophic lakes and cutover bog; swimming on diving on flooded bog - bog pool	NM
LG002		16/09/2021	16:30	Little Grebe	2	depositing/lowland rivers; swimming and diving on river	NM
LG008	L. Sheelin	16/09/2021	10:03	Little Grebe	9	mesotrophic lakes; swimming and diving on lake - close to reed bed border	NM
LG001	L. Bracklagh	16/09/2021	10:40	Little Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
LG004	Derragh Lough	16/09/2021	12:23	Little Grebe	11	mesotrophic lakes; calling within reedbeds	NM
LG006	S1	16/09/2021	10:07	Little Grebe	3	mesotrophic lakes; calling and swimming within edge reeds	NM
LG005	L. Sheelin	16/09/2021	09:17	Little Grebe	3	mesotrophic lakes; calling and diving within overhanging boughs of willow and ashe	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG007	L. Sheelin	16/09/2021	09:47	Little Grebe	4	mesotrophic lakes and reed and large sedge swamps; calling along lake shore	NM
MA001	L. Sheelin	16/09/2021	09:17	Mallard	7	mesotrophic lakes; swimming on lake and around weedy fringes	NM
MA002		16/09/2021	17:00	Mallard	12	mesotrophic lakes; swimming on lake	NM
MA003	L. Kinale	16/09/2021	11:32	Mallard	11	mesotrophic lakes; swimming and dabbling within reeds and floating vegetation	NM
MA004	BN2	16/09/2021	14:12	Mallard	6	cutover bog; roosting on bare peat within flooded bog area	NM
MA005	Derragh Lough	16/09/2021	12:15	Mallard	49	mesotrophic lakes; dabbling on lake, throughout lake	NM
MA006	L. Sheelin	16/09/2021	08:50	Mallard	4	mesotrophic lakes; calling and frequent noise from reedy fringes	NM
MH001	L. Bracklagh	16/09/2021	10:40	Moorhen	6	mesotrophic lakes; wading within reedbed at lake fringe, most likely a lot more individuals around reedbed perimeter of lake	NM
MH002	L. Sheelin	16/09/2021	08:37	Moorhen	7	reed and large sedge swamps and mesotrophic lakes; wading at reedy fringes of lake	NM
MH003	R. Inny - Carnagh Br.	16/09/2021	15:25	Moorhen	3	depositing/lowland rivers; swimming on weedy river	NM
MH004		16/09/2021	16:30	Moorhen	2	depositing/lowland rivers; swimming on river	NM
MH005		16/09/2021	16:27	Moorhen	18	mesotrophic lakes; swimming at reedbed fringe on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH006	BN2	16/09/2021	14:21	Moorhen	2	cutover bog; calling within reedy part of bog wetland	NM
MH007	L. Sheelin	16/09/2021	09:19	Moorhen	3	mesotrophic lakes; calling within reedy fringes of lake	NM
MH008	L. Sheelin	16/09/2021	10:12	Moorhen	5	mesotrophic lakes; calling within reeds and overhanging trees at edge of lake	NM
MH009	L. Sheelin	16/09/2021	08:30	Moorhen	3	mesotrophic lakes and reed and large sedge swamps; calling within reeds	NM
MH010	L. Sheelin	16/09/2021	09:57	Moorhen	13	mesotrophic lakes; calling from lakes edge + swimming amongst reed beds	NM
MH011	L. Sheelin	16/09/2021	09:50	Moorhen	3	mesotrophic lakes; calling from edge of lake	NM
MH012	Derragh Lough	16/09/2021	12:17	Moorhen	26	mesotrophic lakes; calling and wading within reedy lake fringes, throughout lake	NM
	R. Inny	16/09/2021	16:10	Mute Swan	3	depositing/lowland rivers; swimming on river - 2 adults + 1 juvenile	NM
	R. Inny	16/09/2021	15:53	Mute Swan	5	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	16/09/2021	09:58	Mute Swan	8	mesotrophic lakes; swimming on lake and around small islands	NM
	Derrach Lough	16/09/2021	12:14	Mute Swan	88	mesotrophic lakes; swimming on lake + social calls (+ with 4 juveniles), throughout lake	NM
	L. Bracklagh	16/09/2021	10:41	Mute Swan	9	mesotrophic lakes; swimming on lake, 5 adults + 4 juveniles	NM

Wildfowl Distribution Surveys

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		16/09/2021	16:27	Mute Swan	19	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:34	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:40	Mute Swan	37	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:51	Mute Swan	6	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:45	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:54	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:18	Mute Swan	29	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:27	Mute Swan	3	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	10:23	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	10	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	63	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:52	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:28	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:45	Mute Swan	2	mesotrophic lakes; noisily taking off from lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA001	BN2	16/09/2021	14:16	Water Rail	1	cutover bog; pig calls coming from far side of bog wetland	NM
WA002	L. Sheelin	16/09/2021	08:43	Water Rail	2	reed and large sedge swamps and mesotrophic lakes; pig calls coming from edge reeds	NM
BH012	L. D'varagh	17/09/2021	15:45	Black-headed Gull	12	mesotrophic lakes; swirling over n side of lake	NM
BH011	L. D'varagh	17/09/2021	15:54	Black-headed Gull	8	mesotrophic lakes; swirling over lake + diving to surface on occasion	NM
BH015	L. D'varagh	17/09/2021	15:58	Black-headed Gull	7	mesotrophic lakes; swirling over lake	NM
BH017	L. D'varagh	17/09/2021	13:04	Black-headed Gull	2	mesotrophic lakes; swirling over lake	NM
BH009	L. Iron	17/09/2021	18:34	Black-headed Gull	5	mesotrophic lakes; swirling and swooping over nw side of lake before flying away n	NM
BH007		17/09/2021	14:45	Black-headed Gull	49	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge - some individuals flying low and chasing each other near	NM
BH016		17/09/2021	16:00	Black-headed Gull	23	mesotrophic lakes; flying over lake, numerous flyovers throughout	NM
BH018	L. D'varagh	17/09/2021	13:50	Black-headed Gull	3	mesotrophic lakes; flying low over edge of lake - perching on pontoon and landing on water (+ calling)	NM
BH004	L. D'varagh	17/09/2021	13:00	Black-headed Gull	1	mesotrophic lakes; flying across lake	NM
BH010	L. D'varagh	17/09/2021	15:45	Black-headed Gull	17	mesotrophic lakes; flying across lake, numerous flyovers	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH013	L. D'varagh	17/09/2021	15:54	Black-headed Gull	25	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH014	L. D'varagh	17/09/2021	15:43	Black-headed Gull	9	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH003	L. D'varagh	17/09/2021	13:02	Black-headed Gull	5	mesotrophic lakes; circling over narrow end of lake	NM
BH006		17/09/2021	14:54	Black-headed Gull	6	mesotrophic lakes, reed and large sedge swamps and scrub; circling over lake and adjacent land	NM
BH005	L. D'varagh	17/09/2021	13:11	Black-headed Gull	3	mesotrophic lakes; circling over lake	NM
BH002	L. D'varagh	17/09/2021	13:35	Black-headed Gull	2	mesotrophic lakes; circling low over small floating jetty - landing briefly on water and on jetty	NM
BH008	L. D'varagh	17/09/2021	14:32	Black-headed Gull	4	mesotrophic lakes; circling and diving over lake	NM
CA001	L. D'varagh	17/09/2021	13:21	Cormorant	1	mesotrophic lakes; swimming and diving on lake	NM
CA002	L. D'varagh	17/09/2021	15:53	Cormorant	1	mesotrophic lakes; flying e across lake	NM
CA003	L. D'varagh	17/09/2021	13:19	Cormorant	1	mesotrophic lakes; flying along lake	NM
CM005		17/09/2021	13:58	Common Gull	2	improved agricultural grassland and treelines; flying nw along far side of lake	NM
GA002	L. Iron	17/09/2021	19:00	Gadwall	24	mesotrophic lakes; swimming and foraging on lake	NM
GG018	L. D'varagh	17/09/2021	15:41	Great Crested Grebe	23	mesotrophic lakes; swimming on lake (+ with present juveniles)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG023	L. D'varagh	17/09/2021	13:16	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (+ constant calling by juvenile)	NM
GG017	L. D'varagh	17/09/2021	14:40	Great Crested Grebe	16	mesotrophic lakes; swimming on lake - n section of lake	NM
GG011	L. D'varagh	17/09/2021	12:58	Great Crested Grebe	2	mesotrophic lakes; swimming on lake	NM
GG012	L. D'varagh	17/09/2021	13:03	Great Crested Grebe	9	mesotrophic lakes; swimming on lake	NM
GG015	L. D'varagh	17/09/2021	13:09	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG016	L. D'varagh	17/09/2021	13:22	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG019	L. D'varagh	17/09/2021	16:10	Great Crested Grebe	14	mesotrophic lakes; swimming on lake	NM
GG020	L. D'varagh	17/09/2021	16:14	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG022	L. D'varagh	17/09/2021	13:10	Great Crested Grebe	4	mesotrophic lakes; swimming on lake	NM
GG024	L. D'varagh	17/09/2021	13:56	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG025	L. Iron	17/09/2021	19:17	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG010	L. D'varagh	17/09/2021	12:55	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with young calling)	NM
GG021	L. D'varagh	17/09/2021	13:07	Great Crested Grebe	3	mesotrophic lakes; swimming (resting) on lake	NM
GG013	L. D'varagh	17/09/2021	13:21	Great Crested Grebe	2	mesotrophic lakes; resting on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG014	L. D'varagh	17/09/2021	13:35	Great Crested Grebe	4	mesotrophic lakes; adults and young on lake - constant chirping from juveniles	NM
H008	L. D'varagh	17/09/2021	12:56	Grey Heron	1	mesotrophic lakes; perched on floating jetty	NM
H009	L. D'varagh	17/09/2021	14:59	Grey Heron	1	mesotrophic lakes and reed and large sedge swamps; calling from edge of lake	NM
LB008		17/09/2021	14:45	Lesser Black-backed Gull	23	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge	NM
LB009		17/09/2021	18:47	Lesser Black-backed Gull	2	improved agricultural grassland and hedgerows; flying nw over farmland	NM
LB007		17/09/2021	14:35	Lesser Black-backed Gull	1	mesotrophic lakes; flying ne across w edge of lake	NM
LB010	L. D'varagh	17/09/2021	15:51	Lesser Black-backed Gull	2	mesotrophic lakes; flying ne across lake	NM
LG009		17/09/2021	12:38	Little Grebe	1	cutover bog; swimming on flooded bog pool	NM
LG012	L. Iron	17/09/2021	19:00	Little Grebe	23	mesotrophic lakes; swimming and foraging on lake	NM
LG010	L. D'varagh	17/09/2021	15:40	Little Grebe	15	mesotrophic lakes; swimming and calling within reedy islets on lake	NM
LG011	L. D'varagh	17/09/2021	16:32	Little Grebe	4	mesotrophic lakes; calling and diving on lake	NM
MA007	L. Iron	17/09/2021	19:10	Mallard	46	mesotrophic lakes; swimming and foraging on lake	NM
MA008	L. D'varagh	17/09/2021	16:35	Mallard	2	mesotrophic lakes; flushed from edge reeds	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH013	L. Iron	17/09/2021	19:15	Moorhen	38	mesotrophic lakes and reed and large sedge swamps; wading along reedy edges and amonsgt weedy floating vegetation, most likely an underestimate of numbers	NM
MH014	L. D'varagh	17/09/2021	16:03	Moorhen	27	mesotrophic lakes; calling within fringe reed beds, most likely an underestimate	NM
MH015	L. D'varagh	17/09/2021	13:21	Moorhen	15	mesotrophic lakes; calling within edge reed beds (throughout narrow part of lake)	NM
MH016	L. D'varagh	17/09/2021	15:47	Moorhen	16	mesotrophic lakes; calling and waqding within reed islets on lake fringe	NM
MH017	L. D'varagh	17/09/2021	14:43	Moorhen	6	mesotrophic lakes and reed and large sedge swamps; calling and wading within fringe reedbeds	NM
MH018	L. D'varagh	17/09/2021	16:33	Moorhen	3	mesotrophic lakes; calling and ading in reedy lake fringes	NM
	L. D'varagh	17/09/2021	12:59	Mute Swan	6	mesotrophic lakes; swimming on lake and along reed fringes (2 adults + 4 juveniles)	NM
	L. D'varagh	17/09/2021	16:35	Mute Swan	5	mesotrophic lakes; swimming on lake (+ 2 juveniles)	NM
	Bracklagh Lough	17/09/2021	12:30	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	30	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	17	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. D'varagh	17/09/2021	15:49	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:39	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. D'vaagh	17/09/2021	16:09	Mute Swan	4	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	13:06	Mute Swan	2	mesotrophic lakes; swimming on lake	NM
	L. Iron	17/09/2021	19:15	Mute Swan	38	mesotrophic lakes; swimming and foraging on lake	NM
WA003	L. D'varagh	17/09/2021	15:52	Water Rail	2	mesotrophic lakes; pig calls from lake fringes	NM
BH023	L. D'varagh	29/09/2021	15:58	Black-headed Gull	12	mesotrophic lakes; swirling and swooping over lake	NM
BH021	L. D'varagh	29/09/2021	15:38	Black-headed Gull	2	mesotrophic lakes and mixed broadleaved woodland; flying over sw of lake and adjacent woodland	NM
BH019	Bracklagh Lough	29/09/2021	09:25	Black-headed Gull	3	mesotrophic lakes; flying over and swimming on lake	NM
BH020	L. Kinale	29/09/2021	10:04	Black-headed Gull	6	mesotrophic lakes; flying and swooping over lake	NM
BH022	L' D'varagh	29/09/2021	16:00	Black-headed Gull	1	mesotrophic lakes; flying and swooping over lake	NM
BH024	L. Sheelin	29/09/2021	08:07	Black-headed Gull	5	lakes and ponds; flying across lake	NM
BH026	L. Sheelin	29/09/2021	08:16	Black-headed Gull	6	lakes and ponds; flying across lake	NM
BH028	L. Sheelin	29/09/2021	08:45	Black-headed Gull	4	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH027		29/09/2021	08:36	Black-headed Gull	2	raised bog and scrub; flying across bog and scrub	NM
BH025	L. Sheelin	29/09/2021	08:17	Black-headed Gull	16	lakes and ponds; circlng and swooping over lake	NM
CA004	L. Sheelin	29/09/2021	08:11	Cormorant	1	lakes and ponds; flying low across lake	NM
CA005	L. Sheelin	29/09/2021	08:20	Cormorant	2	lakes and ponds; flying low across lake	NM
GA003	Derragh Lough	29/09/2021	11:04	Gadwall	35	mesotrophic lakes; swimming and foraging on lake	NM
GG031	L. Sheelin	29/09/2021	08:03	Great Crested Grebe	3	lakes and ponds; swimming on lake (w/ 2x juveniles)	NM
GG030	L. Sheelin	29/09/2021	08:12	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG033	L. Sheelin	29/09/2021	08:45	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG027	L. D'varagh	29/09/2021	15:56	Great Crested Grebe	3	mesotrophic lakes; swimming at lake fringes (+ 2 juveniles calling)	NM
GG026	L. Kinale	29/09/2021	10:16	Great Crested Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
GG028	L. D'varagh	29/09/2021	15:58	Great Crested Grebe	3	mesotrophic lakes; swimming and diving on lake	NM
GG029	L. Sheelin	29/09/2021	08:00	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG032	L. Sheelin	29/09/2021	08:19	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM
GG034	L. Sheelin	29/09/2021	08:53	Great Crested Grebe	1	lakes and ponds; swimming and diving on lake	NM
H010		29/09/2021	09:24	Grey Heron	1	mesotrophic lakes; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H011	L. Kinale	29/09/2021	12:10	Grey Heron	1	mesotrophic lakes; calling from lake edge	NM
LB012	L. Sheelin	29/09/2021	08:10	Lesser Black-backed Gull	3	lakes and ponds; flying over lake	NM
LB011		29/09/2021	16:02	Lesser Black-backed Gull	1	mesotrophic lakes; flying across lake	NM
LG014	L. D'varagh	29/09/2021	15:58	Little Grebe	13	mesotrophic lakes; swimming and diving within reedy fringes	NM
LG015	Derragh Lough	29/09/2021	10:57	Little Grebe	38	mesotrophic lakes; swimming and diving on lake	NM
LG017	L. Sheelin	29/09/2021	08:13	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG013		29/09/2021	13:10	Little Grebe	3	cutover bog; swimming and diving on bog pool	NM
LG018	L. Sheelin	29/09/2021	08:46	Little Grebe	8	lakes and ponds; swimming and diving near lake edge	NM
LG016	L. Sheelin	29/09/2021	08:12	Little Grebe	6	lakes and ponds; calling within reedy margins of lake	NM
MA009	L. Sheelin	29/09/2021	08:24	Mallard	5	lakes and ponds; swimming on lake	NM
MA010	L. Sheelin	29/09/2021	08:46	Mallard	7	lakes and ponds; swimming on lake	NM
MA011	L. D'varagh	29/09/2021	16:17	Mallard	19	mesotrophic lakes; swimming and foraging on lake	NM
MA012	Derragh Lough	29/09/2021	10:55	Mallard	57	mesotrophic lakes; swimming and foraging on lake	NM
MA013	L. D'varagh	29/09/2021	15:42	Mallard	24	mesotrophic lakes; swimming and dabbling on lake	NM
MA014	L. D'varagh	29/09/2021	16:15	Mallard	9	mesotrophic lakes; swimming and dabbling in weedy edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA015	L. Kinale	29/09/2021	10:03	Mallard	23	mesotrophic lakes; swimming and dabbling along lake fringes	NM
MA016	Derragh Lough	29/09/2021	12:45	Mallard	7	mesotrophic lakes; flying over lake	NM
MA017		29/09/2021	12:43	Mallard	18	mesotrophic lakes; flying in wide circles over w of derragh lough	NM
MA018	L. D'varagh	29/09/2021	15:09	Mallard	2	mesotrophic lakes; calling within reeds	NM
MA019	L. Kinale	29/09/2021	12:15	Mallard	2	mesotrophic lakes; calling from lake edge	NM
MA020	L. Sheelin	29/09/2021	08:13	Mallard	5	lakes and ponds; calling and swimming within reedy edges of lake	NM
MH019	L. Sheelin	29/09/2021	08:18	Moorhen	3	lakes and ponds; wading on edge of reedbed	NM
MH020	Derragh Lough	29/09/2021	11:00	Moorhen	22	mesotrophic lakes; swimming and wading within reedy fringes, approx. count - likely that some were missed	NM
MH021	L. Sheelin	29/09/2021	08:02	Moorhen	7	lakes and ponds; calling within reedy margins of lake	NM
MH022	L. Sheelin	29/09/2021	08:23	Moorhen	3	lakes and ponds; calling within reedy edges of lake	NM
MH023	Bracklagh Lough	29/09/2021	09:34	Moorhen	1	mesotrophic lakes and reed and large sedge swamps; calling within reeds along fringes of lake	NM
MH024	L. Kinale	29/09/2021	12:16	Moorhen	2	mesotrophic lakes; calling from lake edge	NM
	L. D'varagh	29/09/2021	16:06	Mute Swan	6	mesotrophic lakes; swimming within reedy lake fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	29/09/2021	10:00	Mute Swan	6	mesotrophic lakes; swimming on lake and within reedy fringes	NM
	L. Kinale	29/09/2021	10:02	Mute Swan	56	mesotrophic lakes and reed and large sedge swamps; swimming on lake + roosting within reedy edges	NM
	L. Sheelin	29/09/2021	08:20	Mute Swan	29	lakes and ponds; swimming on lake (n shore)	NM
	Bracklagh Lough	29/09/2021	09:25	Mute Swan	16	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:06	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:32	Mute Swan	17	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:55	Mute Swan	28	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	16:16	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	29/09/2021	07:57	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:05	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	07:04	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:15	Mute Swan	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	29/09/2021	08:45	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:50	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:57	Mute Swan	46	lakes and ponds; swimming on lake	NM
	Derragh Lough	29/09/2021	10:56	Mute Swan	155	mesotrophic lakes; swimming and foraging on lake, approx count	NM
	L. Sheelin	29/09/2021	08:22	Mute Swan	8	lakes and ponds; swimmiming on lake	NM
WA004	L. Sheelin	29/09/2021	08:19	Water Rail	3	lakes and ponds; calling from within reedy margins	NM
BH029	L. Iron	30/09/2021	17:51	Black-headed Gull	6	lakes and ponds, reed and large sedge swamps and scrub; flying around lake perimeter	NM
GG035	L. Iron	30/09/2021	18:12	Great Crested Grebe	6	lakes and ponds; swimming on lake	NM
LG019	L. Iron	30/09/2021	18:27	Little Grebe	21	lakes and ponds; swimming and diving on lake	NM
MA021	L. Iron	30/09/2021	18:30	Mallard	79	lakes and ponds; swimming and dabbling on lake	NM
	L. Iron	30/09/2021	18:30	Mute Swan	28	lakes and ponds; swimming on lake	NM
H012	L. Iron	11/10/2021	17:02	Grey Heron	1	lakes and ponds and reed and large sedge swamps; flying low and calling along lake shore	NM
LG020	L. Iron	11/10/2021	17:30	Little Grebe	14	lakes and ponds; swimming on lake	NM
MA022	L. Iron	11/10/2021	17:30	Mallard	56	lakes and ponds; swimming and dabbling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Iron	11/10/2021	17:30	Mute Swan	24	lakes and ponds; swimming on lake	NM
BH035	L. D'varagh	12/10/2021	16:33	Black-headed Gull	9	lakes and ponds; swirling over lake	NM
BH031	L. Sheelin	12/10/2021	08:06	Black-headed Gull	7	lakes and ponds; roosting near lake edge + flying around spot	NM
BH032	L. Sheelin	12/10/2021	08:16	Black-headed Gull	32	lakes and ponds; flying out over open water - not as open group but as frequent individuals	NM
BH030	Bracklagh Lough	12/10/2021	08:57	Black-headed Gull	7	lakes and ponds; flying and diving over lake and around fringes	NM
BH033	L. Sheelin	12/10/2021	08:20	Black-headed Gull	2	lakes and ponds and scrub; flying along s shore	NM
BH034	L. D'varagh	12/10/2021	16:20	Black-headed Gull	25	lakes and ponds; flying across lake - not as one large group but as frequent individuals	NM
CA006	Derragh Lough	12/10/2021	11:08	Cormorant	3	lakes and ponds; swimming and flying over lake	NM
CA007	L. D'varagh	12/10/2021	16:35	Cormorant	2	lakes and ponds; flying low across lake	NM
CA008		12/10/2021	09:25	Cormorant	1	depositing/lowland rivers and mixed broadleaved woodland; flying	NM
CA009		12/10/2021	09:29	Cormorant	1	mixed broadleaved woodland and lakes and ponds; flying	NM
GG036	L. Kinale	12/10/2021	10:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG037	L. Kinale	12/10/2021	12:02	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG038	L. Sheelin	12/10/2021	08:03	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG039	L. Sheelin	12/10/2021	08:06	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG040	L. Sheelin	12/10/2021	08:12	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG041	L. Sheelin	12/10/2021	08:15	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG042	L. Sheelin	12/10/2021	08:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG043	L. D'varagh	12/10/2021	16:05	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG045	L. D'varagh	12/10/2021	16:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG044	L. D'varagh	12/10/2021	16:17	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
H013	R. Inny	12/10/2021	09:21	Grey Heron	1	depositing/lowland rivers; perched on bridge	NM
H014		12/10/2021	09:26	Grey Heron	1	depositing/lowland rivers and mixed broadleaved woodland; perched in tree along river	NM
H015		12/10/2021	09:30	Grey Heron	1	lakes and ponds; foraging within reeds	NM
H016	L. D'varagh	12/10/2021	16:57	Grey Heron	1	lakes and ponds; flying across lake and calling	NM
H017	L. Sheelin	12/10/2021	08:18	Grey Heron	2	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H018	L. D'varagh	12/10/2021	16:15	Grey Heron	1	lakes and ponds; flying across lake	NM
H019	L. D'varagh	12/10/2021	16:12	Grey Heron	2	lakes and ponds and scrub; flushed from edges of lake	NM
H020	L. Sheelin	12/10/2021	08:20	Grey Heron	1	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
LB013	L. Sheelin	12/10/2021	08:09	Lesser Black-backed Gull	2	lakes and ponds; flying across sw corner of lake	NM
LB014	L. D'varagh	12/10/2021	16:21	Lesser Black-backed Gull	3	lakes and ponds; flying across lake	NM
LG029	L. D'varagh	12/10/2021	16:12	Little Grebe	4	lakes and ponds; swimming and diving with complex of reedy islets	NM
LG024	Derragh Lough	12/10/2021	11:10	Little Grebe	18	lakes and ponds; swimming and diving on lake (+ calling)	NM
LG023	L. Kinale	12/10/2021	10:18	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG027	L. Sheelin	12/10/2021	08:26	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG028	L. D'varagh	12/10/2021	16:05	Little Grebe	14	lakes and ponds; swimming and diving on lake	NM
LG030	L. D'varagh	12/10/2021	16:18	Little Grebe	6	lakes and ponds; swimming and diving near lake shore	NM
LG022	L. Kinale	12/10/2021	10:06	Little Grebe	5	lakes and ponds; swimming and diving along reedy fringes	NM
LG031	L. D'varagh	12/10/2021	16:09	Little Grebe	8	lakes and ponds; calling within reedy margins of lake	NM
LG025	L. Sheelin	12/10/2021	08:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG026	L. Sheelin	12/10/2021	08:20	Little Grebe	6	lakes and ponds; calling within reedy margins	NM
LG021	L. Kinale	12/10/2021	09:51	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
MA023	L. Kinale	12/10/2021	12:06	Mallard	6	lakes and ponds; swimming on lake	NM
MA024	L. D'varagh	12/10/2021	16:04	Mallard	12	lakes and ponds; swimming on lake	NM
MA025	L. D'varagh	12/10/2021	16:30	Mallard	6	lakes and ponds; swimming on lake	NM
MA026	L. Kinale	12/10/2021	10:12	Mallard	7	lakes and ponds; swimming and dabbling on lake	NM
MA027	Derragh Lough	12/10/2021	11:10	Mallard	18	lakes and ponds; swimming and dabbling mostly along lake fringes	NM
MA028	L. D'varagh	12/10/2021	16:07	Mallard	5	lakes and ponds; flushed from lake edge	NM
MA029	L. Sheelin	12/10/2021	08:23	Mallard	12	lakes and ponds; calling within reedy fringes of lake	NM
MH025	L. Sheelin	12/10/2021	08:26	Moorhen	2	lakes and ponds; swimming near reedy lake edges	NM
MH026	L. Sheelin	12/10/2021	08:18	Moorhen	7	lakes and ponds; swimming and calling near lake edge - around r. inny exit	NM
MH027	L. Sheelin	12/10/2021	08:02	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH028	L. Sheelin	12/10/2021	08:07	Moorhen	1	lakes and ponds; calling within reedy margins of lake	NM
MH029	Derragh Lough	12/10/2021	11:10	Moorhen	29	lakes and ponds; calling within reedy margins, all over lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH030	L. Sheelin	12/10/2021	08:21	Moorhen	3	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH031		12/10/2021	10:08	Moorhen	9	lakes and ponds; calling within reedy lake margins	NM
MH032	L. D'varagh	12/10/2021	16:31	Moorhen	3	lakes and ponds; calling within reedy edges	NM
MH033		12/10/2021	09:51	Moorhen	4	lakes and ponds; calling with reedy margins of lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	6	lakes and ponds; swimming within reedbeds	NM
	L. D'varagh	12/10/2021	16:14	Mute Swan	6	lakes and ponds; swimming within complex of reedy islets	NM
	L. Sheelin	12/10/2021	08:20	Mute Swan	27	lakes and ponds; swimming on lake - n side	NM
	L. Kinale	12/10/2021	10:05	Mute Swan	9	lakes and ponds; swimming on lake	NM
	Derragh Lough	12/10/2021	11:10	Mute Swan	156	lakes and ponds; swimming on lake, all over lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:03	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:04	Mute Swan	63	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	17:11	Mute Swan	39	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:05	Mute Swan	3	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	12/10/2021	08:05	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:08	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:14	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:08	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:06	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:10	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:24	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:20	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:29	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:32	Mute Swan	5	lakes and ponds; swimming on lake	NM
	R. Inny	12/10/2021	15:24	Mute Swan	2	watercourses; swimming and feeding on river	NM
	Bracklagh Lough	12/10/2021	08:54	Mute Swan	16	lakes and ponds; swimming and feeding on lake	NM
	L. D'varagh	12/10/2021	15:36	Mute Swan	29	lakes and ponds; swimmimg on lake	NM
	L. Sheelin	12/10/2021	08:09	Mute Swan	3	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA005		12/10/2021	10:15	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from wet reedy margins	NM
WA006	L. Sheelin	12/10/2021	08:07	Water Rail	3	lakes and ponds; pig calls from reedy margins	NM
BH036	L. Iron	25/10/2021	17:35	Black-headed Gull	15	lakes and ponds and reed and large sedge swamps; swirling over lake and adjacent wetland	NM
GG046	L. Iron	25/10/2021	17:50	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG032	L. Iron	25/10/2021	17:08	Little Grebe	20	lakes and ponds; swimming and diving on lake, ideal lg habitat	NM
MA030	L. Iron	25/10/2021	17:30	Mallard	59	lakes and ponds; swimming on lake	NM
MH034	L. Iron	25/10/2021	17:30	Moorhen	12	lakes and ponds and reed and large sedge swamps; calling and wading within wetland margins of lake	NM
	L. Iron	25/10/2021	17:32	Mute Swan	57	lakes and ponds; swimming on lake	NM
BH037		26/10/2021	09:16	Black-headed Gull	3	lakes and ponds; flying and swirling low over lake	NM
BH038	L. Sheelin	26/10/2021	14:18	Black-headed Gull	2	lakes and ponds; flying across lake	NM
CA010		26/10/2021	15:08	Cormorant	2	lakes and ponds; soaring over lake	NM
CA011	L. Sheelin	26/10/2021	14:02	Cormorant	6	lakes and ponds; roosting on buoys	NM
CA012	L. Sheelin	26/10/2021	15:01	Cormorant	1	lakes and ponds; perched on rock	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA013		26/10/2021	15:59	Cormorant	1	improved agricultural grassland and hedgerows; flying s across farmland	NM
CA014		26/10/2021	09:23	Cormorant	1	lakes and ponds; flying low across lake	NM
CA015		26/10/2021	09:35	Cormorant	2	lakes and ponds; flying high across lake	NM
CA016		26/10/2021	11:27	Cormorant	1	lakes and ponds, semi-natural grassland and mixed broadleaved woodland; flying high across lake	NM
GG050		26/10/2021	09:46	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG051	Derragh Lough	26/10/2021	11:23	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG052	L. Sheelin	26/10/2021	14:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG053	L. Sheelin	26/10/2021	14:52	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG054	L. Sheelin	26/10/2021	14:57	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG055	L. Sheelin	26/10/2021	14:56	Great Crested Grebe	7	lakes and ponds; swimming on lake	NM
GG056	L. Sheelin	26/10/2021	15:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG057	L. Sheelin	26/10/2021	15:13	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG058		26/10/2021	15:20	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG047		26/10/2021	09:11	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG048		26/10/2021	09:14	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG049		26/10/2021	09:15	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM
GG059	L. Kinale	26/10/2021	16:09	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H021		26/10/2021	12:47	Grey Heron	1	cutover bog; perched on flooded bog	NM
H022	Bracklagh Lough	26/10/2021	16:19	Grey Heron	1	lakes and ponds; perched along lake shore	NM
H023	Derragh Lough	26/10/2021	11:20	Grey Heron	1	lakes and ponds; flying across lake	NM
H024		26/10/2021	10:16	Grey Heron	1	depositing/lowland rivers; flushed from river	NM
H025		26/10/2021	12:45	Grey Heron	1	scrub; calling within wet scrub	NM
H026		26/10/2021	15:14	Grey Heron	1	lakes and ponds; calling from reedy fringes	NM
H027	L. Sheelin	26/10/2021	14:26	Grey Heron	1	lakes and ponds; calling from lake margin	NM
LG035	Derragh Lough	26/10/2021	11:24	Little Grebe	47	lakes and ponds; swimming and diving on lake + calling within reedy fringes	NM
LG037	L. Sheelin	26/10/2021	14:15	Little Grebe	13	lakes and ponds; swimming and diving on lake	NM
LG039	L. Sheelin	26/10/2021	14:18	Little Grebe	7	lakes and ponds; swimming and diving on lake	NM
LG038	L. Sheelin	26/10/2021	14:23	Little Grebe	2	lakes and ponds; diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG036		26/10/2021	12:15	Little Grebe	1	lakes and ponds and cutover bog; diving on bog drainage pond	NM
LG034		26/10/2021	09:33	Little Grebe	6	lakes and ponds; calling within reedy islets	NM
LG040		26/10/2021	14:54	Little Grebe	6	lakes and ponds; calling within reedy fringes	NM
LG033		26/10/2021	09:11	Little Grebe	7	lakes and ponds; calling within reed islets + diving	NM
MA031		26/10/2021	15:09	Mallard	6	lakes and ponds; swimming within reeds	NM
MA032		26/10/2021	09:45	Mallard	6	lakes and ponds; swimming on lake	NM
MA033		26/10/2021	09:47	Mallard	4	lakes and ponds; swimming on lake	NM
MA034		26/10/2021	10:21	Mallard	17	lakes and ponds; swimming and dabbling on lake	NM
MA035	Derragh Lough	26/10/2021	11:25	Mallard	15	lakes and ponds; swimming and dabbling on lake	NM
MA036	Lough Bane	26/10/2021	13:19	Mallard	16	lakes and ponds; swimming and calling on lake	NM
MA037	L. Sheelin	26/10/2021	14:01	Mallard	4	lakes and ponds; swimming and calling on lake	NM
MA038		26/10/2021	09:41	Mallard	12	lakes and ponds; flying n across lake	NM
MA039		26/10/2021	11:41	Mallard	2	lakes and ponds and mixed broadleaved woodland; flying across lake and woodland fringes	NM
MA040		26/10/2021	08:45	Mallard	2	lakes and ponds; calling within reedy fringes of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH035	Derragh Lough	26/10/2021	11:25	Moorhen	4	lakes and ponds; wading within reedy fringes	NM
MH036		26/10/2021	14:53	Moorhen	6	lakes and ponds; calling within reedy fringes of lake	NM
MH037		26/10/2021	09:18	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH038		26/10/2021	09:51	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH039		26/10/2021	15:10	Moorhen	8	lakes and ponds; calling and swimming within reeds	NM
		26/10/2021	09:39	Mute Swan	16	lakes and ponds; wading and foraging along grassy fringe	NM
		26/10/2021	15:08	Mute Swan	1	lakes and ponds; swimming within reeds	NM
		26/10/2021	09:17	Mute Swan	12	lakes and ponds; swimming on lake	NM
		26/10/2021	09:36	Mute Swan	28	lakes and ponds; swimming on lake	NM
		26/10/2021	09:42	Mute Swan	19	lakes and ponds; swimming on lake	NM
		26/10/2021	09:48	Mute Swan	6	lakes and ponds; swimming on lake	NM
		26/10/2021	09:47	Mute Swan	36	lakes and ponds; swimming on lake	NM
		26/10/2021	09:45	Mute Swan	2	lakes and ponds; swimming on lake	NM
	Derragh Lough	26/10/2021	11:23	Mute Swan	202	lakes and ponds; swimming on lake	NM
	Lough Bane	26/10/2021	13:21	Mute Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	26/10/2021	14:05	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:13	Mute Swan	8	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:51	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:59	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	15:03	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Kinale	26/10/2021	16:08	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	26/10/2021	16:17	Mute Swan	24	lakes and ponds; swimming on lake	NM
		26/10/2021	09:35	Mute Swan	4	lakes and ponds; swimming near campsite	NM
		26/10/2021	09:10	Mute Swan	2	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	10:21	Mute Swan	34	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	14:14	Mute Swan	39	lakes and ponds; swimming along lake edge + grazing on shore	NM
WA007		26/10/2021	15:15	Water Rail	2	lakes and ponds; pig calls from reedy fringes	NM
BH039	L. D'varagh	08/11/2021	12:30	Black-headed Gull	56	lakes and ponds and mixed broadleaved woodland; swirling over lower narrow part of lake	NM
CA017	L. D'varagh	08/11/2021	12:31	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA018	L. D'varagh	08/11/2021	12:56	Cormorant	2	lakes and ponds; flying se low across lake	NM
GG060	L. D'varagh	08/11/2021	12:33	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG061	Bracklagh Lough	08/11/2021	14:34	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG041	L. D'varagh	08/11/2021	12:31	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
	Bracklagh Lough	08/11/2021	14:33	Mute Swan	26	lakes and ponds; swimming on lake	NM
BH040	L. Sheelin	09/11/2021	09:37	Black-headed Gull	13	lakes and ponds; circling over lake - wheeling and descending regularly towards water	NM
CA019	L. Sheelin	09/11/2021	10:02	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA020		09/11/2021	11:48	Cormorant	2	improved agricultural grassland and hedgerows; flyinfg n along adjacent area	NM
GA004	Derragh Lough	09/11/2021	11:32	Gadwall	9	lakes and ponds; swimming and feeding along lake edge	NM
GG063	L. Sheelin	09/11/2021	09:24	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG062	L. Sheelin	09/11/2021	09:14	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
LB015	L. Sheelin	09/11/2021	09:38	Lesser Black-backed Gull	4	lakes and ponds; flying high across lake	NM
LB016		09/11/2021	10:12	Lesser Black-backed Gull	3	bogs and scrub; flying across bog and scrub to s of lake	NM
LG042	L. Iron	09/11/2021	16:21	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG044	Derragh Lough	09/11/2021	11:32	Little Grebe	4	lakes and ponds; swimming and diving on lake	NM
LG043	L. Sheelin	09/11/2021	09:23	Little Grebe	5	lakes and ponds; calling within reedy fringes of lake	NM
MA041	L. Iron	09/11/2021	10:56	Mallard	45	lakes and ponds; swimming on lake	NM
MA042	Derragh Lough	09/11/2021	09:35	Mallard	14	lakes and ponds; swimming and dabbling along reedy edges of lake	NM
MA043	L. Sheelin	09/11/2021	09:12	Mallard	5	lakes and ponds; swimming along reedy lake edge	NM
MA044	L. Sheelin	09/11/2021	09:21	Mallard	4	lakes and ponds; calling within reedy fringes of lake	NM
MH040	L. Iron	09/11/2021	16:32	Moorhen	5	lakes and ponds; swimming and calling within reedy margins	NM
	R. Inny	09/11/2021	14:02	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	09/11/2021	09:12	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:13	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:34	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:57	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Derragh Lough	09/11/2021	11:35	Mute Swan	68	lakes and ponds; swimming on lake	NM
	L. Iron	09/11/2021	16:30	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:26	Mute Swan	7	lakes and ponds; swimming along reedy edges of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		09/11/2021	09:58	Mute Swan	7	lakes and ponds; flying nw across lake	NM
WA008	L. Sheelin	09/11/2021	09:30	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from within reedy lake margins	NM
BH041		22/11/2021	16:05	Black-headed Gull	58	improved agricultural grassland and hedgerows; swirling and flying over farmland in large group - landing occasionally. ~45mins continuously	NM
MA045	L. Iron	22/11/2021	16:02	Mallard	24	lakes and ponds; swimming on lake	NM
MH041	L. Sheelin	22/11/2021	08:40	Moorhen	3	lakes and ponds; calling within reedy boundaries	NM
	L. Iron	22/11/2021	16:00	Mute Swan	27	lakes and ponds; swimming on lake	NM
BH045	L. Sheelin	23/11/2021	09:32	Black-headed Gull	7	lakes and ponds; wheeling and circling over lake	NM
BH042		23/11/2021	10:11	Black-headed Gull	2	improved agricultural grassland; flying sw across farmland	NM
BH043	L. D'varagh	23/11/2021	15:41	Black-headed Gull	5	lakes and ponds; flying and swirling over lake	NM
BH044	L. Sheelin	23/11/2021	09:07	Black-headed Gull	6	lakes and ponds; flying across lake	NM
CA021	L. Kinale	23/11/2021	09:52	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA022	Bracklagh Lough	23/11/2021	10:15	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA023	L. Sheelin	23/11/2021	09:26	Cormorant	5	lakes and ponds; perched on tree	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA024	Derragh Lough	23/11/2021	11:18	Cormorant	2	lakes and ponds; flying low across lake	NM
CA025	L. Sheelin	23/11/2021	09:31	Cormorant	2	lakes and ponds; flying low across lake	NM
CA026		23/11/2021	10:36	Cormorant	1	depositing/lowland rivers and highly modified/non-native woodland; flying high along r. inny	NM
CA027		23/11/2021	10:51	Cormorant	1	bogs; flying across bog	NM
GA005	L. Bane	23/11/2021	14:21	Gadwall	6	lakes and ponds; swimming on lake	NM
GG064	L. Kinale	23/11/2021	09:47	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG065	L. Kinale	23/11/2021	10:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG066	L. D'varagh	23/11/2021	15:42	Great Crested Grebe	13	lakes and ponds; swimming on lake	NM
GG067	L. D'varagh	23/11/2021	15:40	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG068	L. Sheelin	23/11/2021	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG069	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG071	L. Sheelin	23/11/2021	08:58	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG073	L. Sheelin	23/11/2021	09:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG070	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG072	L. Sheelin	23/11/2021	09:07	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
H028		23/11/2021	11:05	Grey Heron	1	semi-natural grassland; wading in wet reedy grassland	NM
H029	BN2	23/11/2021	14:04	Grey Heron	1	cutover bog; flying low across wetland	NM
H030		23/11/2021	13:45	Grey Heron	1	cutover bog and scrub/transitional woodland; flying low across bog + perching in adjacent scrubby woodland	NM
LB017		23/11/2021	15:41	Lesser Black-backed Gull	1	lakes and ponds; flying over lake	NM
LG045	Derragh Lough	23/11/2021	11:10	Little Grebe	21	lakes and ponds; swimming and diving on lake + calling within reedy margins	NM
LG046		23/11/2021	15:45	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG047	L. D'varagh	23/11/2021	15:48	Little Grebe	6	lakes and ponds; swimming and diving on lake	NM
LG049	L. Sheelin	23/11/2021	09:27	Little Grebe	3	lakes and ponds; swimming and diving near to sheltered lake shore	NM
LG048	L. Sheelin	23/11/2021	09:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA046	L. D'varagh	23/11/2021	15:39	Mallard	5	lakes and ponds; swimming on lake	NM
MA047	L. D'varagh	23/11/2021	15:50	Mallard	8	lakes and ponds; swimming on lake	NM
MA048	L. Sheelin	23/11/2021	09:27	Mallard	9	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA049	L. Bane	23/11/2021	14:20	Mallard	46	lakes and ponds; swimming and dabbling on lake	NM
MA050	L. Kinale	23/11/2021	09:48	Mallard	3	lakes and ponds; flying low across lake and fringes	NM
MA051	L. Sheelin	23/11/2021	08:45	Mallard	5	lakes and ponds; calling within reedy margins	NM
MA052	L. Sheelin	23/11/2021	09:08	Mallard	3	lakes and ponds; calling within reedy margins	NM
MH042	R. Inny	23/11/2021	13:06	Moorhen	1	depositing/lowland rivers; wading along river	NM
MH043	L. Kinale	23/11/2021	10:55	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH044	L. Kinale	23/11/2021	09:50	Moorhen	2	lakes and ponds and reed and large sedge swamps; calling within reedy lake fringes	NM
MH045	L. D'varagh	23/11/2021	15:51	Moorhen	3	lakes and ponds; calling within lake fringes	NM
	L. D'varagh	23/11/2021	15:40	Mute Swan	12	lakes and ponds; swimming on lake + roosting on slipway	NM
	Derragh Lough	23/11/2021	11:10	Mute Swan	177	lakes and ponds; swimming on lake (+ juveniles)	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	32	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	22	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:55	Mute Swan	8	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	23/11/2021	10:15	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	23/11/2021	10:55	Mute Swan	15	lakes and ponds; swimming on lake	NM
		23/11/2021	15:22	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:44	Mute Swan	27	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:52	Mute Swan	58	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:35	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:46	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:47	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:55	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:58	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:14	Mute Swan	11	lakes and ponds; flying across lake	NM
WA009	L. Sheelin	23/11/2021	08:45	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reedy margins	NM
BH046	BN2	10/12/2021	15:34	Black-headed Gull	7	cutover bog; swirling over bog wetland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA028		10/12/2021	09:43	Cormorant	2	improved agricultural grassland; flying ne across farmland	NM
GG075	L. Sheelin	10/12/2021	09:04	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG076		10/12/2021	14:06	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG074	L. Sheelin	10/12/2021	08:35	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
H031	L. Bane	10/12/2021	16:04	Grey Heron	2	lakes and ponds and transition mire and quaking bog; perched on wet boggy margins of lake	NM
H032	R. Inny	10/12/2021	10:45	Grey Heron	1	highly modified/non-native woodland and depositing/lowland rivers; perched in tree along river	NM
H033	L. Kinale	10/12/2021	09:57	Grey Heron	1	lakes and ponds, semi-natural grassland and reed and large sedge swamps; calling from wet lake margins	NM
LB018	L. Sheelin	10/12/2021	08:37	Lesser Black-backed Gull	3	lakes and ponds; flying and swirling over lake	NM
LG050	L. Sheelin	10/12/2021	09:02	Little Grebe	6	lakes and ponds; swimming and diving close to lake shore	NM
LG051	Derragh Lough	10/12/2021	10:55	Little Grebe	12	lakes and ponds; calling within reedy margins	NM
MA053	L. Sheelin	10/12/2021	09:04	Mallard	12	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA054	Derragh Lough	10/12/2021	10:51	Mallard	16	lakes and ponds; swimming and dabbling along reedy margins of lake	NM
MA055	L. Sheelin	10/12/2021	08:36	Mallard	6	lakes and ponds; swimming along reedy shores	NM
MA056	BN2	10/12/2021	15:40	Mallard	7	cutover bog; foraging on rushy bare peat within bog wetland	NM
MA057	Bracklagh Lough	10/12/2021	09:26	Mallard	3	lakes and ponds; feeding near to reedy lake edges	NM
MH046	R. Inny	10/12/2021	12:07	Moorhen	3	depositing/lowland rivers; swimming on river	NM
MH047	L. Kinale	10/12/2021	09:54	Moorhen	7	lakes and ponds; swimming and calling along lake edges	NM
MH048	L. Sheelin	10/12/2021	08:41	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
	L. Sheelin	10/12/2021	08:35	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:40	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:59	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Kinale	10/12/2021	10:03	Mute Swan	9	lakes and ponds; swimming on lake	NM
		10/12/2021	14:06	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	10/12/2021	09:24	Mute Swan	12	lakes and ponds; swimming and feeding on lake	NM
	Derragh Lough	10/12/2021	10:50	Mute Swan	76	lakes and ponds; swimming and feeding on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA010	L. Kinale	10/12/2021	09:52	Water Rail	3	lakes and ponds and reed and large sedge swamps; pig calls from lake margins	NM
BH050	L. Sheelin	22/12/2021	13:45	Black-headed Gull	2	lakes and ponds; wheeling over lake	NM
BH047	L. D'varagh	22/12/2021	08:45	Black-headed Gull	5	lakes and ponds; swirling and swooping over lake	NM
BH048		22/12/2021	12:14	Black-headed Gull	6	improved agricultural grassland, hedgerows and lakes and ponds; flying s over farmland	NM
BH049		22/12/2021	13:35	Black-headed Gull	26	lakes and ponds; flying high and sw across lake	NM
CA029	Bracklagh Lough	22/12/2021	12:04	Cormorant	1	lakes and ponds; swimming on lake	NM
CA030	L. Sheelin	22/12/2021	13:40	Cormorant	1	lakes and ponds; flying low across lake	NM
GG077		22/12/2021	08:43	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG078	Deragh Lough	22/12/2021	11:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG080	L. Sheelin	22/12/2021	13:38	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG081	L. Sheelin	22/12/2021	13:41	Great Crested Grebe	23	lakes and ponds; swimming on lake	NM
GG082	L. Sheelin	22/12/2021	14:09	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG079	L. Kinale	22/12/2021	12:24	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H034	L. Sheelin	22/12/2021	13:35	Grey Heron	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H035		22/12/2021	15:47	Grey Heron	1	lakes and ponds and transition mire and quaking bog; perched on saturated lake fringes	NM
H036	R. Inny	22/12/2021	10:36	Grey Heron	1	semi-natural grassland and depositing/lowland rivers; perched along river	NM
H037	L. Sheelin	22/12/2021	13:10	Grey Heron	1	lakes and ponds; flying low and calling across lake	NM
H038		22/12/2021	13:47	Grey Heron	1	bogs and scrub; flying and calling across bog	NM
H039	L. Sheelin	22/12/2021	13:54	Grey Heron	1	lakes and ponds; flying across reedy lake fringes	NM
H040		22/12/2021	16:07	Grey Heron	1	cutover bog and scrub; flying across bog	NM
H041	L. Kinale	22/12/2021	12:21	Grey Heron	2	reed and large sedge swamps and lakes and ponds; calling from lake edge	NM
LB019	L. Sheelin	22/12/2021	13:37	Lesser Black-backed Gull	2	lakes and ponds; swooping over lake	NM
LG053	L. D'varagh	22/12/2021	08:35	Little Grebe	3	lakes and ponds; swimming close to shore	NM
LG058	L. Sheelin	22/12/2021	13:57	Little Grebe	3	lakes and ponds; swimming and diving within reedy margins	NM
LG057	Deragh Lough	22/12/2021	11:00	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM
LG055		22/12/2021	08:42	Little Grebe	3	lakes and ponds; swimming and calling within reedy margins	NM
LG054	L. D'varagh	22/12/2021	08:43	Little Grebe	7	lakes and ponds; swimming and calling within emergent reedy islets	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG052	L. D'varagh	22/12/2021	08:31	Little Grebe	3	lakes and ponds; calling within reedy margins of lake	NM
LG056	L. Kinale	22/12/2021	11:23	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA058	L. D'varagh	22/12/2021	08:34	Mallard	3	lakes and ponds; swimming on lake	NM
MA059	L. Kinale	22/12/2021	12:20	Mallard	5	lakes and ponds; swimming on lake	NM
MA060	L. Bane	22/12/2021	15:46	Mallard	41	lakes and ponds; swimming on lake	NM
MA061	BN2	22/12/2021	15:34	Mallard	7	cutover bog; swimming and foraging on bog wetland	NM
MA062	L. Sheelin	22/12/2021	13:36	Mallard	5	lakes and ponds; swimming along edge of reedy fringes	NM
MA063	Bracklagh Lough	22/12/2021	12:16	Mallard	2	lakes and ponds; flying low across lake	NM
MA064		22/12/2021	09:21	Mallard	2	watercourses; flushed from wet drain	NM
MA065		22/12/2021	09:32	Mallard	2	lakes and ponds; calling within reedy margins	NM
MH049	L. D'varagh	22/12/2021	08:32	Moorhen	4	lakes and ponds and highly modified/non-native woodland; wading within flooded willow margins	NM
MH050		22/12/2021	09:31	Moorhen	3	scrub and reed and large sedge swamps; calling within wetland / wet willow scrub	NM
MH051	L. Kinale	22/12/2021	11:23	Moorhen	2	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH052	L. Kinale	22/12/2021	12:14	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH053	L. Sheelin	22/12/2021	13:32	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH054	L. Sheelin	22/12/2021	13:55	Moorhen	5	lakes and ponds; calling within reedy margins	NM
	L. Sheelin	22/12/2021	13:05	Mute Swan	3	lakes and ponds; swimming within reedy corners of lake	NM
	L. D'varagh	22/12/2021	08:30	Mute Swan	46	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	11:25	Mute Swan	5	lakes and ponds; swimming on lake	NM
	Deragh Lough	22/12/2021	11:00	Mute Swan	128	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	22/12/2021	12:03	Mute Swan	13	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:18	Mute Swan	35	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:35	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:43	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	7	lakes and ponds; swimming on lake	NM
		22/12/2021	08:40	Mute Swan	7	lakes and ponds; swimming and foraging near lake edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		22/12/2021	09:30	Mute Swan	29	lakes and ponds; swimming and feeding on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	15	lakes and ponds; swimming and feeding along reedy lake fringes	NM
		22/12/2021	08:54	Mute Swan	5	lakes and ponds; roosting on lake edge	NM
	L. Bane	22/12/2021	15:44	Mute Swan	3	lakes and ponds; foraging within saturated edges of lake	NM
	R. Inny	22/12/2021	10:19	Mute Swan	3	depositing/lowland rivers; foraging along river edge (juveniles)	NM
WA011		22/12/2021	11:23	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reeds	NM
BH051	L. Iron	23/12/2021	15:16	Black-headed Gull	12	lakes and ponds; swimming on lake + flying along edges	NM
H042		23/12/2021	16:18	Grey Heron	1	lakes and ponds; flying low and calling adjacenet to lake	NM
MH055	L. Iron	23/12/2021	15:32	Moorhen	16	lakes and ponds; swimming within weedy edges of lake	NM
		23/12/2021	16:29	Mute Swan	3	improved agricultural grassland and hedgerows; flying sw across farmland	NM
BH054	L. D'varagh	04/01/2022	13:34	Black-headed Gull	8	lakes and ponds; flying and swooping over lake	NM
BH053	L. D'varagh	04/01/2022	10:10	Black-headed Gull	2	lakes and ponds, improved agricultural grassland and scrub; flying along lake shore	NM
BH052	L. D'varagh	04/01/2022	09:08	Black-headed Gull	34	lakes and ponds; circling and soaring over se end of lake	NM
CA031	L. D'varagh	04/01/2022	09:16	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA032	L. D'varagh	04/01/2022	10:05	Cormorant	2	lakes and ponds; swimming on lake	NM
CA033	L. D'varagh	04/01/2022	13:41	Cormorant	2	lakes and ponds; flyinglow across lake	NM
CA034	L. D'varagh	04/01/2022	09:21	Cormorant	2	lakes and ponds; flying low across lake	NM
CA035	L. D'varagh	04/01/2022	10:10	Cormorant	1	lakes and ponds; flying low across lake	NM
GG083	L. D'varagh	04/01/2022	09:10	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG084	L. D'varagh	04/01/2022	13:30	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
LB020	L. D'varagh	04/01/2022	13:37	Lesser Black-backed Gull	2	lakes and ponds; flying over lake	NM
LG061	L. D'varagh	04/01/2022	10:00	Little Grebe	7	lakes and ponds; swimming on lake	NM
LG063	L. D'varagh	04/01/2022	13:25	Little Grebe	5	lakes and ponds; swimming on lake	NM
LG065	L. D'varagh	04/01/2022	13:37	Little Grebe	6	lakes and ponds; swimming on lake	NM
LG060	L. D'varagh	04/01/2022	09:10	Little Grebe	9	lakes and ponds; swimming and diving on lake	NM
LG062	L. D'varagh	04/01/2022	13:30	Little Grebe	7	lakes and ponds; swimming and diving near edge of lake	NM
LG064	L. D'varagh	04/01/2022	13:31	Little Grebe	6	lakes and ponds; swimming and calling within tangled margins	NM
LG066	L. D'varagh	04/01/2022	14:47	Little Grebe	9	lakes and ponds; swimming and calling within reedbed boundary	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG059	L. Iron	04/01/2022	15:40	Little Grebe	37	lakes and ponds; swimming and calling on lake and within reedy boundaries	NM
MA066	L. D'varagh	04/01/2022	11:23	Mallard	18	other artificial lakes and ponds; swimming on pond	NM
MA067	L. Iron	04/01/2022	15:40	Mallard	32	lakes and ponds; swimming and foraging on lake and within reedy fringes	NM
MH056	L. D'varagh	04/01/2022	09:10	Moorhen	3	lakes and ponds; wading within flooded margins	NM
MH057	L. D'varagh	04/01/2022	11:40	Moorhen	3	other artificial lakes and ponds; swimming on pond	NM
MH058	L. D'varagh	04/01/2022	13:25	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH059	L. D'varagh	04/01/2022	14:45	Moorhen	6	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH060	L. D'varagh	04/01/2022	14:17	Moorhen	2	lakes and ponds; calling from lake edge	NM
	L. D'varagh	04/01/2022	10:48	Mute Swan	2	other artificial lakes and ponds; swimming on pond	NM
	L. Iron	04/01/2022	15:40	Mute Swan	43	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:35	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:27	Mute Swan	2	lakes and ponds; swimming and foraging in tangled margins of lake	NM
	L. D'varagh	04/01/2022	14:45	Mute Swan	7	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG085	L. D'varagh	05/01/2022	13:27	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
H043	BN2	05/01/2022	09:32	Grey Heron	2	cutover bog; flying low across bog wetland	NM
LG067	Derragh Lough	05/01/2022	10:35	Little Grebe	21	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG068	L. D'varagh	05/01/2022	13:21	Little Grebe	16	lakes and ponds; swimming and calling within reedy edges	NM
	Derragh Lough	05/01/2022	10:34	Mute Swan	115	lakes and ponds; swimming on lake	NM
	L. D'varagh	05/01/2022	13:21	Mute Swan	50	lakes and ponds; swimming on lake	NM
BH057	L. Sheelin	17/01/2022	09:47	Black-headed Gull	4	lakes and ponds; swirling over lake	NM
BH061	L. D'varagh	17/01/2022	13:13	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH063	L. Sheelin	17/01/2022	08:45	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH058	Bracklagh Lough	17/01/2022	10:56	Black-headed Gull	6	lakes and ponds; swimming and swirling over lake	NM
BH056	L. Sheelin	17/01/2022	09:50	Black-headed Gull	19	lakes and ponds; flying and swooping over lake - spread out over s of lake	NM
BH055	L. Sheelin	17/01/2022	09:46	Black-headed Gull	6	lakes and ponds; flying and swooping over lake	NM
BH059		17/01/2022	15:54	Black-headed Gull	2	lakes and ponds, transition mire and quaking bog and semi-natural grassland; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH060	L. D'varagh	17/01/2022	13:00	Black-headed Gull	4	lakes and ponds; flying across lake	NM
BH062	L. Sheelin	17/01/2022	08:34	Black-headed Gull	3	lakes and ponds; flying across lake	NM
CA036	Derragh Lough	17/01/2022	11:20	Cormorant	1	lakes and ponds; swimming on lake	NM
CA037	L. Sheelin	17/01/2022	09:50	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA038	L. Sheelin	17/01/2022	08:38	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA039	L. Sheelin	17/01/2022	08:46	Cormorant	14	scrub and lakes and ponds; perched in tree along lake	NM
CA040	L. Sheelin	17/01/2022	08:47	Cormorant	24	lakes and ponds; flying low across lake - not as one group but as numerous pairs and solitary individuals	NM
CA041	L. Sheelin	17/01/2022	09:49	Cormorant	1	lakes and ponds; flying high across sw area of lake	NM
GA006	L. Kinale N	17/01/2022	10:37	Gadwall	8	lakes and ponds; swimming on lake	NM
GA007	L. Bane	17/01/2022	15:50	Gadwall	6	lakes and ponds; swimming on lake	NM
GD002	L. Sheelin	17/01/2022	08:47	Goosander	28	lakes and ponds; swimming on lake	NM
GD001	L. Kinale	17/01/2022	10:35	Goosander	6	lakes and ponds and reed and large sedge swamps; flying s across lake	NM
GE001	BN2	17/01/2022	16:10	Green Sandpiper	1	cutover bog; flying rapidly across bog wetland + foraging + piercing call	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG087	Derragh Lough	17/01/2022	11:21	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG088	L. D'varagh	17/01/2022	13:02	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG090	L. D'varagh	17/01/2022	13:04	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG091	L. Sheelin	17/01/2022	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG093	L. Sheelin	17/01/2022	08:48	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG086	L. Kinale	17/01/2022	10:38	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG089	L. D'varagh	17/01/2022	13:10	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GG092	L. Sheelin	17/01/2022	08:45	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
H044	L. Bane	17/01/2022	15:50	Grey Heron	1	transition mire and quaking bog; perched on fringes	NM
H045	L. Sheelin	17/01/2022	09:50	Grey Heron	1	lakes and ponds; flying lowvand calling across lake	NM
H046	L. D'varagh	17/01/2022	13:07	Grey Heron	1	scrub and reed and large sedge swamps; flying low across scrub and wetland	NM
H047	L. Kinale	17/01/2022	10:40	Grey Heron	1	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H048	BN2	17/01/2022	16:20	Grey Heron	1	cutover bog and scrub; flying and calling across bog wetland	NM
H049	L. D'varagh	17/01/2022	13:17	Grey Heron	2	lakes and ponds; flying across lake	NM
H050	BN2	17/01/2022	16:24	Grey Heron	1	cutover bog; flying across bog + harried by rn	NM
LB021	L. Sheelin	17/01/2022	09:48	Lesser Black-backed Gull	2	lakes and ponds; flying across lake	NM
LG069	L. Sheelin	17/01/2022	10:26	Little Grebe	6	lakes and ponds and scrub; swimming close to and within flooded scrubby shore	NM
LG075	L. Sheelin	17/01/2022	08:53	Little Grebe	13	lakes and ponds; swimming and diving in sheltered area of lake	NM
LG071	L. D'varagh	17/01/2022	12:59	Little Grebe	5	lakes and ponds; swimming and diving close to lake shore	NM
LG072	L. D'varagh	17/01/2022	13:12	Little Grebe	12	lakes and ponds; swimming and calling within reedy islets close to lake shore	NM
LG074	L. Sheelin	17/01/2022	08:30	Little Grebe	6	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG073	L. D'varagh	17/01/2022	13:12	Little Grebe	7	lakes and ponds; swimming and calling on lake	NM
LG070	Derragh Lough	17/01/2022	11:20	Little Grebe	32	lakes and ponds; calling and swimming on lake and within reeds	NM
MA068	L. D'varagh	17/01/2022	13:10	Mallard	18	lakes and ponds; swimming on lake	NM
MA069	L. Sheelin	17/01/2022	08:46	Mallard	6	lakes and ponds; swimming on lake	NM
MA070	L. D'varagh	17/01/2022	13:52	Mallard	7	lakes and ponds; swimming and calling along reedy fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA071	L. D'varagh	17/01/2022	13:04	Mallard	4	lakes and ponds; flying low across lake	NM
MA072	L. Sheelin	17/01/2022	08:52	Mallard	4	lakes and ponds; calling within reedy margins of lake	NM
MH061	R. Inny	17/01/2022	14:38	Moorhen	3	depositing/lowland rivers; wading along river banks	NM
MH062	L. Sheelin	17/01/2022	08:45	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
MH063	L. D'varagh	17/01/2022	13:53	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH064	L. D'varagh	17/01/2022	13:08	Moorhen	6	lakes and ponds; calling within reedy margins	NM
MH065	L. D'varagh	17/01/2022	13:06	Moorhen	4	lakes and ponds and scrub; calling within flooded wooded margins of lake	NM
MH066	L. D'varagh	17/01/2022	13:14	Moorhen	6	lakes and ponds; calling and wading within reedy margins of lake	NM
MH067	Derragh Lough	17/01/2022	11:21	Moorhen	25	lakes and ponds and reed and large sedge swamps; calling and wading within reedy fringed	NM
	BN2	17/01/2022	16:09	Mute Swan	3	cutover bog; wading on bog wetland	NM
	L. Sheelin	17/01/2022	08:35	Mute Swan	7	lakes and ponds; swimminmg on lake	NM
	L. D'varagh	17/01/2022	13:23	Mute Swan	7	lakes and ponds; swimming within sw corner of lake	NM
	L. Sheelin	17/01/2022	09:56	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	09:45	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	17/01/2022	10:22	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Kinale N	17/01/2022	10:40	Mute Swan	220	lakes and ponds; swimming on lake	NM
	L. Kinale	17/01/2022	10:41	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	17/01/2022	10:56	Mute Swan	12	lakes and ponds; swimming on lake	NM
	Derragh Lough	17/01/2022	11:20	Mute Swan	76	lakes and ponds; swimming on lake	NM
	L. Kinale S	17/01/2022	11:46	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:51	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Bane	17/01/2022	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	12:58	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:15	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:05	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:18	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:30	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:43	Mute Swan	14	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:39	Mute Swan	5	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	17/01/2022	09:53	Mute Swan	17	lakes and ponds; swimming close to s shore	NM
	L. D'varagh	17/01/2022	13:06	Mute Swan	15	scrub and lakes and ponds; swimming and foraging along lake fringes and within edges of flooded woodland	NM
	L. Sheelin	17/01/2022	09:50	Mute Swan	18	lakes and ponds; swimming along n shore	NM
		17/01/2022	13:53	Mute Swan	2	improved agricultural grassland and semi-natural grassland; roosting on edge of flooding	NM
	R. Inny	17/01/2022	14:05	Mute Swan	61	improved agricultural grassland and depositing/lowland rivers; grazing on grassland along river (+5 swimming on river	NM
	R. Inny	17/01/2022	14:00	Mute Swan	14	improved agricultural grassland and depositing/lowland rivers; grazing on grassland adjacent to river (4 swimming on river)	NM
	BN2	17/01/2022	16:40	Mute Swan	2	cutover bog and scrub; flying sw across bog wetland and adjacent cutover bog	NM
		17/01/2022	11:16	Mute Swan	6	lakes and ponds and mixed broadleaved woodland; flying sw	NM
WA012	BN2	17/01/2022	16:46	Water Rail	3	cutover bog; pig calls within bog wetland	NM
WA013	L. Sheelin	17/01/2022	08:41	Water Rail	3	lakes and ponds; pig calls from within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH067		18/01/2022	11:15	Black-headed Gull	28	improved agricultural grassland; swirling and swooping over grassland	NM
BH064	L. Iron	18/01/2022	16:23	Black-headed Gull	6	improved agricultural grassland, semi-natural grassland and scrub; soaring over swollen lake fringes	NM
BH065		18/01/2022	10:18	Black-headed Gull	4	improved agricultural grassland and lakes and ponds; roosting and foraging beside flooded hollow of field	NM
BH066		18/01/2022	10:23	Black-headed Gull	1	improved agricultural grassland and hedgerows; flying across farmland	NM
CA042	L. D'varagh	18/01/2022	13:45	Cormorant	2	lakes and ponds; flying across lake	NM
LG076	L. Iron	18/01/2022	16:00	Little Grebe	17	lakes and ponds; swimming on lake	NM
MA073		18/01/2022	10:31	Mallard	2	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
MA074	L. Iron	18/01/2022	16:00	Mallard	67	lakes and ponds; swimming on lake	NM
		18/01/2022	10:30	Mute Swan	1	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
	L. Iron	18/01/2022	16:00	Mute Swan	34	lakes and ponds; swimming on lake and within swollen edges	NM
BH068	Lough Sheelin west	14/02/2022	11:45	Black-headed Gull	65	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH069	Bracklagh Lough	14/02/2022	12:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH070	Robinstown pond	14/02/2022	14:32	Black-headed Gull	7	lakes and ponds; foraging	KB
CA043	Lough Sheelin west	14/02/2022	11:45	Cormorant	3	lakes and ponds; foraging	KB
GG094	Lough Sheelin west	14/02/2022	11:45	Great Crested Grebe	17	lakes and ponds; foraging	KB
GG095	Bracklagh Lough	14/02/2022	12:20	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG096	Derragh Lough	14/02/2022	13:26	Great Crested Grebe	2	lakes and ponds; foraging	KB
H051	Lough Sheelin west	14/02/2022	11:45	Grey Heron	1	lakes and ponds; foraging	KB
HG001	Lough Sheelin west	14/02/2022	11:45	Herring Gull	1	lakes and ponds; foraging	KB
LG077	Lough Sheelin west	14/02/2022	11:45	Little Grebe	5	lakes and ponds; foraging	KB
LG078	Derragh Lough	14/02/2022	13:26	Little Grebe	4	lakes and ponds; foraging	KB
MA075	Derragh Lough	14/02/2022	13:26	Mallard	1	lakes and ponds; roosting	KB
MA076	Bracklagh Lough	14/02/2022	12:20	Mallard	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA077	Derragh Lough	14/02/2022	13:26	Mallard	2	lakes and ponds; foraging	KB
MH068	Lough Sheelin west	14/02/2022	11:45	Moorhen	2	lakes and ponds; foraging	KB
MH069	Bracklagh Lough	14/02/2022	12:20	Moorhen	3	lakes and ponds; foraging	KB
MH070	Lough Kinale south	14/02/2022	13:40	Moorhen	2	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	12	lakes and ponds; roosting	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	7	lakes and ponds; roosting	KB
	Lough Sheelin east	14/02/2022	10:40	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin centre	14/02/2022	11:00	Mute Swan	1		KB
	Lough Sheelin west	14/02/2022	11:45	Mute Swan	43	lakes and ponds; foraging	KB
	Bracklagh Lough	14/02/2022	12:20	Mute Swan	9	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	89	lakes and ponds; foraging	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	37	lakes and ponds; foraging	KB
	River Inny	14/02/2022	13:35	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	14/02/2022	13:40	Mute Swan	5	lakes and ponds; foraging	KB
SU001	Robinstown pond	14/02/2022	14:32	Shelduck	2	lakes and ponds; foraging	KB
CA044	Lough Derravaragh north	15/02/2022	13:13	Cormorant	2	lakes and ponds; foraging	KB
GG097	Lough Derravaragh south	15/02/2022	12:20	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG098	Lough Derravaragh north	15/02/2022	13:13	Great Crested Grebe	2	lakes and ponds; foraging	KB
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
LG079	Lough Derravaragh south	15/02/2022	12:20	Little Grebe	4	lakes and ponds; foraging	KB
LG080	Lough Derravaragh north	15/02/2022	13:13	Little Grebe	11	lakes and ponds; foraging	KB
MH071	Lough Derravaragh north	15/02/2022	13:13	Moorhen	1	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	4	lakes and ponds; roosting	KB
	Lough Derravaragh north	15/02/2022	13:13	Mute Swan	1		KB
	Lough Iron	15/02/2022	09:40	Mute Swan	12	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	15/02/2022	11:47	Mute Swan	8	watercourses and lakes and ponds; foraging	KB
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	24	lakes and ponds; foraging	KB
	River Inny and lake off Lough Derravaragh	15/02/2022	12:50	Mute Swan	4	lakes and ponds; foraging	KB
	Clonave, river Inny	15/02/2022	12:56	Mute Swan	19	improved agricultural grassland and watercourses; foraging	KB
	River Inny	15/02/2022	12:58	Mute Swan	4	improved agricultural grassland and watercourses; foraging	KB
	Derrycrave	15/02/2022	15:30	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
BH071	Bracklagh Lough	26/02/2022	09:00	Black-headed Gull	108	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH072	Lough Sheelin west	26/02/2022	09:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH073	Lough Kinale	26/02/2022	10:26	Black-headed Gull	56	lakes and ponds; foraging	KB
CA045	Lough Sheelin west	26/02/2022	09:20	Cormorant	2	lakes and ponds; foraging	KB
CA046	Lough Sheelin east	26/02/2022	10:14	Cormorant	1	lakes and ponds; foraging	KB
GG099	Bracklagh Lough	26/02/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG100	Lough Sheelin west	26/02/2022	09:20	Great Crested Grebe	22	lakes and ponds; foraging	KB
GG101	Lough Sheelin centre	26/02/2022	09:53	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG102	Lough Kinale	26/02/2022	10:26	Great Crested Grebe	9	lakes and ponds; foraging	KB
GG103	Derragh Lough	26/02/2022	11:04	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG104	Lough Kinale south	26/02/2022	11:28	Great Crested Grebe	1	lakes and ponds; foraging	KB
H052	Lough Sheelin west	26/02/2022	09:20	Grey Heron	2	lakes and ponds; foraging	KB
H053	Lough Kinale	26/02/2022	10:26	Grey Heron	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H054	Derragh Lough	26/02/2022	11:04	Grey Heron	3	lakes and ponds; foraging	KB
LG081	Lough Sheelin west	26/02/2022	09:20	Little Grebe	8	lakes and ponds; foraging	KB
LG082	Derragh Lough	26/02/2022	11:04	Little Grebe	4	lakes and ponds; foraging	KB
MA078	Derragh Lough	26/02/2022	11:04	Mallard	5	lakes and ponds; foraging	KB
MA079	Derrycrave	26/02/2022	13:28	Mallard	5	lakes and ponds and cutover bog; foraging	KB
MH072	Derragh Lough	26/02/2022	11:04	Moorhen	1	lakes and ponds; foraging	KB
MH073	Lough Kinale south	26/02/2022	11:28	Moorhen	1	lakes and ponds; foraging	KB
	Bracklagh Lough	26/02/2022	09:00	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin west	26/02/2022	09:20	Mute Swan	19	lakes and ponds; foraging	KB
	Lough Sheelin centre	26/02/2022	09:53	Mute Swan	5	lakes and ponds; foraging	KB
	Lough Kinale	26/02/2022	10:26	Mute Swan	218	lakes and ponds; foraging	KB
	Derragh Lough	26/02/2022	11:04	Mute Swan	35	lakes and ponds; foraging	KB
	Inny River	26/02/2022	11:22	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	26/02/2022	11:28	Mute Swan	8	lakes and ponds; foraging	KB
	Flooded cutaway bog on site	26/02/2022	12:58	Mute Swan	2	cutover bog; foraging	KB
	Derrycrave	26/02/2022	13:28	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
SU002	Robinstown pond	26/02/2022	13:42	Shelduck	2	lakes and ponds; foraging	KB
BH074	Lough Derravaragh south	28/02/2022	11:45	Black-headed Gull	28	lakes and ponds; foraging	KB
BH075	lake off Lough Derravaragh	28/02/2022	12:28	Black-headed Gull	8	lakes and ponds; foraging	KB
BH076	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Black-headed Gull	3	lakes and ponds and watercourses; foraging	KB
GG105	Lough Derravaragh south	28/02/2022	11:45	Great Crested Grebe	10	lakes and ponds; foraging	KB
GG106	lake off Lough Derravaragh	28/02/2022	12:28	Great Crested Grebe	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG107	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Great Crested Grebe	3	lakes and ponds and watercourses; foraging	KB
LG083	Lough Derravaragh south	28/02/2022	11:45	Little Grebe	6	lakes and ponds; foraging	KB
LG084	Lough Derravaragh north	28/02/2022	13:31	Little Grebe	3	lakes and ponds; foraging	KB
MH074	lake off Lough Derravaragh	28/02/2022	12:28	Moorhen	2	lakes and ponds; foraging	KB
MH075	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Moorhen	2	lakes and ponds and watercourses; foraging	KB
MH076	River Inny	28/02/2022	14:00	Moorhen	2	watercourses; foraging	KB
	Lough Derravaragh south	28/02/2022	11:45	Mute Swan	11	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	28/02/2022	12:28	Mute Swan	5	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava island	28/02/2022	13:13	Mute Swan	36	improved agricultural grassland and watercourses; foraging	KB
	Clonava island	28/02/2022	13:21	Mute Swan	14	improved agricultural grassland and watercourses; foraging	KB
	Lough Derravaragh north	28/02/2022	13:31	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Iron - piercefield fields	28/02/2022	15:20	Mute Swan	3	improved agricultural grassland; foraging	KB
BH077	Brackagh Lough	07/03/2022	09:00	Black-headed Gull	12	lakes and ponds; foraging	KB
BH078	Lough Kinale	07/03/2022	10:20	Black-headed Gull	8	lakes and ponds; foraging	KB
CA047	Lough Sheelin west	07/03/2022	09:16	Cormorant	8	lakes and ponds; roosting	KB
GG108	Brackagh Lough	07/03/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG109	Lough Sheelin west	07/03/2022	09:16	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG110	Lough Kinale	07/03/2022	10:20	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG111	Derragh Lough	07/03/2022	10:51	Great Crested Grebe	3	lakes and ponds; foraging	KB
LG085	Brackagh Lough	07/03/2022	09:00	Little Grebe	6	lakes and ponds; foraging	KB
LG086	Lough Sheelin west	07/03/2022	09:16	Little Grebe	4	lakes and ponds; foraging	KB
LG087	Derragh Lough	07/03/2022	10:51	Little Grebe	4	lakes and ponds; foraging	KB
LG088	Lough Kinale south	07/03/2022	11:08	Little Grebe	1	lakes and ponds; foraging	KB
LG089	Robinstown pond	07/03/2022	12:39	Little Grebe	2	lakes and ponds; foraging	KB
MH077	Brackagh Lough	07/03/2022	09:00	Moorhen	4	lakes and ponds; foraging	KB
MH078	Lough Sheelin west	07/03/2022	09:16	Moorhen	2	lakes and ponds; foraging	KB
MH079	Derragh Lough	07/03/2022	10:51	Moorhen	2	lakes and ponds; foraging	KB
MH080	Robinstown flooded fields	07/03/2022	12:50	Moorhen	2	wet grassland; foraging	KB
	Brackagh Lough	07/03/2022	09:00	Mute Swan	2	lakes and ponds; roosting	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	5	lakes and ponds; roosting	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Brackagh Lough	07/03/2022	09:00	Mute Swan	16	lakes and ponds; foraging	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	23	lakes and ponds; foraging	KB
	Lough Sheelin centre	07/03/2022	19:42	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin east	07/03/2022	10:05	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	07/03/2022	10:20	Mute Swan	42	lakes and ponds; foraging	KB
	Derragh Lough	07/03/2022	10:51	Mute Swan	31	lakes and ponds; foraging	KB
	Lough Kinale south	07/03/2022	11:08	Mute Swan	4	lakes and ponds; foraging	KB
	Robinstown pond	07/03/2022	12:39	Mute Swan	1	lakes and ponds; foraging	KB
	Robinstown flooded fields	07/03/2022	12:50	Mute Swan	2	wet grassland; foraging	KB
BH079	Lough Derravaragh south	08/03/2022	12:01	Black-headed Gull	33	lakes and ponds; foraging	KB
BH080	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	143	improved agricultural grassland; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH081	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	61	lakes and ponds; foraging	KB
CM006	Lough Derravaragh south	08/03/2022	12:01	Common Gull	1	lakes and ponds; foraging	KB
GG112	Lough Derravaragh south	08/03/2022	12:01	Great Crested Grebe	13	lakes and ponds; foraging	KB
GG113	Lake off Lough Derravaragh	08/03/2022	12:37	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG114	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Great Crested Grebe	4	lakes and ponds and watercourses; foraging	KB
GG115	Lough Derravaragh north	08/03/2022	13:32	Great Crested Grebe	2	lakes and ponds; foraging	KB
LG090	Lough Derravaragh south	08/03/2022	12:01	Little Grebe	4	lakes and ponds; foraging	KB
LG091	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Little Grebe	2	lakes and ponds and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA080	Lake off Lough Derravaragh	08/03/2022	12:37	Mallard	7	lakes and ponds; foraging	KB
MA081	Lough Derravaragh north	08/03/2022	13:32	Mallard	20	lakes and ponds; foraging	KB
MA082	Lough Bane	08/03/2022	15:30	Mallard	2	lakes and ponds; foraging	KB
MA083	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mallard	1	lakes and ponds; foraging	KB
	Lough Derravaragh south	08/03/2022	12:01	Mute Swan	8	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	2	improved agricultural grassland; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	4	lakes and ponds; foraging	KB
	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava	08/03/2022	13:22	Mute Swan	38	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny	08/03/2022	13:24	Mute Swan	17	watercourses; foraging	KB
	Lough Derravaragh north	08/03/2022	13:32	Mute Swan	5	lakes and ponds; foraging	KB
	Flooded bog on site	08/03/2022	15:24	Mute Swan	1	cutover bog; foraging	KB
	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mute Swan	2	lakes and ponds; foraging	KB
BH082	Brackagh Lough	31/03/2022	08:00	Black-headed Gull	3	lakes and ponds; foraging	KB
BH083	Lough Sheelin west	31/03/2022	08:20	Black-headed Gull	32	lakes and ponds; foraging	KB
BH084	Derragh Lough	31/03/2022	09:32	Black-headed Gull	2	lakes and ponds; foraging	KB
BH086	Lough Derravaragh south	31/03/2022	15:27	Black-headed Gull	16	lakes and ponds; foraging	KB
BH085	River Inny	31/03/2022	10:24	Black-headed Gull	3	watercourses and cutover bog; flying over	KB
GG116	Lough Sheelin west	31/03/2022	08:20	Great Crested Grebe	15	lakes and ponds; foraging	KB
GG117	Lough Kinale	31/03/2022	09:07	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG118	Derragh Lough	31/03/2022	09:32	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG119	Lough Kinale south	31/03/2022	09:50	Great Crested Grebe	1	lakes and ponds; foraging	KB
GG120	Lough Derravaragh north	31/03/2022	13:41	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG121	Lake off Lough Derravaragh	31/03/2022	15:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG122	Lough Derravaragh south	31/03/2022	15:27	Great Crested Grebe	13	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB
H055	Lough Sheelin west	31/03/2022	08:20	Grey Heron	1	lakes and ponds; foraging	KB
H056	Derragh Lough	31/03/2022	09:32	Grey Heron	1	lakes and ponds; foraging	KB
LG092	Derragh Lough	31/03/2022	09:32	Little Grebe	2	lakes and ponds; foraging	KB
LG093	Lough Kinale south	31/03/2022	09:50	Little Grebe	1	lakes and ponds; foraging	KB
LG094	Lough Derravaragh north	31/03/2022	13:41	Little Grebe	3	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG095	Lough Derravaragh south	31/03/2022	15:27	Little Grebe	1	lakes and ponds; foraging	KB
MA084	Brackagh Lough	31/03/2022	08:00	Mallard	2	lakes and ponds; foraging	KB
MA085	Lough Kinale	31/03/2022	09:07	Mallard	2	lakes and ponds; foraging	KB
MA086	Derragh Lough	31/03/2022	09:32	Mallard	3	lakes and ponds; foraging	KB
MA087	Flooded bog on site	31/03/2022	11:20	Mallard	1	cutover bog; foraging	KB
MA088	Lough Bane	31/03/2022	11:25	Mallard	1	lakes and ponds; foraging	KB
MA089	Lough Derravaragh north	31/03/2022	13:41	Mallard	10	lakes and ponds; foraging	KB
MA090	Lake off Lough Derravaragh	31/03/2022	15:00	Mallard	4	lakes and ponds; foraging	KB
MA091	Lough Derravaragh south	31/03/2022	15:27	Mallard	6	lakes and ponds; foraging	KB
MH081	Lough Sheelin east	31/03/2022	08:45	Moorhen	1	lakes and ponds; foraging	KB
MH082	River Inny	31/03/2022	09:40	Moorhen	1	watercourses; foraging	KB
MH083	Robinstown flooded fields	31/03/2022	13:16	Moorhen	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH084	Lough Derravaragh north	31/03/2022	13:41	Moorhen	2	lakes and ponds; foraging	KB
	Brackagh Lough	31/03/2022	08:00	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin west	31/03/2022	08:20	Mute Swan	11	lakes and ponds; foraging	KB
	Lough Sheelin centre	31/03/2022	08:32	Mute Swan	21	lakes and ponds; foraging	KB
	Lough Sheelin east	31/03/2022	08:45	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	31/03/2022	09:07	Mute Swan	214	lakes and ponds; foraging	KB
	Derragh Lough	31/03/2022	09:32	Mute Swan	34	lakes and ponds; foraging	KB
	Lough Kinale south	31/03/2022	09:50	Mute Swan	7	lakes and ponds; foraging	KB
	Flooded bog on site	31/03/2022	11:20	Mute Swan	1	cutover bog; foraging	KB
	Lough Bane	31/03/2022	11:25	Mute Swan	1	lakes and ponds; foraging	KB
	Lough Derravaragh north	31/03/2022	13:41	Mute Swan	11	lakes and ponds; foraging	KB
	River Inny	31/03/2022	14:02	Mute Swan	7	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Mute Swan	5	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	31/03/2022	15:00	Mute Swan	3	lakes and ponds; foraging	KB
	Lough Derravaragh south	31/03/2022	15:27	Mute Swan	32	lakes and ponds; foraging	KB
SU003	Robinstown pond	31/03/2022	13:10	Shelduck	2	lakes and ponds; foraging	KB

Table 1-67 Incidental Non-target Species Observations

Incidental Records							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
	Breeding Walkover Survey, onsite	07/04/2021	08:21	Hare	1	mixed broadleaved/conifer woodland; feeding	PM
	Breeding Walkover Survey, 500m survey radius	07/04/2021	09:21	Hare	1	cutover bog; walking	PM
	Breeding Raptor Survey, rvp6	29/04/2021	13:21	Mallard	1	wet grassland; travelling	PM
	Breeding Raptor Survey, rvp6	29/04/2021	14:35	Mallard	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:06	Black-Headed Gull	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:41	Grey Heron	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2	30/04/2021	08:16	Mallard	1	improved agricultural grassland and short rotation coppice; travelling; landed	PM
	Breeding Raptor Survey, rvp1	30/04/2021	12:45	Mallard	2	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:29	Ringed Plover	2	cutover bog; landed and began territorial behaviour, either m&f displaying or 2m posturing	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Black-Headed Gull	1	improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:23	Black-Headed Gull	3	cutover bog; travelling; landed	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Grey Heron	1	cutover bog; flew and landed on bog	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:47	Grey Heron	1	depositing/lowland rivers and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Mallard	3	cutover bog; one flew and landed beside pair	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:50	Mallard	3	cutover bog; flew in to join other ma	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:03	Moorhen	1	cutover bog; feeding	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Mute Swan	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:01	Ringed Plover	1	cutover bog; flying; landedand began feeding	PM
	Breeding Walkover Survey, on site	14/05/2021	08:27	Hare	1	cutover bog; running	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Walkover Survey, on site	14/05/2021	05:53	Red Fox	1	improved agricultural grassland; carrying prey (chicken)	PM
	Breeding Walkover Survey, on site	14/05/2021	07:23	Red Squirrel	1	conifer plantation; ran across track	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:12	Grey Heron	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:48	Grey Heron	1	mixed broadleaved/conifer woodland; travelling	PM
	Vantage Point Survey, vp4	21/05/2021	06:37	Hare	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	19:21	Black-Headed Gull	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	18:02	Grey Heron	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:10	Black-Headed Gull	3	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Grey Heron	1	cutover bog; circling before landing	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:30	Irish Hare	1	cutover bog; travelling	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	03/06/2021	18:09	Mallard	5	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:18	Mallard	20	conifer plantation and cutover bog; coming into roost, all males	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:24	Mallard	43	cutover bog; flying to other lake	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Ringed Plover	1	cutover bog; preening	PM
	Breeding Raptor Survey, rvp6	04/06/2021	19:26	Grey Heron	1	depositing/lowland rivers; travelling	PM
	Breeding Raptor Survey, rvp6	04/06/2021	18:47	Mallard	1	cutover bog; travelling, male	PM
	Breeding Woodcock Survey, t3 coole	04/06/2021	21:45	Mink	1	conifer plantation; travelling	TRea
	Breeding Raptor Survey, rvp2	28/06/2021	21:10	Black-Headed Gull	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:10	Black-Headed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:56	Black-Headed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling, juvenile	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:23	Great Spotted Woodpecker	1	conifer plantation; on tree	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp2	28/06/2021	19:52	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	20:24	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, coole brvp5	13/07/2021	14:20	Pine Martin	1	bogs and highly modified/non-native woodland; travelling	TRea
	Breeding Raptor Survey, rvp1 coole	19/07/2021	10:29	Meadow Pipit	2	bogs; display	TRea
	Breeding Walkover Survey, 500m survey radius	23/07/2021	08:01	Irish Hare	1	cutover bog; travelling	PM
	Vantage Point Survey, coole vp6	19/08/2021	15:44	Meadow Pipit	6	cutover bog; flying, calling, present through duration of survey	TRea
GL001	Wildfowl Distribution Survey, r. inny	12/10/2021	15:04	Grey Wagtail	1	depositing/lowland rivers; flying along river	NM
GL002	Wildfowl Distribution Survey,	23/11/2021	13:12	Grey Wagtail	2	depositing/lowland rivers and hedgerows; flitting under bridge	NM
RE001	Vantage Point Survey, clonrobert	25/01/2022	14:07	Redwing	1	improved agricultural grassland and treelines; flying	ZE

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	Vantage Point Survey, coole vp6	08/03/2022	13:13	Mallard	2	cutover bog; flying, 2 ma seen flying in route to site	NS

APPENDIX 3

CONFIDENTIAL DATA

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Table 1-1 Lapwing Breeding Walkover Survey Data 1
Table 1-2 Lapwing Incidental Observations Data 2

1. APPENDIX 3 (CONFIDENTIAL SURVEY DATA)

Table 1-1 Lapwing Breeding Walkover Survey Data

Breeding Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
L001	07/04/2021	09:21	Lapwing	2	cutover bog; roosting (pair; probable breeding)	PM
L002	07/04/2021	12:37	Lapwing	2	cutover bog; pair displaying (courtship and display; probable breeding)	PM
L003	14/05/2021	08:05	Lapwing	1	cutover bog; mobbing bh (distraction display; confirmed breeding)	PM
L004	14/05/2021	08:07	Lapwing	2	cutover bog; displaying/chasing each other, likely 2 pairs in this area; one at each end of wetland (courtship and display; probable breeding)	PM
L005	14/05/2021	11:35	Lapwing	1	cutover bog; aggitated calls/distraction display upon seeing surveyor (distraction display; confirmed breeding)	PM
L006	18/06/2021	07:49	Lapwing	1	cutover bog; territorial calls (permanent territory; probable breeding)	PM
L007	15/03/2022	12:27	Lapwing	8	scrub; nest building (nest building; probable breeding)	NS

Table 1-2 Lapwing Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L001	Breeding Raptor Survey, rvp1	30/04/2021	12:51	Lapwing	1	cutover bog; short display flight	PM
L002	Breeding Raptor Survey, rvp1	30/04/2021	13:11	Lapwing	1	cutover bog; travelling; landed again	PM
L003	Breeding Raptor Survey, rvp1	30/04/2021	13:37	Lapwing	2	cutover bog; feeding together	PM
L004	Breeding Raptor Survey, rvp1	06/05/2021	16:38	Lapwing	2	cutover bog; on ground; one did short display flight	PM
L005	Breeding Raptor Survey, rvp1	06/05/2021	16:49	Lapwing	1	cutover bog; circling before landing	PM
L006	Breeding Raptor Survey, rvp1	06/05/2021	17:23	Lapwing	3	cutover bog; aggitated behaviour; mobbing bh, two pairs present	PM
L007	Breeding Raptor Survey, rvp1	06/05/2021	18:02	Lapwing	1	cutover bog; on nest	PM
L008	Breeding Raptor Survey, rvp1	06/05/2021	19:23	Lapwing	3	cutover bog; travelling; landed on bog, 3 additional birds; not resident birds seen earlier	PM
L009	Breeding Raptor Survey, rvp1	03/06/2021	18:28	Lapwing	1	cutover bog; roosting	PM
L010	Breeding Raptor Survey, rvp1	03/06/2021	18:34	Lapwing	2	cutover bog; circling before landing again	PM

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title
Lapwing Observations Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 2.2
Scale 1:45000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Confirmed Breeding Territory

N

Drawing Title	
Lapwing Breeding Territories	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.2.1
Scale: 1:45000	Date: 05/07/2022

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Drawing Title: Lapwing Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
200445g	Fig. 7.5
Scale	Date
1:50000	06/07/2022

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Map Legend

Wind Farm Site

Turbine Layout

Lapwing Breeding Territories

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Drawing Title

Lapwing
Incidental Observations

Project Title

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 7.5.1
Scale	Date
1:50000	06/07/2022

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Map Legend
Wind Farm Site
Occupied Peregrine Breeding Site
Occupied PE Breeding Territory
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N
Drawing Title
Occupied Peregrine Breeding Location
Project Title
Coole Wind Farm
Drawn By
IH
Checked By
PC
Project No.
200445g
Drawing No.
Fig. 8
Scale
1:48707
Date
27.10.2022
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APPENDIX 4

FIGURES

Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

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N

Drawing Title	
Vantage Point Locations	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 1
Scale: 1:25000	Date: 05/07/2022

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Map Legend

Wind Farm Site

Vantage Point Locations

N

Drawing Title
Viewshed analysis (20m swept Height)

Project Title
Coole Wind Farm

Drawn By	Checked By
IH	PC
Project No. 200445g	Drawing No. Fig. 1.A
Scale 1:48707	Date 27.10.2022

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Map Legend

- Wind Farm Site
- Vantage Point Locations

N

Drawing Title: Viewshed analysis (25m swept Height)	
Project Title: Coole Wind Farm	
Drawn By: IH	Checked By: PC
Project No.: 200445g	Drawing No.: Fig. 1.B
Scale: 1:48707	Date: 27.10.2022

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Map Legend

Wind Farm Site

Vantage Point Locations

N

Drawing Title: Viewshed analysis (26m Swept Height)	
Project Title: Coole Wind Farm	
Drawn By: IH	Checked By: PC
Project No.: 200445g	Drawing No.: Fig. 1.C
Scale: 1:48707	Date: 27.10.2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title	
Golden Plover Observations. Vantage Point Surveys	
Project Title	
Coole Wind Farm	
Drawn By: P. Manley	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.1
Scale: 1:45000	Date: 05/07/2022

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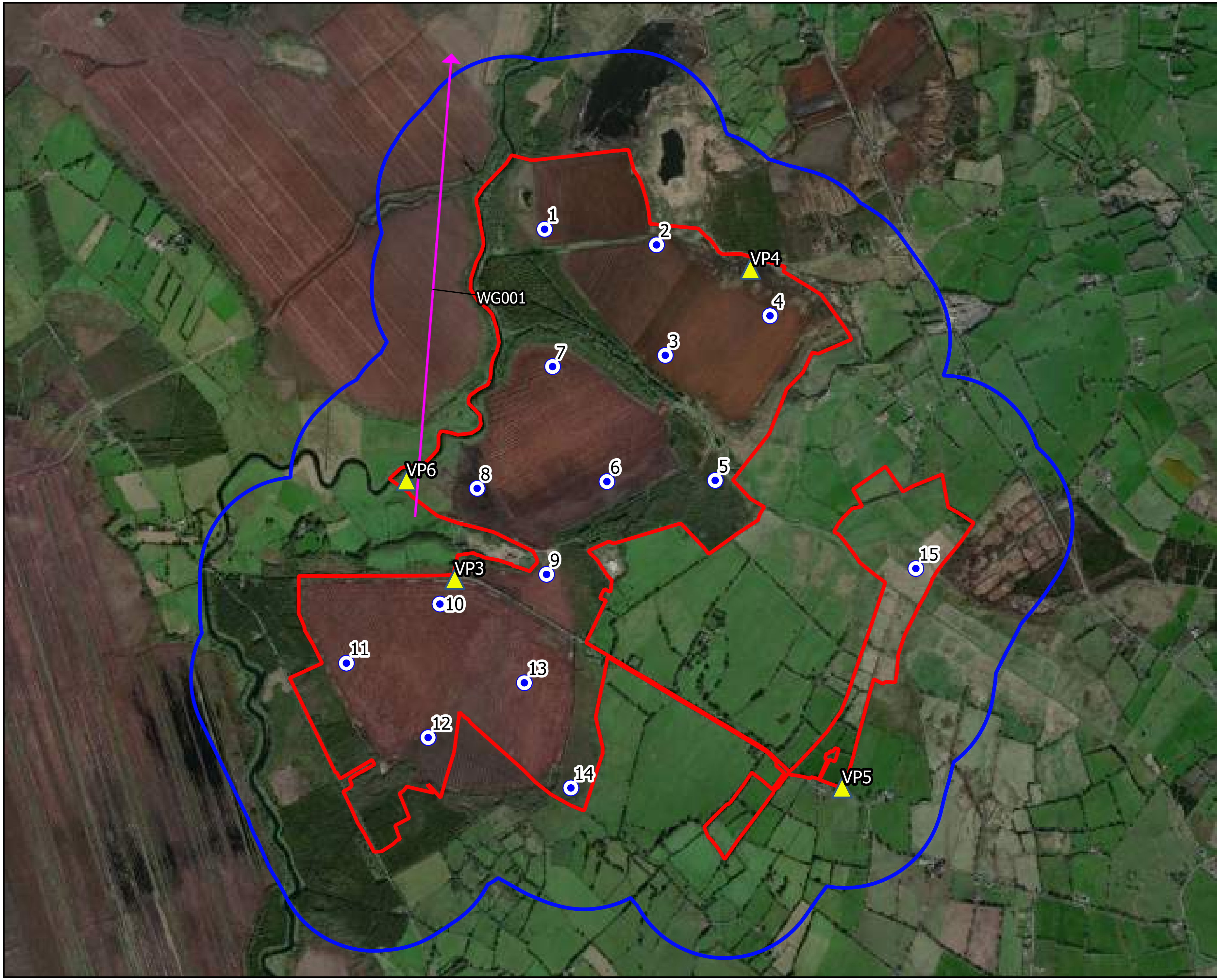

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

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Drawing Title	
White-fronted Goose Obs. Vantage Point Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.2
Scale: 1:25000	Date: 05/07/2022

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Drawing Title
Hen Harrier Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No. 200445g	Drawing No. Fig. 1.3
Scale 1:25000	Date 05/07/2022

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Drawing Title
Kingfisher Observations Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
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Project No. 200445g	Drawing No. Fig. 1.4
Scale 1:25000	Date 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

Flightline

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Drawing Title
Merlin Observations Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
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Project No. 200445g	Drawing No. Fig. 1.5
Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

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Drawing Title	Peregrine Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.6
Scale: 1:25000	Date: 05/07/2022

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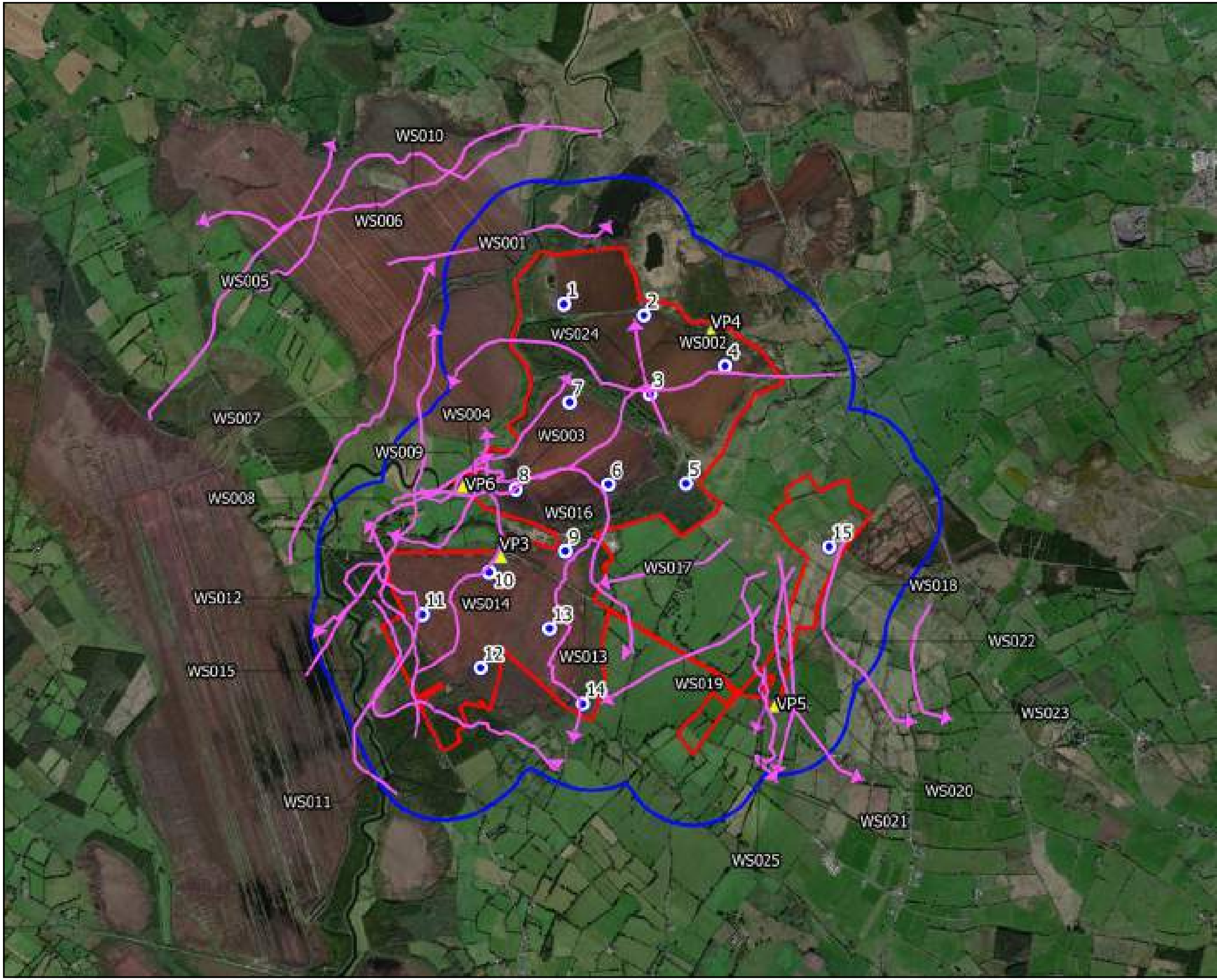

Map Legend

Wind Farm Site
500m Survey Radius
Turbine Layout
Vantage Point Location
Flightline

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N

Drawing Title
Whooper Swan Observations Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
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Project No. 200445g	Drawing No. Fig. 1.7
Scale 1:35000	Date 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

Flightline

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Drawing Title: Coot Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.8
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title	Curlew Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.9
Scale: 1:25000	Date: 05/07/2022

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Map Legend
Wind Farm Site
500m Survey Radius
Turbine Layout
Vantage Point Location
Flightline
K024
K020
K013
K010
K028
K003
VP4
K006
K025
K017
K026
K007
K001
K004
K027
K005
K002
K021
VP6
K022
K009
VP3
K016
K019
K015
K012
K018
K008
K011
VP5
K029
K023
K014
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Drawing Title
Kestrel Observations Vantage Point Surveys
Project Title
Coole Wind Farm
Drawn By
I. Hynes
Checked By
P. Cregg
Project No.
200445g
Drawing No.
Fig. 1.10
Scale
1:30000
Date
05/07/2022
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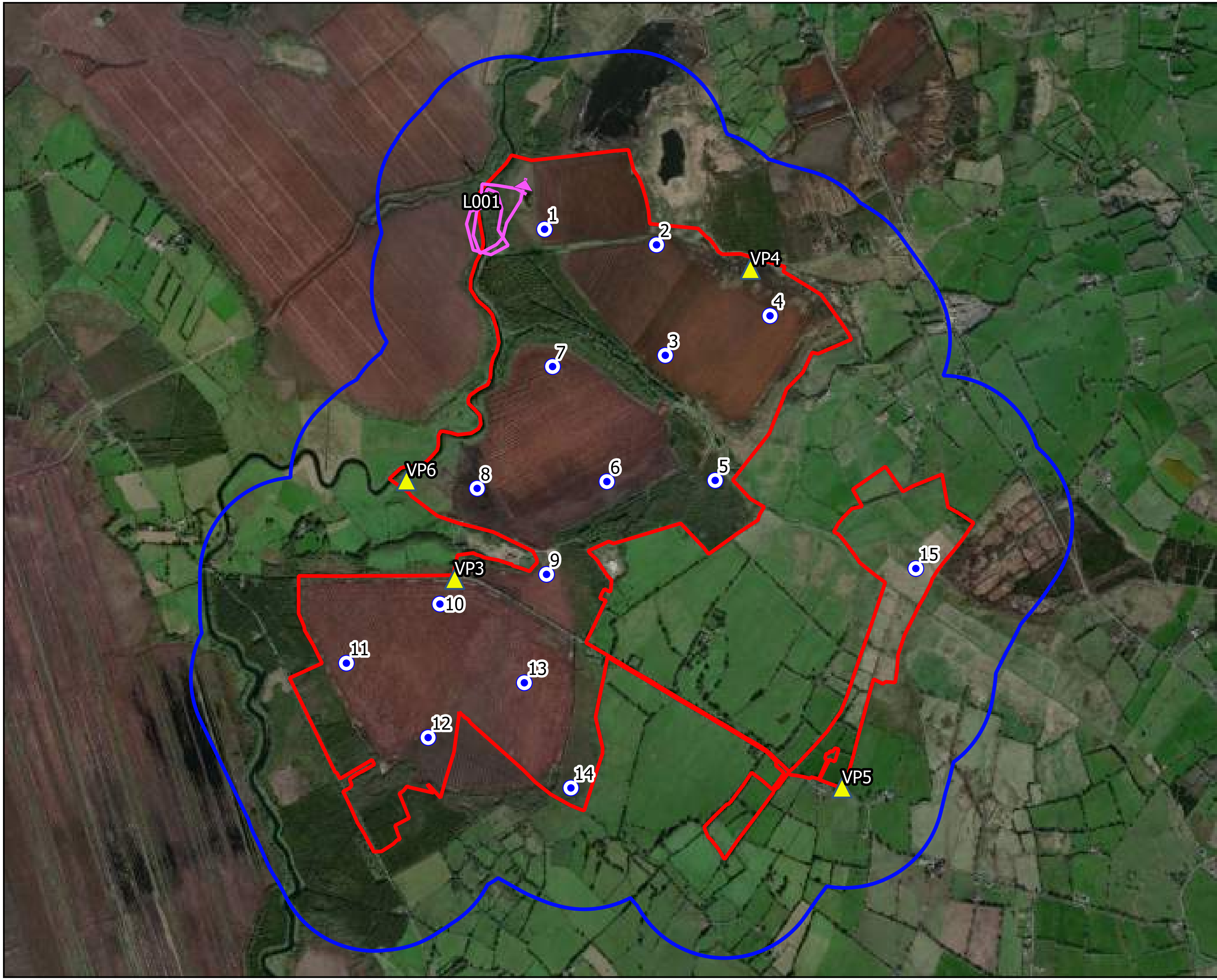

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title: Lapwing Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I. Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.11
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline
- Non-flight observations

Drawing Title: Snipe Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I. hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.12
Scale: 1:25000	Date: 05/07/2022

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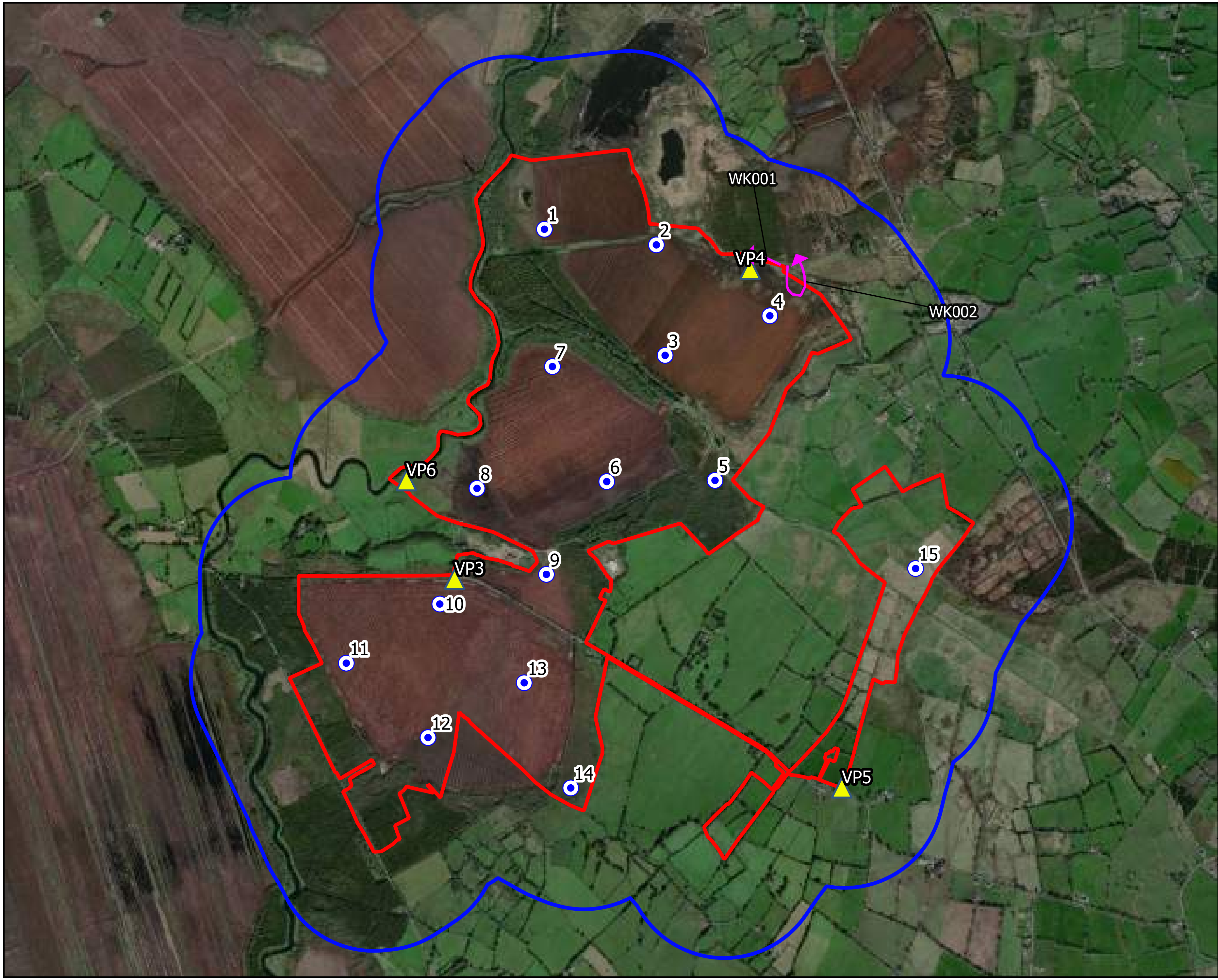

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: Woodcock Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I. Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.13
Scale: 1:25000	Date: 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

Flightline

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Drawing Title: Buzzard Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.14
Scale: 1:45000	Date: 05/07/2022

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Map Legend
Wind Farm Site
500m Survey Radius
Turbine Layout
Vantage Point Location
Possible Breeding Territories
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
VP3
VP4
VP5
VP6
N
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Buzzard Breeding Territories
Vantage Point Surveys
Coole Wind Farm
I.Hynes
P.Cregg
200445g
Fig. 1.14.1
1:45000
05/07/2022
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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title	
Sparrowhawk Observations Vantage Point Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.15
Scale: 1:25000	Date: 05/07/2022

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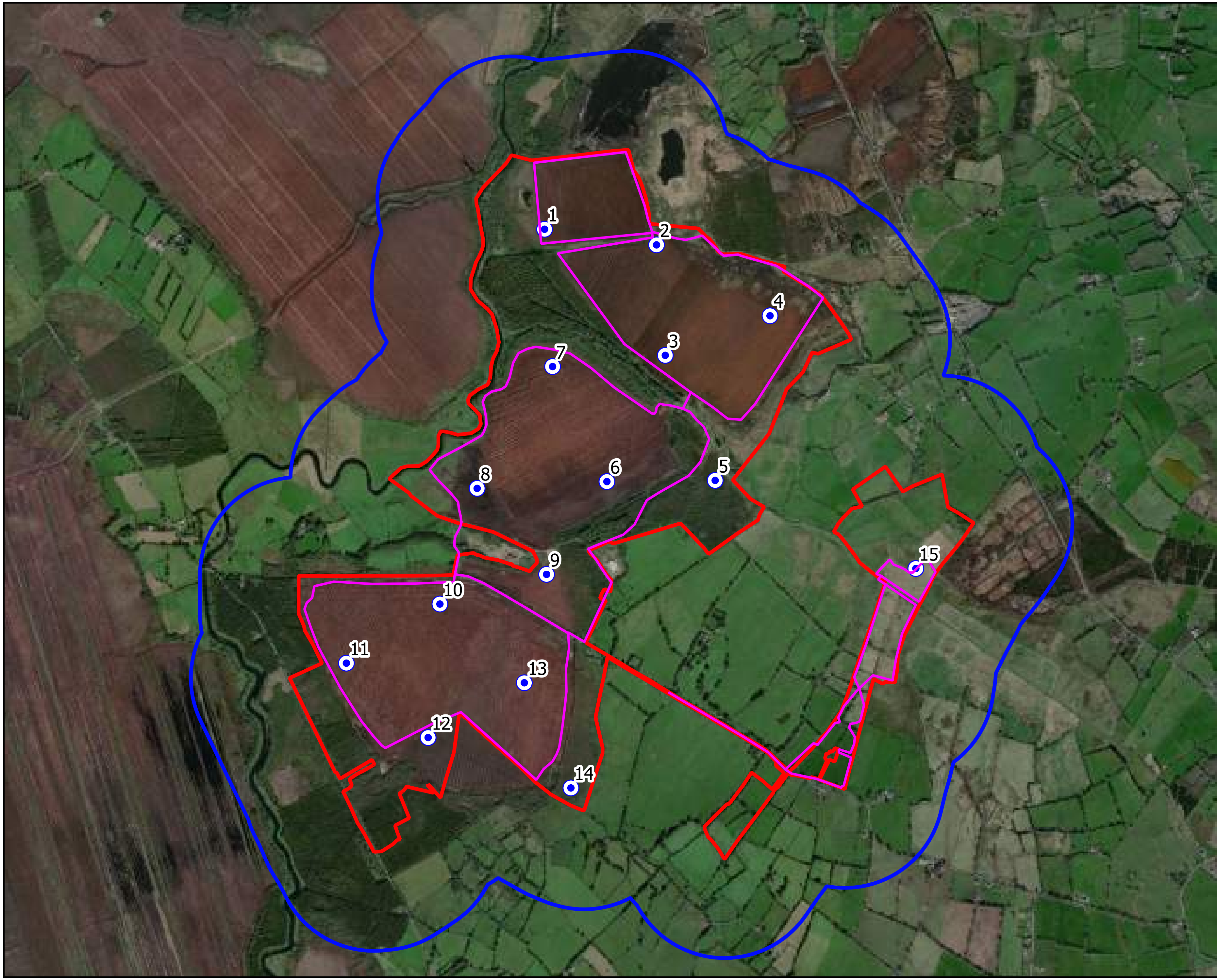

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Walkover Transects

N

Drawing Title	
Breeding Walkover Transects	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	
Golden Plover Observations Breeding Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.1
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	
Snipe Observations Breeding Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.3
Scale: 1:45000	Date: 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Probable Territory

N

Drawing Title: Snipe Breeding Territories

Project Title: Coole Wind Farm

Drawn By	Checked By
P. Manley	P. Cregg
Project No. 200445g	Drawing No. Fig. 6.2
Scale 1:45000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title: Buzzard Observations Breeding Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.4
Scale: 1:45000	Date: 05/07/2022

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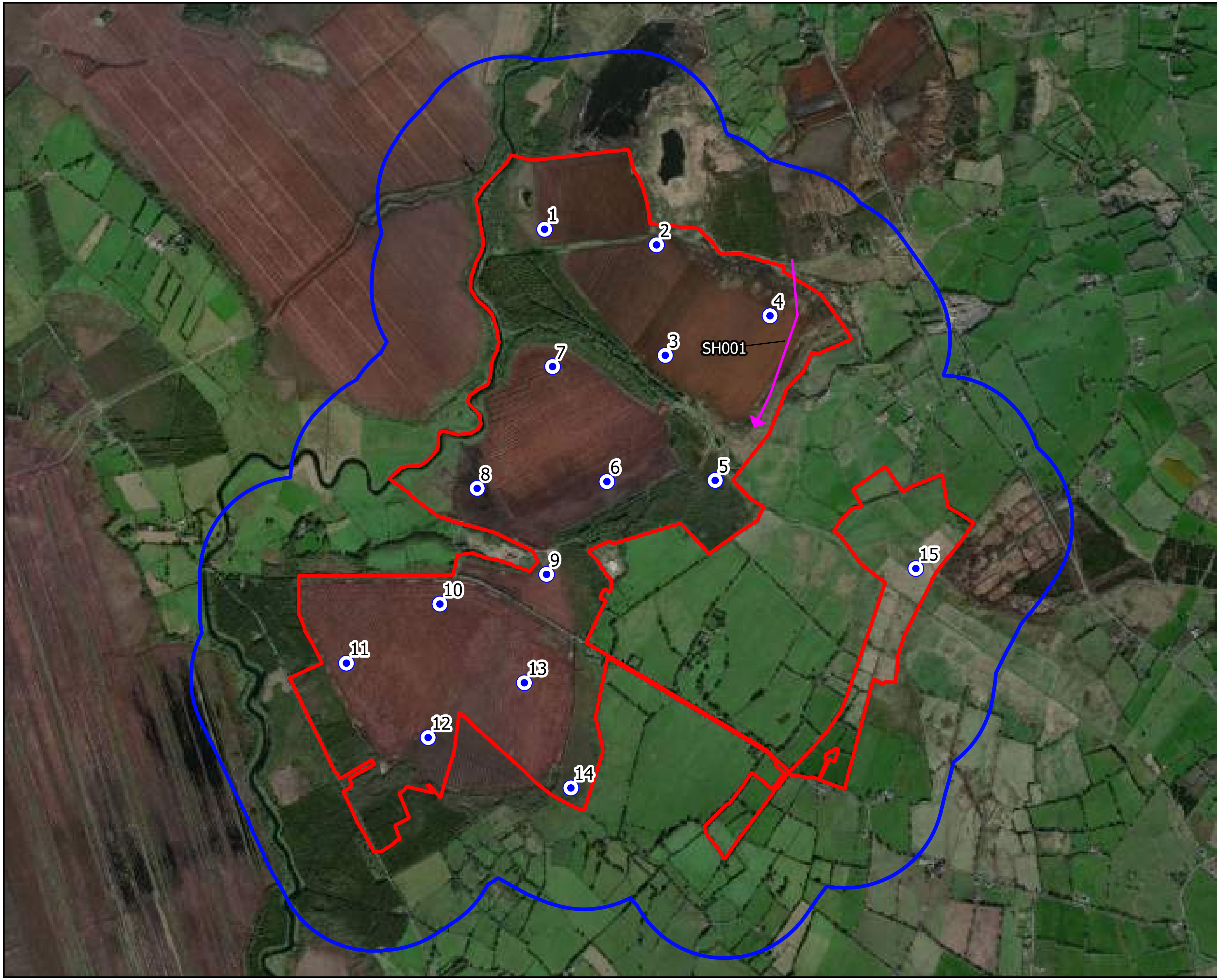

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title	Sparrowhawk Observations Breeding Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.5
Scale: 1:25000	Date: 05/07/2022

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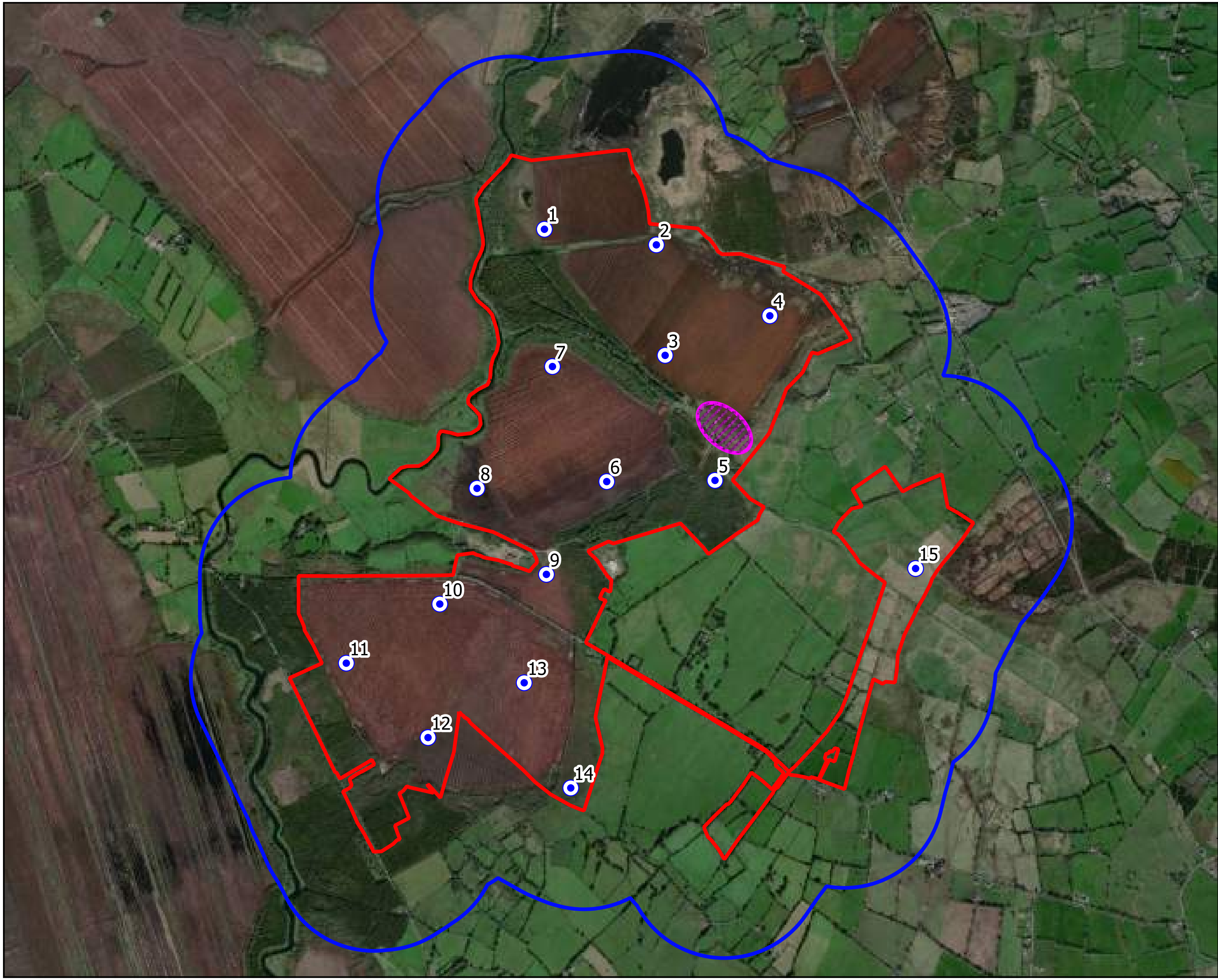

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Confirmed Territory

Drawing Title	Sparrowhawk Breeding Territory
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 2.5.1
Scale: 1:25000	Date: 05/07/2022

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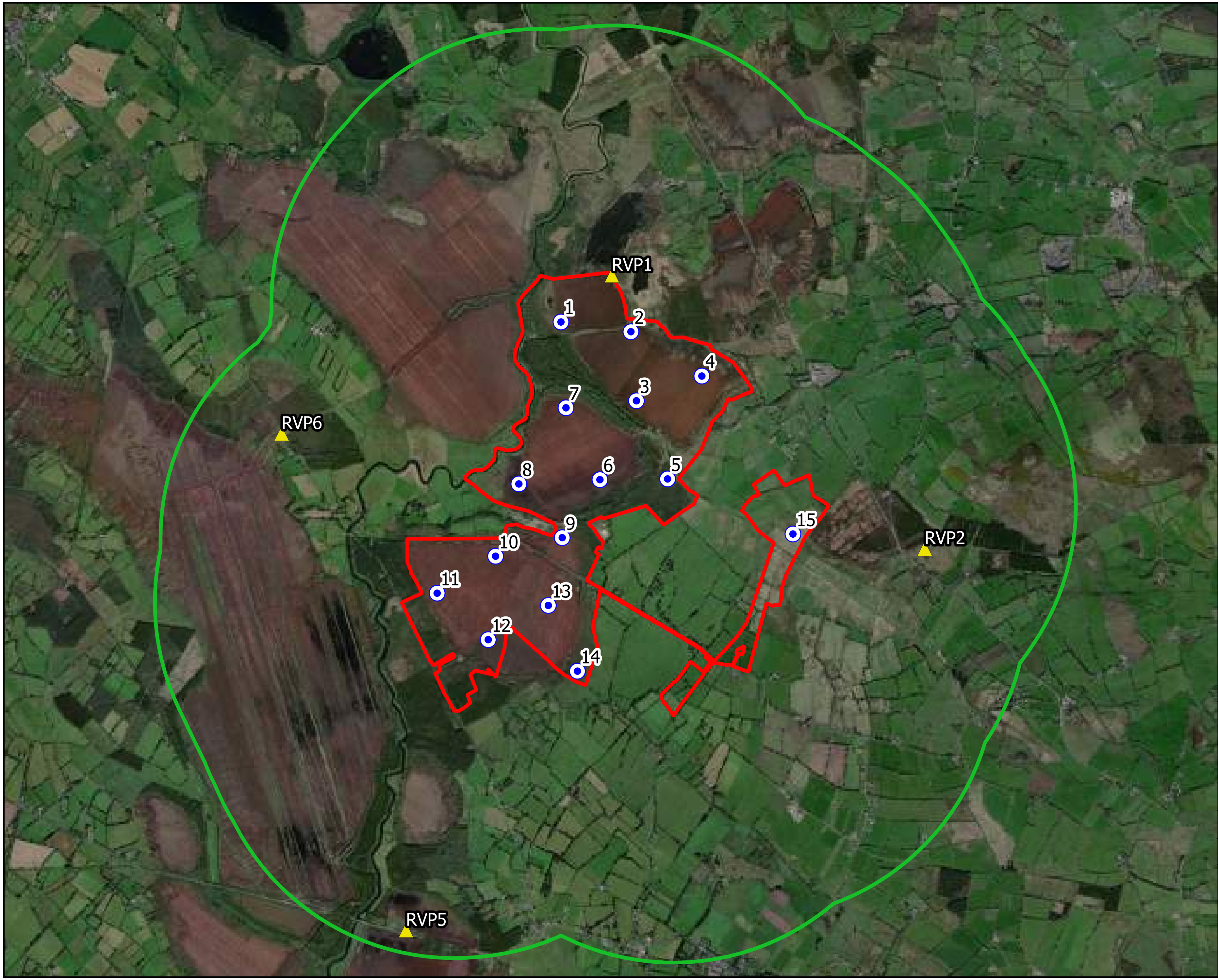

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations

Drawing Title: Breeding Raptor Vantage Point Locations	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3
Scale: 1:40000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

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Drawing Title: Peregrine Observations Breeding Raptor Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.1
Scale: 1:40000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

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Drawing Title	White-tailed Eagle Obs. Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.2
Scale: 1:40000	Date: 05/07/2022

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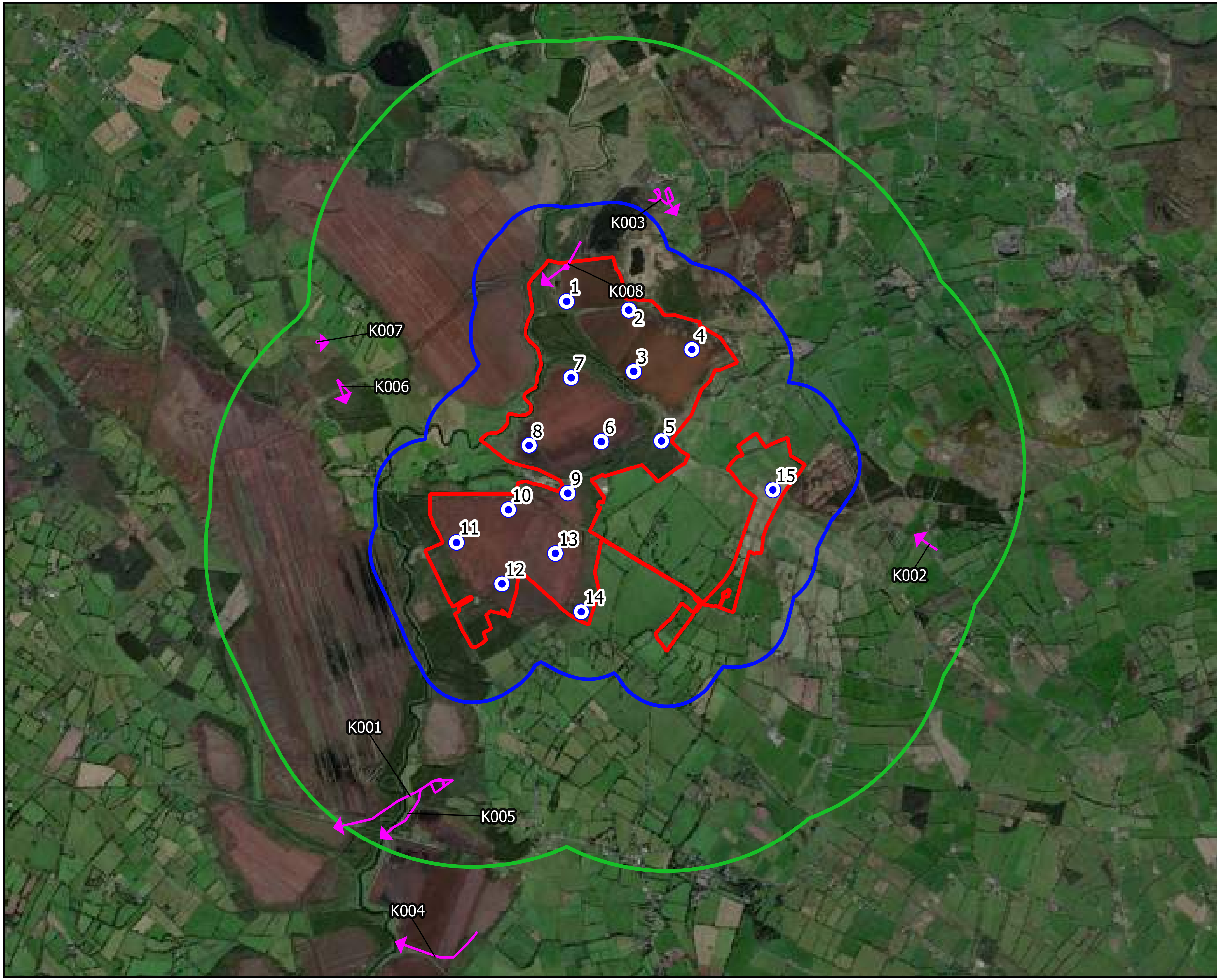

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

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Drawing Title	
Kestrel Observations Breeding Raptor Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.3
Scale: 1:45000	Date: 05/07/2022

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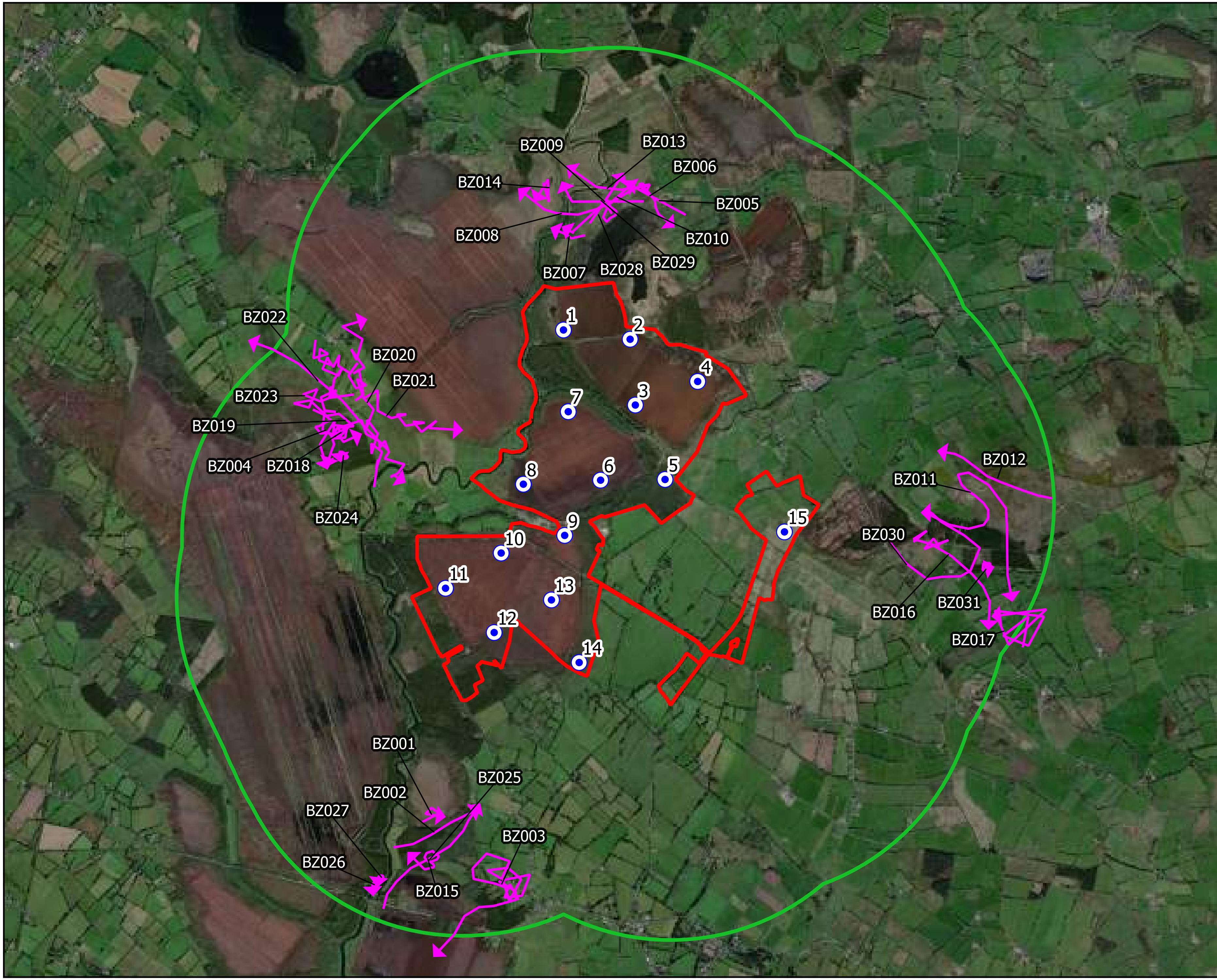

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

Drawing Title: Buzzard Observations Breeding Raptor Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.4
Scale: 1:42000	Date: 05/07/2022

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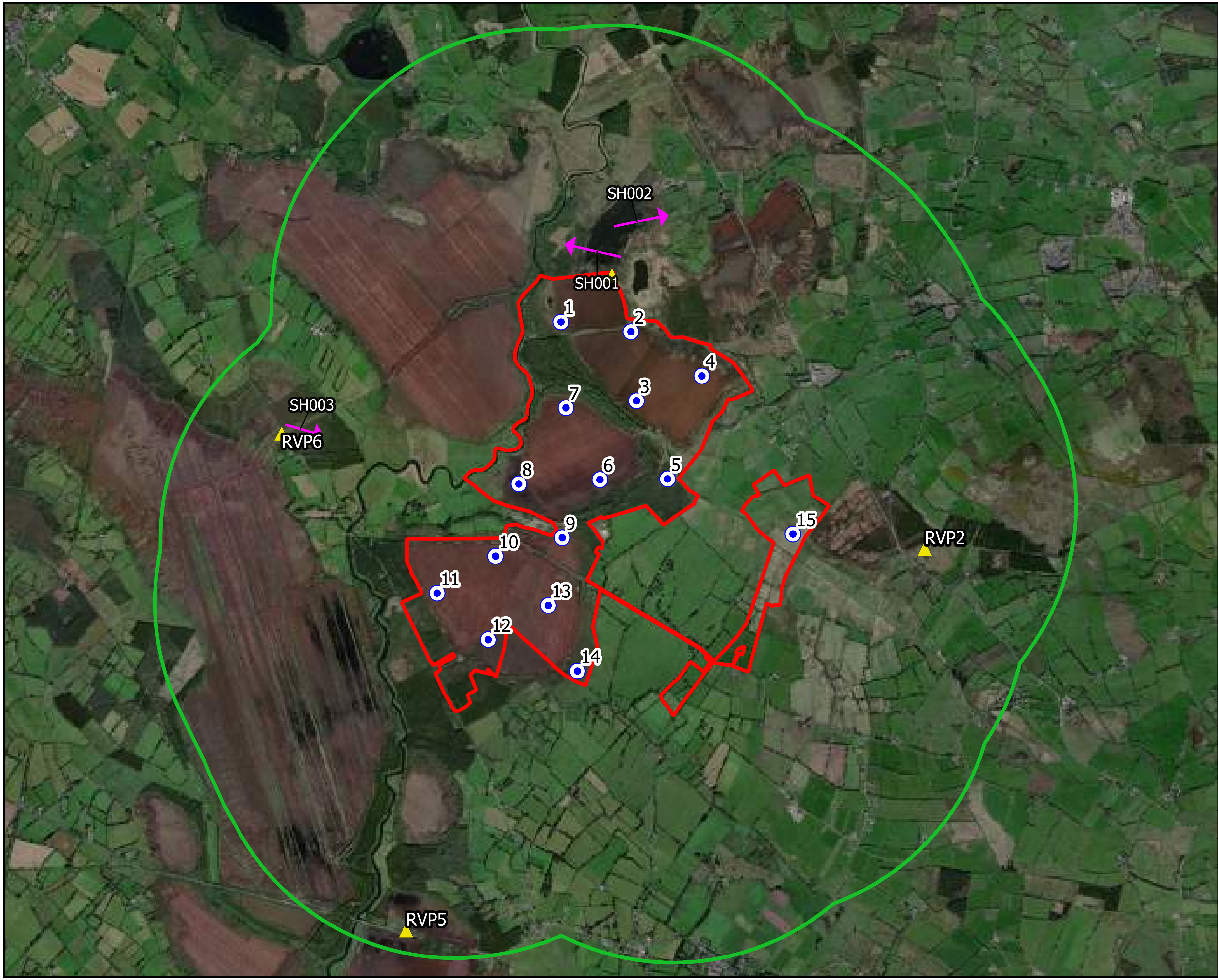

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

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Drawing Title: Sparrowhawk Observations Breeding Raptor Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.5
Scale: 1:40000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Woodcock Transects

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Drawing Title: Breeding Woodcock Transects	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 4
Scale: 1:25000	Date: 05/07/2022

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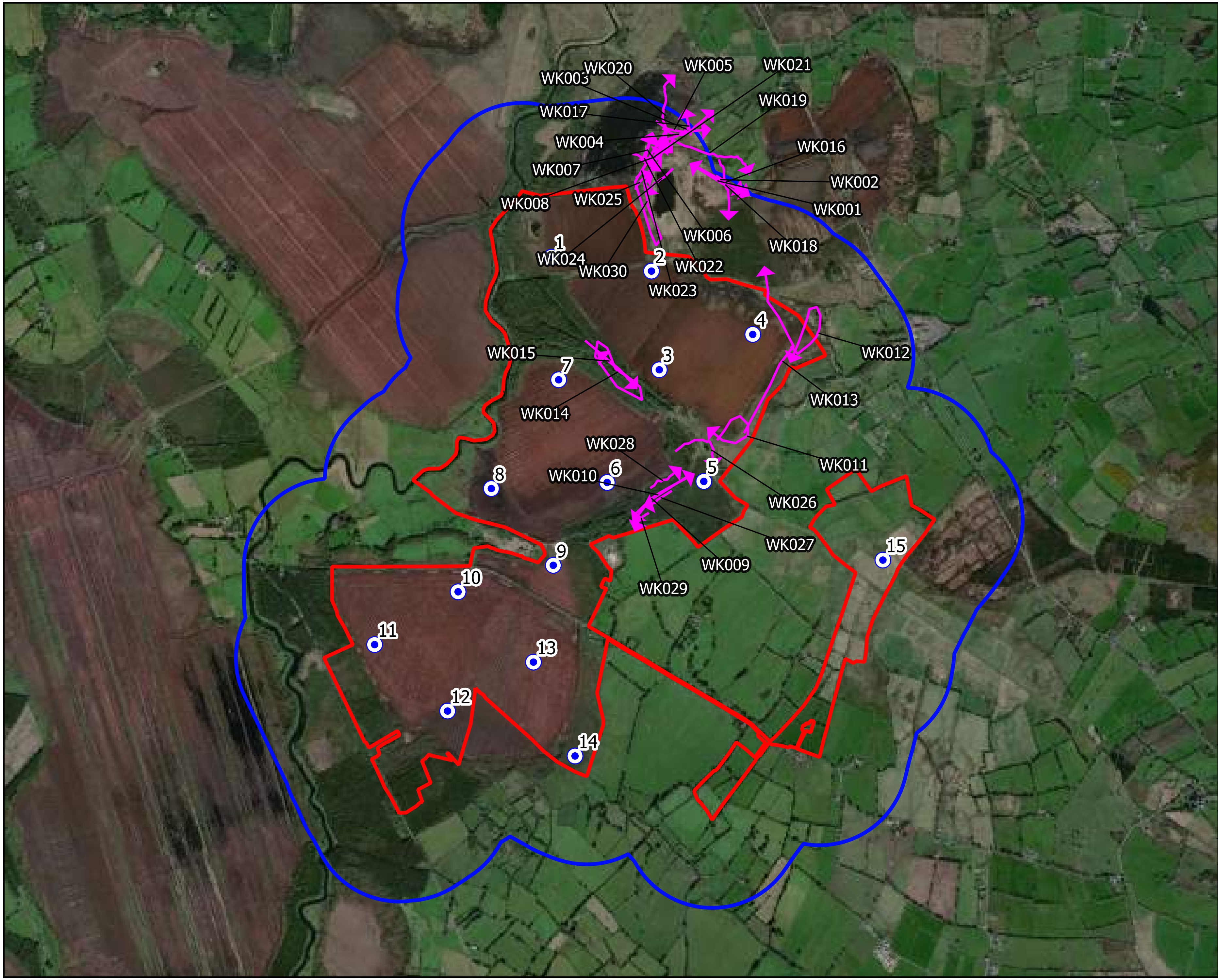

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title	
Woodcock Observations Breeding Woodcock Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 4.1
Scale: 1:28000	Date: 05/07/2022

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Map Legend
Wind Farm Site
500m Survey Radius
Turbine Layout
Possible Breeding Territory
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Drawing Title
Woodcock Territories
Breeding Woodcock Surveys
Project Title
Coole Wind Farm
Drawn By
I.Hynes
Checked By
P.Cregg
Project No.
200445g
Drawing No.
Fig. 4.1.1
Scale
1:28000
Date
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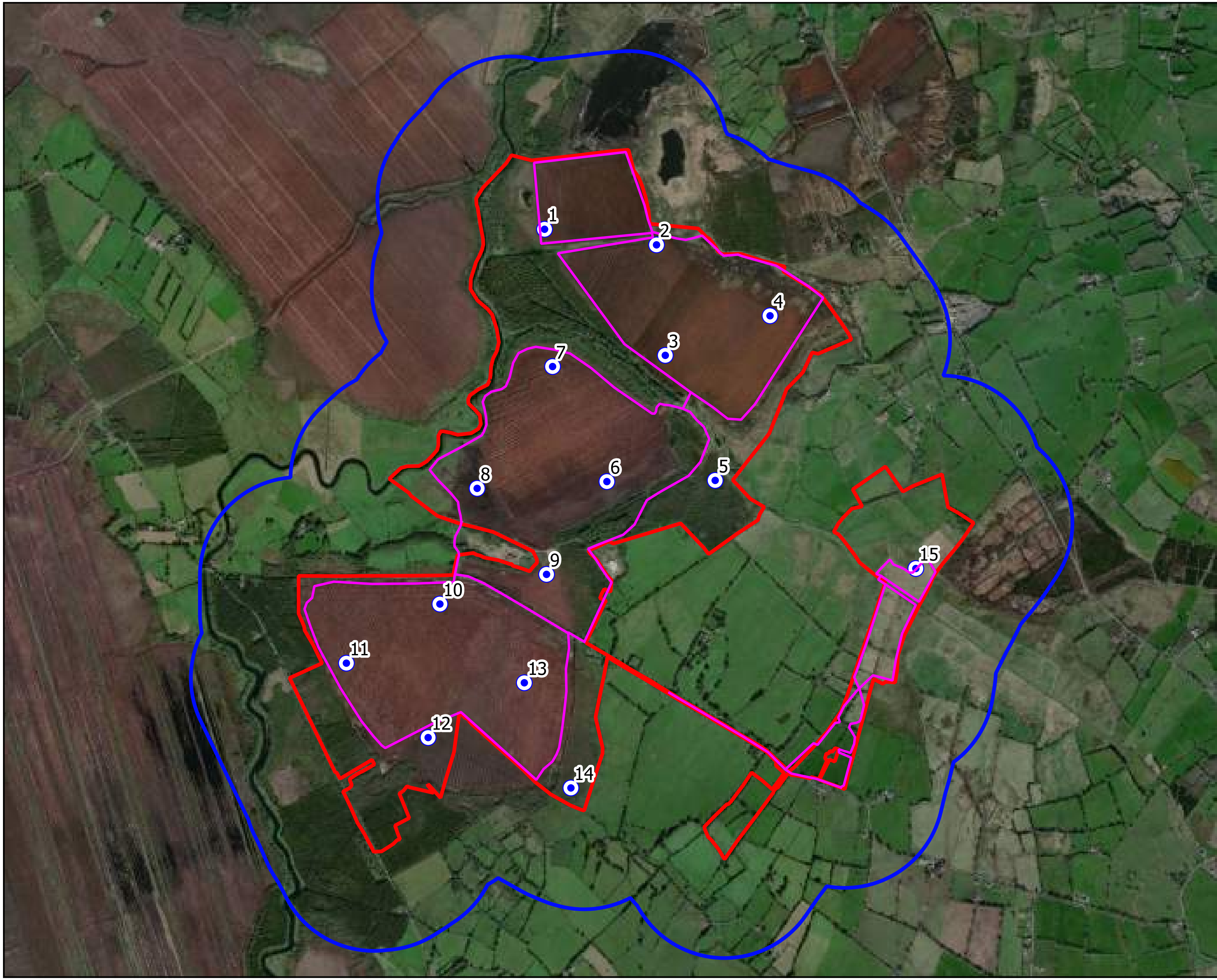

Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Walkover Transects

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Drawing Title	Winter Walkover Transects
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title: Golden Plover Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 5.1
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title	
Greenland white-fronted goose Obs. Winter Walkover Surveys	
Project Title	
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Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.2
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Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

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Drawing Title
Kingfisher Observations Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
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Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title	Teal Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.4
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title: Wigeon Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.5
Scale: 1:25000	Date: 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

Drawing Title	Kestrel Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 5.6
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title: Lapwing Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.7
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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

N

Drawing Title	
Snipe Observations Winter Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.8
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title	Buzzard Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.9
Scale: 1:25000	Date: 05/07/2022

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Drawing Title
Wildfowl Distribution Survey Locations

Project Title
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Drawn By	Checked By
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Scale 1:156501	Date 05/07/2022

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Wind Farm Site

Observations

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Coole Wind Farm

I.Hynes	P.Cregg
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Drawing Title
Greenland white-fronted goose Obs. Wildfowl Distribution Survey
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Kingfisher Observations
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Fig. 6.4
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Map Legend

Wind Farm Site

Observations

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Little Egret Observations Wildfowl Distribution Survey

Coole Wind Farm

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200445g	Fig. 6.5
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Ruff Observations Wildfowl Distribution Survey

Coole Wind Farm

I.Hynes	P.Cregg
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Map Legend

Wind Farm Site

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Whooper Swan Observations
Wildfowl Distribution Survey

Coole Wind Farm

I.Hynes	P.Cregg
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Wind Farm Site

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Drawing Title: Coot Observations Wildfowl Distribution Survey	
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Scale: 1:146501	Date: 05/07/2022

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Shoveler Observations Wildfowl Distribution Survey

Coole Wind Farm

I.Hynes	P Cregg
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Wind Farm Site

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Teal Observations Wildfowl Distribution Survey

Coole Wind Farm

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Wind Farm Site

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Drawing Title
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Project No.: 200445g	Drawing No.: Fig. 6.13
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Curlew Observations Wildfowl Distribution Survey

Coole Wind Farm

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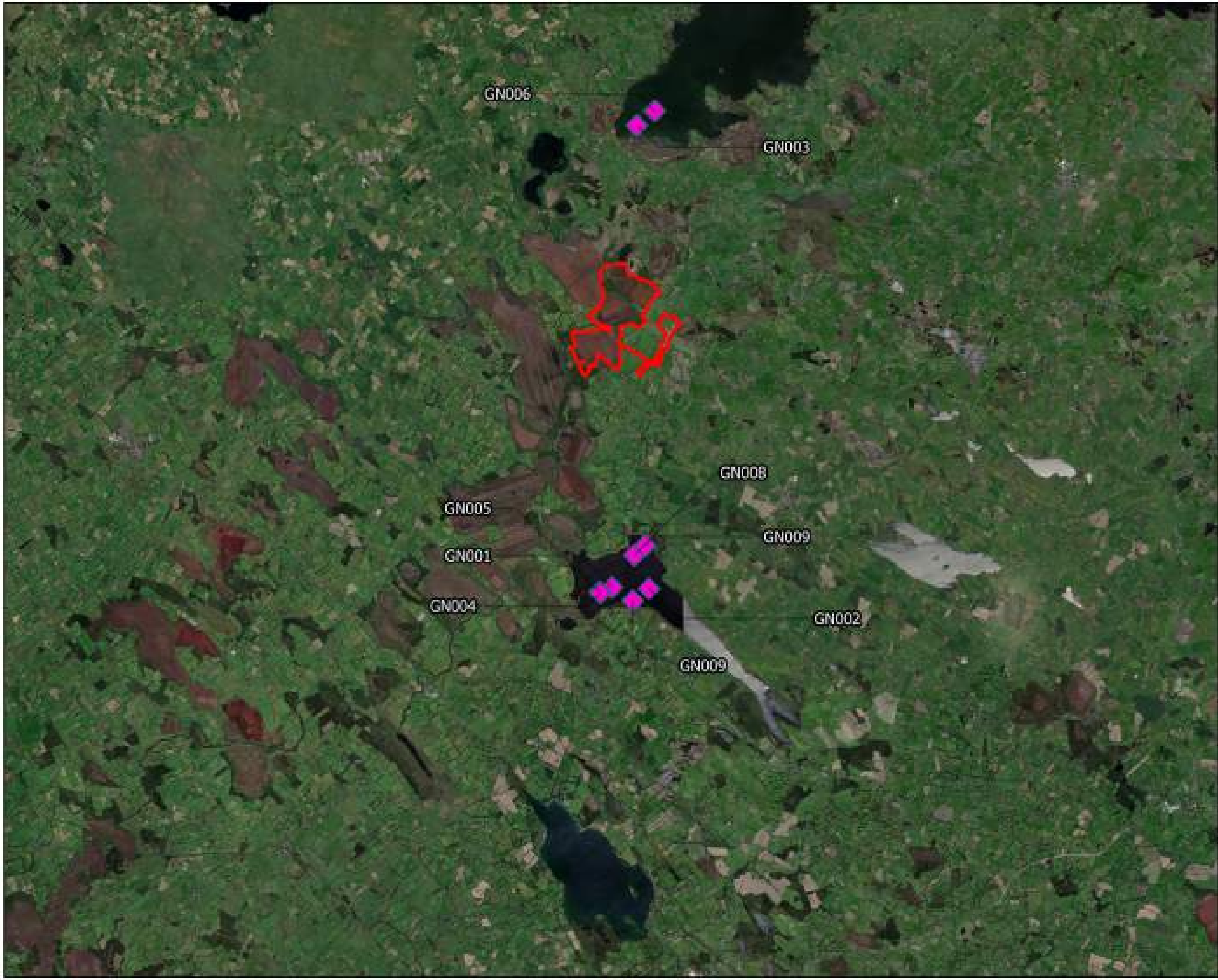

Map Legend

Wind Farm Site

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Goldeneye Observations
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Drawing Title
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Snipe Observations Wildfowl Distribution Survey	
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Drawing Title
Peregrine Incidental Observations

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
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Scale	Date
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White-tailed eagle Incidental Observations
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Map Legend

Wind Farm Site

Turbine Layout

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Drawing Title: Kestrel Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No. 200445g	Drawing No. Fig. 7.4
Scale 1:125250	Date 05/07/2022

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Snipe
Incidental Observations

Coole Wind Farm

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200445g	Fig. 7.6
1:25000	08/07/2022

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Map Legend
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Snipe Breeding Territories
Incidental Observations
Coole Wind Farm
I. Hynes
P Cregg
200445g
Fig. 7.6.1
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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

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Drawing Title: Buzzard Incidental Observations

Project Title: Coole Wind Farm

Drawn By: I. Hynes	Checked By: P Cregg
Project No.: 200445g	Drawing No.: Fig. 7.7
Scale: 1:173666	Date: 08/07/2022

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- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title	
Sparrowhawk Incidental Observations	
Project Title	
Coole Wind Farm	
Drawn By: I. Hynes	Checked By: P Cregg
Project No.: 200445g	Drawing No.: Fig. 7.8
Scale: 1:78417	Date: 08/07/2022

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APPENDIX 5

COLLISION RISK ASSESSMENT

Appendix 5 – Collision Risk Assessment

Coole Wind Farm

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1. INTRODUCTION

This document outlines the methodology used to assess the collision risk for birds at the proposed Coole wind farm, Co. Westmeath. The collision risk assessment is based on vantage point surveys undertaken at the wind farm site from October 2015 up to, and including, September 2017; from April 2018 up to, and including, March 2020; and from March 2021 up to, and including, March 2022. This represents two 24-month survey periods and a 13-month survey period, consisting of five breeding seasons and five non-breeding seasons, which is in full compliance with Scottish Natural Heritage guidance (SNH, 2017). Surveys were undertaken from four fixed Vantage Point (VP) Locations: VP3/VP4 between October 2015 to September 2017, VP3/VP5 between April 2018 to March 2020, VP4/VP6 between March 2021 to March 2022 and VP3/VP5 between October 2021 and March 2022.

Collision risk is calculated using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation is known as the Band Model (Band *et al.,* 2007) and has been used in a number of studies on bird collision with wind turbines (e.g. Chamberlain *et al.,* 2006; Drewitt and Langston, 2006; Fernley *et al.,* 2006; Madders and Whitfield, 2006). Note that these are theoretical predictions, therefore results must be interpreted with a degree of caution.

Two stages are involved in the Band Model. First, the number of bird transits through the air space swept by the rotor blades of the wind turbines per year is estimated. Then the collision risk for a bird passing through the rotor blades is calculated using a mathematical formula. The product of these provides a theoretical annual collision mortality rate. Finally, a bird avoidance rate is applied to the collision mortality rate to account for birds attempting to avoid collision. This final collision mortality rate informs the assessment of impacts of the wind farm development on key ornithological receptors (KORs) in the EIAR.

To ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios are outlined in further detail in Section 2.3 below.

2. METHODOLOGY

2.1 The Band Model

The Band Model is used to predict the number of bird collisions that might be caused by a wind farm development. It uses species-specific information on bird biometrics, flight characteristics and the expected amount of flight activity, along with turbine-specific information on hub height, rotor diameter, pitch and rotational speed. The 15 No. turbines will be between 97.5m and 100.5 at hub height, with 3 blades with a diameter of between 149m and 155m, giving a maximum rotor height of 175m and a minimum rotor height of 20m. The model makes a number of assumptions on the turbine design and on biometrics of birds:

1. Birds are assumed to be of a simple cruciform shape.
2. Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
3. Birds fly through turbines in straight lines.
4. Bird flight is not affected by the slipstream of the turbine blade.

- Because the model assumes that no action is taken by a bird to avoid collision, it is recognised that the collision risk figures derived are purely theoretical and represent worst case estimates

Two forms of collision risk modelling are outlined by Band *et al.* (2007): a **"Regular Flight Model"** and the **"Random Flight Model"**. A Regular Flight Model is generally applied to situations where flightlines form a regular pattern. This may occur, for example, when birds are using the wind farm site as a commuting corridor between roosting and feeding grounds or migratory routes, as is often observed in geese and swans. The Random Flight Model generally applied to situations where flightlines form no discernible patterns or routes. This is often observed, for example when raptors are in foraging or hunting flights.

The Regular Flight Model predicts the number of transits through a cross-sectional area of the wind farm which represents the width of the commuting corridor. A "risk window" is identified: a 2-dimensional line the width of the wind farm to a 500m buffer of the turbines, multiplied by the rotor diameter. All commuting flights which pass through this risk window within the rotor swept height (potential collision height; PCH) are included in collision risk modelling. Any regular flights more than 500m from the turbine layout can be excluded from analysis. There are a number of key assumptions and limitations:

- The turbine rotor swept area is 2-dimensional, i.e. there is a single row of turbines in the windfarm. This represents all turbines within the commuting corridor accounted for by a single straight-line.
- Bird activity is spatially explicit.
- Birds in an observed flight only cross the turbine area once and do not pass through the cross-section a second time (or multiple times).
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

The Random Flight Model predicts the number of transits through the wind farm while assuming that all flights within the vantage point viewshed are randomly occurring, ie. any observed flight could just as easily occur within the wind farm site as outside it. All flights within PCH inside the viewshed are included in the model. There are a number of key assumptions and limitations:

- Bird activity is not spatially explicit, i.e. activity is equal throughout the viewshed area and this is equal to activity in the windfarm area.

- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.

- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

More detail on both the Random and Regular Flight Model calculations are available from SNH: https://www.nature.scot/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action.

In the case of Coole wind farm, for all species recorded in flight in the wind farm study area, flights were randomly distributed. Therefore, a **Random Flight Model** conducted for these species.

2.2 Modelling Process

The steps used in the Band Model to derive the collision mortality rate for each species observed at the wind farm site are outlined below.

- Stage 1: Estimate the number of bird transits through the air space swept by the rotor blades of the wind turbines. Transits are calculated using either the "Regular" or "Random" flight model (Band *et al.,* 2007), depending on flight distribution and behaviour.

- Stage 2: Calculate the collision risk for an individual bird flying through a rotating turbine blade. Collision risk is calculated using a formula which incorporates the number of bird transits (Stage 1), individual species' biometrics, individual species' flight speed and style, and the proposed turbine parameters. This formula is publicly available on the SNH website: https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision. Biometrics are available from the British Trust of Ornithology (BTO, 2021) and flight speeds are available from Alerstam *et al.* (2007). For species that can both flap and glide, the mean of the collision risk for flapping and for gliding flight is taken.

- The product of the number of birds transits per year multiplied by the collision risk provides an annual collision mortality rate. Note that this is the unrealistic/worst-case scenario for collision mortality, as it assumes that birds flying towards the turbines make no attempt to avoid them.

- To account for birds attempting to avoid a collision, an avoidance factor is applied to the annual collision mortality rate. This corrects for the ability of the birds to detect and manoeuvre around the turbines. Avoidance rates are available from SNH (2018). Bird avoidance rates are generally 98-99% or higher for most species, based on empirical evidence, targeted studies and literature reviews, and continue to be updated following further studies of bird behaviour and mortality rates at wind farm sites.

The final annual collision risk corrected for avoidance is a "real-world" estimation of the number of collisions that may occur at the wind farm, based on observed bird activity during the vantage point survey period.

2.3 Turbine specifications

As previously outlined to ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios were as follows:

- Maximum rotor diameter and minimum hub height: 20-175m
- Median rotor diameter and median hub height: 25-175m
- Minimum rotor diameter and maximum hub height: 26-175m

Birds in flight within the viewshed at heights between 15-200m above ground level have been included in the collision risk model, as relevant. The candidate turbine specifications are available in Table 1.

Table 1 Turbine specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Candidate turbine model	Nordex 149[1]
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	155
Rotor radius (m)	77.5
Hub height (m)	97.5
Swept height (m)	20-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

The above candidate turbine parameters were used for the 15 No. turbines with a blade diameter of 155m, giving a maximum rotor height of 175 and a minimum rotor height of 20m are assessed in the analysis.

To ensure that the full range of possible turbine dimensions are assessed, two alternative turbine dimensions were considered. Collision risk models was run to assess the minimum rotor diameter of the range of turbine dimensions (i.e. rotor diameter of 149m) and the median turbine dimensions (i.e. rotor diameter of 150m) considered in this application. The second model assesses the swept path between 26-175m and the third model accesses the swept path between 25-175m. Appendix 1 shows the collision risk assessment based on alternative dimension turbines. These three collision risk assessments allow for the full range of possible turbine dimensions to be assessed (20-175m, 25-175m and 26-175m).

Please note:

Taking a precautionary approach, the highest predicted collision risk (from the three analyses, i.e. at 20-175m, 25-175m and 26-175m) for each species was considered to be the collision risk in the impact assessment.

2.4 Key Ornithological Receptors

[1] *A candidate turbine is used to calculate the maximum chord and the rotational period for the modelling scenario. The best fit turbine model is used, in this case, a 149m Nordex turbine was the closed to the proposed turbine specifications.*

The key ornithological receptors (KORs) recorded within PCH during surveys at Coole were:

- Greenland White-fronted Goose
- Golden Plover
- Hen Harrier
- Merlin
- Peregrine
- Whooper Swan
- Kestrel
- Lapwing
- Snipe
- Woodcock
- Buzzard
- Sparrowhawk

A CRM was conducted for each of these species. It is acknowledged that the predicted number of transits, and hence predicted rate of collision, for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature (during twilight) while the VP survey sample predominantly consists of hours during daylight period when visibility is not an issue. It is assumed that waterbirds (including snipe) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model.

2.5 Calculation Parameters (20-175m)

The calculation parameters for the vantage point are outlined in Table 2. Bird biometrics are presented in Table 3. Table 4 presents the model input values: bird seconds in flight at PCH (random model) or the number of birds crossing the risk window (regular models) observed from the vantage point during the relevant survey period. Bird seconds in flight at PCH is calculated by multiplying the number of birds observed per flight by the duration of the flight spent within PCH.

Table 2 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 20m	Risk Area	Turbines visible	Total Survey Effort (hrs)
VP3	562.4	257.354	6	332.5
VP4	230.057	163.302	4	230.5
VP5	458.258	134.672	2	181
VP6	442.394	175.627	4	72

Table 3 Bird biometrics

Species	Body Length(m)	Wingspan(m)	Flight Speed(m/s)
Greenland White-fronted Goose	0.72	1.48	16.1
Golden Plover	0.28	0.72	17.9
Merlin	0.28	0.56	12.6
Peregrine Falcon	0.42	1.02	20.7
Whooper Swan	1.52	2.3	17.3
Kestrel	0.34	0.76	10.1
Lapwing	0.3	0.84	11.9
Snipe	0.26	0.46	17.1
Woodcock	0.34	0.58	17.1
Buzzard	0.54	1.2	13.3
Sparrowhawk	0.33	0.62	10

Table 4 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	471,229
Merlin	random	All	80
Peregrine	random	All	1,315
Whooper Swan	random	Winter	17,204
Kestrel	random	All	13,505
Lapwing	random	Winter	3,625
Snipe	random	All	1,751
Woodcock	random	Breeding	40
Buzzard	random	All	34,448
Buzzard	random	Breeding	22,219
Sparrowhawk	random	All	1,493

The avoidance rates applied to the collision risk were: 99.8% for Greenland white-fronted goose, 99.6% for golden plover[2]; 99.5% for whooper swan, 95% for kestrel and 98% for the remaining species.

[2] *Please see Appendix 2 for the rationale for the avoidance rate of golden plover.*

3. RESULTS (20-175M)

The predicted number of transits per year and the collision risk is presented in Table 5, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 5 Results of CRM

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	340.5304	5.92%	N/A	5.92%	20.15	99.8%	0.040	1.21 birds	24.81 years
Golden Plover	Winter	random	59,385.08	4.45%	N/A	4.45%	2645.53	99.6%	10.582	317.46 birds	0.09 years
Merlin	All	random	11.8707	4.61%	4.53%	4.57%	0.54	98.0%	0.011	0.33 birds	92.13 years
Peregrine Falcon	All	random	209.7564	4.81%	4.52%	4.67%	9.79	98.0%	0.196	5.87 birds	5.11 years
Whooper Swan	Winter	random	1,987.359	7.98%	N/A	7.98%	158.53	99.5%	0.793	23.78 birds	1.26 years
Kestrel	All	random	975.2979	5.17%	5.07%	5.12%	49.93	95.0%	2.497	74.90 birds	0.40 years
Lapwing	Winter	random	390.1192	4.86%	N/A	4.86%	18.95	98.0%	0.379	11.37 birds	2.64 years
Snipe	All	random	208.2588	4.29%	N/A	4.29%	8.93	98.0%	0.179	5.36 birds	5.60 years
Woodcock	Breeding	random	10.43266	4.53%	N/A	4.53%	0.47	98.0%	0.009	0.28 birds	105.90 years
Buzzard	All	random	3,371.563	5.63%	5.42%	5.52%	186.28	98.0%	3.726	111.77 birds	0.27 years
Buzzard	Breeding	random	2163.464	5.63%	5.42%	5.52%	119.53	98.0%	2.391	71.72 birds	0.42 years
Sparrowhawk	All	random	90.56372	5.09%	5.03%	5.06%	4.59	98.0%	0.092	2.75 birds	10.90 years

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CRA APPENDIX 1

COLLISION RISK ASSESSMENT – ALTERNATIVE TURBINE DIMENSIONS

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3.1 Alternative Turbine 1 Inputs (26-175m)

Table 6 Alternative turbine 1 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	149
Rotor radius (m)	74.5
Hub height (m)	100.5
Swept height (m)	26-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 7 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 26m	Risk Area	Turbines visible	Total Survey Effort
VP3	629.362	258.187	6	332.5
VP4	304.978	210.577	5	230.5
VP5	506.478	157.376	3	181
VP6	512.943	239.32	5	72

Table 8 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

3.2 Alternative Turbine 2 Inputs (25-175m)

Table 9 Alternative turbine 2 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	150
Rotor radius (m)	75
Hub height (m)	100
Swept height (m)	25-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 10 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 25m	Risk Area	Turbines visible	Total Survey Effort
VP3	627.494	256.887	6	332.5
VP4	292.392	201.662	5	230.5
VP5	497.208	154.51	3	181
VP6	505.53	232.92	5	72

Table 11 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

4. ALTERNATIVE TURBINE DIMENSIONS RESULTS

The predicted number of transits per year and the collision risk for the alternative turbine dimensions are presented in Tables 12 and 13 below, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 12 Results of CRM for Alternative Turbine 1 (26-175m)

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	288.1648	6.09%	N/A	6.09%	17.54	99.8%	0.035	1.05 birds	28.51 years
Golden Plover	Winter	random	43507.54	4.62%	N/A	4.62%	2008.25	99.6%	8.033	240.99 birds	0.12 years
Merlin	All	random	8.607914	4.76%	4.68%	4.72%	0.41	98.0%	0.008	0.24 birds	123.08 years
Peregrine Falcon	All	random	104.7015	4.98%	4.66%	4.82%	5.05	98.0%	0.101	3.03 birds	9.90 years
Whooper Swan	Winter	random	802.4748	8.15%	N/A	8.15%	65.39	99.5%	0.327	9.81 birds	3.06 years
Kestrel	All	random	444.1574	5.32%	5.22%	5.27%	23.40	95.0%	1.170	35.10 birds	0.85 years
Lapwing	Winter	random	85.05496	5.01%	N/A	5.01%	4.26	98.0%	0.085	2.56 birds	11.72 years
Snipe	All	random	147.3097	4.43%	N/A	4.43%	6.53	98.0%	0.131	3.92 birds	7.65 years
Buzzard	All	random	1882.868	5.79%	5.58%	5.68%	107.01	98.0%	2.140	64.20 birds	0.47 years
Buzzard	Breeding	random	1286.294	5.79%	5.58%	5.68%	73.10	98.0%	1.462	43.86 birds	0.68 years
Sparrowhawk	All	random	53.84197	5.24%	5.18%	5.21%	2.80	98.0%	0.056	1.68 birds	17.83 years

Table 13 Results of CRM for Alternative Turbine 2 (25-175m)

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Golden Plover	Winter	random	44742.13	4.62%	N/A	4.62%	2065.24	99.6%	8.261	247.83 birds	0.12 years
Merlin	All	random	9.0387	4.76%	4.68%	4.72%	0.43	98.0%	0.009	0.26 birds	117.22 years
Peregrine Falcon	All	random	108.004	4.98%	4.66%	4.82%	5.21	98.0%	0.104	3.13 birds	9.60 years
Whooper Swan	Winter	random	822.1859	8.15%	N/A	8.15%	66.99	99.5%	0.335	10.05 birds	2.99 years
Kestrel	All	random	458.9188	5.32%	5.22%	5.27%	24.18	95.0%	1.209	36.26 birds	0.83 years
Lapwing	Winter	random	89.31155	5.01%	N/A	5.01%	4.48	98.0%	0.090	2.69 birds	11.16 years
Snipe	All	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Buzzard	All	random	1947.209	5.79%	5.58%	5.68%	110.66	98.0%	2.213	66.40 birds	0.45 years
Buzzard	Breeding	random	1309.816	5.79%	5.58%	5.68%	74.44	98.0%	1.489	44.66 birds	0.67 years
Sparrowhawk	All	random	54.82305	5.24%	5.18%	5.21%	2.86	98.0%	0.057	1.71 birds	17.51 years

Table 14 Comparison of collision risk for turbine dimensions and the alternative turbine dimensions

Species	Collision Risk – 155m rotor diameter		Collision Risk – 149m rotor diameter		Collision Risk – 150m rotor diameter	
	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm
Greenland White-fronted Goose	0.040	1.21 birds	0.035	1.05 birds	0.036	1.07 birds
Golden Plover	10.582	317.46 birds	8.033	240.99 birds	8.261	247.83 birds
Merlin	0.011	0.33 birds	0.008	0.24 birds	0.009	0.26 birds
Peregrine Falcon	0.196	5.87 birds	0.101	3.03 birds	0.104	3.13 birds
Whooper Swan	0.793	23.78 birds	0.327	9.81 birds	0.335	10.05 birds
Kestrel	2.497	74.90 birds	1.170	35.10 birds	1.209	36.26 birds
Lapwing (Winter)	0.379	11.37 birds	0.085	2.56 birds	0.090	2.69 birds
Snipe	0.179	5.36 birds	0.131	3.92 birds	0.036	1.07 birds
Woodcock	0.009	0.28 birds	0	0 birds	0	0 birds
Buzzard	3.726	111.77 birds	2.140	64.20 birds	2.213	66.40 birds
Buzzard (Breeding)	2.391	71.72 birds	1.462	43.86 birds	1.489	44.66 birds
Sparrowhawk	0.092	2.75 birds	0.056	1.68 birds	0.057	1.71 birds

CRA APPENDIX 2

GOLDEN PLOVER AVOIDANCE RATE CALCULATION

COOLE WIND FARM: GOLDEN PLOVER AVOIDANCE RATES

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REPORT NUMBER: 2226-F1
STATUS OF REPORT: Revision 1
DATE OF REPORT: 19 October 2022

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SUMMARY

This report assesses the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and makes recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance. This guidance includes two types of avoidance rates: species-specific avoidance rates; and a default avoidance rate that should be applied to all other species. Based on the latest version of the guidance, the default avoidance rate of 98% applies to wintering Golden Plover populations. However, review of the development of the SNH avoidance rate guidance shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

There are reports for four UK wind farms that provide data that can be used to estimate avoidance rates, or which provide their own estimates of avoidance rates, for wintering Golden Plover populations. For three of these wind farms, the collision monitoring methodologies are robust and generally comply with best practice guidance, so the collision fatality estimates can be regarded as reliable. The avoidance rates calculated for the wintering Golden Plover populations at these wind farms range from 99.87-99.98%. For the fourth wind farm, the available information on the collision monitoring methodology was limited, but there may have been some issues with the methodology and results. The avoidance rate for the wintering Golden Plover population given in the relevant reports for this wind farm was 99.6%.

The highest avoidance rate currently recommended by Scottish Natural Heritage / Natural Scotland is 99.8% for geese. The narrow range of the avoidance rate values for wintering Golden Plover populations at the three wind farms with reliable collision fatality estimates would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at the other wind farm is lower than this value, although there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

1. INTRODUCTION

This report was commissioned by MKO.

The objective of the report was to assess the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and, if appropriate, make recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance (referred to hereafter as the SNH avoidance rate guidance). The latest version of this guidance (SNH, 2018) does not include a species-specific avoidance rate for wintering Golden Plover populations. Therefore, following the SNH avoidance rate guidance would mean that the default 98% avoidance rate should be applied to wintering Golden Plover populations. However, there is apparently robust data available from post-construction monitoring that indicates that a much higher avoidance rate should be applied to wintering Golden Plover populations.

In this report, I first review the development of the SNH avoidance rate guidance and consider whether the history of its development affects the interpretation of the fact that it does not include a species-specific avoidance rate for wintering Golden Plover populations. I then review the methods and results of four post-construction monitoring studies, and use the data from these studies to derive empirical avoidance rates for the wintering Golden Plover population in each study. I then assess the overall weight of evidence for applying a species-specific avoidance rate to wintering Golden Plover populations and make recommendations for avoidance rate values that should be used in collision risk modelling for such populations.

2. THE SNH AVOIDANCE RATE GUIDANCE

2.1. TYPES OF AVOIDANCE RATES

The SNH avoidance rate guidance includes two types of avoidance rates: specific avoidance rates for individual species, or groups of closely-related species (e.g., swans or geese); and a default avoidance rate that should be applied to all other species.

2.2. THE EVOLUTION OF THE SNH AVOIDANCE RATES

The latest version of the SNH avoidance rate guidance (SNH, 2018) includes a default 98% avoidance rate for species not listed in their guidance. However, this default avoidance rate does not appear to have any empirical basis.

In 2000, the first guidance from Scottish Natural Heritage on avoidance rates recommended a precautionary avoidance rate of 95%, which was "based solely on expert opinion and has little or no empirical basis, as no sound, relevant data were available at the time" (SNH, 2010). In 2010, Scottish Natural Heritage updated their guidance on avoidance rates to included species-specific avoidance rates where relevant data was available (SNH, 2010). They also updated the default avoidance rate for other species to 98% because "in the majority of cases where avoidance rates have been derived from empirical data, the avoidance rates are higher than 95%" (SNH, 2010). Further revisions of the SNH avoidance rate guidance were published in 2016 and 2018 (SNH, 2016; 2018). Comparison of the first species-specific avoidance rates published by Scottish Natural Heritage with the latest species-specific avoidance rates (Table 2.1) shows that as the knowledge base has developed there has been an increase in the recommended avoidance rates. Most species-specific avoidance rates are 99% or higher. The only species with species-specific avoidance rates of less than 99% are White-tailed Eagle and Kestrel.

Table 2.1. Species-specific avoidance rates defined in SNH guidance

Species	SNH Guidance	
	2010	2018
Divers	98%	99.5%
Swans	98%	99.5%
Geese	99%	99.8%
Red Kite	98%	99%
Hen Harrier	99%	99%
Golden Eagle	99%	99%
White-tailed Eagle	95%	95%
Kestrel	95%	95%
Skuas	98%	99.5%

Sources: SNH (2010, 2018). Divers: the 2010 guidance gives a species-specific avoidance rate for Red-throated Diver and a default avoidance rate for Black-throated Diver. Swans: the 2010 guidance gives a species-specific avoidance rate for Whooper Swan, and does not provide avoidance rates for other swan species, while the 2018 guidance gives a species-specific avoidance rate for all swan species. Geese: the 2010 guidance gives separate (but identical) species-specific avoidance rates for Greylag, Pink-footed, Greenland White-fronted and Barnacle Geese, while the 2018 guidance gives a single species-specific avoidance rate for all geese species. Skuas: the 2010 guidance gives a single default avoidance rate for all skua species, while the 2018 guidance gives separate (but identical) species-specific avoidance rates for Great Skua and Arctic Skua.

2.3. EXAMPLES OF SPECIES-SPECIFIC AVOIDANCE RATES IN THE SNH AVOIDANCE RATE GUIDANCE

The 95% avoidance rate for White-tailed Eagle is described as being based on: "sufficient evidence from flight behaviour and collision monitoring studies in Norway for vulnerability to collisions; see May *at al.* (2011)" (SNH, 2018). However, this appears to include a citation error as May *at al.* (2011) provides an estimate for a year-round avoidance rate of 98%, with a confidence interval of 95-99%, based on satellite telemetry data. Presumably, the intended citation was May *at al.* (2010), which included an estimated avoidance rate of 95.8%, based on VP survey data, corrected for the observed wind speed distribution at the study site. This latter reference also included avoidance rates of 97.8% and 97.9% for fixed rotation speeds, and an avoidance rate of 92.5% when the collision risk was modelled using uncertainty levels. The SNH avoidance rate guidance on avoidance rates does not discuss these differing estimates of White-tailed Eagle avoidance rates, and the recommended 95% avoidance rate has remained unchanged since 2010 without any caveats added to reflect the various avoidance rates indicated by the May *at al.* (2010 and 2011) studies.

The 95% avoidance rate for Kestrel is described as being based on: *"*sufficient evidence from flight behaviour (including hovering) and collision monitoring studies for vulnerability to collisions*"* (SNH, 2018). The cited source (Whitfield and Madders, 2006) is, in fact, a review of avoidance rates for Red Kite. The information on Kestrel is derived from an analysis which finds a significant correlation between the *"*numbers of individuals seen*"* against numbers of carcasses found for 16 raptor species at a single wind farm in Spain. Kestrel is a large outlier above the regression line, and this appears to be the only empirical evidence that has been used by SNH to support the 95% avoidance rate for Kestrel. However, even taken at face value, all this analysis does is indicate that Kestrel has a lower avoidance rate than other raptor species, but it does not provide any quantitative data that can be used to estimate the avoidance rate. More seriously, this analysis does not account for behavioural and ecological differences between species that may affect the relationship between recorded bird activity and collisions. It is also subject to the perennial problem with analyses of collision rates: the small absolute numbers of collisions which means that random sampling error may have significant effects.

These two examples show that the species-specific avoidance rates in the SNH avoidance rate guidance do not necessarily reflect all the available evidence (White-tailed Eagle) and can be based on rather sketchy evidence (Kestrel).

2.4. UPDATING THE SNH AVOIDANCE RATE GUIDANCE

The SNH avoidance rate guidance states that *"*it is updated when robust new information becomes available*"* (SNH, 2018). However, while this may be an aspiration, it may not necessarily happen quickly. For example, the SNH avoidance rate guidance currently does not give species-specific avoidance rates for gulls, so the default avoidance rate of 98% applies to all gull species. This guidance refers specifically to onshore wind farms, while separate guidance has been developed for offshore wind farms (JNCC *at al.*, 2014). The latter guidance recommends an avoidance rate of 99.5% for large gulls, based on a review by Cook *at al.* (2014). The discrepancy between the recommended avoidance rates for large gulls between offshore and onshore wind farms, was not addressed until a review by Furness (2019), which was commissioned by SNH. This review recommended that the 99.5% avoidance rate for large gulls at offshore wind farms should also be adopted for onshore wind farms. The review also recommended an avoidance rate of 99.2% for small gulls, which was also based on the data in Cook *at al.* (2014). However, as of June 2022, Scottish Natural Heritage / NatureScot have not updated their guidance on avoidance rates for onshore wind farms to reflect the robust evidence that has been available about species-specific avoidance rates for gulls since at least 2014.

2.5. CONCLUSIONS

The above analysis of the development of the SNH avoidance rate guidance and its treatment of avoidance rates for White-tailed Eagle, Kestrel and gulls, shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

3. REVIEW OF GOLDEN PLOVER AVOIDANCE RATES

3.1. SOURCES

I found post-construction monitoring reports for three UK wind farms that provide robust data on Golden Plover collision fatality rates, and, for which, there was appropriate data available that could be used to estimate avoidance rates. These reports were for the Blood Hill Wind Farm (Percival *at al.*, 2008), the Goole Fields I Wind Farm (Percival *at al.*, 2018a) and the Goole Fields II Wind Farm (Percival *at al.*, 2018b, 2019). In addition, information on Golden Plover collision fatality rates and avoidance rates is included in the Habitats Regulations Assessment reports for another UK wind farm site (Haverigg II and III[1]; Percival, 2020a, 2020b), although the reports do not contain sufficient detail to allow full review of the collision monitoring methods and results. Unless otherwise stated, all information and data used in this report for each wind farm was taken from the relevant references cited above.

The characteristics of these wind farms are summarised in Table 3.1.

Table 3.1. Characteristics of the wind farms.

Wind farm	Location	Commissioned	Number of turbines	Hub height (m)	Turbine dimeter (m)
Blood Hill Wind Farm	Norfolk	1992	10	30	27
Goole Fields I	Yorkshire	2014	16	80	92
Goole Fields II	Yorkshire	2016	17	80	92
Haverigg II	Cumbria	1998	4	62.5	42
Haverigg III	Cumbria	2005	4	76	52

Sources: Percival (2020a, 2020 b); Percival *at al.* (2008, 2018a, 2018b, 2019).

3.2. COLLISION MONITORING

3.2.1. Methods

The post-construction monitoring for the Blood Hill and Goole Fields I and II wind farms were carried out by the same consultancy and used the similar methodology for collision monitoring. These included weekly searches for carcasses, and searcher efficiency trials and carcass removal trials (Table 3.2). The weekly carcass searches included detailed searches of radii of 100 m (Blood Hill and Goole Fields I), or 130 m (Goole Fields II) around each turbine, with an additional 250 m scanned for large carcasses (Goole Fields I and Goole Fields II). The carcasses found were left in situ to provide data on searcher efficiency and removal rates. In addition, dedicated searcher efficiency, and carcass removal, trials were carried out at all three wind farms. These involved putting out a number of carcasses. A separate observer then tried to locate these carcasses the same day, while the carcasses were also monitored by trail cameras to investigate removal rates.

Table 3.2. Collision monitoring methods.

Wind farm	Seasons	Search frequency	Search radius	Searcher efficiency / carcass removal trials
Blood Hill	2006/07-2007/08	weekly	100 m	67 carcasses
Goole Fields I	2015/16-2018/19	weekly	100 m detailed search 250 m large carcass search	18 carcasses
Goole Fields II	2017/18-2018/19	weekly	130 m detailed search 250 m large carcass search	48 carcasses

Sources: Percival *at al.* (2008, 2018a, 2018b, 2019).

[1] Haverigg I and II are separate, but adjacent, wind farms. However, the reports combine the data for the two wind farms to calculate a single avoidance rate.

The post-construction monitoring for the Haverigg II and III wind farms was carried out between September 2018 and February 2019, with approximately monthly visits. Detailed information about the methodology of this monitoring was not available to me for this review. However, it included searcher efficiency and carcass removal trials.

3.2.2. Results

No Golden Plover fatalities were recorded at the Blood Hill Wind Farm, single fatalities were recorded at the Goole Fields I and Goole Fields II Wind Farms, and one probable Golden Plover fatality and another probable wader fatality were recorded at the Haverigg II and III Wind Farms (Table 3.3). At Blood Hill, searcher efficiency was very high, and the report notes that conditions were good for searching with winter cereals or bare ploughed ground under the turbines. At Goole Fields I and Goole Fields II, crop growth prevented full coverage of the search area on each visit, with overall coverage levels of 60-88% across the five winters covered at these two wind farms. Searcher efficiency was lower than at Blood Hill but still relatively high.

Table 3.3. Collision monitoring results.

Wind farm	Seasons	Golden Plover / wader fatalities recorded	Coverage	Searcher efficiency	% of carcasses missed due to scavengers
Blood Hill	2006/07 2007/08	0 0	100% 100%	> 99%	38%
Goole Fields I	2015/16 2016/17 2018/19	1 0 0	60% 81% 79%	82%	14%
Goole Fields II	2017/18 2018/19	1 0	81% 88%	91%	17%
Haverigg II and III	2018/19	2	no data	93%	33%

All data taken from the relevant reports cited in Section 3.1. The fatalities at Goole Fields I and Goole Fields II were confirmed Golden Plover fatalities. The fatalities at Haverigg II and III were one probable Golden Plover and one probable wader.

3.3. DERIVATION OF AVOIDANCE RATES

3.3.1. Avoidance rate calculations

Table 3.4 shows the predicted number of collisions using the SNH default 98% avoidance rate, the estimated number of collision fatalities, and the empirical avoidance rates for each site. The estimated number of collision fatalities are the actual number of collision fatalities recorded adjusted for coverage, searcher efficiency and carcass removal. Note that the data for Haverigg II and III is a combined estimate for Golden Plover and Curlew. At Blood Hill, Goole Fields I and Goole Fields II, the estimated numbers of collision fatalities were 30-90 times lower than the predicted collisions. The difference was lower at Haverigg II and III, but the estimated numbers of collision fatalities number of collision fatalities was still around six times lower than the predicted collisions. The empirical avoidance rates vary from 99.6% to 99.98%.

For the Blood Hill Wind Farm, there does not appear to be any pre-construction collision risk estimates available. Instead, collision risk estimates were obtained from post-construction vantage point surveys. The reports for the Haverigg II and III Wind Farms were for lifetime extension applications, so the collision risk estimates were also obtained from post-construction vantage point surveys. As noted in the reports, comparison of these estimates with the collision monitoring results may underestimate the avoidance rate, as birds avoiding the wind farm (macro-avoidance) will not be included in the collision risk predictions. However, the monitoring data does not indicate any significant displacement impacts to Golden Plover, so macro-avoidance may not be a significant factor for this species. For the Goole Fields I and Goole Fields II Wind Farms, the post-construction monitoring reports include the pre-construction collision risk predictions from the Environmental Statements for the projects.

No Golden Plover fatalities were recorded in the post-construction monitoring at Blood Hill. However, it would be incorrect to assume a 100% avoidance rate as, where collision rates are low, zero fatalities will be expected in some years ("false negatives"; SNH, 2009). The study by Fijn et al. (2012), which was used by Whitfield and Urquhart (2015) to derive an avoidance rate for Whooper Swan, also did not record any fatalities. To derive an avoidance rate, they assumed that one swan had been killed, and Whitfield and Urquhart (2015) followed that assumption. Therefore, to obtain an avoidance rate estimate for Blood Hill, I used a nominal value of 0.7 Golden Plover fatalities at Blood Hill (equal to one Golden Plover carcass found over two years, corrected for the expected percentage of carcasses missed due to scavenger removal).

Table 3.4. Comparison of collision risk predictions with collision monitoring results.

Wind farm	Predicted collisions (98% avoidance rate) per year	Golden Plover / wader fatalities per year	Avoidance rate
Blood Hill	62	0.7	99.98%
Goole Fields I	56	0.6	99.98%
Goole Fields II	53	1.7	99.94%
Haverigg II and III	28	5.0	99.6%

The data in this table for Haverigg II and III are combined calculations for Golden Plover and Curlew.

The predicted collisions were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the predicted collisions were calculated from post-construction vantage point survey data for Blood Hill and Haverigg II and III, and from pre-construction vantage point survey data for Goole Fields I and Goole Fields II. For Blood Hill, the post-construction monitoring report includes the predicted collisions with an avoidance rate of 0% and the predicted collisions with a 98% avoidance rate were calculated from this figure. For Goole Fields I and Goole Fields II, the post-construction monitoring reports include the predicted collisions with a 99% avoidance rate, and the predicted collisions with a 98% avoidance rate were calculated from these figures.

The Golden Plover / wader fatalities (excluding Blood Hill) were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the Golden Plover / wader fatalities are estimated figures that were calculated from the recorded collisions, adjusted for coverage, searcher efficiency and carcass removal. For Blood Hill, as no Golden Plover fatalities were recorded, a nominal value of 0.7 Golden Plover fatalities is used here to calculate the avoidance rate (see text). For Haverigg II and III, the recorded collisions used for the calculations comprised one probable Golden Plover and one probable wader.

The avoidance rates for Blood Hill, Goole Fields I and Goole Fields II were calculated from the predicted collisions and Golden Plover fatality data provided in the relevant post-construction monitoring reports (see Section 3.1). The avoidance rate for Haverigg II and III is the avoidance rate figure provided in the relevant reports (see Section 3.1).

3.3.2. Correction factors

There are some complicating factors that need to be taken into account in assessing the reliability of the avoidance rate estimates in Table 3.4.

The maps of Golden Plover flightlines in the Blood Hill post-construction monitoring report show a concentration of flightlines in the western section of the 500 m buffer used for the collision risk model, with relatively few flightlines actually crossing the central part of the buffer where the turbines are located. This pattern suggests that the assuming random distribution of flight activity within the 500 m buffer will overestimate the actual collision risk.

For the Goole Fields I and Goole Fields II Wind Farms, the use of pre-construction vantage point survey data for the collision risk predictions means that the accuracy of the avoidance rate estimates is dependent on the pre-construction Golden Plover flight activity being representative of the post-construction Golden Plover flight activity (allowing for any macro-avoidance effects). At Goole Fields II, the mean Golden Plover bird-days/km^2 were around 2.1 times higher in the pre-construction surveys, compared to the post-construction surveys (Figure 15 in Percival *at al.*, 2019), while the mean Golden Plover count within the 600 m buffer zone was around 2.2 times higher during the pre-construction surveys, compared to the post-construction surveys (Table 22 in Percival *at al.*, 2019). These differences seem unlikely to be due to macro-avoidance effects as any displacement impacts to wintering Golden Plover would be likely to be contained within the 600 m buffer zone (and the mean Golden Plover bird-days/km^2 included counts outside the 600 m buffer zone).

The collision risk predictions used for the avoidance rate calculation for the Haverigg II and III Wind Farms used post-construction vantage point survey data. However, this was from a different winter (2014/15) than the winter used for the collision monitoring (2018/19). Therefore, the accuracy of the avoidance rate estimates is dependent on the Golden Plover flight activity patterns being similar in the two winters.

To allow for the above issues, I have used correction factors of 2.0 for the Blood Hill non-avoidance rate estimate, and 2.15 for the Goole Fields II non-avoidance rate estimate. The correction factor of 2.0 for the Blood Hill non-avoidance rate estimate is based on a visual estimate of differences in flightline densities in the western section of the buffer, compared to the central and eastern sections. The correction factor of 2.15 for the Goole Fields II non-avoidance rate estimate is the mean of the pre-construction / post-construction ratio of Golden Plover bird-days/km^2 and the pre-construction / post-construction ratio of Golden Plover counts within the 600 m buffer zone.

Applying correction factors of 2.0 to the Blood Hill non-avoidance rate estimate, and 2.15 to the Goole Fields II non-avoidance rate estimate, gives corrected avoidance rate estimates of 99.87-99.98%, while sufficient information is not available to assess whether a correction factor should be applied to the 99.6% avoidance rate for Haverigg II and III (Table 3.5).

Table 3.5. Corrected avoidance rate estimates.

Wind farm	Avoidance rate		Correction factor	Reason
	original	corrected		
Blood Hill	99.98%	99.96%	2.0	Uneven distribution of flight activity relative to turbine locations
Goole Fields I	99.98%	99.98%	1.0	-
Goole Fields II	99.94%	99.87%	2.15	Reduction in Golden Plover numbers
Haverigg II and III	99.6%	-	-	No data available to assess whether correction factor is needed (see text)

Note that the correction factor is applied to the non-avoidance rate. See text for further details of the reasons for the avoidance rate correction factors.

4. CONCLUSIONS

The collision monitoring methodologies used in the Blood Hill, Goole Fields I and Goole Fields II post-construction monitoring studies are robust and generally comply with best practice guidance (SNH, 2009). Therefore, I consider that the Golden Plover collision fatality estimates for the Goole Fields I and Goole Fields II Wind Farms from these studies are reliable. The reported zero collision fatality estimate for the Blood Hill Wind Farm does not include any correction for “false negatives” (cf., SNH, 2009), but I have allowed for this by using a nominal estimate in my calculations of avoidance rates.

The avoidance rates derived from these studies are very high, and even when I corrected two of them by doubling the non-avoidance rate to reflect uneven distribution of flight activity (Blood Hill) and apparent reductions in Golden Plover numbers (Goole Fields II), they remain around, or higher than, 99.9%. However, a degree of caution is necessary in applying these figures. Due to the low collision rate, very few collision fatalities are found. This means that random variation in the number of collision fatalities found can cause significant changes in the avoidance rate estimate. For example, if a second fatality had been found at Goole Fields II, then the corrected avoidance rate estimate would decrease from 99.87%-99.74%. While this change may seem small, it would cause a doubling in the predicted collision risk.

Detailed information about the collision monitoring methodology used for the Haverigg II and III Wind Farms post-construction monitoring study was not available to me for this review. However, I note that there was a lower frequency of monitoring (approximately monthly) compared to the other studies (weekly). This will have made the collision fatality estimate less reliable. The avoidance rate calculation for this wind farm used combined data for Golden Plover and Curlew, while the two collision fatalities were a probable Golden Plover and a probable wader. Also, the avoidance rate calculations used flight activity and collision fatality data from different winters, and, unlike with Goole Fields I and Goole Fields II it was not possible for me to assess whether differences in Golden Plover flight activity patterns between the winters could have affected the calculations[2]. Therefore, it is possible that the significantly lower avoidance rate calculated for this wind farm, compared to the avoidance rates for Blood Hill, Goole Fields I and Goole Fields II, reflects methodological issues.

These avoidance rates are only derived from four studies, with two of these studies carried out at adjoining wind farms. However, these still represent a much stronger evidence base for a species-specific avoidance rate than the evidence used for Kestrel in the SNH avoidance rate guidance (see Section 2.3). Also, other species-specific avoidance rates in the SNH avoidance rate guidance are based on data from limited numbers of sites: e.g., both the White-tailed Eagle avoidance rate (see Section 2.3) and the Whooper Swan avoidance rate (Whitfield and Urquhart, 2015) are based on data from single sites. Therefore, the evidence base for a species-specific avoidance rate is relatively strong for Golden Plover compared to some of the species for which the SNH avoidance rate guidance does include species-specific avoidance rates. The lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance may reflect the fact that the conservation concern about Golden Plover and wind farms in Scotland is focussed on breeding populations. Data from wintering populations (such as in the studies reviewed here) may not be applicable to breeding populations due to the differences in their behaviour and ecology.

The highest avoidance rate currently recommended by SNH (2018) is 99.8% for geese. The narrow range of the corrected avoidance rates for Blood Hill, Goole Fields I and Goole Fields II (99.87-99.98%) would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at Haverigg II and III is lower than this value, although

[2] Note that, while my assessment of this issue for the Goole Fields II Wind Farm resulted in an increase in the corrected avoidance rate, compared to the original value, it is equally plausible that differences in flight activity between winters could cause a decrease in the corrected avoidance rate, compared to the original value.

there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

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APPENDIX 5

BIRD SURVEY REPORT: MARCH 2021-MARCH 2022

MKO Planning and Environmental Consultants

Bird Survey Report: March 2021 – March 2022

Coole Wind Farm

DOCUMENT DETAILS

Client: **Statkraft**

Project Title: **Coole Wind Farm**

Project Number: **200445g**

Document Title: **Bird Survey Report: March 2021 – March 2022**

Document File Name: **200445g– F – Bird Report Mar21-Mar22 2022.10.27**

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Rev	Status	Date	Author(s)	Approved By
01	Draft	21/10/2022	PM	PC
02	Final	27/10/2022	PM	PC

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1. INTRODUCTION

McCarthy Keville O'Sullivan (MKO) was appointed to carry out bird survey works at Coole Wind Farm during the period from March 2021 to March 2022 inclusive. This report also includes discussion of the key observations from the 2022 breeding season. It is further noted that surveys will continue this winter 2022/23, this data was not available at the time of writing this response but can be collated and made available on request. The site is located north of Coole Village in County Westmeath (53.734193, -7.3807204). The dominant habitat onsite is cutover bog, conifer plantation and improved agricultural grassland with accompanying smaller areas of wet grassland. The wider surroundings are predominantly cutover bog, to the west and north, and improved agricultural grassland, to the east and south. The total area of the wind farm site is approximately 495ha.

This report describes the ornithological survey methods employed and survey data collected at Coole for the period from March 2021 to March 2022 inclusive. The key observations from the 2022 breeding season are included in Section 3.2.9. This report also contains information compiled during desktop studies. Particular attention has been paid to species of conservation importance and identified target species.

The report is supported by Technical Appendix 1 (Survey Effort), Appendix 2 (Survey Data) and Appendix 3 (Confidential Data) which contains the raw data from the breeding bird surveys undertaken during the survey period. This includes detail on survey times, weather conditions, surveyors, survey results and other additional information. Flight line figures from surveys are included in Appendix 4. Appendix 5 contains the collision risk assessment.

The report is structured as follows:

- An introduction providing a description of the background and statement of authority regarding ornithological works.
- An update to the desktop study that was carried out as part of the EIAR.
- A comprehensive description of the ornithological surveys carried out.
- A full description of results for all ornithological surveys carried out.
- An updated impact assessment incorporating the data contained within the EIAR and this report.
- Conclusion

The following defines terms used in this report:

- "Zones of Influence" (ZOI) for potential ornithological receptors refer to the zone within which potential effects are anticipated. ZOIs were assigned following the best available guidance (SNH 2016 and McGuinness et.al 2015).

1.1 Statement of Authority

This report has been prepared by Patrick Manley (B.Sc.) Project Ornithologist with MKO. The field surveys were undertaken by Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Patrick Manley, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

2. DESK STUDY & CONSULTATION

2.1 Desk Study Methods

A comprehensive desk study was undertaken to search for any changes in the relevant information on species of conservation concern which may potentially make use of the study area since the EIAR was submitted. The assessment included a thorough review of the latest ornithological data not available at the time of EIAR submission. These include:

- Review of online web-mappers with more up to date available data: Irish Wetland Bird Survey (I-WeBS).
- Review of Birds of Conservation Concern (BoCCI) in Ireland 2020-2026 (Gilbert et al., 2021)
- Review of the 2020 International Swan Census data (Burke et al., 2021).

2.2 Desk Study Results

2.2.1 Bird of Conservation Concern (BoCCI) in Ireland 2020-2026

As per Bird of Conservation Concern (BoCCI) in Ireland 2020-2026, the following key ornithological receptors from the EIAR have been added to the BoCCI red-list:

- Kestrel
- Snipe

The following key ornithological receptors from the EIAR have been moved from the BoCCI red-list to the BoCCI Amber-list:

- Black-headed Gull
- Teal
- Wigeon

2.2.2 Irish Wetland Bird Surveys (I-WeBS)

The I-WeBS data presented in the EIAR was the county population estimate based on the five year mean from 2011/12 to 2015/16. The most up to date I-WeBS data currently available is the five year mean from 2015/16 to 2019/20. It is noted that this is an estimate, based on the best available information for water bird species. The table below shows the change in county population size for each species discussed in the EIAR, where I-WeBS data was used to evaluate county importance thresholds.

Table 1 I-WeBS updated county population sizes

Species	2011/12-2015/16 Mean	2015/16-2019/20 Mean
Greenland White-fronted Goose	291	235
Golden Plover	2,610	264
Wigeon	632	248
Teal	450	221

2.2.3 2020 International Swan Census

At the time of submission of the EIAR the Swan Census 2015 (Crowe et al., 2015) was the latest available data for whooper swan. In 2021, the 2020 International Swan Census data was published (Burke et al., 2021). The EIAR referenced the Westmeath county population to be 389 whooper swan. The 2020 Swan Census estimated the Westmeath whooper swan population to be 982 birds.

2.2.4 EPA Guidelines

The Environmental Protection Agency guidelines on the information to be contained in Environmental Impact Assessment Reports were updated in May 2022 (EPA, 2022). This document was reviewed for changes compared to the EPA (2017) guidelines and the new guidelines were adhered to in this report.

3. FIELD SURVEYS

3.1 Field Survey Methods

This section of the report describes the various field survey methods employed. Field surveys were undertaken from March 2021 to March 2022 inclusive[1]. The data provided in this report is robust and allows clear, precise and definitive conclusions to be made with regard to the likely significant effects on avian receptors identified within the subject site. Field survey methodologies have been devised to survey for the bird species composition and assemblages that occur within the study area.

3.1.1 Initial Site Assessment

The likely importance of the study area for bird species was determined, based on the results of the previous surveys as reported in the EIAR, the desk study and reconnaissance site visits. Based on the collated information available from the above preliminary assessment and adopting a precautionary approach, a site-specific scope for the ornithological surveys was developed.

3.1.2 Vantage Point Surveys

Vantage point (VP) surveys were undertaken in accordance with SNH guidance (SNH, 2017) from two vantage point locations from March 2021 to September 2021 (VP4 & VP6) and from four vantage point locations from October 2021 to March 2022 (VP3, VP4, VP5 & VP6). Data on bird observations and flight activity was collected from a scanning arc of 180° and a two-kilometre radius by an observer at each fixed location for six hours per month. Surveys were timed to provide a spread over the full daylight period including at dawn and dusk to coincide with the highest peaks of bird activity.

Details on the vantage point watch survey effort are presented in Appendix 1 of this report. This appendix includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Appendix 4, Figure 1 shows the locations of vantage points and technical data is provided in Appendix 2.

Flight activity was assigned to distinct height bands. The flight bands were chosen with reference to the dimensions of likely turbine models for the site and the resulting potential collision height. Bands are split into 0-15m, 15-25m, 25m-200m and 200m+. Taking a precautionary approach 15-200m is considered potential collision height (PCH), i.e. the height of the rotating turbine blade.

3.1.2.1 Viewshed Analysis

Viewshed analysis was carried out to confirm the sufficiency of the selected fixed vantage point locations (VP3, VP4, VP5 & VP6) prior to the commencement of surveys in March 2021(or September 2022 where relevant). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional and precautionary layer suspended at 20m, which represents the lowest swept height of the turbine blades. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance emphasises the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a view shed point two metres in height (to represent the height of the observer) on a map using 10 metre contours terrain data. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 20

[1] *In addition, the key observations from the 2022 breeding season are included in Section 3.2.9 below.*

metres from ground level up to a two-kilometre radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the likely maximum viable area of the site for a wind energy development in line with SNH's recommendation to conduct surveys to 500m from the outermost turbines of a proposed wind farm site (2017). The viewshed analysis offers maximum views of the study area with adequate coverage of the proposed turbine layout. As described above, the predicted collision risk height band that was used in the current assessment is considered to be precautionary and in line with previous recommended height bands advocated in SNH (2005) guidance documents. Appendix 4, Figure 1a, 1b and 1c show the viewshed analysis of the four vantage point locations at 20m, 26m and 25m, respectively.

3.1.3 Breeding Walkover Surveys

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable, or confirmed breeding territories for bird species observed within the study area. The survey methodology followed the O'Brien and Smith method for lowland sites as outlined in Gilbert et al. (1998). The study area for these surveys was the wind farm site and a 500m survey radius of the wind farm site.

Transects were selected in order to survey all areas of suitable breeding/ foraging habitat to within 100m, where access allowed. Target species included waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out during daylight hours, during the core breeding season months of April, May, June and July (2021), with the wind farm site being visited three days per month on each occasion. Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 2 in Appendix 3 shows the survey area.

3.1.4 Breeding Raptor Surveys

Breeding raptor surveys (*i.e.,* birds of prey and owls) were undertaken within the study area and its immediate surroundings. These surveys aimed to identify occupied territories and ascertain whether breeding was successful. Methodology followed Hardey *et al.* (2013). Raptor surveys were undertaken onsite and to a 2km radius from the wind farm site every month during the core breeding season period (April to July 2021).

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 3 in Appendix 4 shows the study area extending 2km from the wind farm site.

3.1.5 Woodcock Surveys

Breeding season surveys for woodcock were undertaken in accordance with Gilbert et. al (1998). The survey area extended 500m beyond the wind farm site. All surveys were undertaken in areas of suitable breeding habitat during May and June 2021. Surveys commenced one hour before sunset and continue for an hour after sunset/ until it was too dark to see. The survey aimed to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area. This survey method also allowed the observer to survey for owls, i.e., barn owls and long-eared owls.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 4 in Appendix 4 shows survey area and technical data is provided in Appendix 2.

3.1.6 Winter Walkover Surveys

Winter walkover surveys were undertaken to record the presence of bird species of high conservation concern within areas of potentially suitable habitat in the wind farm site and a 500m survey radius of the wind farm site.

Transect routes, devised to ensure coverage of different habitat complexes, were visited within the study area during the winter months. Methodology was broadly based on adapted Brown and Shepherd methods. Target species included raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 5 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.7 Wildfowl Distribution Surveys

Significant wetland sites and waterbodies within eight kilometres of the study area were surveyed for waterbird populations between September 2021 and March 2022. The area surveyed exceeded the requirements of SNH (SNH, 2017), i.e., 500m for foraging wildfowl and one kilometre for roosting wildfowl. In addition, the Lough Iron waterbird population situated approximately 12.8km to the south-west of the wind farm site was monitored one day per month during the same period, with a particular focus on Greenland white-fronted goose. The count methodology was in line with survey guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours from suitable vantage points at the wetland sites.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 6 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.8 Survey Justification

A comprehensive suite of bird surveys was undertaken at the site between March 2021 and March 2022, as detailed in this report. Results in this report are derived from a continuous thirteen months of surveying undertaken in accordance with SNH Guidance.

The surveys undertaken provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the wind farm site on avian receptors. The survey duration and scope are considered entirely satisfactory.

3.2 Field survey results

3.2.1 Introduction

The following target species were recorded between March 2021 and March 2022 and observations are described in detail in subsequent sections below. The list is ordered in accordance with conservation significance: Annex I species, SCIs of designated sites, Red listed species and raptors:

- Common Tern (Annex I)
- Golden Plover (Annex I; SCI species of nearby SPA)
- Greenland White-fronted Goose (Annex I; SCI species of nearby SPAs)
- Hen harrier (Annex I)
- Kingfisher (Annex I)
- Little Egret (Annex I)
- Merlin (Annex I; Schedule IV of the Wildlife Act; 1976)
- Peregrine Falcon (Annex I; Schedule IV of the Wildlife Act; 1976)
- Ruff (Annex I)
- White-tailed Eagle (Annex I; Schedule IV of the Wildlife Act; 1976)
- Whooper Swan (Annex I; SCI species of nearby SPA)
- Coot (SCI species of nearby SPA)
- Shoveler (SCI species of nearby SPAs)
- Teal (SCI species of nearby SPA)
- Tufted Duck (SCI species of nearby SPAs)
- Wigeon (SCI species of nearby SPA)
- Curlew (BoCCI Red listed)
- Goldeneye (BoCCI Red listed)
- Kestrel (BoCCI Red listed)
- Lapwing (BoCCI Red listed)
- Pochard (BoCCI Red listed)
- Snipe (BoCCI Red listed)
- Woodcock (BoCCI Red listed)
- Buzzard
- Long-eared Owl
- Sparrowhawk

The following sections describe the observations of each target species under the individual survey headings. Raw data and maps are provided in Appendix 2 and Appendix 4, respectively.

3.2.2 Vantage Point Survey Results

Vantage point surveys were undertaken at the site between March 2021 and March 2022 inclusive. Summary results from vantage point surveys are presented below in Table 3-1 and discussed in further detail in Section 4 of this report.

Table 3-1 Vantage Point Survey Results

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	9	126,830	8	Flocks of between six and 175 birds commuting or circling over the wind farm site.	Appendix 4, Figure 1.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1,400	1	One observation of a flock of 14 birds commuting.	Appendix 4, Figure 1.2
Annex I; BoCCI Red Listed	Hen Harrier	8	0	7	There were eight observations of hen harrier at the wind farm site. All of which were of birds commuting or landing in scrub near the River Inny.	Appendix 4, Figure 1.3
Annex I	Kingfisher	2	0	2	One observation of a bird flying from a drain and one of a bird heard calling.	Appendix 4, Figure 1.4
Annex I; Schedule IV of the Wildlife Act	Merlin	5	0	5	Four observations of an individual hunting and one observation of an individual commuting.	Appendix 4, Figure 1.5
Annex I; Schedule IV of the Wildlife Act	Peregrine	2	12	1	One observation of an individual hunting and one of an individual commuting.	Appendix 4, Figure 1.6
Annex I; SCI of nearby SPAs	Whooper Swan	25	13,704	19	All observations were of birds commuting. Flocks ranged from two to sixteen birds.	Appendix 4, Figure 1.7
SCI of nearby SPAs	Coot	4	317	4	All observations were of one or two birds commuting.	Appendix 4, Figure 1.8

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
BoCCI Red Listed	Curlew	2	590	2	There were two observations of birds commuting/soaring, ranging from one to three birds.	Appendix 4, Figure 1.9
BoCCI Red Listed	Kestrel	30	5,655	25	Most observations were of birds hunting or commuting. There was one observation of a kestrel being chased by a buzzard. All observations were of individuals.	Appendix 4, Figure 1.10
BoCCI Red Listed	Lapwing	1	2,025	1	There was one observation of a flock of 25 birds commuting.	Appendix 4, Figure 1.11
BoCCI Red Listed	Snipe	18	130	15	There were four observations of one or two birds commuting. There was one observation of a bird being flushed. Additionally, there were four birds heard drumming and nine calling.	Appendix 4, Figure 1.12
BoCCI Red Listed	Woodcock	2	0	2	Two observations of birds roding in March.	Appendix 4, Figure 1.13
Schedule IV of the Wildlife Act	Buzzard	62	8,452	49	Most observations were of birds soaring, travelling or hunting. There was one observation of a buzzard chasing a kestrel in August. There were six observations of buzzards displaying between January and March 2022.	Appendix 4, Figure 1.14
Schedule IV of the Wildlife Act	Long-eared Owl	1	0	0	One observation of a bird perched in a tree and being mobbed by corvids.	Not Mapped
Schedule IV of the Wildlife Act	Sparrowhawk	7	166	7	There were three observations of sparrowhawk in April. Flying and perching at the known nest site. The remaining flights were of birds hunting or commuting.	Appendix 4, Figure 1.15

3.2.3 Breeding Walkover Survey Results

Breeding walkover surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding walkover surveys are presented below in Table 3-2 and discussed in more detail in Section 4 of this report.

Table 3-2 Breeding Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Breeding Status	Figure
Annex I; SCI of nearby SPA	Golden Plover	1	1	One observation of three birds travelling at the beginning of April 2021. Likely remnant wintering birds on route north to summer breeding grounds.	**Non-breeding**	Appendix 4, Figure 2.1
BoCCI Red Listed	Lapwing	6	3	Four observations of territorial behaviour. There were three territories identified, two to the north of the wind farm site (one immediately adjacent to the wind farm site and one approx. 400m from the wind farm site). The third territory was at the historical territory, approximately 3.8km south of the wind farm site	**Confirmed – Three breeding territories**	Appendix 4, Figure 2.2
BoCCI Red Listed	Snipe	8	4	There were six observations of flushed birds, one of a bird flying and one of a bird displaying, approximately 3.8km south of the wind farm site	**Probable – One breeding territory**	Appendix 4, Figure 2.3
Schedule IV of the Wildlife Act	Buzzard	4	4	There were three observations of birds calling, and one observation of a bird flying from trees and circling	**Non-breeding**	Appendix 4, Figure 2.4
Schedule IV of the Wildlife Act	Sparrowhawk	1	1	One observation of a bird carrying nesting material to a nest site	**Confirmed – One breeding territory**	Appendix 4, Figure 2.5

3.2.4 Breeding Raptor Survey Results

Breeding raptor surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding raptor surveys are presented in Table 3-3 below and discussed in more detail in Section 4 of this report.

Table 3-3 Breeding Raptor Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/within 500m	Activity of note	Breeding Status	Figure
Annex I	Peregrine	2	0	Two observations of birds travelling/soaring	**Non-breeding**	Appendix 4, Figure 3.1
Annex I	White-tailed Eagle	1	0	One observation of a bird travelling, and being mobbed by buzzard	**Non-breeding**	Appendix 4, Figure 3.2
BoCCI Red Listed	Kestrel	8	1	All observations were of birds travelling or hunting	**Non-breeding**	Appendix 4, Figure 3.3
Schedule IV of the Wildlife Act	Buzzard	31	0	Most observations were of birds travelling, soaring or hunting. There was one observation of two buzzards mobbing a white-tailed eagle in July	**Non-breeding**	Appendix 4, Figure 3.4
Schedule IV of the Wildlife Act	Sparrowhawk	3	1	All observations were of birds travelling	**Non-breeding**	Appendix 4, Figure 3.5

3.2.5 Breeding Woodcock Survey Results

A number of woodcock observations were recorded during targeted breeding woodcock surveys. All observations are detailed in Table 3-4 below and discussed in further detail in Section 4 of this report.

Table 3-4 Breeding Woodcock Observations

Conservation Status	Species	Observations recorded during surveys	Number of birds within 500m of site	Activity of note	Breeding Status	Figure
BoCCI Red List (Breeding populations only)	Woodcock	30	30	All observations were of birds roding	**Probable – Seven breeding territories**	Appendix 4, Figure 4.1

3.2.6 Winter Walkover Survey Results

Winter walkover surveys were carried out during the 2021/2022 winter season: October to March. Summary results from winter walkover surveys are presented below in Table 3-5 and discussed in more detail in Section 4 of this report.

Table 3-5 Winter Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	4	4	Observations ranged from four to sixteen birds. There were two observations of birds commuting and two of birds roosting on the bog.	Appendix 4, Figure 5.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1	One observation of five birds commuting over the wind farm site.	Appendix 4, Figure 5.2
Annex I	Kingfisher	1	1	One observation of an individual flying along the River Inny.	Appendix 4, Figure 5.3
SCI of nearby SPA	Teal	3	3	There was one observation of two birds commuting, one of two birds roosting and one of a flock of 22 birds foraging.	Appendix 4, Figure 5.4
SCI of nearby SPA	Wigeon	1	1	There was one observation of a flock of eight birds foraging.	Appendix 4, Figure 5.5
BoCCI Red Listed	Kestrel	1	1	One observation of an individual perched.	Appendix 4, Figure 5.6
BoCCI Red Listed	Lapwing	1	1	One observation of 4 pairs of lapwing nest building in mid-March.	Appendix 4, Figure 5.7
BoCCI Red Listed	Snipe	8	8	All observations were of birds being flushed by the observer. Numbers ranged from one to four birds.	Appendix 4, Figure 5.8

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	7	7	All observations were of one or two birds commuting.	Appendix 4, Figure 5.9

3.2.7 Wildfowl Distribution Surveys

Wildfowl distribution surveys were carried out during the 2021/22 winter season: September to March. Summary results from wildfowl distribution surveys are presented below in Table 3-6 and discussed in more detail in Section 4 of this report.

Table 3-6 Wildfowl Distribution Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
Annex I	Common Tern	1	2	0	Two birds seen flying at Lough Derravaragh.	Appendix 4, Figure 6.1
Annex I; SCI of nearby SPA	Golden Plover	4	5 – 160	1	All observations were of birds commuting or circling.	Appendix 4, Figure 6.2
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	4	4 – 24	0	All observations were of birds foraging at Piercefield, near Lough Iron.	Appendix 4, Figure 6.3
Annex I	Kingfisher	1	1	0	One observation of a bird foraging along the River Inny.	Appendix 4, Figure 6.4
Annex I	Little Egret	16	1 – 2	2	All observations were of birds commuting, foraging or roosting. Birds were observed at Lough Iron, Lough Bane, Lough Sheelin, Derragh Lough and Brackragh Lough.	Appendix 4, Figure 6.5
Annex I	Ruff	1	2	1	One observation of two birds perched on peat at the wetland west of Lough Bane.	Appendix 4, Figure 6.6
Annex I	Whooper Swan	36	1 – 77	3	Birds observed at Lough Iron, Derragh Lough, River Inny, Lough Bane and Lough Sheelin.	Appendix 4, Figure 6.7

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
SCI of nearby SPA	Coot	167	1 – 890	0	Birds observed on Deragh Lough, Lough Iron Lough Kinale, Lough Sheelin, Lough Derravaragh, Bracklagh Lough and along the River Inny.	Appendix 4, Figure 6.8
SCI of nearby SPAs	Pochard	18	1 – 182	0	Birds observed on Lough Kinale, Lough Sheelin, Lough Derravaragh and Bracklagh Lough.	Appendix 4, Figure 6.9
SCI of nearby SPAs	Shoveler	11	5 – 36	0	Birds observed at Derragh Lough, Lough Iron, And Lough Sheelin.	Appendix 4, Figure 6.10
SCI of nearby SPA	Teal	41	3 – 240	7	Birds observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown.	Appendix 4, Figure 6.11
SCI of nearby SPAs	Tufted Duck	48	2 – 190	0	Birds observed at Lough Kinale, Bracklagh Lough, Lough Sheelin, Lough Derravaragh, Deragh Lough, Lough Iron and Robinstown.	Appendix 4, Figure 6.12
SCI of nearby SPA	Wigeon	37	2 – 263	8	Birds observed at Derragh Lough, Lough Derravaragh, Lough Sheelin, Lough Iron, Lough Kinale and Lough Bane.	Appendix 4, Figure 6.13
BoCCI Red Listed	Curlew	3	2 – 57	1	All observations were of birds commuting.	Appendix 4, Figure 6.14
BoCCI Red Listed	Goldeneye	9	5 – 24	0	Birds observed on Lough Derravaragh and Lough Sheelin.	Appendix 4, Figure 6.15
BoCCI Red Listed	Lapwing	28	1 – 245	6	All observations were of birds commuting, foraging or roosting.	Appendix 4, Figure 6.16

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
BoCCI Red Listed	Snipe	13	1 – 4	5	All observations were of birds being flushed by the observer.	Appendix 4, Figure 6.17

3.2.8 Incidentals

A number of incidental observations of target species were recorded during the survey period. The most significant of these observations are detailed in Table 3-7 below and discussed in further detail in Section 4 of this report.

Table 3-7 Incidental Observations

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Annex I	Kingfisher	Wildfowl distribution surveys	8	Birds observed along the River Inny.	Appendix 4, Figure 7.1
Annex I	Peregrine	Vantage point survey	1	One bird commuting at Doon.	Appendix 4, Figure 7.2
Annex I	White-tailed Eagle	Wildfowl distribution surveys	1	One observation of a birds soaring over Lough Derravaragh.	Appendix 4, Figure 7.3
BoCCI Red Listed	Kestrel	Wildfowl distribution surveys & winter walkover surveys	18	All observations were of birds commuting, hunting or perched.	Appendix 4, Figure 7.4
BoCCI Red Listed	Lapwing	Breeding raptor surveys	10	Two breeding territories identified to the north of the wind farm site.	Appendix 4, Figure 7.5
BoCCI Red Listed	Snipe	Breeding woodcock & vantage point surveys	10	Five observations of birds drumming and five observations of birds being flushed by the observer.	Appendix 4, Figure 7.6

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	32	All observations were of birds commuting, soaring or perched.	Appendix 4, Figure 7.7
Schedule IV of the Wildlife Act	Sparrowhawk	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	6	All observations were of birds commuting.	Appendix 4, Figure 7.8

3.2.9 Target Species Status Summary

While breeding/roosting status is assigned according to the evidence obtained during individual breeding bird surveys as reported in Tables 3-1 to 3-7 above, Table 3-8 below provides the status of target species observed during surveys between March 2021 and March 2022 at Coole Wind Farm. In addition, the key observations from the 2022 breeding bird surveys are also summarised in the below table.

Table 3-8 Target Species Status Summary

Species	Overall breeding status	Overall roosting status
Greenland White-fronted Goose	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Golden Plover	**No breeding site identified.**	**No regularly used roosts identified.**
Hen Harrier	**No breeding site identified.**	**No regularly used roosts identified.**
Kingfisher	**No breeding site identified.**	**No regularly used roosts identified.**
Peregrine	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** Peregrine occupied the known breeding territory, approximately 1.3km from the wind farm site, during the 2022 breeding season. This site was last occupied in 2016. Please refer to Confidential Appendix 3 for location details.	**No regularly used roosts identified.**
White-tailed Eagle	**No breeding site identified.**	**No regularly used roosts identified.**
Whooper Swan	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Kestrel	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** One observation of a bird being agitated and one of a bird carrying prey, within the wind farm site. It is assumed both of these observations relate to one confirmed breeding territory, within the wind farm site.	**No regularly used roosts identified.**
Lapwing	**Confirmed breeding** **March 2021 to March 2022:** Three breeding territories, one presumed successful and two failed to fledge young. Two within 500m of the wind farm site, and one approximately 3.8km from the wind farm site. Please refer to Confidential Appendix 3 for location details. **Summer 2022:** There was an estimated 4 – 10 pairs of lapwing breeding in this area c. 441m from the nearest proposed infrastructure. This is discussed further in Section 4.4.7.	**No regularly used roosts identified.**

Species	Overall breeding status	Overall roosting status
Snipe	**Probable breeding –** Nine breeding territories identified, six within, or partially within, the wind farm site, to the north. Two within 500m of the wind farm site to the north. One approximately 3.8km south of the wind farm site. **Summer 2022** – Snipe were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Woodcock	**Probable breeding –** Seven breeding territories identified. Five within, or partially within, the wind farm site. **Summer 2022** – Woodcock were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Buzzard	**No breeding site identified.**	**No regularly used roosts identified.**
Sparrowhawk	**Confirmed breeding –** One territory, within the wind farm site. Sparrowhawk were also confirmed to have bred successfully within the wind farm site during the 2022 breeding season.	**No regularly used roosts identified.**

4. IMPACT ASSESSMENT

The ornithological evaluation criteria and impact assessment methods are outlined in Section 7.2.5 of the EIAR.

4.1 Identification of Key Ornithological Receptors

The identification of KOR species is outlined in Section 7.6 of the EIAR. Given the observations between March 2021 and March 2022 are in keeping with those outlined in the EIAR, the identified KOR species remains the same.

The following species were not discussed in the EIAR but were observed during surveys between March 2021 and March 2022:

- Common Tern
- Kingfisher
- Little Egret
- Ruff
- White-tailed Eagle
- Goldeneye

Of these, only kingfisher was observed at, or within 500m of, the wind farm site. This species was recorded infrequently and in low numbers. Therefore, kingfisher is not considered a KOR. The remaining species were only observed during the wildfowl distribution surveys, up to 8km from the wind farm site and are therefore not considered a KOR.

The following species have been moved from the BoCCI red list to the BoCCI amber list and were only recorded infrequently and in low numbers during surveys at, or near, the wind farm site between March 2021 and March 2022. Therefore, an updated impact assessment for these species is not required:

- Black-headed gull
- Teal
- Wigeon

Furthermore, osprey, barn owl and red kite were not recorded during these surveys, therefore, an updated impact assessment for these species is not required.

Please refer to the EIAR as lodged for the impact assessment.

4.2 KOR Sensitivity Determination

Criteria developed by Percival (2003) is presented in **Error! Reference source not found.** (Section **Error! Reference source not found.**) of the EIAR for assessing bird sensitivity within the study area. The sensitivity of KOR as per Percival are listed below and includes the rationale for their respective sensitivity classification included in brackets.

Very High Sensitivity KORs include:

- Greenland White-fronted Goose (Annex I; EU Birds Directive, SCI of nearby SPAs)

Medium Sensitivity KORs include:

- Golden Plover (Annex I; EU Birds Directive)

- Merlin (Annex I; EU Birds Directive)
- Peregrine Falcon (Annex I; EU Birds Directive)
- Whooper Swan (Annex I; EU Birds Directive)
- Kestrel (BoCCI Red-listed)
- Lapwing (BoCCI Red-listed)
- Snipe (BoCCI Red-listed)
- Woodcock (BoCCI Red-listed)

The remaining KORs identified in the study area were classified as **Low Sensitivity**:

- Buzzard
- Long-eared Owl
- Sparrowhawk

Please note since the lodging of the planning application for the proposed development the conservation status of several species has changed due to the recent update of the BoCCI red-list (Gilbert et al. 2021), this change is reflected in the classification of sensitivity for those species. The following updates have been made:

- Kestrel was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.
- Snipe was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.

4.3 Potential Effects Associated with the Proposed Development

As per SNH Guidance, wind farms present three potential risks to birds (Drewitt & Langston 2006, 2008; Band et al. 2007):

- **Direct habitat loss** through construction of wind farm infrastructure;
- **Displacement** (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds;
- Death through **Collision** or interaction with turbine blades and other infrastructure.

4.4 Effects on Key Ornithological Receptors during Construction and Operation

4.4.1 Greenland White-fronted Goose (*Wintering*)

As outlined in Section 7.8.2.2 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.2 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.2 of the EIAR, the vast majority of observations were of flocks recorded at Lough Iron, approximately 12.8km from the wind farm site. During surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). There was no evidence of roosting or foraging within 1km of the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.2 of the EIAR, this species was not recorded utilising habitats on, or within 500m of, the wind farm site. The species was observed flying over the site on only one occasion between March 2021 and March 2022.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
	Given the low numbers recorded and the abundance of suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. Significant effects with regard to displacement are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	*Negligible* Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Similar to the data outlined in Section 7.8.2.2 of the EIAR, there was only one observation of birds commuting over the wind farm site between March 2021 and March 2022. Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind site. There was no foraging birds recorded on, or within 500m of, the wind farm site. Similarly, there was no evidence of roosting birds on, or within 1km of, the wind farm site. No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A “Random” collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.04 collisions per year, or one bird every 25 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.2 Golden Plover (*Wintering*)

As outlined in Section 7.8.2.3 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.3 of the EIAR for further details on the impact assessment for golden plover. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	In contrast to the data presented in Section 7.8.2.3 of the EIAR, there were no observations of golden plover utilizing habitats on, or within 500m of, the wind farm site between March 2021 and March 2022. Significant effects with regard to direct habitat loss are not predicted, given the development infrastructure is confined to a narrow corridor, therefore direct habitat loss will be minimal. Furthermore, the habitats within the Site are not of particularly high quality and there is an abundance of similar habitat in the surrounding area. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As per McGuinness et al. (2015) the zone of sensitivity for the species is 800m during the breeding season only. The species is not identified as being particularly sensitive to wind farm developments during the wintering period. This species was recorded commuting or circling over the bog on, or within 500m of, the wind farm site during the winter season. Numbers of county importance were observed on six occasions on, or within 500m of, the wind farm site.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	This is a marked reduction in the use of the Site compared to the regular use of the Site as reported in the EIAR. Given the abundance of similar suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	A review of 29 studies suggests golden plover will approach wind turbines to an average distance of 175m in non-breeding season (Hötker et al., 2006). There were 10 observations of golden plover within 200m of the proposed turbine layout during surveys between March 2021 and March 2022. In the event of displacement, there are sufficient areas of suitable habitat in the wider area to render such an effect inconsequential. Furthermore, habitats within the wind farm site (e.g. cutover bog) are not of particularly high quality. There is no evidence to suggest that the wind farm site lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (EIAR Appendix 7-5). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. Please see Appendix 5 for further discussion.	Impact corresponds to a ***Low*** effect significance. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.3 Merlin (All Seasons)

As outlined in Section 7.8.2.4 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.4 of the EIAR for further details on the impact assessment for merlin. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	A similar abundance and rate of occurrence was recorded between March 2021 and March 2022 as reported in Section 7.8.2.4 of the EIAR. This species was not recorded utilising habitats within the wind farm site for roosting or breeding. Significant effects are not anticipated particularly given the low levels of activity recorded. The species was recorded hunting onsite on only four occasions between March 2021 and March 2022. This is not significantly different from the seven observations over four years as outlined in Section 7.8.2.4 of the EIAR. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.4 of the EIAR, there was no breeding activity recorded within the study area during the 2021 breeding season. Significant displacement effects are not anticipated, given how infrequently the wind farm site was visited by this species. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated particularly given the low levels of activity recorded throughout surveys. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was infrequently recorded flying with the potential collision risk zone during Vantage Point surveys. A “Random” collision risk analysis has been undertaken on a precautionary basis and full details are provided in Appendix 5. The collision risk has been calculated to be 0.011 collisions per year, or approximately one bird every 92 years. The results of this analysis are not significantly different from the collision risk report in the EIAR as lodged. The predicted collision risk is insignificant.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.4 Peregrine (*All Seasons*)

As outlined in Section 7.8.2.5 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.5 of the EIAR for further details on the impact assessment for peregrine. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented in Section 7.8.2.5 of the EIAR, this species was only occasionally recorded commuting/hunting at the wind farm site. There is no significant difference in the rate of occurrence of peregrine between these surveys and those discussed in Section 7.8.2.5 of the EIAR. There is no suitable breeding habitat for this species within the wind farm site. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	No breeding territories or roost sites were recorded within the wind farm site. Breeding activity was recorded at the historic nest site (please see Confidential Appendix 3 for further details), approximately 1.3km from the wind farm site, during the 2022 breeding season. Peregrine were recorded foraging on one occasion within the wind farm site between March 2021 and March 2022. However, the wind farm site does not contain habitats that are of particularly high quality or unique to the local area. Therefore, if displacement was to occur it would not result in the loss of a scarce resource for the local population.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement or barrier effects are not predicted, particularly given the separation distance between the wind farm site and the nest site. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Disturbance impacts are not predicted for the nest, given the significant separation distance involved, i.e. 1.6km from the nearest proposed turbine. As previously discussed, this species was only recorded foraging within the wind farm site on one occasion between March 2021 and March 2022, which is less frequent that the data presented in the EIAR shows. Furthermore, the wind farm site does not contain habitats that are of particularly high quality for this species or unique to the local area. Therefore, if displacement were to occur it would not result in the loss of a scarce resource for the local population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at 0.196 collisions per year or one bird every 5 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. Significant effects are not predicted for a rate of one potential collision every eight years.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.5 Whooper Swan (*Wintering*)

As outlined in Section 7.8.2.1 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.1 of the EIAR for further details on the impact assessment for whooper swan. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	The wind farm site is dominated by cutover bog, this is not considered suitable for wintering whooper swan. There were no whooper swans observed utilising the habitats within the wind farm site. The unfavourable nature of this habitat limits the potential for construction activities to result in ecologically significant habitat loss for whooper swan. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data presented in Section 7.8.2.1 of the EIAR, most observations were of flocks recorded during the wildfowl distribution surveys, with the majority of these being at Lough Iron, approximately 12.8km from the wind farm site. In contrast to the data presented in Section 7.8.2.1 of the EIAR, the frequency of whooper swan commuting flights over the wind farm site increased during surveys between March 2021 and March 2022. There were 25 observations of whooper swan commuting during this period, compared to an average of three flights per winter presented in Section 7.4.1 of the EIAR (twelve flights total over a four-year period). The number of birds per flock remained similar to	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	those presented in Section 7.4.1 of the EIAR, with between two and sixteen birds being observed. However, the number of flights over the wind farm site remains low and given that the habitats on site are unlikely to attract whooper swan significant disturbance impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	No foraging areas were recorded on, or within 500m of, the wind farm site and there was no evidence of roosting on, or within 1km of, the wind farm site. Whooper swan were rarely recorded flying over the wind farm site during surveys presented in the EIAR. The frequency of flights increased slightly between March 2021 and March 2022 compared to data presented in Section 7.4.2 of the EIAR, but whooper swans were still infrequently observed. Survey results indicate that the wind farm site does not lie on a migratory corridor for this species. Therefore, no barrier effect is predicted. Based on the complete dataset there is no potential for significant displacement effects given that whooper swans were not dependent on the habitats of the whooper swan for roosting or feeding. Furthermore, it is unlikely that any significant displacement impact will result during the operational phase, given the low level of flight activity and particularly the low numbers recorded per flight.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.79 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.6 Kestrel (All Seasons)

As outlined in Section 7.8.2.17 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.17 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented Section 7.8.2.17 in the EIAR, this species was frequently recorded hunting, potentially breeding and commuting on, or within 500m of, the wind farm site. Direct loss of foraging habitat relative to its availability onsite and within the surrounding area, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[2] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded on, or within 500m of, the wind farm site. The majority of observations involve hunting or commuting birds. The proposed development area does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local kestrel population.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

[2] *Note that kestrel is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).*

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Studies on raptors have generally found only low levels of turbine avoidance (Hötker et al., 2006; Madders & Whitfield, 2006), with some species, such as kestrels, known to continue foraging activity close to turbines (Pearce Higgins et al., 2009). Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 2.5 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore negligible in the context of the county population.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.7 Lapwing (All Seasons)

As outlined in Section 7.8.2.11 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.11 of the EIAR for further details on the impact assessment for lapwing. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.11 of the EIAR, lapwing nested within 500m of the wind farm site (Please see Confidential Appendix 3 for details). In 2021, there were two breeding pairs in this area, with one nest fledging young and the second nest was presumed to have failed (furthermore, these breeding territories remained active in 2022 breeding season). Additionally, there was one breeding territory located approximately 3.8km from the wind farm site and adjacent to the grid connection. This pair was presumed to have hatched chicks but was predated before fledging. Lapwing were observed utilising habitats on, or within 500m of, the wind farm site on seven occasions during the winter season (October 2021 to March 2022). The majority of observations were near Lough Bane. No development infrastructure is proposed in the areas of bog where breeding was recorded and lapwing were recorded infrequently and in low numbers within the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Disturbance	Construction works can result in disturbance impacts within 350m of lapwing breeding habitat (Hotker et al. 2006). The species was rarely encountered within the wind farm site. This species was recorded breeding adjacent to the wind farm site. As reported in Section 7.8.2.11 of the EIAR birds were previously recorded breeding 380m from the nearest infrastructure. More recently, in 2021 and 2022, the closest breeding territories within this same approx. area were c. 441m from the nearest proposed infrastructure. Taking a highly precautionary approach, if it is assumed that construction works could occur anywhere within the EIAR Site boundary. In which case, construction works adjacent (within 350m) to this nesting area have the potential to cause disturbance of breeding lapwing. Additionally, breeding activity was recorded c. 3.8km from the wind farm site, adjacent to the grid connection route. There is little similar suitable habitat available locally (i.e. a mosaic of revegetating bog, with exposed shale and pools). Construction works adjacent to this nesting area associated with the grid connection route has the potential to cause disturbance of breeding lapwing. The majority of winter season (October 2021 to March 2022) observations were recorded at Lough Bane. Wintering birds are unlikely to be significantly impacted.	The magnitude of the effect is assessed as *Medium.* The cross tablature of *Medium* sensitivity species and *Medium* Impact corresponds to a ***Low*** effect significance.	**Short-term Moderate Negative Effect** **Please see Section 4.6 below for proposed mitigation.**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Hotker et al. (2006) undertook a meta-analysis of existing literature on disturbance distances from turbines. This review reported from the 13 studies examined the disturbance distance could occur up to 350m for breeding	The magnitude of the effect is assessed as *Low.*	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lapwing. This species was recorded breeding: the nearest proposed infrastructure is between 380-441m from the closest territory to the wind farm site. Based on the separation distance, significant disturbance displacement of these breeding birds is not predicted. The majority of winter season (October 2021 to March 2022) observations were at Lough Bane. No significant operational phase displacement impacts are predicted for the identified nesting habitat along the grid connection route. As previously discussed, this species was infrequently recorded within the wind farm site. Significant effects are not predicted particularly given the low levels of activity recorded within the wind farm site. Significant displacement or barrier effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.38 collisions per winter season and there were no collisions predicted for the breeding season[3]. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore insignificant.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

[3] *There were no breeding season flights recorded at possible collision height.*

4.4.8 Snipe (*All Seasons*)

As outlined in Section 7.8.2.18 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.18 of the EIAR for further details on the impact assessment for snipe. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.18 of the EIAR, snipe were recorded regularly during surveys, during both the summer and winter months. Snipe favour open habitats for foraging and breeding. There will likely be the loss of some suitable habitat within the wind farm site as a result of construction works. However, the (direct) loss of breeding and foraging habitat will be minimal as the infrastructure is confined to a narrow corridor. Significant effects are not anticipated at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[4] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Snipe were regularly recorded during surveys between March 2021 and March 2022. Disturbance from construction activities could result in the loss of snipe breeding and wintering habitat locally. Pearce Higgins et. al (2009), found a c. 50% reduction in breeding density of snipe within 500m of turbines. The majority of the open habitat onsite is located within 500m of turbines. There is therefore potential for a measurable reduction in breeding density of snipe due	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low*	**Short-term Slight Negative Effect**

[4] *Note that snipe is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).*

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	to disturbance associated with construction works. However, the wind farm site does not contain habitats that are of particularly high quality to this species or unique to the local area. Therefore, were disturbance to occur it would not result in the loss of a scarce resource for the local snipe population. Significant displacement effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Snipe were regularly recorded during surveys between March 2021 and March 2022. As previously discussed, Pearce Higgins et. al (2009), found a 50% reduction in breeding density of snipe within 500m of turbines. A 500m buffer around the turbines would cover the majority of the open habitat onsite, therefore it is likely that there will be a measurable reduction in breeding density of snipe within the development and its immediate surroundings. However, the Proposed Development Site does not contain habitats that are unique to the local area nor are cutover bogs of particularly high-quality breeding habitat for this species. If displacement were to occur, it would not result in the loss of a scarce resource for the local snipe population Significant displacement or barrier effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	It is acknowledged that the predicted number of transits, and hence the predicted rate of collision for common snipe may be underestimated, as flight	The magnitude of the effect is assessed as *Low.*	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	activity for this species is predominantly crepuscular in nature while the Vantage Point surveys are largely diurnal (Table 1.4, SNH (2017)). The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.18 collisions per year, or one bird every 5.6 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is low in the context of the county, national and international population.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	

4.4.9 Woodcock (*Breeding*)

As outlined in Section 7.8.2.12 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.12 of the EIAR for further details on the impact assessment for woodcock. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct loss of habitat will be minimal. The majority of the wind farm site is bare peat which does not provide optimal habitat for the species. The felling of forestry may temporarily reduce the distribution and availability of suitable habitat. However significant areas of forestry will remain within the wind farm site and surrounding area. Significant effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.12 of the EIAR, this species was frequently recorded during breeding woodcock surveys. Disturbance from construction activities could result in the disturbance of woodcock from suitable breeding habitat locally. However, habitat loss will be restricted to the small areas of forestry onsite. It is noted that the majority of proposed development infrastructure will be sited in cutover bog, a habitat of very limited ecological value to this species. Should any potential displacement effect occur, there are extensive areas of suitable habitat in the wider area, to render this potential impact inconsequential. Significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	There is potential for displacement of breeding woodcock in areas of forestry adjacent to proposed turbines. The wind farm site does not contain habitats that are unique to the local area nor are commercial forestry plantations of particularly high-quality breeding habitat for this species. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.009 collisions per year or one bird every 106 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.10 Buzzard (All Seasons)

As outlined in Section 7.8.2.15 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.15 of the EIAR for further details on the impact assessment for buzzard. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. Direct loss of foraging habitat relative to its availability onsite, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involve foraging or commuting birds. The wind farm site does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local buzzard population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not anticipated at any geographical scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 3.7 collisions per year. A separate collision risk was run relating to breeding buzzard specifically. The collision risk for breeding buzzard was calculated as 2.4 birds per breeding season. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The favourable conservation status of this species (Green-listed BoCCI) limits the potential for ecologically significant effects to result. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.11 Long-eared Owl (All Seasons)

As outlined in Section 7.8.2.14 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.14 of the EIAR for further details on the impact assessment for long-eared owl. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	This species was observed perched in a tree on one occasion, within the wind farm site (along the internal road route) and 1.2km from the closest turbine. This is the same location where birds were observed during surveys outlined in the EIAR. The habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. However, habitat loss in this area is likely to be insignificant given the availability of similar habitat in the wider surroundings. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As previously discussed, the habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. Therefore, disturbance from construction works is unlikely to be significant as birds would not be foraging in habitats where the majority of these works will be taking place.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant disturbance effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant displacement is not predicted given the area of grassland (i.e. long-eared owl foraging habitat) within the wind farm site is confined to a small marginal area and there is an abundance of similar suitable habitat in the wider surroundings. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was not recorded flying at Potential Collision Height during Vantage Point Surveys. Collision related mortality is not likely to significantly impact this species.	**No Effect**	**No Effect**

4.4.12 Sparrowhawk (*All Seasons*)

As outlined in Section 7.8.2.16 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.16 of the EIAR for further details on the impact assessment for sparrowhawk. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data discussed in Section 7.8.2.16 the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. There was one confirmed breeding territory within the wind farm site. Direct loss of foraging and breeding habitat relative to its availability onsite will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted at the county or national level. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involved foraging and commuting birds, with one confirmed breeding territory within the wind farm site during the 2021 breeding season. Construction adjacent to these nest sites could potentially cause displacement of breeding and foraging sparrowhawk. The disturbance associated with construction works will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. However, these	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lands (e.g. cutover bog and scrub) are not considered unique to the wind farm site or rare in the wider surroundings. Significant displacement effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As previously discussed, the wind farm site hosts breeding and foraging sparrowhawk. Displacement from turbines is not reported for sparrowhawk, however, it is assumed for the purposes of the assessment that sparrowhawk show avoidance to a distance of 500m from turbines as with other raptors (Pearce-Higgins et al., 2009). There was one breeding territory within 500m of the proposed turbine layout in 2021. The disturbance associated with operational turbines will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. Notwithstanding this, extensive areas of suitable foraging habitat exist and will remain in the wider area (i.e. outside 500m from the proposed turbine layout). Moreover, onsite habitats are not considered unique to the wind farm site. Significant displacement or barrier effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5.	The magnitude of the effect is assessed as *Negligible*.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	The collision risk has been calculated to be 0.09 collisions per year, equating to one bird every 10.9 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The cross tablature of *Low* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	

4.5 Effects on Key Ornithological Receptors during Decommissioning

4.5.1 All Species

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	As above for construction phase for each species listed as a KOR.	As above for construction phase for each KOR	As above for construction phase for each KOR

4.6 Mitigation

Lapwing continues to breed locally the potential for the construction works to impact breeding lapwing persists and requires mitigation (as per Section 4.4.7 above). This further corroborates the results of the impact assessment as reported the EIAR as lodged. Please refer to Section 7.9.2.1 of the EIAR for the prescriptive mitigation measures that have been designed to ensure significant impacts are avoided.

4.7 Cumulative Effects

There has been no significant changes to the bird communities observed at the wind farm site during surveys between March 2021 and March 2022 when compared to those outlined in the EIAR. Furthermore, there have been no significant changes to the effects of the wind farm site on key ornithological receptors to those outlined in the EIAR. Therefore, the cumulative effects as described in the EIAR remain unchanged, and no additional information is required.

5. CONCLUSION

Following consideration of the residual effects (post-mitigation), it is concluded that the proposed development will not result in any significant effects on any of the identified KORs. No significant effects on receptors of International, National or County Importance were identified.

Provided that the proposed development is constructed, operated and decommissioned in accordance with the design, best practice and mitigation that is described within the EIAR, significant individual or cumulative effects on ornithology are not anticipated at the international, national or county scales or on any of the identified KORs.

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APPENDIX 1

SURVEY EFFORT

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1. APPENDIX 1 (SURVEY EFFORT)

Table 1-1 Vantage Point Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/04/2021	Vantage Point Survey	VP6	3:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	1:00 starting at 18:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	2:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 15:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 04:20	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 07:50	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 04:15	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 07:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No target species	PM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 13:00	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 08:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 09:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 10:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 09:30	Visibility: limited; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Fog for at beginning limited visibility	TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 10:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 18:05	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 19:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 20:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 18:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 19:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 20:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 06:50	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none	Sunrise - 07:45. Persistent lights and drizzly showers throughout which reduced visibility a great deal (especially at a distance). Occasional clear and brighter spells but drizzle was always threatening. Very mild with fresh S breeze (14 - 17°C).	NM
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NM
19/10/2021	Vantage Point Survey	VP4	6:30 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	Sunrise - 08:05	

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 07:15	Visibility: moderate; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Sunrise - 08:06. Cool with moderate W breeze (which was especially apparent in open areas). Largely overcast early on with thin sheets of cloud being blown across. 90% cover. Frequent drizzly and misty showers moving across early in the survey which produced sporadic decreases in visibility. (6 - 12°C)	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Became a lot brighter by mid-morning with prolonged periods of sunny and clearer conditions stretching into lunchtime. Cloud cover reduced but the threat of showers remained. Wind increased to fresh W which made it feel cold despite the sun. Very occasional drizzly shower	NM
23/10/2021	Vantage Point Survey	VP3	6:10 starting at 07:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunrise - 08:06. Cool and moderate S breeze (5 - 13°C). Patchy cloud and partly overcast with some clearer spots. Continued to be largely cloudy with moderate breeze (+ fresher gusts).	
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 11:17	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 14:47	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 11:05	Visibility: good; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		CR

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 14:35	Visibility: moderate; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility until 15:26 pm.	CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 11:04	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 14:34	Visibility: moderate; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility from 16:23 pm.	CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 11:02	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 14:32	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: ; Snow:		CR
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 07:33	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 11:03	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 07:39	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 11:10	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 07:44	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 11:14	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 07:45	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none		KB
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZE

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/01/2022	Vantage Point Survey	VP3	3:00 starting at 11:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 15:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 16:00	Visibility: moderate; Wind speed and direction: fresh breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 17:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Occasional light drizzle for few minutes	ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 11:40	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 15:10	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:00	Visibility: none; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:30	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 08:00	Visibility: poor; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Very misty, visibility reduced greatly	NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 09:00	Visibility: ; Wind speed and direction: SW; Cloud cover and height: ; Rain: ; Frost: ; Snow:		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 10:30	Visibility: good; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 11:30	Visibility: moderate; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:30 starting at 12:00	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	0:30 starting at 06:45	Visibility: none; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	2:30 starting at 07:15	Visibility: good; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: light breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 06:45	Visibility: poor; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:15 starting at 08:30	Visibility: moderate; Wind speed and direction: fresh breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none	visibility low, very misty	NS
16/02/2022	Vantage Point Survey	VP4	0:45 starting at 10:15	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	0:30 starting at 11:00	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 11:30	Visibility: limited; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:50 starting at 06:40	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:30 starting at 07:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:40 starting at 09:00	Visibility: poor; Wind speed and direction: SW; Cloud cover and height: ; Rain: heavy showers; Frost: none; Snow: none		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
17/02/2022	Vantage Point Survey	VP6	2:00 starting at 10:10	Visibility: poor; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:00 starting at 12:10	Visibility: moderate; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 13:20	Visibility: moderate; Wind speed and direction: near gale SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 16:50	Visibility: good; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 13:25	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 16:55	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 13:10	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 16:40	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 13:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 0-33% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 16:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC

Table 1-2 Breeding Bird Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
07/04/2021	Breeding Walkover Survey	500m Survey Radius	6:00 starting at 07:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 05:30	Visibility: poor; Wind speed and direction: light air S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Foggy	PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
18/06/2021	Breeding Walkover Survey	500M Survey Radius	6:00 starting at 05:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
21/06/2021	Breeding Walkover Survey	500M Survey Radius	9:00 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: light; Snow: none	Cool, bright and clear with almost no clouds early on and some light frost in places (2 - 11°C). No apparent breeze to start with but gentle - moderate W wind emerged (in open areas). Remaining clear and bright for the majority of the survey (cool in wind but warm in shade). Cloud cover gradually increasing towards evening with very light passing showers - but continued to be clear and cloud cover never went above 30%.	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
23/07/2021	Breeding Walkover Survey	500M Survey Radius	5:00 starting at 05:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2022	Breeding Walkover Survey	VP3	3:00 starting at 10:00	Visibility: poor; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
09/05/2022	Breeding Walkover Survey	VP6	3:30 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
09/05/2022	Breeding Walkover Survey	VP4	3:30 starting at 13:30	Visibility: moderate; Wind speed and direction: strong breeze NE; Cloud cover and height: 66-100% <150m; Rain: ; Frost: none; Snow: none		NS
10/05/2022	Breeding Walkover Survey	VP5	3:00 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
24/05/2022	Breeding Walkover Survey	500M Survey Radius	11:00 starting at 06:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Primarily clear throughout with widespread sunny spells. Occasional showers with some heavier ones emerging later in the day. 9 - 14°C	NM
25/05/2022	Breeding Walkover Survey	500M Survey Radius	12:00 starting at 06:00	Visibility: good; Wind speed and direction: fresh breeze WSW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Largely clear throughout with bright spells. Occasional light showers but they were seldom and short-lived. 9 - 13°C. Fresh WSW breeze with some stronger gusts.	NM

Table 1-3 Breeding Raptor Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/04/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
29/04/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 07:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 16:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none	No Raptors Observed	PM
24/05/2021	Breeding Raptor Survey	BRVP2a	3:00 starting at 17:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 17:45	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
04/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:20	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		PM
28/06/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
29/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 10:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 11:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	No target species observed	Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 13:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 12:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 13:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 14:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea

Table 1-4 Winter Transect Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
20/10/2021	Winter Walkover Survey	500M Survey Radius	7:25 starting at 08:35	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Grey and dark with persistent heavy showers to start with but cleared considerably by mid-morning - leading to relatively bright conditions and occasional sunny spells. Occasional heavy showers and drizzly outbursts. (10 - 17°C).	NM
27/01/2022	Winter Walkover Survey	T1	6:00 starting at 11:30	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		AOD
28/01/2022	Winter Walkover Survey	T1,T2	6:00 starting at 11:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		AOD
22/02/2022	Winter Walkover Survey	T1	6:00 starting at 11:50	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		AOD
23/02/2022	Winter Walkover Survey	T1,T2	6:00 starting at 12:00	Visibility: good; Wind speed and direction: fresh breeze SE; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		AOD
15/03/2022	Winter Walkover Survey	VP3&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/03/2022	Winter Walkover Survey	VP6&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS

Table 1-5 Wildfowl Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/09/2021	Waterfowl Distribution Survey	8km buffer	9:10 starting at 08:00	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Overcast with some patchy clearences peeking through at times. Quite calm with light SE breeze, mild (10 - 18˚C). Some lights showers emerging by mid-morning - mixture of random showers and hazy sunshine for the remainder of survey	NM
17/09/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 12:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Warm and humid throughout (16 - 18˚C) with largely cloudy sky but with clearer spells on occasion. Occasional sporadic lights showers. Moderate SW breeze.	NM
17/09/2021	Waterfowl Distribution Survey	L. Iron Roost	11:30 starting at 18:00	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild conditions continued along with a reduction in cloud cover leading to a bright a largely clear evening. Wind dropped considerably - light air from SW. 14 - 17˚C. Sunset - 19:40	NM

29/09/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 07:45	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Relatively mild (6 - 14°C) and entirely overcast. Moderate SW breeze. Grey and drear throughout. Blustery showers at dawn followed by sporadic drizzly showers throughout the morning - some heavier and more persistent showers towards evening.	NM
30/09/2021	Waterfowl Distribution Survey	L. Iron Roost	2:45 starting at 17:30	Visibility: good; Wind speed and direction: fresh breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Breezy with fresh SW breeze. Sunny spells and scattered showers blowing across. Relatively mild (10 - 14°C) but wind made it feel colder	NM
11/10/2021	Waterfowl Distribution Survey	L. Iron Roost	3:15 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 18:56. Cool and bright evening with bright sunny patches. Almost no breeze whatsoever with light movement of air on occasion. Cool with the temperature dropping towards dusk (4 - 10°C). Mist gathering low of fields and wetlands at dusk also.	NM

12/10/2021	Waterfowl Distribution Survey	8km buffer (point survey on water bodies)	9:15 starting at 08:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none	Grey and overcast but with thinner and brighter patches at times (remaining largely overcast throughout). Patches of sunny spells emerging towards mid afternoon but continued to remain rather cloudy. (8 - 13°C).	NM
25/10/2021	Waterfowl Distribution Survey	L. Iron roost	2:30 starting at 16:45	Visibility: moderate; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Sunset - 18:10	NM
26/10/2021	Waterfowl Distribution Survey	8km buffer	8:45 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Very mild and humid (12 - 15°C) with overcast sky and sporadic light SW breeze. Occasional drizzly showers. Brightening up as morniong progressed with some patchy brighter spots but remaining largely overcast. Prolonged clear spells in afternoon.	NM

08/11/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Mild with moderate SW breeze (10 - 13°C). Damp with rain in the morning - but when survey started it had cleared significantly. Extensive clearer spells throughout the day with drifting lines of stratus clouds. Becoming cloudier and darker in afternoon.	NM
09/11/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	9:10 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 16:40. L. Iron roost: 15:15 - 17:30	NM
22/11/2021	Waterfowl Distribution Survey	L. Iron Roost	2:30 starting at 15:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Cool (3 - 8°C) with light S breeze. Bright and clear with no cloud. Sunset - 16:21	NM

23/11/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Cool (4 - 6°C) with light SW breeze. Almost entirely overcast with occasional thinner and brighter areas but these were fleeting. Still and quiet for the most part with breeze apparent in open areas. L. Bane - almost inaccesible, perimter of tangled and boggy birch woodland and scrub + very wet and boggy shores (with Sphagnum) - fully saturated (quaking bog??).	NM
09/12/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	4:20 starting at 13:00	Visibility: limited; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Constant drizzle and rain throughout made survey unpleasent. Very poor visibility throughout. Cold with moderate W breeze (4 - 6°C). The weather during this survey was very bad and the visibility very poor. The lake was seen to be full of wildfowl but ID was nearly impossible.	NM

10/12/2021	Waterfowl Distribution Survey	8km buffer	8:05 starting at 08:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: drizzle; Frost: light; Snow: none	Cold and crisp throughout the day with light NW breeze (3 - 7°C). Cold and sleety showers to start with but by mid-morning it had tunred into a clear and bright day.	NM
22/12/2021	Waterfowl Distribution Survey	8km buffer	7:50 starting at 08:30	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Cool with gentle SE breeze throuough (2 - 7°C). Grey and entirely overcast	NM
23/12/2021	Waterfowl Distribution Survey	L. Iron roost	2:15 starting at 14:45	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild and calm with clear bright skies (9 - 12°C). No wind. Good visibility.	NM

04/01/2022	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost	8:20 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze SE; Cloud cover and height: 33-66% 150-500m; Rain: drizzle; Frost: heavy; Snow: falling	Cold all day (-1 - 3°C). Light snow on ground along with heavy frost which stayed put all day. Predominantly overcast througout with snow showers up until 13:00 - visibility greatly reduced during snow. Turning clear and bright very abruptly in the afternoon with clear and sunny conditions - but remained very cold. Clouding over once again in evening but remaining high and bright. L. Iron roost: 15:00 - 17:20. Numbers of WF recorded were likely to be understimates due to high numbers and distance away from lake by surveyor. Sunset: 16:22	NM

05/01/2022	Waterfowl Distribution Survey	8km buffer	7:45 starting at 08:45	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: light; Snow: none	Predominantly bright and clear with prolonged sunny spells which persisted for the survey duration. Cold and crisp (-2 - 4°C) and remained so throughout.	NM

17/01/2022	Waterfowl Distribution Survey	8km buffer	8:30 starting at 08:30	Visibility: good; Wind speed and direction: calm W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: heavy; Snow: none	Cold and crisp early in the morning (-3 - 7°C) with heavy frost on ground. No wind, very calm all day. Patchy mist and haze early on which hampered visibility but it was quickly burned off. Clear and bright all day, never a cloud to be seen. Warming up gradually with frost disappearing mostly by mid-morning (except in shaded areas). Remaining clear and calm throughout. Large numbers of wildfowl on L. Sheelin, with CO & TU being notable numerous - underestimation of numbers likely. Large RE & SG flocks flying over site at dusk.	NM

18/01/2022	Waterfowl Distribution Survey	8km buffer	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Largely clear and bright early on with with prolonged sunny spells (5 - 8°C). Relatively calm with light S breeze. Becoming gradually cloudier and greyer towards lunchtime with rain showers blowing in - turning entirely overcast and wet by mid-afternoon.	NM
18/01/2022	Waterfowl Distribution Survey	L. Iron roost	2:00 starting at 15:30	Visibility: poor; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none	Entirely overcast with mid-height cloud (5 - 9°C). Consistent heavy rain and very wet conditions - some occasional but short-lived clearences. Rain hampered visibility greatly. Sunset - 16:43	NM
14/02/2022	Waterfowl Distribution Survey	5km buffer	4:40 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
15/02/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		KB
26/02/2022	Waterfowl Distribution Survey	5km buffer	5:00 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		KB
28/02/2022	Waterfowl Distribution Survey	5km buffer	3:50 starting at 11:40	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		KB
07/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB

08/03/2022	Waterfowl Distribution Survey	5km buffer	4:30 starting at 11:30	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 08:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	3:30 starting at 13:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
17/04/2022	Waterfowl Distribution Survey	5km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none		KB
04/05/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
20/05/2022	Waterfowl Distribution Survey	8km buffer	11:00 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze WSW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Consistent rain for the first half of the day - light showers. Clearing gradually towards the evening with the onset of clearer and sunny spells. Moderate WSW breeze, 11 - 15°C	NM
27/05/2022	Waterfowl Distribution Survey	5km buffer	10:15 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Moderate SW breeze , 10 - 16°C. Largely clear and bright and remained so throughout - some darker and cloudier spells came and went. Brightening significantly (and warming) from 1pm onwards with a decrease in cloud cover	NM

Table 1-6 Woodcock Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/05/2021	Breeding Woodcock Survey	T1	2:30 starting at 20:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Woodcock Survey	T4	2:00 starting at 20:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	No WK Observed	PM
24/05/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		Trea
04/06/2021	Breeding Woodcock Survey	T4	3:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
04/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
28/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
28/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/06/2021	Breeding Woodcock Survey	T4	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
29/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK Observed	Trea
16/05/2022	Breeding Woodcock Survey	T4	2:10 starting at 20:30	Visibility: moderate; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
20/05/2022	Breeding Woodcock Survey	T2	2:20 starting at 20:30	Visibility: moderate; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
24/05/2022	Breeding Woodcock Survey	T1	2:10 starting at 20:40	Visibility: moderate; Wind speed and direction: light air NE; Cloud cover and height: 33-66% <150m; Rain: none; Frost: none; Snow: none		NS

APPENDIX 2

SURVEY DATA

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1. APPENDIX 2 (SURVEY DATA)

Table 1-1 Common Tern Wildfowl Distribution Survey Data

Vantage Point Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CN001	L. D'varagh	17/09/2021	13:48	Common Tern	2	mesotrophic lakes; appeared to be doing laps around lake shore	NM

Table 1-2 Golden Plover Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
GP001	VP5	08/10/2021	12:43	Golden Plover	175	330	0	0	0	330	improved agricultural grassland, semi-natural grassland and scrub; flying high over and back far to the s of vp	NM
GP002	VP4	19/10/2021	09:13	Golden Plover	65	170	0	0	170	0	cutover bog; flying w across site	NM
GP003	VP6	22/10/2021	13:05	Golden Plover	54	245	0	40	205	0	cutover bog and scrub; flying and swirling over bog in flock	NM
GP004	VP3	23/10/2021	10:10	Golden Plover	6	65	0	65	0	0	cutover bog; flying s	NM
GP005	VP3	23/10/2021	10:18	Golden Plover	6	60	25	35	0	0	cutover bog; flying across bog + rapidly low across ground	NM
GP006	VP3	23/10/2021	10:21	Golden Plover	148	650	0	60	590	0	cutover bog, improved agricultural grassland and hedgerows; flying and swirling in group over bog and farmland	NM
GP007	VP3	23/10/2021	10:27	Golden Plover	46	125	0	0	125	0	cutover bog, improved agricultural grassland and scrub; flying across s of site	NM
GP008	VP3	23/12/2021	08:47	Golden Plover	11	5	5	0	0	0	cutover bog; travelling	KB
GP009	VP3	23/12/2021	09:14	Golden Plover	10	8	8	0	0	0	cutover bog; travelling	KB

Table 1-3 Golden Plover Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	07/04/2021	08:47	Golden Plover	3	cutover bog; travelling (flyover; non-breeding)	PM

Table 1-4 Golden Plover Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP002	20/10/2021	10:56	Golden Plover	6	cutover bog; flying and swirling across bog (wintering)	NM
GP003	20/10/2021	16:13	Golden Plover	6	improved agricultural grassland and scattered tress and parkland; flying and calling (wintering)	NM
GP004	20/10/2021	10:56	Golden Plover	16	cutover bog; on bog and calling (wintering)	NM
GP005	27/01/2022	16:27	Golden Plover	14	cutover bog; roosting, roosting on bog (wintering)	AOD

Table 1-5 Golden Plover Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	L. D'varagh	12/10/2021	16:16	Golden Plover	6	lakes and ponds; flying low and rapidly across lake - heading w	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP002		26/10/2021	12:47	Golden Plover	5	cutover bog; flying low across bog wetland	NM
GP003		23/11/2021	15:40	Golden Plover	160	lakes and ponds; flying over farmland to n of lake	NM
GP004	L. D'varagh	04/01/2022	09:14	Golden Plover	19	improved agricultural grassland and hedgerows; swirling low over fields	NM

Table 1-6 Greenland White-fronted Goose Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WG001	VP6	06/04/2021	19:54	Greenland White-fronted Goose	14	100	0	0	100	0	cutover bog and wet grassland; travelling	PM

Table 1-7 Greenland White-fronted Goose Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	21/10/2021	10:14	Greenland White-fronted Goose	5	cutover bog and scrub; flying sw across site (wintering)	NM

Table 1-8 Greenland White-fronted Goose Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	24	wet grassland; foraging, rest of the flock was unseen through vegetation/trees but more birds heard calling	KB
WG002	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	4	wet grassland; foraging, more birds likely present but unseen through hedgerow	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WG003	Lough Iron - piercefield fields	28/02/2022	15:30	Greenland White-fronted Goose	9	wet grassland; foraging, more birds present but not visible through the vegetation/trees - calling heard indicating larger flock	KB
WG004	Lough Iron - piercefield	08/03/2022	11:42	Greenland White-fronted Goose	12	wet grassland; foraging, whole flock not visible through the vegetation/trees - more birds likely present	KB

Table 1-9 Hen Harrier Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
HH001	VP6	06/04/2021	19:53	Hen Harrier	1	110	110	0	0	0	wet grassland, cutover bog and conifer plantation; travelling, 2cy male	PM
HH002	VP6	06/09/2021	17:30	Hen Harrier	1	6	6	0	0	0	cutover bog; flying, ringtail, glided in and landed out of site in scrub near river	TRea
HH003	VP6	06/09/2021	18:13	Hen Harrier	1	27	27	0	0	0	cutover bog; travelling, ringtail, flew low over bog and landed by stream	TRea
HH004	VP6	22/10/2021	12:14	Hen Harrier	1	95	95	0	0	0	semi-natural grassland, scrub and cutover bog; flying low with acrobatics across grassland and scrub along river, diving at passerines	NM
HH005	VP6	17/02/2022	09:48	Hen Harrier	1	20	20	0	0	0	lowland blanket bog; flying, male	NS
HH006	VP6	17/02/2022	12:35	Hen Harrier	1	150	150	0	0	0	lowland blanket bog; flying, male	NS
HH008	VP6	17/02/2022	10:17	Hen Harrier	1	15	15	0	0	0	improved agricultural grassland; flying, male	NS
HH008	VP6	17/02/2022	12:13	Hen Harrier	1	25	25	0	0	0	improved agricultural grassland; flying, same male in the area seen 4 times	NS

Table 1-10 Kingfisher Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
KF001	VP4	27/07/2021	12:38	Kingfisher	1	40	40	0	0	0	cutover bog; flew from drain	PM
KF002	VP6	22/11/2021	16:03	Kingfisher	1	21	21	0	0	0	eroding/upland rivers; flying	CR

Table 1-11 Kingfisher Vantage Point Survey Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
KF003	VP6	22/11/2021	16:07	Kingfisher	1	depositing/lowland rivers; calling/flying, kingfisher heard calling whilst travelling downstream.	CR

Table 1-12 Kingfisher Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	28/01/2022	13:04	Kingfisher	1	depositing/lowland rivers; fly, along inny (wintering)	AOD

Table 1-13 Kingfisher Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Kingfisher	1	watercourses; foraging	KB

Table 1-14 Kingfisher Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	Wildfowl Distribution Survey, r. inny	16/09/2021	16:24	Kingfisher	1	depositing/lowland rivers; flying over river, perching on riverbank willow before flying low and rapidly upstream, appeared to be hunting	NM
KF002	Wildfowl Distribution Survey,	12/10/2021	09:45	Kingfisher	1	depositing/lowland rivers; flying rapidly along wooded river	NM
KF003	Wildfowl Distribution Survey, r. inny	12/10/2021	15:10	Kingfisher	1	depositing/lowland rivers; flying low and rapidly over river	NM
KF004	Wildfowl Distribution Survey,	26/10/2021	10:37	Kingfisher	1	depositing/lowland rivers; flying rapidly along river, perched	NM
KF005	Wildfowl Distribution Survey, r. inny	23/11/2021	13:10	Kingfisher	1	depositing/lowland rivers; flying low downstream along river edge	NM
KF006	Wildfowl Distribution Survey, r. inny	10/12/2021	13:08	Kingfisher	1	depositing/lowland rivers; flushed from perch at bridge, flying low and rapidly along river	NM
KF007	Wildfowl Distribution Survey,	22/12/2021	11:32	Kingfisher	1	lakes and ponds; flying rapidly along vegetated river channel	NM
KF008	Wildfowl Distribution Survey, r. inny	05/01/2022	11:18	Kingfisher	1	depositing/lowland rivers; flying low and rapidly along river, perching in willow	NM

Table 1-15 Little Egret Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
ET001		12/10/2021	10:18	Little Egret	1	lakes and ponds and scrub; flying over scrubby lake shore	NM
ET002		12/10/2021	15:41	Little Egret	1	lakes and ponds and semi-natural grassland; flying over lake fringes	NM
ET003	L. Iron	22/11/2021	16:06	Little Egret	1	lakes and ponds; flying across lake	NM
ET004		10/12/2021	08:35	Little Egret	2	scrub; flying over bog and scrubland near to lake	NM
ET005	L. Iron	23/12/2021	15:43	Little Egret	2	lakes and ponds; flying low along lake edge	NM
ET006	L. Sheelin	17/01/2022	08:34	Little Egret	2	scrub, semi-natural grassland and lakes and ponds; perched on scrubby lake shore	NM
ET007		17/01/2022	11:28	Little Egret	1	depositing/lowland rivers and semi-natural grassland; perched on grassy bank of river	NM
ET008		17/01/2022	12:30	Little Egret	1	improved agricultural grassland; grazing on farmland	NM
ET009	BN2	17/01/2022	16:08	Little Egret	2	cutover bog; flying low across bog wetland + landing and foraging sporadically at different locations on wetland, consistently in area for over an hour	NM
ET010	BN2	17/01/2022	16:16	Little Egret	1	cutover bog; flying across bog wetland + landing within	NM
ET011	Derragh Lough	14/02/2022	13:26	Little Egret	1	lakes and ponds; foraging	KB
ET012	Bracklagh Lough	26/02/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB

ET013	Lough Derravaragh north	28/02/2022	13:31	Little Egret	1	lakes and ponds; foraging	KB
ET014	Brackagh Lough	07/03/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB
ET015	Derragh Lough	07/03/2022	10:51	Little Egret	1	lakes and ponds; foraging	KB
ET016	Derragh Lough	31/03/2022	09:32	Little Egret	1	lakes and ponds; foraging	KB

Table 1-16 Merlin Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ML001	VP4	09/12/2021	10:21	Merlin	1	5	5	0	0	0	cutover bog; foraging, adult male	KB
ML002	VP6	15/12/2021	09:31	Merlin	1	6	6	0	0	0	cutover bog; foraging - landed on ground, female	KB
ML003	VP6	15/12/2021	09:42	Merlin	1	8	8	0	0	0	cutover bog and semi-natural grassland; foraging, female	KB
ML004	VP6	15/12/2021	14:01	Merlin	1	6	6	0	0	0	scrub and semi-natural grassland; foraging, male	KB
ML005	VP4	10/03/2022	15:12	Merlin	1	18	18	0	0	0	cutover bog; flying	NS

Table 1-17 Peregrine Falcon Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
PE001	VP5	03/01/2022	09:17	Peregrine Falcon	1	12	0	12	0	0	improved agricultural grassland and hedgerows; foraging	KB
PE002	VP3	26/01/2022	15:05	Peregrine Falcon	1	25	25	0	0	0	cutover bog; flying	ZE

Table 1-18 Peregrine Falcon Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
PE001	BRVP6	29/06/2021	17:46	Peregrine Falcon	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring/travelling	flyover; non-breeding	PM
PE002	BRVP6	13/07/2021	15:13	Peregrine Falcon	1	highly modified/non-native woodland and bogs, travelling	suitable nesting habitat; possible breeder	TRea

Table 1-19 Peregrine Falcon Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PE001	Vantage Point Survey, doon	31/01/2022	14:55	Peregrine Falcon	1	lowland blanket bog and improved agricultural grassland; flying	ZE

Table 1-20 Ruff Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
RU001	BN2	16/09/2021	14:13	Ruff	2	cutover bog; perched on bare peat at edge of shallow bog pool	NM

Table 1-21 White-tailed Eagle Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
WE001	BRVP2	19/07/2021	14:20	White-tailed Eagle	1	highly modified/non-native woodland and improved grassland, fighting buzzards, buzzards soaring above and diving down, eagle flipped to repel with talons.	flyover; non-breeding	TRea

Table 1-22 White-tailed Eagle Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WE001	Wildfowl Distribution Survey,	12/10/2021	16:33	White-Tailed Eagle	1	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; soaring over lake and adjacent sloping ground - appeared to descend and land within scrub	NM

Table 1-23 Whooper Swan Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS001	VP4	19/10/2021	08:12	Whooper Swan	7	100	0	100	0	0	cutover bog; flying across bog and calling, descending towards bn2	NM
WS002	VP4	19/10/2021	12:34	Whooper Swan	4	210	0	0	210	0	cutover bog; flying w across bog	NM
WS003	VP6	22/10/2021	09:05	Whooper Swan	7	120	105	15	0	0	cutover bog, scrub and improved agricultural grassland; flying sw across site	NM
WS004	VP6	22/10/2021	08:53	Whooper Swan	2	85	40	45	0	0	cutover bog and depositing/lowland rivers; flying along river and adjacent bog	NM
WS005	VP6	22/10/2021	09:02	Whooper Swan	9	150	0	130	20	0	improved agricultural grassland, hedgerows and semi-natural grassland; flying ne across farmland	NM
WS006	VP6	22/10/2021	10:27	Whooper Swan	8	130	0	0	130	0	cutover bog and improved agricultural grassland; flying and calling to w of site	NM
WS007	VP6	22/10/2021	10:56	Whooper Swan	16	140	0	125	15	0	improved agricultural grassland and bogs; flying ne and calling	NM
WS008	VP6	22/10/2021	10:58	Whooper Swan	3	65	0	65	0	0	cutover bog, improved agricultural grassland and semi-natural grassland; flying n	NM
WS009	VP6	22/10/2021	11:24	Whooper Swan	3	65	0	40	25	0	watercourses and cutover bog; flying ne along river and bog fringes	NM
WS010	VP6	22/10/2021	11:32	Whooper Swan	12	170	0	0	170	0	cutover bog, scrub and improved agricultural grassland; flying w across bog to nw of site	NM
WS011	VP3	23/10/2021	08:22	Whooper Swan	5	180	25	155	0	0	cutover bog, scrub and hedgerows; flying along s boundary of site	NM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS012	VP3	23/10/2021	08:16	Whooper Swan	7	90	0	90	0	0	treelines, improved agricultural grassland and cutover bog; flying n	NM
WS013	VP3	23/10/2021	09:23	Whooper Swan	8	125	0	125	0	0	cutover bog, scrub and improved agricultural grassland; flying s across bog	NM
WS014	VP3	23/10/2021	09:28	Whooper Swan	15	95	25	70	0	0	cutover bog and scrub; flying n across bog	NM
WS015	VP3	23/10/2021	10:25	Whooper Swan	12	95	95	0	0	0	depositing/lowland rivers and cutover bog; flying and calling along river	NM
WS016	VP3	23/10/2021	11:00	Whooper Swan	7	240	210	30	0	0	cutover bog and scrub; flying low across bog	NM
WS017	VP5	03/01/2022	08:24	Whooper Swan	5	8	0	0	8	0	improved agricultural grassland; travelling	KB
WS018	VP5	03/01/2022	08:31	Whooper Swan	5	30	0	0	30	0	improved agricultural grassland; travelling	KB
WS019	VP5	03/01/2022	08:32	Whooper Swan	9	10	0	0	10	0	improved agricultural grassland; travelling	KB
WS020	VP5	03/01/2022	08:46	Whooper Swan	10	50	0	0	50	0	improved agricultural grassland; travelling	KB
WS021	VP5	03/01/2022	09:05	Whooper Swan	3	70	0	20	50	0	improved agricultural grassland; travelling	KB
WS022	VP5	03/01/2022	09:09	Whooper Swan	2	25	0	0	25	0	improved agricultural grassland; travelling	KB
WS023	VP5	03/01/2022	09:12	Whooper Swan	2	20	0	0	20	0	improved agricultural grassland; travelling	KB
WS024	VP4	27/01/2022	17:54	Whooper Swan	8	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
WS025	VP5	08/02/2022	09:08	Whooper Swan	2	30	0	30	0	0	improved agricultural grassland; flying	NS

Table 1-24 Whooper Swan Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	L. Iron	30/09/2021	18:30	Whooper Swan	3	lakes and ponds; swimming on lake	NM
WS002	L. Iron	11/10/2021	18:00	Whooper Swan	3	improved agricultural grassland and scrub; flying in from s and descending onto lake, roost	NM
WS003	L. Iron	25/10/2021	17:20	Whooper Swan	26	lakes and ponds; swimming on lake	NM
WS004	L. Iron	25/10/2021	17:47	Whooper Swan	5	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; flying onto lake from w/sw, roost	NM
WS005	L. Iron	25/10/2021	18:29	Whooper Swan	9	semi-natural grassland and reed and large sedge swamps; flying in and landing on lake - coming from n, roost	NM
WS008		26/10/2021	10:21	Whooper Swan	18	lakes and ponds; swimming on lake, some individuals grazing on banks	NM
WS007		26/10/2021	09:40	Whooper Swan	49	improved agricultural grassland; foraging on grassy edge of lake	NM
WS009		26/10/2021	14:58	Whooper Swan	11	lakes and ponds and highly modified/non-native woodland; flying sw along lake shore	NM
WS006		26/10/2021	09:46	Whooper Swan	16	lakes and ponds; flying e across lake	NM
WS010	Derragh Lough	09/11/2021	11:34	Whooper Swan	25	lakes and ponds; swimming on lake	NM
WS012	L. Iron	09/11/2021	16:24	Whooper Swan	21	lakes and ponds; swimming on lake, roost	NM
WS011	Lough Iron	09/11/2021	16:53	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; commuting towards and landing on lake - arriving in group from farmland to w	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS015	L. Iron	22/11/2021	16:00	Whooper Swan	24	lakes and ponds; swimming on lake, roost	NM
WS013	Lough Iron	22/11/2021	16:30	Whooper Swan	5	semi-natural grassland, scrub and lakes and ponds; flying in from s and landing on lake	NM
WS014	Lough Iron	22/11/2021	16:46	Whooper Swan	7	improved agricultural grassland and lakes and ponds; flying from farmland to sw of lake, roost	NM
WS016		23/11/2021	10:47	Whooper Swan	7	improved agricultural grassland and highly modified/non-native woodland; flying sw across farmland	NM
WS017		10/12/2021	14:10	Whooper Swan	4	lakes and ponds and semi-natural grassland; feeding on reedy grassland adjacent to lake	NM
WS019	R. Inny	22/12/2021	10:16	Whooper Swan	2	depositing/lowland rivers; swimming on river	NM
WS021	L. Bane	22/12/2021	15:45	Whooper Swan	39	lakes and ponds; swimming and foraging on lake, calling	NM
WS018		22/12/2021	10:10	Whooper Swan	8	lakes and ponds; swimming and feeding within reedy lake margins	NM
WS020		22/12/2021	10:34	Whooper Swan	16	cutover bog and scrub; flying sw across bog	NM
WS024	L. Iron	23/12/2021	15:32	Whooper Swan	16	lakes and ponds; swimming on lake, roost	NM
WS022	Lough Iron	23/12/2021	16:16	Whooper Swan	5	semi-natural grassland and scrub; flying in from fields to n	NM
WS023	Lough Iron	23/12/2021	16:35	Whooper Swan	16	semi-natural grassland, reed and large sedge swamps and scrub; flying in from fields and wetland to the n, calling profusely, roost	NM
WS025	L. Iron	04/01/2022	15:40	Whooper Swan	12	lakes and ponds; swimming on lake	NM
WS026	L. Bane	05/01/2022	09:02	Whooper Swan	16	lakes and ponds; swimming on lake	NM
WS029	L. Sheelin	17/01/2022	08:47	Whooper Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS028	R. Inny	17/01/2022	14:00	Whooper Swan	7	improved agricultural grassland; grazing on grassland adjacent to river	NM
WS027	L. Sheelin	17/01/2022	09:55	Whooper Swan	6	lakes and ponds; flying low across lake	NM
WS030	L. Iron	18/01/2022	15:43	Whooper Swan	45	lakes and ponds, reed and large sedge swamps and scrub; swimming on lake and within swollen edges	NM
WS031	Lough Iron	18/01/2022	16:56	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; flying in from lands to sw and landing on lake - calling. numbers unclear due to poor visibility, roost	NM
WS032	Piercefield	15/02/2022	09:40	Whooper Swan	77	improved agricultural grassland; foraging	KB
WS033	Piercefield	15/02/2022	10:10	Whooper Swan	1	wet grassland; foraging	KB
WS034	Lough Iron - piercefield fields	28/02/2022	15:20	Whooper Swan	31	improved agricultural grassland; foraging	KB
WS035	Lough Iron - piercefield fields	28/02/2022	15:30	Whooper Swan	2	wet grassland; foraging	KB
WS036	Flooded bog on site	08/03/2022	15:24	Whooper Swan	4	cutover bog; foraging	KB

Table 1-25 Coot Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CO001	VP6	31/01/2022	15:37	Coot	1	111	0	0	111	0	improved agricultural grassland and conifer plantation; flying	ZE
CO002	VP6	31/01/2022	16:19	Coot	1	121	0	0	121	0	cutover bog and conifer plantation; flying	ZE
CO003	VP6	17/02/2022	07:30	Coot	2	30	0	30	0	0	lowland blanket bog; flying west	NS
CO004	VP6	17/02/2022	11:56	Coot	1	25	0	25	0	0	lowland blanket bog and improved agricultural grassland; flying	NS

Table 1-26 Coot Waterfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO001	Derragh Lough	16/09/2021	12:16	Coot	96	mesotrophic lakes; swimming on lake - in groups and frequently within reed boundaries + diving, throughout lake	NM
CO002		16/09/2021	17:00	Coot	5	mesotrophic lakes; swimming on lake	NM
CO003	L. Kinale	16/09/2021	10:56	Coot	9	mesotrophic lakes; swimming on lake	NM
CO004	L. Kinale	16/09/2021	11:05	Coot	13	mesotrophic lakes; swimming on lake	NM
CO005	L. Sheelin	16/09/2021	10:03	Coot	16	mesotrophic lakes; swimming and diving on lake near reed beds - forming group with lg	NM
CO006	L. D'varagh	17/09/2021	14:40	Coot	25	mesotrophic lakes; swimming on lake - n section	NM
CO007	Bracklagh Lough	17/09/2021	12:30	Coot	10	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO008	L. D'varagh	17/09/2021	12:59	Coot	9	mesotrophic lakes; swimming on lake	NM
CO009	L. D'varagh	17/09/2021	13:06	Coot	3	mesotrophic lakes; swimming on lake	NM
CO010	L. D'varagh	17/09/2021	13:10	Coot	13	mesotrophic lakes; swimming on lake	NM
CO011	L. D'varagh	17/09/2021	14:01	Coot	3	mesotrophic lakes; swimming on lake	NM
CO012	L. D'varagh	17/09/2021	13:08	Coot	6	mesotrophic lakes; swimming in reedy fringes	NM
CO013	L. Iron	17/09/2021	19:00	Coot	78	mesotrophic lakes; swimming and foraging on lake	NM
CO014	L. D'varagh	17/09/2021	13:05	Coot	7	mesotrophic lakes; swimming and diving on lake	NM
CO015	L. D'varagh	17/09/2021	13:49	Coot	8	mesotrophic lakes; swimming and diving on lake	NM
CO016	L. D'varagh	17/09/2021	16:16	Coot	9	mesotrophic lakes; swimming and diving along lake fringes	NM
CO017	L. D'varagh	17/09/2021	16:07	Coot	18	mesotrophic lakes; swimming and calling on lake and within reeds	NM
CO018	L. D'varagh	17/09/2021	15:45	Coot	37	mesotrophic lakes; swimming and calling on lake (+ foraging within reeds)	NM
CO019	L. D'varagh	17/09/2021	13:06	Coot	8	mesotrophic lakes; swimming along edge of lake	NM
CO020	Bracklagh Lough	29/09/2021	09:25	Coot	16	mesotrophic lakes; swimming on lake	NM
CO021	L. D'varagh	29/09/2021	16:15	Coot	31	mesotrophic lakes; swimming on lake	NM
CO022	L. Sheelin	29/09/2021	08:07	Coot	6	lakes and ponds; swimming on lake	NM
CO023	L. Sheelin	29/09/2021	08:45	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO024	Derragh Lough	29/09/2021	10:53	Coot	180	mesotrophic lakes; swimming and foraging on lake, approx. count	NM
CO025	L. D'varagh	29/09/2021	16:00	Coot	47	mesotrophic lakes; swimming and foraging in and around reed islets	NM
CO026	L. Kinale	29/09/2021	12:15	Coot	16	mesotrophic lakes; swimming along lake edge	NM
CO027	L. D'varagh	29/09/2021	16:15	Coot	58	mesotrophic lakes; swimming along lake edge	NM
CO028	L. D'varagh	12/10/2021	16:07	Coot	12	lakes and ponds; swimming within reedy islets	NM
CO029	L. Kinale	12/10/2021	12:05	Coot	19	lakes and ponds; swimming on lake	NM
CO030	L. D'varagh	12/10/2021	16:02	Coot	53	lakes and ponds; swimming on lake	NM
CO031	L. Sheelin	12/10/2021	08:18	Coot	287	lakes and ponds; swimming in large group in open water	NM
CO032	Derragh Lough	12/10/2021	11:10	Coot	91	lakes and ponds; swimming and diving on lake	NM
CO033	L. D'varagh	12/10/2021	15:37	Coot	13	lakes and ponds; swimming and diving on lake	NM
CO034	L. D'varagh	12/10/2021	16:31	Coot	14	lakes and ponds; swimming and diving on lake	NM
CO035	L. D'varagh	12/10/2021	16:14	Coot	10	lakes and ponds; swimming and calling within complex of reedy islets	NM
CO036	L. Sheelin	26/10/2021	15:04	Coot	265	lakes and ponds; swimming on lake in large dense flock	NM
CO037	L. Sheelin	26/10/2021	15:00	Coot	129	lakes and ponds; swimming on lake in dense flock	NM
CO038	Derragh Lough	26/10/2021	11:24	Coot	58	lakes and ponds; swimming on lake and foraging around fringes	NM
CO039		26/10/2021	09:12	Coot	6	lakes and ponds; swimming on lake	NM
CO040		26/10/2021	09:12	Coot	15	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO041		26/10/2021	09:34	Coot	156	lakes and ponds; swimming on lake	NM
CO042		26/10/2021	09:38	Coot	24	lakes and ponds; swimming on lake	NM
CO043		26/10/2021	10:22	Coot	9	lakes and ponds; swimming on lake	NM
CO044	L. Sheelin	26/10/2021	14:06	Coot	6	lakes and ponds; swimming on lake	NM
CO045	L. Sheelin	26/10/2021	15:00	Coot	34	lakes and ponds; swimming on lake	NM
CO046		26/10/2021	09:06	Coot	39	lakes and ponds; swimming and calling on lake	NM
CO047		26/10/2021	09:21	Coot	2	lakes and ponds; flying w across lake	NM
CO048	L. D'varagh	26/10/2021	08:36	Coot	5	lakes and ponds; calling within reedy fringes of lake	NM
CO049		26/10/2021	10:18	Coot	6	reed and large sedge swamps and dystrophic lakes; calling within reeds	NM
CO050	L. D'varagh	08/11/2021	12:26	Coot	6	lakes and ponds; swimming on lake	NM
CO051	L. Sheelin	09/11/2021	09:28	Coot	87	lakes and ponds; swimming on lake - large group in open water	NM
CO052	L. Sheelin	09/11/2021	10:02	Coot	8	lakes and ponds; swimming on lake	NM
CO053	Derragh Lough	09/11/2021	11:34	Coot	46	lakes and ponds; swimming and diving on lake	NM
CO054	L. Iron	22/11/2021	16:02	Coot	56	lakes and ponds; swimming on lake	NM
CO055	Derragh Lough	23/11/2021	11:10	Coot	56	lakes and ponds; swimming on lake + calling within reedy margins	NM
CO056	L. Sheelin	23/11/2021	09:13	Coot	70	lakes and ponds; swimming on lake - large 'raft' in open water	NM
CO057	L. D'varagh	23/11/2021	15:40	Coot	11	lakes and ponds; swimming on lake	NM
CO058	L. D'varagh	23/11/2021	15:41	Coot	26	lakes and ponds; swimming on lake	NM
CO059	L. D'varagh	23/11/2021	15:45	Coot	149	lakes and ponds; swimming on lake	NM
CO060		23/11/2021	15:45	Coot	7	lakes and ponds; swimming on lake	NM
CO061	L. D'varagh	23/11/2021	15:46	Coot	61	lakes and ponds; swimming on lake	NM
CO062	L. D'varagh	23/11/2021	15:49	Coot	23	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO063	L. Sheelin	23/11/2021	08:46	Coot	6	lakes and ponds; swimming on lake	NM
CO064	L. Sheelin	23/11/2021	08:53	Coot	4	lakes and ponds; swimming and diving on lake	NM
CO065	Derragh Lough	10/12/2021	10:48	Coot	37	lakes and ponds; swimming on lake and around reedy margins	NM
CO066	L. Sheelin	10/12/2021	09:05	Coot	13	lakes and ponds; swimming on lake	NM
CO067	L. Sheelin	10/12/2021	08:40	Coot	54	lakes and ponds; swimming in large raft on lake	NM
CO068	L. Sheelin	22/12/2021	13:40	Coot	890	lakes and ponds; swimming on lake - 3 large rafts of birds floating in open water	NM
CO069	L. D'varagh	22/12/2021	08:34	Coot	13	lakes and ponds; swimming on lake	NM
CO070	L. D'varagh	22/12/2021	08:40	Coot	64	lakes and ponds; swimming on lake	NM
CO071	L. D'varagh	22/12/2021	08:50	Coot	14	lakes and ponds; swimming on lake	NM
CO072	L. D'varagh	22/12/2021	08:43	Coot	5	lakes and ponds; swimming on lake	NM
CO073	L. Kinale	22/12/2021	11:27	Coot	6	lakes and ponds; swimming on lake	NM
CO074	L. Sheelin	22/12/2021	13:53	Coot	170	lakes and ponds; swimming on lake	NM
CO075	L. Kinale	22/12/2021	12:24	Coot	43	lakes and ponds; swimming and diving on lake	NM
CO076	Deragh Lough	22/12/2021	11:01	Coot	68	lakes and ponds; swimming and calling on lake	NM
CO077	L. Kinale	22/12/2021	12:22	Coot	5	lakes and ponds; swimming and calling on lake	NM
CO078	L. Kinale	22/12/2021	11:23	Coot	4	lakes and ponds; calling within reedy margins	NM
CO079		22/12/2021	09:30	Coot	46	lakes and ponds; calling and swimming on lake	NM
CO080	L. Iron	23/12/2021	15:30	Coot	36	lakes and ponds; swimming on lake	NM
CO081	L. D'varagh	04/01/2022	09:10	Coot	5	lakes and ponds; swimming on lake	NM
CO082	L. D'varagh	04/01/2022	10:00	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO083	L. D'varagh	04/01/2022	13:30	Coot	5	lakes and ponds; swimming on lake	NM
CO084	L. D'varagh	04/01/2022	14:45	Coot	11	lakes and ponds; swimming and calling on lake	NM
CO085	L. D'varagh	04/01/2022	14:16	Coot	6	lakes and ponds; calling from lake edge	NM
CO086	L. D'varagh	05/01/2022	13:20	Coot	77	lakes and ponds; swimming on lake	NM
CO087	Derragh Lough	05/01/2022	10:34	Coot	80	lakes and ponds; swimming and calling on lake	NM
CO088	R. Inny	17/01/2022	11:28	Coot	7	depositing/lowland rivers; swimming on river	NM
CO089	L. Kinale N	17/01/2022	10:40	Coot	146	lakes and ponds; swimming on lake	NM
CO090	Derragh Lough	17/01/2022	11:20	Coot	81	lakes and ponds; swimming on lake	NM
CO091	L. Kinale S	17/01/2022	11:46	Coot	9	lakes and ponds; swimming on lake	NM
CO092	L. D'varagh	17/01/2022	13:05	Coot	16	lakes and ponds; swimming on lake	NM
CO093	L. D'varagh	17/01/2022	13:08	Coot	16	lakes and ponds; swimming on lake	NM
CO094	L. Sheelin	17/01/2022	08:32	Coot	4	lakes and ponds; swimming on lake	NM
CO095	L. Sheelin	17/01/2022	08:35	Coot	13	lakes and ponds; swimming on lake	NM
CO096	L. Sheelin	17/01/2022	08:38	Coot	6	lakes and ponds; swimming on lake	NM
CO097	L. Sheelin	17/01/2022	09:30	Coot	37	lakes and ponds; swimming on lake	NM
CO098	L. Sheelin	17/01/2022	08:49	Coot	340	lakes and ponds; swimming on lake	NM
CO099	L. Sheelin	17/01/2022	08:46	Coot	130	lakes and ponds; swimming on lake	NM
CO100	L. D'varagh	17/01/2022	13:10	Coot	196	lakes and ponds; swimming in large group within sw corner of lake	NM
CO101	L. D'varagh	17/01/2022	13:04	Coot	8	lakes and ponds; swimming and diving on lake	NM
CO102	L. D'varagh	17/01/2022	13:12	Coot	5	lakes and ponds; swimming and calling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO103	L. Sheelin	17/01/2022	08:55	Coot	15	lakes and ponds; swimming and calling on lake	NM
CO104	L. D'varagh	17/01/2022	13:05	Coot	7	lakes and ponds; swimming and calling close to lake fringes	NM
CO105	L. D'varagh	17/01/2022	13:52	Coot	32	lakes and ponds; swimming all over lake	NM
CO106	L. Sheelin	17/01/2022	08:52	Coot	3	lakes and ponds; calling within reedy margins of lake	NM
CO107	L. D'varagh	18/01/2022	13:03	Coot	9	lakes and ponds; swimming on lake	NM
CO108	Lough Sheelin west	14/02/2022	11:45	Coot	8	lakes and ponds; foraging	KB
CO109	Lough Kinale	14/02/2022	12:50	Coot	153	lakes and ponds; foraging	KB
CO110	Derragh Lough	14/02/2022	13:26	Coot	27	lakes and ponds; foraging	KB
CO111	Lough Kinale south	14/02/2022	13:40	Coot	7	lakes and ponds; foraging	KB
CO112	Lough Iron	15/02/2022	09:40	Coot	70	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	KB
CO113	lake off Lough Derravaragh	15/02/2022	11:47	Coot	9	lakes and ponds; foraging	KB
CO114	Lough Derravaragh south	15/02/2022	12:20	Coot	347	lakes and ponds; foraging	KB
CO115	Lough Derravaragh north	15/02/2022	13:13	Coot	13	lakes and ponds; foraging	KB
CO116	Bracklagh Lough	26/02/2022	09:00	Coot	3	lakes and ponds; foraging	KB
CO117	Lough Sheelin west	26/02/2022	09:20	Coot	151	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO118	Lough Sheelin centre	26/02/2022	09:53	Coot	1	lakes and ponds; foraging	KB
CO119	Lough Kinale	26/02/2022	10:26	Coot	266	lakes and ponds; foraging	KB
CO120	Derragh Lough	26/02/2022	11:04	Coot	29	lakes and ponds; foraging	KB
CO121	Lough Kinale south	26/02/2022	11:28	Coot	1	lakes and ponds; foraging	KB
CO122	Robinstown flooded fields	26/02/2022	13:46	Coot	4	wet grassland; foraging	KB
CO123	Lough Derravaragh south	28/02/2022	11:45	Coot	272	lakes and ponds; foraging	KB
CO124	lake off Lough Derravaragh	28/02/2022	12:28	Coot	16	lakes and ponds; foraging	KB
CO125	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Coot	10	lakes and ponds and watercourses; foraging	KB
CO126	Lough Derravaragh north	28/02/2022	13:31	Coot	10	lakes and ponds; foraging	KB
CO127	Lough Sheelin west	07/03/2022	09:16	Coot	1	lakes and ponds; foraging	KB
CO128	Lough Kinale	07/03/2022	10:20	Coot	53	lakes and ponds; foraging	KB
CO129	Derragh Lough	07/03/2022	10:51	Coot	22	lakes and ponds; foraging	KB
CO130	Lough Kinale south	07/03/2022	11:08	Coot	13	lakes and ponds; foraging	KB
CO131	Lough Derravaragh south	08/03/2022	12:01	Coot	137	lakes and ponds; foraging	KB
CO132	Lake off Lough Derravaragh	08/03/2022	12:37	Coot	17	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO133	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Coot	14	lakes and ponds and watercourses; foraging	KB
CO134	Lough Derravaragh north	08/03/2022	13:32	Coot	7	lakes and ponds; foraging	KB
CO135	Lough Kinale	31/03/2022	09:07	Coot	7	lakes and ponds; foraging	KB
CO136	Derragh Lough	31/03/2022	09:32	Coot	22	lakes and ponds; foraging	KB
CO137	Lough Kinale south	31/03/2022	09:50	Coot	3	lakes and ponds; foraging	KB
CO138	Robinstown flooded fields	31/03/2022	13:16	Coot	5	lakes and ponds; foraging	KB
CO139	Lough Derravaragh north	31/03/2022	13:41	Coot	16	lakes and ponds; foraging	KB
CO140	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Coot	1	lakes and ponds; foraging	KB
CO141	Lake off Lough Derravaragh	31/03/2022	15:00	Coot	5	lakes and ponds; foraging	KB
CO142	Lough Derravaragh south	31/03/2022	15:27	Coot	34	lakes and ponds; foraging	KB

Table 1-27 Shoveler Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SV001	Derragh Lough	16/09/2021	12:18	Shoveler	12	mesotrophic lakes; foraging on lake + a few resting	NM
SV002	L. Iron	17/09/2021	18:56	Shoveler	13	mesotrophic lakes; swimming and foraging on lake	NM
SV003	Derragh Lough	29/09/2021	11:04	Shoveler	6	mesotrophic lakes; swimming and foraging on lake	NM
SV004	L. Iron	25/10/2021	17:40	Shoveler	36	lakes and ponds; swimming and dabbling on lake	NM
SV005		26/10/2021	10:21	Shoveler	5	lakes and ponds; swimming on lake	NM
SV006	L. Iron	09/11/2021	16:32	Shoveler	14	lakes and ponds; swimming on lake	NM
SV007	L. Iron	22/11/2021	16:05	Shoveler	27	lakes and ponds; swimming on lake	NM
SV008	L. Sheelin	23/11/2021	08:46	Shoveler	5	lakes and ponds; flying low across lake	NM
SV009	Derragh lough	10/12/2021	10:52	Shoveler	6	lakes and ponds; swimming and feeding on lake	NM
SV010	L. Iron	23/12/2021	15:35	Shoveler	19	lakes and ponds; swimming on lake	NM
SV011	L. Sheelin	17/01/2022	08:54	Shoveler	7	lakes and ponds; flying low across lake	NM

Table 1-28 Teal Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	27/01/2022	16:07	Teal	2	cutover bog; fly, m and f pair (wintering)	AOD
T002	28/01/2022	16:55	Teal	22	lakes and ponds; foraging (wintering)	AOD
T003	22/02/2022	17:11	Teal	2	cutover bog; roosting (wintering)	AOD

Table 1-29 Teal Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	BN2	16/09/2021	14:10	Teal	31	cutover bog; roosting in shallow water and on bare peat with flooded area of bog	NM
T004	L. Iron	17/09/2021	19:28	Teal	14	reed and large sedge swamps and mesotrophic lakes; wading within reedy pool at se end of lake	NM
T002	L. D'varagh	17/09/2021	13:37	Teal	3	mesotrophic lakes and reed and large sedge swamps; wading within reedbeds at edge of lake	NM
T003	L. Iron	17/09/2021	19:04	Teal	94	mesotrophic lakes; swimming and foraging on lake	NM
T005		29/09/2021	12:36	Teal	145	raised bog, immature woodland and mesotrophic lakes; swimming in large frantic flock over s of l. kinale	NM
T006		29/09/2021	12:40	Teal	23	mesotrophic lakes and mixed conifer woodland; flying s across woodland and lake fringes	NM
T008	L. Sheelin	29/09/2021	08:29	Teal	16	lakes and ponds; flying ne across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T007		29/09/2021	12:49	Teal	33	mixed broadleaved woodland, raised bog and mesotrophic lakes; flying in wide random circles	NM
T009	L. Iron	30/09/2021	18:30	Teal	57	lakes and ponds; swimming on lake	NM
T010	L. Sheelin	12/10/2021	08:12	Teal	6	lakes and ponds; flying low across lake	NM
T011	L. Iron	25/10/2021	17:48	Teal	134	lakes and ponds; swimming on lake and around wetland fringes	NM
T012		26/10/2021	14:54	Teal	16	lakes and ponds; calling within reedy fringes	NM
T013	L. Sheelin	09/11/2021	10:01	Teal	16	lakes and ponds; swimming on lake	NM
T014		09/11/2021	11:54	Teal	6	improved agricultural grassland; swimming and feeding on pond within field	NM
T015	L. Iron	22/11/2021	16:04	Teal	95	lakes and ponds; swimming on lake	NM
T016	L Kinale	23/11/2021	10:56	Teal	26	lakes and ponds; calling within reedy & flooded margins	NM
T017	L. Bane	10/12/2021	15:57	Teal	34	lakes and ponds and semi-natural grassland; swimming on lake and foraging on wet boggy margins	NM
T020		22/12/2021	14:24	Teal	4	lakes and ponds; swimming on pool within field hollow	NM
T018	Deragh Lough	22/12/2021	11:04	Teal	13	lakes and ponds; swimming on lake	NM
T019	L. Sheelin	22/12/2021	13:45	Teal	7	lakes and ponds; swimming on lake	NM
T021	L. Bane	22/12/2021	15:45	Teal	26	lakes and ponds; swimming and calling on lake	NM
T022		22/12/2021	15:57	Teal	23	bogs and scrub; flying in wide circles over lake area	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T023	L. Iron	23/12/2021	15:37	Teal	52	lakes and ponds; swimming and calling on lake	NM
T024	L. Iron	04/01/2022	15:40	Teal	240	lakes and ponds; swimming and calling on lake and within reedy fringes	NM
T025	L. D'varagh	04/01/2022	09:10	Teal	12	lakes and ponds; calling within flooded reedy margins of lake	NM
T026	L. D'varagh	04/01/2022	12:40	Teal	15	semi-natural grassland, highly modified/non-native woodland and lakes and ponds; calling within flooded birch / willow woodland along lake perimeter	NM
T027	L. Bane	05/01/2022	09:06	Teal	6	lakes and ponds; swimming on lake	NM
T030	L. Bane	17/01/2022	15:50	Teal	28	lakes and ponds, semi-natural grassland and transition mire and quaking bog; swimming on lake and within saturated margins	NM
T028	L. Kinale N	17/01/2022	10:40	Teal	67	lakes and ponds; swimming on lake	NM
T033	L. Sheelin	17/01/2022	08:58	Teal	13	lakes and ponds; swimming and calling within reedy margins	NM
T029		17/01/2022	13:54	Teal	16	improved agricultural grassland and reed and large sedge swamps; swimming and calling on flooding adjacent to lake	NM
T032	L. Sheelin	17/01/2022	08:50	Teal	16	lakes and ponds; flying across lake	NM
T031		17/01/2022	13:13	Teal	7	reed and large sedge swamps, scrub and lakes and ponds; bursting from wetland surrounding lake, flying	NM
T034	L. Iron	18/01/2022	16:00	Teal	45	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T035		18/01/2022	10:33	Teal	4	turloughs, lakes and ponds and improved agricultural grassland; calling within flooded reeds	NM
T036	Robinstown flooded fields	14/02/2022	14:50	Teal	12	wet grassland; foraging	KB
T038	Lough Bane	26/02/2022	12:50	Teal	4	lakes and ponds; roosting	KB
T037	Derragh Lough	26/02/2022	11:04	Teal	4	lakes and ponds; foraging	KB
T039	Robinstown flooded fields	07/03/2022	12:50	Teal	5	wet grassland; foraging	KB
T040	Robinstown pond	31/03/2022	13:10	Teal	12	lakes and ponds; foraging	KB
T041	Lough Derravaragh north	31/03/2022	13:41	Teal	6	lakes and ponds; foraging	KB

Table 1-30 Tufted Duck Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU001	L. Kinale	16/09/2021	10:52	Tufted Duck	2	mesotrophic lakes; swimming on lake	NM
TU002	Bracklagh Lough	29/09/2021	09:26	Tufted Duck	57	mesotrophic lakes; swimming and diving on lake	NM
TU003	L. Kinale	29/09/2021	10:12	Tufted Duck	6	mesotrophic lakes; swimming and diving on lake	NM
TU004	L. Sheelin	29/09/2021	08:43	Tufted Duck	6	lakes and ponds; swimming and diving on lake	NM
TU005	Bracklagh Lough	12/10/2021	08:55	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU006	L. Sheelin	12/10/2021	08:07	Tufted Duck	4	lakes and ponds; swimming on lake	NM
TU007		26/10/2021	15:12	Tufted Duck	5	lakes and ponds; swimming on lake	NM
TU008	Bracklagh Lough	28/10/2021	16:18	Tufted Duck	14	lakes and ponds; swimming and diving on lake	NM
TU010	L. Sheelin	23/11/2021	09:00	Tufted Duck	7	lakes and ponds; swimming and diving on lake	NM
TU009	L. Kinale	23/11/2021	09:55	Tufted Duck	3	lakes and ponds; diving on lake	NM
TU011	Bracklagh Lough	10/12/2021	09:26	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU013	Deragh Lough	22/12/2021	11:02	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU016	L. Sheelin	22/12/2021	13:47	Tufted Duck	12	lakes and ponds; swimming on lake	NM
TU012	L. D'varagh	22/12/2021	08:32	Tufted Duck	10	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU014	Bracklagh Lough	22/12/2021	12:03	Tufted Duck	9	lakes and ponds; swimming and diving on lake	NM
TU015	L. Sheelin	22/12/2021	13:40	Tufted Duck	5	lakes and ponds; swimming and diving on lake	NM
TU017	L. D'varagh	04/01/2022	13:34	Tufted Duck	2	lakes and ponds; swimming and diving on lake	NM
TU018	L. Sheelin	17/01/2022	09:46	Tufted Duck	38	lakes and ponds; swimming on lake	NM
TU020	L. Sheelin	17/01/2022	09:49	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU022	L. Sheelin	17/01/2022	08:37	Tufted Duck	13	lakes and ponds; swimming on lake	NM
TU023	L. Sheelin	17/01/2022	08:48	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU024	L. Sheelin	17/01/2022	08:46	Tufted Duck	19	lakes and ponds; swimming on lake	NM
TU025	L. Sheelin	17/01/2022	08:47	Tufted Duck	78	lakes and ponds; swimming on lake	NM
TU026	L. Sheelin	17/01/2022	08:47	Tufted Duck	190	lakes and ponds; swimming on lake	NM
TU027	L. Sheelin	17/01/2022	09:25	Tufted Duck	49	lakes and ponds; swimming on lake	NM
TU021	L. Kinale N	17/01/2022	10:40	Tufted Duck	36	lakes and ponds; swimming and diving on lake	NM
TU019	L. Sheelin	17/01/2022	09:57	Tufted Duck	16	lakes and ponds; flying across sw of lake	NM
TU028	Bracklagh Lough	18/01/2022	10:00	Tufted Duck	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU029	Lough Sheelin west	14/02/2022	11:45	Tufted Duck	183	lakes and ponds; foraging	KB
TU030	Bracklagh Lough	14/02/2022	12:20	Tufted Duck	10	lakes and ponds; foraging	KB
TU031	Lough Kinale	14/02/2022	12:50	Tufted Duck	81	lakes and ponds; foraging	KB
TU032	Robinstown pond	14/02/2022	14:32	Tufted Duck	2	lakes and ponds; foraging	KB
TU033	Lough Iron	15/02/2022	09:40	Tufted Duck	20	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	
TU034	Lough Derravaragh south	15/02/2022	12:20	Tufted Duck	174	lakes and ponds; foraging	KB
TU035	Bracklagh Lough	26/02/2022	09:00	Tufted Duck	11	lakes and ponds; foraging	KB
TU036	Lough Sheelin west	26/02/2022	09:20	Tufted Duck	74	lakes and ponds; foraging	KB
TU037	Lough Sheelin centre	26/02/2022	09:53	Tufted Duck	76	lakes and ponds; foraging	KB
TU038	Lough Kinale	26/02/2022	10:26	Tufted Duck	98	lakes and ponds; foraging	KB
TU039	Derragh Lough	26/02/2022	11:04	Tufted Duck	7	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU040	Lough Derravaragh south	28/02/2022	11:45	Tufted Duck	96	lakes and ponds; foraging	KB
TU041	Lough Derravaragh north	28/02/2022	13:31	Tufted Duck	7	lakes and ponds; foraging	KB
TU042	Brackagh Lough	07/03/2022	09:00	Tufted Duck	43	lakes and ponds; foraging	KB
TU043	Lough Sheelin west	07/03/2022	09:16	Tufted Duck	8	lakes and ponds; foraging	KB
TU044	Lough Kinale	07/03/2022	10:20	Tufted Duck	33	lakes and ponds; foraging	KB
TU045	Lough Derravaragh south	08/03/2022	12:01	Tufted Duck	49	lakes and ponds; foraging	KB
TU046	Brackagh Lough	31/03/2022	08:00	Tufted Duck	23	lakes and ponds; foraging	KB
TU047	Lough Sheelin west	31/03/2022	08:20	Tufted Duck	6	lakes and ponds; foraging	KB
TU048	Lough Kinale	31/03/2022	09:07	Tufted Duck	62	lakes and ponds; foraging	KB

Table 1-31 Wigeon Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	28/01/2022	16:55	Wigeon	8	lakes and ponds; foraging (wintering)	AOD

Table 1-32 Wigeon Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	Derragh Lough	16/09/2021	12:18	Wigeon	7	mesotrophic lakes; swimming on lake	NM
WN004		29/09/2021	12:36	Wigeon	243	mesotrophic lakes and immature woodland; swirling in large frantic flock over s of l. kinale	NM
WN005	L. Sheelin	29/09/2021	08:50	Wigeon	10	lakes and ponds; swimming on lake	NM
WN003	Derragh Lough	29/09/2021	11:00	Wigeon	15	mesotrophic lakes; swimming and foraging on lake	NM
WN002	L. D'varagh	29/09/2021	16:18	Wigeon	14	mesotrophic lakes; swimming and dabbling on lake	NM
WN006	L. Iron	30/09/2021	18:30	Wigeon	25	lakes and ponds; swimming on lake	NM
WN007	L. Iron	11/10/2021	17:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN008	L. Kinale	12/10/2021	10:11	Wigeon	16	lakes and ponds; swimming on lake	NM
WN009	Derragh Lough	12/10/2021	11:12	Wigeon	7	lakes and ponds; swimming and dabbling on lake	NM
WN010	L. Sheelin	12/10/2021	08:14	Wigeon	5	lakes and ponds; flying high across lake	NM
WN011		26/10/2021	09:49	Wigeon	7	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN015		09/11/2021	12:13	Wigeon	4	improved agricultural grassland; swimming on pond (flooding) within field	NM
WN014	Derragh Lough	09/11/2021	11:36	Wigeon	263	lakes and ponds; swimming on lake, flying around in vicinity, approximate numbers, numbers regulary cycling as individuals arrived and departed	NM
WN013	L. Sheelin	09/11/2021	09:27	Wigeon	5	lakes and ponds; swimming on lake	NM
WN016	L. Iron	09/11/2021	16:26	Wigeon	71	lakes and ponds; swimming on lake	NM
WN012	L. Sheelin	09/11/2021	09:29	Wigeon	13	lakes and ponds; flying low across lake, heading e	NM
WN017	L. Iron	22/11/2021	16:03	Wigeon	120	lakes and ponds; swimming on lake	NM
WN018	L. Bane	23/11/2021	14:20	Wigeon	39	lakes and ponds; swimming and dabbling on lake	NM
WN019	L. Sheelin	10/12/2021	09:03	Wigeon	5	lakes and ponds; swimming on lake	NM
WN021	L. Bane	10/12/2021	15:54	Wigeon	16	lakes and ponds; swimming on lake	NM
WN020	L. Kinale	10/12/2021	10:02	Wigeon	12	lakes and ponds; flying low across lake	NM
WN023		22/12/2021	14:24	Wigeon	3	lakes and ponds; swimming on pool within field hollow	NM
WN022	Deragh Lough	22/12/2021	11:00	Wigeon	22	lakes and ponds; swimming and calling on lake	NM
WN024	L. Bane	22/12/2021	15:44	Wigeon	34	lakes and ponds; swimming and calling on lake	NM
WN025		22/12/2021	15:46	Wigeon	9	lakes and ponds and bogs; flying in wide circles over lake area	NM
WN026	L. Iron	23/12/2021	15:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN027	L. Iron	04/01/2022	15:40	Wigeon	70	lakes and ponds; swimming on lake	NM
WN028	L. Bane	05/01/2022	09:05	Wigeon	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN030	L. Bane	17/01/2022	15:50	Wigeon	34	lakes and ponds, transition mire and quaking bog and semi-natural grassland; swimming on lake and within saturated edges	NM
WN029	L. Kinale N	17/01/2022	10:39	Wigeon	23	lakes and ponds; swimming on lake	NM
WN033	L. Sheelin	17/01/2022	08:42	Wigeon	11	lakes and ponds; swimming on lake	NM
WN032	L. D'varagh	17/01/2022	13:09	Wigeon	26	lakes and ponds; swimming and foraging on lake	NM
WN031	L. D'varagh	17/01/2022	13:13	Wigeon	6	reed and large sedge swamps and lakes and ponds; spooked and bursting from wetland, flying	NM
WN034	L. Iron	18/01/2022	16:00	Wigeon	46	lakes and ponds; swimming on lake	NM
WN035	Lough Sheelin west	26/02/2022	09:20	Wigeon	2	lakes and ponds; foraging	KB
WN036	Lough Bane	26/02/2022	12:50	Wigeon	2	lakes and ponds; foraging	KB
WN037	Lough Bane	31/03/2022	11:25	Wigeon	2	lakes and ponds; foraging	KB

Table 1-33 Curlew Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU001	VP5	08/10/2021	09:53	Curlew	3	80	0	80	0	0	improved agricultural grassland, semi-natural grassland and scrub; flying n along e 500m boundary + calling	NM
CU002	VP6	22/10/2021	09:32	Curlew	1	350	0	140	210	0	depositing/lowland rivers, cutover bog and semi-natural grassland; flying and soaring along river and adjacent areas, calling	NM

Table 1-34 Curlew Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001		16/09/2021	08:54	Curlew	2	mesotrophic lakes, immature woodland and raised bog; flying se across lake, bog and scrubby woodland	NM
CU002	BN2	22/12/2021	15:35	Curlew	6	cutover bog, scrub and mixed conifer woodland; flying high and calling, heading s	NM
CU003		23/12/2021	15:50	Curlew	57	improved agricultural grassland and hedgerows; flying low across farmland, heading sw	NM

Table 1-35 Goldeneye Wildfowl Distribution Survey Date

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB

Table 1-36 Kestrel Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K002	VP4	28/04/2021	17:09	Kestrel	1	212	0	100	112	0	mixed broadleaved/conifer woodland and improved agricultural grassland; hunting	PM
K003	VP4	21/05/2021	06:34	Kestrel	1	58	58	0	0	0	cutover bog; travelling low	PM
K004	VP4	21/05/2021	10:12	Kestrel	1	192	0	92	100	0	mixed broadleaved/conifer woodland; hunting	PM
K005	VP6	30/07/2021	13:23	Kestrel	1	175	0	0	175	0	cutover bog and mixed broadleaved/conifer woodland; hunting	PM
K006	VP4	26/08/2021	13:48	Kestrel	1	186	0	0	186	0	cutover bog; hunting	TRea
K007	VP4	26/08/2021	15:54	Kestrel	1	182	20	43	129	0	cutover bog and treelines; chased by bzto open bog, flew low to edged, soared, flew off	TRea
K008	VP5	08/10/2021	08:17	Kestrel	1	130	80	50	0	0	improved agricultural grassland and hedgerows; hunting and hovering along hedgerows within farmland	NM
K009	VP6	22/10/2021	08:15	Kestrel	1	75	35	40	0	0	scrub and cutover bog; flying over bog and fringes	NM
K010	VP6	22/10/2021	09:26	Kestrel	1	70	0	70	0	0	cutover bog; commuting s across bog	NM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K011	VP3	15/11/2021	13:00	Kestrel	1	53	13	40	0	0	cutover bog and conifer plantation; flying, male observed descending into conifer plantation.	CR
K012	VP3	15/11/2021	13:06	Kestrel	1	292	9	37	246	0	conifer plantation and cutover bog; hunting, male observed hunting before descending into conifer plantation.	CR
K013	VP4	16/11/2021	13:02	Kestrel	1	444	6	98	340	0	highly modified/non-native woodland and cutover bog; hunting, observed hunting before descending into woodland.	CR
K014	VP5	19/11/2021	13:22	Kestrel	1	40	40	0	0	0	improved grassland; flying, male observed heading south east.	CR
K015	VP5	19/11/2021	13:47	Kestrel	1	250	5	25	220	0	improved grassland and conifer plantation; hunting, observed hunting for four minutes before descending into conifer woodland to the west of the 500 buffer.	CR
K016	VP6	22/11/2021	13:16	Kestrel	1	133	133	0	0	0	improved grassland, cutover bog and highly modified/non-native woodland; flying, male observed heading east before descending into woodland.	CR
K017	VP6	15/12/2021	13:36	Kestrel	1	660	60	570	30	0	cutover bog, wet grassland and scrub; foraging	KB
K018	VP5	03/01/2022	08:20	Kestrel	1	480	30	200	250	0	immature woodland and wet grassland; foraging	KB
K019	VP4	27/01/2022	15:24	Kestrel	1	510	0	0	510	0	conifer plantation and cutover bog; flying, hovering	ZE
K020	VP6	31/01/2022	14:22	Kestrel	1	648	0	26	622	0	cutover bog and conifer plantation; flying, hovering	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K021	VP6	31/01/2022	14:32	Kestrel	1	370	0	0	370	0	improved agricultural grassland and conifer plantation; flying	ZE
K022	VP6	31/01/2022	16:04	Kestrel	1	38	10	28	0	0	lowland blanket bog and improved agricultural grassland; flying	ZE
K023	VP3	15/02/2022	10:51	Kestrel	1	240	0	60	180	0	cutover bog; flying	NS
K024	VP4	16/02/2022	10:11	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying	NS
K025	VP6	17/02/2022	13:05	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying, no hovering just flying	NS
K026	VP4	10/03/2022	15:22	Kestrel	1	86	0	0	86	0	cutover bog; flying	NS
K027	VP1	15/03/2022	15:49	Kestrel	1	420	0	0	420	0	cutover bog; flying	NS
K028	VP1	15/03/2022	17:03	Kestrel	1	20	0	20	0	0	cutover bog; flying	NS
K029	VP5	22/03/2022	14:04	Kestrel	1	120	0	20	100	0	improved agricultural grassland; hunting	ZOC

Table 1-37 Kestrel Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K001	BRVP5	29/04/2021	09:07	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K002	BRVP2	30/04/2021	09:23	Kestrel	1	improved agricultural grassland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K003	BRVP1	30/04/2021	13:11	Kestrel	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
K004	BRVP6	04/06/2021	17:42	Kestrel	1	cutover bog, hunting	flyover; non-breeding	PM
K005	BRVP6	04/06/2021	18:25	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K006	BRVP6	13/07/2021	09:25	Kestrel	1	highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K007	BRVP6	13/07/2021	10:37	Kestrel	1	bogs and highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K008	BRVP1	19/07/2021	12:48	Kestrel	1	bogs and highly modified/non-native woodland, flying, hovering, soaring, perched on tree, flew off hovering and soaring over bog	suitable nesting habitat; possible breeder	TRea

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
	BRVP6	06/05/2022	15:39	Kestrel	1	scrub and bogs, hunting, female observed hunting before descending beyond row of trees heading north west.	suitable nesting habitat; possible breeder	CR
	BRVP6	06/05/2022	16:06	Kestrel	1	scrub, bogs and conifer plantation, hunting, female kestrel last seen heading west.	suitable nesting habitat; possible breeder	CR
	BRVP2	23/05/2022	14:05	Kestrel	1	cutover bog, hunting and hovering over bog	flyover; non-breeding	NM
	BRVP1	26/05/2022	10:40	Kestrel	1	highly modified/non-native woodland and cutover bog, flying over bog wetland	flyover; non-breeding	NM
	BRVP1	26/05/2022	11:21	Kestrel	1	mixed conifer woodland and scrub, hunting and hovering	suitable nesting habitat; possible breeder	NM
	BRVP6	26/05/2022	16:30	Kestrel	1	bogs, flying across bog	flyover; non-breeding	NM

Table 1-38 Kestrel Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	27/01/2022	14:55	Kestrel	1	cutover bog; fly/perch, k male (wintering)	AOD

Table 1-39 Kestrel Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	Wildfowl Distribution Survey, lough bane 2	16/09/2021	14:06	Kestrel	1	cutover bog, scrub and immature woodland; soaring high above scrubby bog wetland, moving n, hassled by sl & mp	NM
K002	Wildfowl Distribution Survey,	16/09/2021	14:19	Kestrel	2	cutover bog; flying low over bog, individuals then started chasing each other and flying rapidly low to w	NM
K003	Wildfowl Distribution Survey,	16/09/2021	15:39	Kestrel	1	improved agricultural grassland and hedgerows; flying low across farmland	NM
K004	Wildfowl Distribution Survey,	16/09/2021	16:17	Kestrel	1	scrub and dry meadows and grassy verges; perched on telephone wire along road	NM
K005	Wildfowl Distribution Survey,	17/09/2021	19:18	Kestrel	1	marsh and immature woodland; hunting and hovering over s marsh of lake	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K006	Wildfowl Distribution Survey,	12/10/2021	10:41	Kestrel	1	raised bog and scrub; hunting and hovering over scrubby bog fringes	NM
K007	Winter Walkover Survey,	20/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K008	Winter Walkover Survey,	21/10/2021	13:44	Kestrel	1	immature woodland and cutover bog; flying low over scrubby woodland / farmland near bog fringes	NM
K009	Winter Walkover Survey,	21/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K010	Winter Walkover Survey,	21/10/2021	15:25	Kestrel	1	semi-natural grassland, improved agricultural grassland and scrub; hunting and hovering over grassland	NM
K011	Wildfowl Distribution Survey,	26/10/2021	11:29	Kestrel	1	semi-natural grassland and mixed broadleaved woodland; flying across woodland	NM
K12	Wildfowl Distribution Survey,	26/10/2021	12:41	Kestrel	1	cutover bog and scrub; hunting and hovering over bog wetland and fringes	NM
K013	Wildfowl Distribution Survey, derragh lough	23/11/2021	10:40	Kestrel	1	improved agricultural grassland, semi-natural grassland and mixed broadleaved woodland; hunting and hovering over grassland	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K014	Wildfowl Distribution Survey,	10/12/2021	08:54	Kestrel	1	bogs and scrub; hunting and hovering over bog and scrubland	NM
K015	Wildfowl Distribution Survey,	22/12/2021	15:31	Kestrel	1	cutover bog and scrub; flying across bog and scrub fringes	NM
K016	Wildfowl Distribution Survey,	17/01/2022	15:20	Kestrel	1	cutover bog and scrub; flying across bog	NM
K017	Wildfowl Distribution Survey,	17/01/2022	16:30	Kestrel	1	cutover bog and scrub; commuting across bog and wetland	NM
K018	Wildfowl Distribution Survey,	18/01/2022	11:31	Kestrel	1	improved agricultural grassland and scrub; hunting and hovering over farmland	NM

Table 1-40 Lapwing Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
L001	VP6	22/11/2021	12:05	Lapwing	25	151	70	81	0	0	cutover bog; flying, flock of 25 birds observed flying in circles before heading east.	CR

Table 1-41 Lapwing Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
L007	15/03/2022	12:27	Lapwing	8	scrub; nest building (nest building; probable breeding)	NS

Table 1-42 Lapwing Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L002	L. D'varagh	17/09/2021	13:17	Lapwing	32	mesotrophic lakes; flying in v shaped flock low across water - heading nw up length of length	NM
L001		17/09/2021	13:09	Lapwing	81	mesotrophic lakes, mixed broadleaved woodland and improved agricultural grassland; flying in lare flock over narrow 'foot' of lake - heading ne across farmland	NM
L003		25/10/2021	16:36	Lapwing	43	improved agricultural grassland; grazing on grassland to s of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L006		26/10/2021	12:50	Lapwing	32	cutover bog; perched on bog wetland, dispersed across area	NM
L004		26/10/2021	09:34	Lapwing	79	lakes and ponds and improved agricultural grassland; flying and swirling low over lake edge, landing on grassy edge	NM
L005		26/10/2021	12:43	Lapwing	54	cutover bog and scrub; flying across bog wetland	NM
L007		09/11/2021	09:32	Lapwing	18	scrub and bogs; circling over bog / scrubland to w	NM
L011	L. Sheelin	23/11/2021	08:46	Lapwing	145	lakes and ponds and semi-natural grassland; roosting on grassy shore + occasionally smaller groups would fly low across lake and return to land	NM
L010		23/11/2021	12:45	Lapwing	23	improved agricultural grassland; roosting and foraging within rushy wetland area - turlough? wetland?, habitat??	NM
L008		23/11/2021	09:56	Lapwing	8	lakes and ponds, scrub and semi-natural grassland; flying over shore of lake	NM
L012	L. Sheelin	23/11/2021	09:15	Lapwing	34	lakes and ponds; flying e across lake	NM
L009	L. D'varagh	23/11/2021	15:39	Lapwing	86	lakes and ponds; flying across lake	NM
L013	L. Sheelin	10/12/2021	08:45	Lapwing	28	lakes and ponds and scrub; swirling over w shore area	NM
L014	BN2	10/12/2021	15:41	Lapwing	19	cutover bog; roosting and foraging on bare peat within bog wetland area	NM
L016		22/12/2021	14:34	Lapwing	31	lakes and ponds and improved agricultural grassland; foraging and roosting at edge of pool within field, turlough?	NM
L015	L. D'varagh	22/12/2021	08:43	Lapwing	78	lakes and ponds; flying low across lake - heading w	NM
L017		23/12/2021	15:35	Lapwing	245	semi-natural grassland and scrub; flying high across grassland and scrub to n of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L018		23/12/2021	15:37	Lapwing	87	improved agricultural grassland; flying across grassland to nw of lake	NM
L020		04/01/2022	14:15	Lapwing	38	improved agricultural grassland; grazing on field	NM
L019		04/01/2022	13:57	Lapwing	158	improved agricultural grassland, hedgerows and lakes and ponds; flock wheeling and flying high over farmland and lake edges	NM
L021	BN2	05/01/2022	09:43	Lapwing	23	cutover bog; roosting on bog wetland	NM
L023		17/01/2022	13:52	Lapwing	7	improved agricultural grassland and semi-natural grassland; roosting on flooding	NM
L024	L. Sheelin	17/01/2022	08:36	Lapwing	38	lakes and ponds; flying low across lake - heading se	NM
L022	L. Sheelin	17/01/2022	09:45	Lapwing	26	lakes and ponds; flying low across lake	NM
L025	Lough Sheelin centre	14/02/2022	11:00	Lapwing	76	lakes and ponds; flying over	KB
L027	Flooded cutaway bog on site	26/02/2022	12:58	Lapwing	6	cutover bog; foraging on ground and flying over	KB
L026	Derragh Lough	26/02/2022	11:04	Lapwing	1	wet grassland; foraging	KB
L028	Flooded bog on site	31/03/2022	11:20	Lapwing	2	cutover bog; foraging and alarm calling	KB

Table 1-43 Pochard Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PO001	L. Kinale	29/09/2021	10:23	Pochard	5	mesotrophic lakes; swimming and diving on lake	NM
PO002	L. Sheelin	26/10/2021	14:21	Pochard	5	lakes and ponds; swimming and diving on lake	NM
PO003	L. D'varagh	08/11/2021	12:23	Pochard	12	lakes and ponds; swimming on lake	NM
PO004	L. Sheelin	09/11/2021	09:15	Pochard	7	lakes and ponds; swimming and diving on lake	NM
PO005	L. Kinale	23/11/2021	09:52	Pochard	12	lakes and ponds; swimming on lake	NM
PO006	L. D'varagh	23/11/2021	15:42	Pochard	24	lakes and ponds; swimming on lake	NM
PO007	L. Sheelin	23/11/2021	09:10	Pochard	4	lakes and ponds; swimming and diving on lake	NM
PO008	L. Kinale	22/12/2021	12:20	Pochard	16	lakes and ponds; swimming on lake	NM
PO009	L. Sheelin	22/12/2021	13:52	Pochard	9	lakes and ponds; swimming and diving on lake	NM
PO010	L. D'varagh	04/01/2022	10:08	Pochard	5	lakes and ponds; swimming on lake	NM
PO011	L. Kinale	17/01/2022	10:41	Pochard	7	lakes and ponds; swimming on lake	NM
PO012	L. Sheelin	17/01/2022	08:59	Pochard	12	lakes and ponds; swimming and diving on lake	NM
PO013	Bracklagh Lough	14/02/2022	12:20	Pochard	1	lakes and ponds; foraging	KB
PO014	Lough Sheelin west	26/02/2022	09:20	Pochard	177	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PO015	Lough Sheelin centre	26/02/2022	09:53	Pochard	182	lakes and ponds; foraging	KB
PO016	Lough Derravaragh south	28/02/2022	11:45	Pochard	6	lakes and ponds; foraging	KB
PO017	Brackagh Lough	07/03/2022	09:00	Pochard	76	lakes and ponds; foraging	KB
PO018	Derragh Lough	31/03/2022	09:32	Pochard	4	lakes and ponds; foraging	KB

Table 1-44 Snipe Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SN001	VP6	06/04/2021	20:31	Snipe	1	10	10	0	0	0	cutover bog; flew from long grass	PM
SN002	VP6	26/05/2021	06:20	Snipe	1	15	15	0	0	0	cutover bog; travelling; landed in vegetation	PM
SN003	VP5	19/11/2021	12:03	Snipe	1	81	11	70	0	0	improved grassland; flying, landed in grassland to the north.	CR
SN004	VP6	31/01/2022	15:17	Snipe	1	10	10	0	0	0	improved agricultural grassland; flying, flushed	ZE
SN005	VP5	22/03/2022	19:25	Snipe	2	30	0	30	0	0	improved agricultural grassland; flying	ZOC

Table 1-45 Snipe Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN004	VP6	06/04/2021	20:44	Snipe	1	cutover bog; calling	PM
SN005	VP4	28/04/2021	21:29	Snipe	1	cutover bog; drumming, not seen	PM
SN007	VP4	28/04/2021	21:33	Snipe	1	cutover bog; drumming, second male; not seen	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN006	VP4	28/04/2021	21:39	Snipe	1	cutover bog; drumming, not seen; possibly same bird as earlier	PM
SN008	VP3	15/11/2021	17:07	Snipe	1	cutover bog; calling	CR
SN009	VP3	15/11/2021	17:15	Snipe	1	cutover bog; calling	CR
SN010	VP3	15/11/2021	17:19	Snipe	1	cutover bog; calling	CR
SN011	VP5	19/11/2021	17:07	Snipe	1	improved grassland; calling	CR
SN012	VP6	22/11/2021	15:54	Snipe	1	depositing/lowland rivers; calling	CR
SN013	VP6	22/11/2021	16:42	Snipe	1	improved grassland and depositing/lowland rivers; calling	CR
SN014	VP6	22/11/2021	17:12	Snipe	1	cutover bog; calling	CR
SN015	VP6	31/01/2022	17:47	Snipe	1	lowland blanket bog; calling	ZE

Table 1-46 Snipe Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	07/04/2021	07:23	Snipe	1	wet grassland; flushed (flyover; non-breeding)	PM
SN002	07/04/2021	11:32	Snipe	2	cutover bog; flushed (summering; non-breeding)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN003	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN004	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN005	18/06/2021	07:22	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN006	18/06/2021	07:49	Snipe	1	cutover bog; flying (flyover; non-breeding)	PM
SN007	18/06/2021	10:40	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN008	18/06/2021	10:40	Snipe	1	cutover bog; displaying (courtship and display; probable breeding)	PM

Table 1-47 Snipe Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN009	21/10/2021	11:52	Snipe	1	cutover bog, semi-natural grassland and depositing/lowland rivers; flushed from wet grassland along river (wintering)	NM
SN010	21/10/2021	11:57	Snipe	4	cutover bog; flushed from cutover bog fringes (wintering)	NM
SN011	28/01/2022	13:03	Snipe	2	raised bog; fly, flushed (wintering)	AOD
SN012	28/01/2022	16:56	Snipe	2	lakes and ponds; flushed (wintering)	AOD
SN013	22/02/2022	17:01	Snipe	4	lakes and ponds; flushed (wintering)	AOD
SN014	23/02/2022	17:08	Snipe	1	cutover bog; flushed (wintering)	AOD

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN015	23/02/2022	16:08	Snipe	1	cutover bog; flushed (wintering)	AOD
SN016	15/03/2022	15:10	Snipe	1	cutover bog; flying, flushed while walking (nest building; probable breeding)	NS

Table 1-48 Snipe Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001		29/09/2021	08:43	Snipe	1	raised bog; flushed from bog	NM
SN002		12/10/2021	13:27	Snipe	4	improved agricultural grassland and hedgerows; flying over farmland	NM
SN003		23/11/2021	14:18	Snipe	1	semi-natural grassland; flushed from wet grassland	NM
SN004		22/12/2021	15:46	Snipe	2	scrub and bogs; flushed from saturated fringes of lake, willow shrubs - wn7?	NM
SN005	L. D'varagh	04/01/2022	12:50	Snipe	2	highly modified/non-native woodland and semi-natural grassland; flushed from wet grass within woodland	NM
SN006	L. D'varagh	04/01/2022	13:30	Snipe	2	improved agricultural grassland; flushed from partially flooded field along lake edge	NM
SN008	BN1	17/01/2022	15:46	Snipe	1	scrub and semi-natural grassland; flushed from wet willow scrub	NM
SN009		17/01/2022	15:53	Snipe	1	transition mire and quaking bog and semi-natural grassland; flushed from saturated fringes	NM
SN007		17/01/2022	11:16	Snipe	1	improved agricultural grassland; flushed from disturbed farmland	NM
SN010	Lough Sheelin centre	14/02/2022	11:00	Snipe	1	raised bog; flushed	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN011	Lough Sheelin centre	26/02/2022	09:53	Snipe	1	raised bog; flushed	KB
SN012	Lough Bane	26/02/2022	12:50	Snipe	1	bogs and lakes and ponds; flushed	KB
SN013	Lough Derravaragh north	08/03/2022	13:32	Snipe	1	lakes and ponds; flushed	KB

Table 1-49 Snipe Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	Breeding Woodcock Survey, t1	06/05/2021	22:39	Snipe	1	cutover bog; drumming	PM
SN002	Breeding Woodcock Survey, t1	06/05/2021	22:10	Snipe	1	cutover bog; drumming	PM
SN003	Breeding Woodcock Survey, t1	06/05/2021	22:30	Snipe	1	cutover bog and conifer plantation; drumming	PM
SN004	Breeding Woodcock Survey, t1 coole	03/06/2021	22:37	Snipe	2	bogs and woodland and scrub; drumming, 2 individuals drumming	TRea
SN005	Breeding Woodcock Survey, wkt1	28/06/2021	23:28	Snipe	1	bogs; drumming	TRea
SN006	Vantage Point Survey, vp6	06/09/2021	17:28	Snipe	1	cutover bog; travelling, took off from scrub as hh passed over	TRea

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN007	Vantage Point Survey, walking to vp6	15/12/2021	07:37	Snipe	1	cutover bog; flushed	KB
SN008	Vantage Point Survey, walking from vp6	15/12/2021	14:13	Snipe	1	cutover bog; flushed	KB
SN009	Vantage Point Survey, doon	31/01/2022	11:37	Snipe	1	lowland blanket bog; flying - flushed	ZE
SN010	Vantage Point Survey, coole westmeath	17/02/2022	13:17	Snipe	1	lowland blanket bog; flying, flushed while walking back from vp	NS

Table 1-50 Woodcock Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WK001	VP4	31/03/2021	20:26	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland; roding, displaying bird	AOD
WK002	VP4	31/03/2021	20:36	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland and cutover bog; roding, displaying male	AOD

Table 1-51 Breeding Woodcock Survey Data

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK001	T1	06/05/2021	21:35	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK002	T1	06/05/2021	21:37	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK003	T1	06/05/2021	21:41	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK004	T1	06/05/2021	21:43	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK005	T1	06/05/2021	21:48	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK006	T1	06/05/2021	21:52	Woodcock	1	short rotation coppice, roding, t1 bird 3	PM
WK007	T1	06/05/2021	21:54	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM
WK008	T1	06/05/2021	21:58	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK009	T3	18/05/2021	21:50	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK010	T3	18/05/2021	21:53	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK011	T2	24/05/2021	22:22	Woodcock	1	mixed broadleaved/conifer woodland, roding, t2 bird 1	PM
WK012	T2	24/05/2021	22:30	Woodcock	1	mixed broadleaved/conifer woodland and cutover bog, roding, t2 bird 2	PM
WK013	T2	03/06/2021	21:42	Woodcock	2	mixed broadleaved/conifer woodland, chasing each other	PM
WK014	T2	03/06/2021	22:14	Woodcock	1	conifer plantation, roding	PM
WK015	T2	03/06/2021	22:34	Woodcock	1	conifer plantation, roding	PM
WK016	T1	03/06/2021	21:45	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK017	T1	03/06/2021	21:54	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK018	T1	03/06/2021	21:56	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK019	T1	03/06/2021	22:10	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK020	T1	03/06/2021	22:16	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK021	T1	03/06/2021	22:22	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK022	T1	03/06/2021	22:24	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK023	T1	03/06/2021	22:42	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK024	T1	03/06/2021	22:19	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK025	T1	03/06/2021	22:50	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK026	T3	04/06/2021	21:58	Woodcock	1	conifer plantation and bogs, roding	TRea
WK027	T3	04/06/2021	22:51	Woodcock	1	conifer plantation and bogs, roding	TRea
WK028	T3	04/06/2021	22:19	Woodcock	1	conifer plantation and bogs, roding	TRea
WK029	T3	04/06/2021	22:31	Woodcock	1	conifer plantation and bogs, roding	TRea
WK030	T1	28/06/2021	22:35	Woodcock	2	highly modified/non-native woodland and bogs, roding, 2 flying in loop aa individuals	TRea

Table 1-52 Buzzard Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ002	VP6	06/04/2021	15:00	Buzzard	1	117	0	0	117	0	cutover bog and conifer plantation; soaring	PM
BZ003	VP6	06/04/2021	15:31	Buzzard	1	244	0	0	244	0	conifer plantation and cutover bog; soaring before dropping down to land in tree	PM
BZ004	VP6	06/04/2021	16:17	Buzzard	1	155	0	0	155	0	conifer plantation and cutover bog; hunting/travelling	PM
BZ005	VP6	26/05/2021	10:18	Buzzard	1	20	20	0	0	0	improved agricultural grassland; travelling; being mobbed by hc	PM
BZ006	VP4	17/06/2021	15:03	Buzzard	2	200	0	0	100	100	conifer plantation and improved agricultural grassland; soaring	PM
BZ007	VP4	17/06/2021	15:32	Buzzard	1	450	0	0	400	50	cutover bog, conifer plantation and improved agricultural grassland; hunting; then soaring	PM
BZ008	VP4	17/06/2021	15:38	Buzzard	1	60	60	0	0	0	cutover bog; travelling	PM
BZ009	VP4	17/06/2021	15:42	Buzzard	1	23	23	0	0	0	cutover bog; travelling	PM
BZ010	VP4	17/06/2021	15:49	Buzzard	1	17	17	0	0	0	cutover bog; hunting	PM
BZ011	VP6	30/07/2021	12:48	Buzzard	1	19	0	19	0	0	cutover bog; hunting	PM
BZ012	VP6	30/07/2021	15:15	Buzzard	1	52	52	0	0	0	wet grassland; hunting	PM
BZ013	VP6	19/08/2021	11:00	Buzzard	1	787	0	127	660	0	cutover bog and semi-natural woodland; travelling, soaring	TRea
BZ014	VP6	19/08/2021	14:42	Buzzard	1	220	0	0	220	0	cutover bog; travelling	TRea
BZ015	VP6	19/08/2021	16:10	Buzzard	1	521	0	15	516	0	cutover bog; hunting	TRea
BZ016	VP4	26/08/2021	11:22	Buzzard	1	354	0	0	354	0	cutover bog; hunting	TRea
BZ017	VP4	26/08/2021	12:09	Buzzard	1	277	0	0	277	0	cutover bog and treelines; soaring	TRea
BZ018	VP4	26/08/2021	12:13	Buzzard	1	249	0	72	177	0	cutover bog and linear woodland/scrub; hunting	TRea

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ019	VP4	26/08/2021	12:47	Buzzard	1	77	0	77	0	0	cutover bog; travelling	TRea
BZ020	VP4	26/08/2021	14:46	Buzzard	2	360	0	41	319	0	cutover bog and treelines; hunting	TRea
BZ021	VP4	26/08/2021	14:59	Buzzard	1	208	0	0	208	0	cutover bog; soaring	TRea
BZ022	VP4	26/08/2021	15:58	Buzzard	1	5	5	0	0	0	cutover bog and treelines; fighting k.	TRea
BZ023	VP5	08/10/2021	11:01	Buzzard	1	240	0	0	60	180	improved agricultural grassland, mixed conifer woodland and cutover bog; soaring over forestry and bog fringes	NM
BZ024	VP4	19/10/2021	11:28	Buzzard	1	120	0	50	70	0	bogs and highly modified/non-native woodland; soaring over woodland on bog	NM
BZ025	VP6	22/10/2021	11:59	Buzzard	1	560	65	150	330	20	scrub, treelines and cutover bog; soaring and hunting over bog and scrub fringes, perched for period	NM
BZ026	VP3	23/10/2021	12:03	Buzzard	1	160	0	0	140	20	cutover bog and scrub; soaring over bog and fringes	NM
BZ027	VP3	23/10/2021	12:24	Buzzard	1	70	0	0	70	0	mixed broadleaved woodland, improved agricultural grassland and cutover bog; flying across hazel woodland and farmland	NM
BZ028	VP3	15/11/2021	12:06	Buzzard	1	465	0	0	115	350	highly modified/non-native woodland, improved grassland and cutover bog; soaring, observed heading north west.	CR
BZ029	VP6	22/11/2021	11:06	Buzzard	1	40	40	0	0	0	highly modified/non-native woodland and cutover bog; flying, observed heading north west before descending beyond line of trees.	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ030	VP6	22/11/2021	14:49	Buzzard	1	80	80	0	0	0	cutover bog, improved grassland and highly modified/non-native woodland; flying, adult buzzard observed heading south before landing on tree top.	CR
BZ031	VP6	22/11/2021	15:00	Buzzard	1	42	20	22	0	0	highly modified/non-native woodland and improved grassland; flying, last seen heading south west.	CR
BZ032	VP6	15/12/2021	08:53	Buzzard	1	30	10	20	0	0	mixed broadleaved woodland; foraging	KB
BZ033	VP6	15/12/2021	09:42	Buzzard	1	10	10	0	0	0	semi-natural grassland; foraging	KB
BZ034	VP5	25/01/2022	14:57	Buzzard	1	5	0	5	0	0	improved agricultural grassland; flying	ZE
BZ035	VP5	25/01/2022	15:25	Buzzard	1	3	0	5	0	0	improved agricultural grassland and treelines; flying	ZE
BZ036	VP5	25/01/2022	16:20	Buzzard	1	19	19	0	0	0	improved agricultural grassland and hedgerows; flying	ZE
BZ037	VP3	26/01/2022	11:50	Buzzard	1	50	40	10	0	0	conifer plantation and treelines; flying, circling	ZE
BZ038	VP3	26/01/2022	13:24	Buzzard	1	3	3	0	0	0	conifer plantation and treelines; flying, landed on the field	ZE
BZ039	VP3	26/01/2022	12:43	Buzzard	2	85	0	85	0	0	conifer plantation and treelines; flying, displaying	ZE
BZ040	VP4	27/01/2022	14:13	Buzzard	2	180	10	10	160	0	conifer plantation; flying, displaying, one flew south after two minutes	ZE
BZ041	VP6	31/01/2022	14:25	Buzzard	1	26	0	26	0	0	conifer plantation; flying	ZE
BZ042	VP4	10/03/2022	13:47	Buzzard	2	50	8	0	0	50	cutover bog; flying, soaring high. lost sight behind clouds	NS
BZ043	VP4	10/03/2022	13:57	Buzzard	1	319	0	0	0	319	cutover bog; flying	NS
BZ044	VP4	10/03/2022	14:23	Buzzard	1	78	0	0	78	0	cutover bog; flying	NS

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ045	VP4	10/03/2022	14:46	Buzzard	2	136	30	106	0	0	cutover bog; breeding behaviour	NS
BZ046	VP4	10/03/2022	15:15	Buzzard	2	500	0	200	300	0	cutover bog; flying	NS
BZ047	VP4	10/03/2022	17:30	Buzzard	1	30	0	30	0	0	cutover bog; flying	NS
BZ048	VP1	15/03/2022	15:46	Buzzard	2	68	0	68	0	0	cutover bog; flying	NS
BZ049	VP1	15/03/2022	15:53	Buzzard	1	8	8	0	0	0	cutover bog; flying	NS
BZ050	VP5	22/03/2022	13:47	Buzzard	1	60	0	10	50	0	oak-birch-holly woodland and improved agricultural grassland; soaring/ circling, soaring before dropping into woodland below	ZOC
BZ051	VP5	22/03/2022	14:00	Buzzard	1	190	0	0	190	0	dry calcareous and neutral grassland; travelling displaying, travelling and displaying briefly	ZOC
BZ052	VP5	22/03/2022	14:02	Buzzard	1	100	0	0	100	0	dry calcareous and neutral grassland; displaying, displaying	ZOC
BZ053	VP5	22/03/2022	16:55	Buzzard	1	50	5	10	35	0	improved agricultural grassland and oak-birch-holly woodland; travelling	ZOC
BZ054	VP3	23/03/2022	15:40	Buzzard	2	170	0	0	170	0	cutover bog and conifer plantation; flying, displaying	ZOC

Table 1-53 Buzzard Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ023	VP4	26/08/2021	14:07	Buzzard	1	improved agricultural grassland and treelines; calling	TRea
BZ061	VP4	07/09/2021	15:16	Buzzard	1	cutover bog and woodland and scrub; calling	TRea
BZ055	VP6	22/11/2021	11:37	Buzzard	1	highly modified/non-native woodland and cutover bog; calling, no visual	CR
BZ056	VP6	22/11/2021	14:50	Buzzard	1	highly modified/non-native woodland and improved grassland; roosting, remained perched on tree top until 15:00.	CR
BZ057	VP5	25/01/2022	15:01	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ058	VP5	25/01/2022	15:33	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ059	VP5	08/02/2022	13:14	Buzzard	1	improved agricultural grassland; calling	NS
BZ060	VP4	10/03/2022	18:16	Buzzard	2	cutover bog; perched, perched in tree	NS

Table 1-54 Buzzard Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ001	07/04/2021	10:16	Buzzard	1	mixed broadleaved/conifer woodland and cutover bog; flew from trees before circling (suitable nesting habitat; possible breeder)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ002	14/05/2021	11:30	Buzzard	1	mixed broadleaved/conifer woodland; calling (suitable nesting habitat; possible breeder)	PM
BZ003	18/06/2021	09:54	Buzzard	1	improved agricultural grassland; flying; calling (flyover; non-breeding)	PM
BZ004	23/07/2021	10:05	Buzzard	1	conifer plantation; calling, not seen (flyover; non-breeding)	PM

Table 1-55 Buzzard Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ005	27/01/2022	14:05	Buzzard	2	cutover bog; fly, soaring over bog (wintering)	AOD
BZ006	22/02/2022	13:04	Buzzard	2	mixed broadleaved/conifer woodland; flying over, calling (wintering)	AOD
BZ007	22/02/2022	15:12	Buzzard	1	improved agricultural grassland and cutover bog; flying over (wintering)	AOD
BZ008	15/03/2022	13:06	Buzzard	1	bog woodland; flying (nest building; probable breeding)	NS
BZ009	15/03/2022	13:23	Buzzard	1	wet willow-alder-ash woodland; flying (nest building; probable breeding)	NS
BZ010	15/03/2022	14:58	Buzzard	1	cutover bog; flying (nest building; probable breeding)	NS
BZ011	16/03/2022	12:51	Buzzard	2	cutover bog; flying (nest building; probable breeding)	NS

Table 1-56 Buzzard Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ001	BRVP5	29/04/2021	09:51	Buzzard	1	raised bog, travelling	flyover; non-breeding	PM
BZ002	BRVP5	29/04/2021	10:09	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ003	BRVP5	29/04/2021	10:29	Buzzard	2	improved agricultural grassland and conifer plantation, soaring, being mobbed by hc	flyover; non-breeding	PM
BZ004	BRVP5	29/04/2021	12:53	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ005	BRVP1	06/05/2021	17:07	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ006	BRVP1	06/05/2021	17:18	Buzzard	1	mixed broadleaved/conifer woodland, rising and travelling away from forestry	suitable nesting habitat; possible breeder	PM
BZ007	BRVP1	06/05/2021	17:33	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ008	BRVP1	06/05/2021	18:39	Buzzard	1	mixed broadleaved/conifer woodland, hunting/travelling	suitable nesting habitat; possible breeder	PM
BZ009	BRVP1	06/05/2021	19:06	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ010	BRVP1	06/05/2021	19:22	Buzzard	1	mixed broadleaved/conifer woodland, travelling	suitable nesting habitat; possible breeder	PM
BZ011	BRVP2	24/05/2021	18:22	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ012	BRVP2	24/05/2021	19:54	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ013	BRVP1	03/06/2021	19:43	Buzzard	1	conifer plantation, travelling; being mobbed by hc and bh	flyover; non-breeding	PM
BZ014	BRVP1	03/06/2021	19:48	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ015	BRVP6	04/06/2021	18:25	Buzzard	1	conifer plantation, travelling; mobbed by crows	flyover; non-breeding	PM
BZ016	BRVP2	28/06/2021	17:39	Buzzard	2	conifer plantation and improved agricultural grassland, circling	pair; probable breeding	PM
BZ017	BRVP2	28/06/2021	18:07	Buzzard	1	improved agricultural grassland, circling	flyover; non-breeding	PM
BZ018	BRVP6	29/06/2021	17:28	Buzzard	1	mixed broadleaved/conifer woodland, circling low	suitable nesting habitat; possible breeder	PM
BZ019	BRVP6	29/06/2021	18:05	Buzzard	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
BZ020	BRVP6	29/06/2021	18:15	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM
BZ021	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ022	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, travelling	flyover; non-breeding	PM
BZ023	BRVP6	29/06/2021	18:55	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring	flyover; non-breeding	PM
BZ024	BRVP6	13/07/2021	09:25	Buzzard	1	highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea
BZ025	BRVP5	13/07/2021	13:42	Buzzard	1	mixed broadleaved/conifer woodland and bogs, soaring, travelling	suitable nesting habitat; possible breeder	TRea
BZ026	BRVP6	13/07/2021	14:34	Buzzard	2	highly modified/non-native woodland and bogs, soaring	pair; probable breeding	TRea
BZ027	BRVP6	13/07/2021	14:34	Buzzard	1	highly modified/non-native woodland and bogs, soaring	suitable nesting habitat; possible breeder	TRea
BZ028	BRVP1	19/07/2021	10:27	Buzzard	1	bogs and highly modified/non-native woodland, soaring, divinng behind treeline	suitable nesting habitat; possible breeder	TRea
BZ029	BRVP1	19/07/2021	11:46	Buzzard	1	bogs and highly modified/non-native woodland, travelling	suitable nesting habitat; possible breeder	TRea
BZ030	BRVP2	19/07/2021	14:20	Buzzard	2	mixed broadleaved/conifer woodland and improved grassland, fighting white tailed eagle, calling and diving at eagle	agitated behaviour; probable breeding	TRea
BZ031	BRVP2	19/07/2021	15:16	Buzzard	1	improved grassland and highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea

Table 1-57 Buzzard Incidental Observation Data

Incidental Records							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
BZ001	Wildfowl Distribution Survey,	16/09/2021	12:53	Buzzard	1	immature woodland, mixed broadleaved woodland and mesotrophic lakes; soaring over woodland	NM
BZ002	Wildfowl Distribution Survey,	16/09/2021	14:26	Buzzard	1	conifer plantation and cutover bog; soaring over forestry fringes of bog	NM
BZ003	Wildfowl Distribution Survey,	16/09/2021	16:49	Buzzard	1	scrub, immature woodland and mixed conifer woodland; perched in scrubby trees along track	NM
BZ004	Wildfowl Distribution Survey,	16/09/2021	16:58	Buzzard	1	mixed conifer woodland, mixed broadleaved woodland and mesotrophic lakes; flying and circling	NM
BZ005	Wildfowl Distribution Survey, s2	16/09/2021	09:14	Buzzard	1	raised bog, mixed conifer woodland and scrub; soaring over bog and forestry	NM
BZ006	Wildfowl Distribution Survey,	17/09/2021	15:00	Buzzard	1	improved agricultural grassland, scrub and hedgerows; soaring and circling over farmland	NM
BZ007	Wildfowl Distribution Survey,	29/09/2021	12:23	Buzzard	1	mesotrophic lakes, mixed conifer woodland and mixed broadleaved woodland; soaring over forestry and s fringes of derragh lough	NM
BZ008	Wildfowl Distribution Survey,	12/10/2021	12:43	Buzzard	1	improved agricultural grassland and hedgerows; soaring and circling over farmland + calling	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ009	Wildfowl Distribution Survey,	12/10/2021	16:33	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland - appeared to be harrying we for a time	NM
BZ010	Winter Walkover Survey,	20/10/2021	10:55	Buzzard	2	scrub and bogs; soaring over scrubby bog areas	NM
BZ011	Winter Walkover Survey,	21/10/2021	12:13	Buzzard	1	improved agricultural grassland, mixed broadleaved woodland and scrub; soaring over woodland and farmland	NM
BZ012	Winter Walkover Survey,	21/10/2021	14:56	Buzzard	1	treelines and improved agricultural grassland; perched low in ashe along road, flushed	NM
BZ013	Wildfowl Distribution Survey,	26/10/2021	10:31	Buzzard	1	improved agricultural grassland; perched in tree in farmland	NM
BZ014	Wildfowl Distribution Survey,	26/10/2021	13:08	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland	NM
BZ015	Wildfowl Distribution Survey,	26/10/2021	14:04	Buzzard	1	raised bog and immature woodland; soaring over bog and woody fringes	NM
BZ016	Wildfowl Distribution Survey,	22/12/2021	10:20	Buzzard	1	scrub, improved agricultural grassland and mixed conifer woodland; disturbed from perch along river, flew away low over farmland and woodland	NM
BZ017	Wildfowl Distribution Survey,	22/12/2021	12:18	Buzzard	1	lakes and ponds, scrub and improved agricultural grassland; soaring and circling over lake fringes	NM
BZ018	Wildfowl Distribution Survey,	22/12/2021	14:14	Buzzard	1	bogs and scrub; flying low across bog and scrub	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ019	Wildfowl Distribution Survey,	22/12/2021	14:30	Buzzard	1	improved agricultural grassland and hedgerows; flying across field	NM
BZ020	Wildfowl Distribution Survey,	23/12/2021	15:27	Buzzard	2	improved agricultural grassland and hedgerows; calling and flying low along hedgerows within farmland	NM
BZ021	Wildfowl Distribution Survey,	23/12/2021	16:11	Buzzard	1	improved agricultural grassland and hedgerows; flying low along hedgerows within farmland, perching briefly within tree	NM
BZ022	Wildfowl Distribution Survey,	04/01/2022	09:01	Buzzard	1	improved agricultural grassland and hedgerows; flying across farmland	NM
BZ023	Wildfowl Distribution Survey,	04/01/2022	13:20	Buzzard	1	improved agricultural grassland and hedgerows; perched on telephone line before flying away over farmland	NM
BZ024	Wildfowl Distribution Survey,	04/01/2022	14:05	Buzzard	1	improved agricultural grassland, hedgerows and mixed conifer woodland; flying across fields	NM
BZ025	Wildfowl Distribution Survey,	05/01/2022	09:28	Buzzard	2	cutover bog, mixed conifer woodland and scrub; soaring over bog	NM
BZ026	Wildfowl Distribution Survey,	17/01/2022	09:35	Buzzard	1	improved agricultural grassland; flying low across farmland	NM
BZ027	Wildfowl Distribution Survey, l. sheelin	17/01/2022	10:20	Buzzard	1	lakes and ponds; flying high and ne across lake	NM
BZ028	Wildfowl Distribution Survey,	17/01/2022	10:27	Buzzard	1	mixed conifer woodland and scrub; perched within forestry before flying off	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ029	Wildfowl Distribution Survey,	18/01/2022	10:23	Buzzard	1	improved agricultural grassland, hedgerows and scrub; soaring over farmland	NM
BZ030	Vantage Point Survey, coole vp4	16/02/2022	08:00	Buzzard	1	cutover bog; flying	NS
BZ031	Waterfowl Distribution Survey,	08/03/2022	15:24	Buzzard	1	cutover bog; foraging	KB
BZ032	Waterfowl Distribution Survey,	31/03/2022	11:25	Buzzard	1	lakes and ponds; foraging	KB

Table 1-58 Sparrowhawk Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SH001	VP4	28/04/2021	16:28	Sparrowhawk	1	12	12	0	0	0	mixed broadleaved/conifer woodland; flew to perch on tree; known nest site, flew from woods to perch on top of tree near nest site	PM
SH002	VP4	28/04/2021	16:34	Sparrowhawk	1	5	5	0	0	0	mixed broadleaved/conifer woodland; flew between perches at known nest site, male	PM
SH003	VP4	28/04/2021	16:39	Sparrowhawk	1	10	10	0	0	0	mixed broadleaved/conifer woodland; flew from perch at known nest site and flew off low, male	PM
SH004	VP4	09/12/2021	09:22	Sparrowhawk	1	10	10	0	0	0	cutover bog and immature woodland; foraging	KB
SH005	VP4	09/12/2021	09:22	Sparrowhawk	2	5	2	3	0	0	cutover bog and immature woodland; foraging	KB
SH006	VP4	09/12/2021	09:22	Sparrowhawk	1	8	8	0	0	0	cutover bog and immature woodland; foraging	KB
SH007	VP4	10/03/2022	13:41	Sparrowhawk	1	190	30	60	100	0	cutover bog; flying	NS

Table 1-59 Sparrowhawk Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	07/04/2021	08:50	Sparrowhawk	1	mixed broadleaved/conifer woodland; carrying nest material into trees (nest building; probable breeding)	PM

Table 1-60 Sparrowhawk Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
SH001	BRVP1	30/04/2021	13:15	Sparrowhawk	1	cutover bog, travelling; landed in tree	suitable nesting habitat; possible breeder	PM
SH002	BRVP1	06/05/2021	18:16	Sparrowhawk	1	mixed broadleaved/conifer woodland and cutover bog, travelling	flyover; non-breeding	PM
SH003	BRVP6	18/05/2021	18:52	Sparrowhawk	1	mixed broadleaved/conifer woodland, travelling, male	flyover; non-breeding	PM

Table 1-61 Sparrowhawk Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	Winter Walkover Survey,	21/10/2021	12:04	Sparrowhawk	1	improved agricultural grassland and semi-natural grassland; flying low across grassland	NM
SH002	Wildfowl Distribution Survey,	26/10/2021	12:38	Sparrowhawk	1	scrub and cutover bog; flying over scrubby bog fringes + perched	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH003	Wildfowl Distribution Survey,	08/11/2021	12:15	Sparrowhawk	1	improved agricultural grassland and hedgerows; flying low between hedgerows of farmland	NM
SH004	Vantage Point Survey, vp6	22/11/2021	14:03	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, female observed during lunch break. last seen heading north.	CR
SH005	Vantage Point Survey, vp6	22/11/2021	14:06	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, possibly same female bird observed three minutes earlier. last seen heading north.	CR
SH006	Wildfowl Distribution Survey,	17/01/2022	13:13	Sparrowhawk	1	lakes and ponds, scrub and reed and large sedge swamps; flying low and acrobatically across wetland - may have caused wn and t to be flushed	NM

Table 1-62 Vantage Point Non-target Species Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	21/05/2021	10:04	Black-headed Gull	1	50	0	50	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP5	08/10/2021	10:15	Black-headed Gull	6	125	15	80	30	0	improved agricultural grassland and hedgerows; flying and swirling across farmland - heading w	NM
	VP5	08/10/2021	08:47	Black-headed Gull	2	60	0	0	55	5	improved agricultural grassland and mixed conifer woodland; flying n and e across famrland	NM
	VP3	23/10/2021	08:15	Cormorant	2	55	15	40	0	0	mixed conifer woodland, depositing/lowland rivers and scrub; flying along sw boundary	NM
	VP4	16/11/2021	13:44	Cormorant	1	43	0	0	43	0	highly modified/non-native woodland and cutover bog; flying, heading north west	CR
	VP6	22/11/2021	15:34	Cormorant	1	291	0	0	214	77	improved grassland, depositing/lowland rivers and highly modified/non-native woodland; flying, last seen heading north at high altitude.	CR
	VP4	09/12/2021	11:38	Cormorant	1	12	0	12	0	0	cutover bog; travelling	KB
	VP6	15/12/2021	11:39	Cormorant	1	30	0	0	30	0	cutover bog and semi-natural grassland; travelling	KB
	VP6	15/12/2021	12:11	Cormorant	1	35	0	0	35	0	semi-natural grassland; travelling	KB

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	15/12/2021	12:31	Cormorant	1	25	10	15	0	0	semi-natural grassland; travelling - descended	KB
	VP6	15/12/2021	13:52	Cormorant	1	20	0	20	0	0	semi-natural grassland; travelling	KB
	VP1	15/03/2022	15:57	Cormorant	1	50	0	50	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:00	Cormorant	1	29	0	29	0	0	cutover bog; flying	NS
GE001	VP6	22/11/2021	15:04	Green Sandpiper	1	18	2	4	12	0	improved grassland and depositing/lowland rivers; flying/calling, observed descending into river.	CR
	VP6	22/10/2021	11:18	Grey Heron	1	80	0	80	0	0	improved agricultural grassland and cutover bog; flying across bog	NM
	VP6	22/10/2021	11:55	Grey Heron	1	25	25	0	0	0	depositing/lowland rivers and semi-natural grassland; flying low along river	NM
	VP4	16/11/2021	12:27	Grey Heron	1	60	60	0	0	0	cutover bog and highly modified/non-native woodland; flying, heading east	CR
	VP4	16/11/2021	14:51	Grey Heron	1	48	48	0	0	0	highly modified/non-native woodland; flying	CR
	VP4	16/11/2021	15:48	Grey Heron	1	27	27	0	0	0	highly modified/non-native woodland; flying	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/11/2021	16:33	Grey Heron	1	40	40	0	0	0	cutover bog and highly modified/non-native woodland; flying	CR
	VP1	15/03/2022	16:42	Grey Heron	1	46	9	37	0	0	cutover bog; flying	NS
	VP6	06/04/2021	16:47	Grey Heron	1	17	0	17	0	0	conifer plantation; travelling along river	PM
	VP6	06/04/2021	16:52	Grey Heron	1	57	0	57	0	0	cutover bog and conifer plantation; travelling; dropped into drain	PM
	VP4	28/04/2021	17:31	Grey Heron	1	25	25	0	0	0	cutover bog; travelling along large drain	PM
	VP4	17/06/2021	13:19	Grey Heron	1	30	30	0	0	0	depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP4	17/06/2021	13:24	Grey Heron	1	14	14	0	0	0	cutover bog; travelling; landed in drain	PM
	VP4	17/06/2021	13:26	Grey Heron	64	0	64	0	0	0	cutover bog; travelling; landed in drain	PM
	VP6	30/07/2021	09:24	Grey Heron	1	52	52	0	0	0	cutover bog; travelling	PM
	VP6	07/09/2021	15:14	Grey Heron	1	14	14	0	0	0	cutover bog and treelines; travelling, roosting	TRea
	VP6	31/01/2022	16:01	Grey Heron	1	61	20	41	0	0	improved agricultural grassland and bogs; flying, ze	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	31/01/2022	17:09	Grey Heron	1	34	34	0	0	0	improved agricultural grassland; flying	ZE
	VP4	21/05/2021	06:58	Lesser Black-backed Gull	1	32	0	32	0	0	cutover bog; travelling	PM
	VP6	26/05/2021	05:43	Lesser Black-backed Gull	1	100	0	100	0	0	cutover bog and wet grassland; travelling	PM
	VP6	26/05/2021	05:44	Lesser Black-backed Gull	1	577	0	577	0	0	cutover bog and wet grassland; travelling/circling bog	PM
	VP6	26/05/2021	08:05	Lesser Black-backed Gull	3	20	0	20	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP4	17/06/2021	17:00	Lesser Black-backed Gull	2	173	0	0	173	0	improved agricultural grassland; travelling/soaring	PM
	VP6	30/06/2021	15:26	Lesser Black-backed Gull	1	120	0	120	0	0	improved agricultural grassland; circling field where grass was being mown	PM
	VP4	27/07/2021	09:33	Lesser Black-backed Gull	1	51	0	0	61	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP6	06/04/2021	18:58	Mallard	3	20	5	15	0	0	conifer plantation; travelling; dropped behind trees toward river	PM
	VP4	28/04/2021	16:55	Mallard	1	47	27	20	0	0	cutover bog; travelling; landed in drain, male	PM
	VP4	28/04/2021	20:12	Mallard	1	25	0	5	20	0	cutover bog; travelling; landed in drain	PM
	VP4	28/04/2021	20:12	Mallard	2	36	0	0	36	0	cutover bog; travelling	PM
	VP4	28/04/2021	21:11	Mallard	2	30	30	0	0	0	cutover bog; travelling; landed in drain	PM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	26/05/2021	06:14	Mallard	2	27	27	0	0	0	cutover bog and depositing/lowland rivers; travelling; landed in river, 2 males	PM
	VP6	26/05/2021	06:41	Mallard	3	126	0	26	100	0	depositing/lowland rivers and cutover bog; travelling, 3 males	PM
	VP6	30/07/2021	09:50	Mallard	1	75	0	0	75	0	cutover bog and conifer plantation; travelling	PM
	VP6	30/07/2021	11:36	Mallard	2	80	0	80	0	0	cutover bog; travelling	PM
	VP5	08/10/2021	08:12	Mallard	3	85	0	25	60	0	cutover bog and mixed conifer woodland; flying in wide circle over cutover bog and adjacent area	NM
	VP5	08/10/2021	12:43	Mallard	2	45	0	45	0	0	improved agricultural grassland; flying s across farmalnd	NM
	VP4	09/12/2021	07:51	Mallard	2	10	10	0	0	0	cutover bog and immature woodland; travelling	KB
	VP4	09/12/2021	08:05	Mallard	10	14	14	0	0	0	cutover bog and immature woodland; travelling	KB
	VP1	08/03/2022	14:16	Mallard	2	120	0	120	0	0	cutover bog; flying	NS
	VP1	15/03/2022	18:49	Mallard	2	24	24	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	19:02	Mallard	2	15	15	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:07	Mallard	2	25	0	25	0	0	cutover bog; flying	NS
	VP4	27/01/2022	11:54	Meadow Pipit	1	41	41	0	0	0	cutover bog; flying, perching on top of a floodlight	ZE
	VP4	27/01/2022	13:50	Meadow Pipit	1	21	21	0	0	0	cutover bog; flying	ZE
	VP6	31/01/2022	12:15	Meadow Pipit	1	4	4	0	0	0	lowland blanket bog; flying	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/02/2022	11:17	Meadow Pipit	3	15	15	0	0	0	lowland blanket bog; flying	NS
	VP6	18/02/2022	12:25	Meadow Pipit	4	10	10	0	0	0	lowland blanket bog; flying, 6 flying around throughout the day	NS
	VP3	23/03/2022	15:10	Meadow Pipit	2	15	5	10	0	0	cutover bog; flying	ZOC
	VP3	23/03/2022	17:19	Meadow Pipit	3	20	20	0	0	0	cutover bog; flying	ZOC
	VP6	26/05/2021	06:37	Mute Swan	1	15	15	0	0	0	depositing/lowland rivers; flew along river before landing again	PM
	VP4	17/06/2021	16:16	Mute Swan	1	67	67	0	0	0	cutover bog, depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP5	08/10/2021	07:43	Mute Swan	16	65	0	65	0	0	improved agricultural grassland and hedgerows; flying e - low across farmalnd and hedgerows	NM
	VP4	27/01/2022	17:55	Mute Swan	5	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
	VP1	15/03/2022	18:57	Mute Swan	2	40	0	0	40	0	cutover bog; flying, not seen only heard	NS
	VP5	25/01/2022	13:58	Redwing	25	35	0	35	0	0	improved agricultural grassland; flying	ZE
	VP6	31/01/2022	12:32	Redwing	13	15	15	0	0	0	lowland blanket bog; flying	ZE
	VP6	31/01/2022	13:55	Redwing	12	20	0	20	0	0	lowland blanket bog; flying	ZE
	VP5	08/02/2022	10:18	Redwing	25	25	25	0	0	0	improved agricultural grassland; flying	NS
	VP4	16/02/2022	07:44	Redwing	30	20	0	20	0	0	lowland blanket bog; flying	NS
	VP5	22/03/2022	16:10	Redwing	2	10	10	0	0	0	hedgerows; flying	ZOC

Table 1-63 Vantage Point Survey Non-target Species Non-flight Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	22/11/2021	17:03	Grey Heron	1	depositing/lowland rivers, improved grassland and cutover bog; calling	CR
	VP6	06/04/2021	20:43	Grey Heron	1	depositing/lowland rivers; calling from river	PM
	VP6	26/05/2021	05:34	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	06:21	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	09:30	Grey Heron	1	depositing/lowland rivers; calling, not seen	PM
	VP3	15/11/2021	16:42	Mistle Thrush	4	cutover bog; flying	CR
	VP6	22/11/2021	12:18	Mistle Thrush	10	improved grassland, cutover bog and highly modified/non-native woodland; flying/calling, observed throughout survey	CR
	VP4	28/04/2021	21:39	Mallard	1	cutover bog; calling, not seen	PM
	VP6	22/10/2021	12:07	Mallard	4	depositing/lowland rivers; swimming on river	NM
	VP4	16/11/2021	17:09	Mallard	1	lakes and ponds and cutover bog; calling, no visual	CR
	VP4	16/11/2021	17:14	Mallard	1	lakes and ponds and cutover bog; calling	CR
	VP4	28/04/2021	20:57	Moorhen	1	lakes and ponds; calling	PM
	VP6	15/12/2021	12:05	Moorhen	1	watercourses; calling heard	KB
	VP6	06/04/2021		Meadow Pipit			PM
	VP6	26/05/2021	05:45	Meadow Pipit	1	cutover bog; displaying	PM
	VP4	17/06/2021	17:12	Meadow Pipit	1	cutover bog; singing intermittently throughout the survey	PM
	VP6	30/06/2021	15:27	Meadow Pipit	2	cutover bog; displaying periodically throughout survey	PM
	VP6	30/07/2021	15:16	Meadow Pipit	4	cutover bog; present throughout survey	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	06/09/2021		Meadow Pipit			TRea
	VP4	07/09/2021		Meadow Pipit			TRea
	VP6	22/10/2021		Meadow Pipit			NM
	VP3	23/10/2021		Meadow Pipit			NM
	VP3	15/11/2021	11:29	Meadow Pipit	11	cutover bog; flying/calling, observed throughout survey	CR
	VP4	16/11/2021	12:00	Meadow Pipit	9	cutover bog; flying/calling	CR
	VP5	19/11/2021	13:30	Meadow Pipit	5	improved grassland; flying/calling	CR
	VP6	22/11/2021	11:05	Meadow Pipit	21	cutover bog and improved grassland; flying/calling, observed throughout the survey.	CR
	VP6	15/12/2021	09:50	Meadow Pipit	2	cutover bog and scrub; foraging	KB
	VP4	16/02/2022	10:13	Meadow Pipit	2	cutover bog; calling	NS
	VP1	08/03/2022	14:28	Meadow Pipit	8	cutover bog; calling, some displaying activity	NS
	VP4	10/03/2022	14:18	Meadow Pipit	20	cutover bog; flying and calling, up to 20 seen flying and calling in the area	NS
	VP6	30/07/2021	10:49	Mute Swan	1	depositing/lowland rivers; call	PM
	VP3	23/10/2021	11:41	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	VP6	17/02/2022	11:08	Mute Swan	1	depositing/lowland rivers; feeding	NS
	VP6	22/10/2021		Redwing			NM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP3	15/11/2021		Redwing			CR
	VP4	16/11/2021		Redwing			CR
	VP5	19/11/2021		Redwing			CR
	VP6	22/11/2021		Redwing			CR
	VP3	23/12/2021	11:21	Redwing	22	hedgerows; foraging	KB
	VP5	03/01/2022	08:08	Redwing	270	hedgerows; foraging	KB
	VP6	22/11/2021	15:59	Water Rail	2	depositing/lowland rivers; calling, at least two water rails heard calling continuously until 16:30.	CR
	VP4	19/10/2021	10:06	Yellowhammer	1	scrub, highly modified/non-native woodland and cutover bog; calling within willow scrub on fringes of bog	NM

Table 1-64 Non-target species data (Vantage Point and Walkover survey Records)

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
06/04/2021	Vantage Point Survey, VP6	Skylark		PM
06/04/2021	Vantage Point Survey, VP6	Blackbird		PM
06/04/2021	Vantage Point Survey, VP6	Barn Swallow		PM
06/04/2021	Vantage Point Survey, VP6	Sand Martin		PM
06/04/2021	Vantage Point Survey, VP6	Hooded Crow		PM
06/04/2021	Vantage Point Survey, VP6	Magpie		PM
06/04/2021	Vantage Point Survey, VP6	Pheasant		PM
06/04/2021	Vantage Point Survey, VP6	Woodpigeon		PM
06/04/2021	Vantage Point Survey, VP6	Pied Wagtail		PM
06/04/2021	Vantage Point Survey, VP6	Raven		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Hooded Crow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jackdaw		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Wren		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Robin		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chaffinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Blackbird		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chiffchaff		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Raven		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Woodpigeon		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Song Thrush		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Linnet		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Skylark		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Starling		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Willow Warbler		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Bullfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jay		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Lesser Redpoll		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Barn Swallow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldcrest		PM
28/04/2021	Vantage Point Survey, VP4	Raven		PM
28/04/2021	Vantage Point Survey, VP4	Hooded Crow		PM
28/04/2021	Vantage Point Survey, VP4	Woodpigeon		PM
28/04/2021	Vantage Point Survey, VP4	Barn Swallow		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
28/04/2021	Vantage Point Survey, VP4	Sand Martin		PM
28/04/2021	Vantage Point Survey, VP4	Chaffinch		PM
28/04/2021	Vantage Point Survey, VP4	Robin		PM
28/04/2021	Vantage Point Survey, VP4	Blackbird		PM
28/04/2021	Vantage Point Survey, VP4	Cuckoo		PM
28/04/2021	Vantage Point Survey, VP4	Song Thrush		PM
28/04/2021	Vantage Point Survey, VP4	Great Tit		PM
28/04/2021	Vantage Point Survey, VP4	Chiffchaff		PM
28/04/2021	Vantage Point Survey, VP4	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Dunnock		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Pheasant		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Starling		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/05/2021	Vantage Point Survey, VP4	Woodpigeon		PM
21/05/2021	Vantage Point Survey, VP4	Raven		PM
21/05/2021	Vantage Point Survey, VP4	Hooded Crow		PM
21/05/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Song Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Blackbird		PM
21/05/2021	Vantage Point Survey, VP4	Willow Warbler		PM
21/05/2021	Vantage Point Survey, VP4	Robin		PM
21/05/2021	Vantage Point Survey, VP4	Wren		PM
21/05/2021	Vantage Point Survey, VP4	Chaffinch		PM
21/05/2021	Vantage Point Survey, VP4	Barn Swallow		PM
21/05/2021	Vantage Point Survey, VP4	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Blackbird		PM
26/05/2021	Vantage Point Survey, VP6	Robin		PM
26/05/2021	Vantage Point Survey, VP6	Barn Swallow		PM
26/05/2021	Vantage Point Survey, VP6	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Song Thrush		PM
26/05/2021	Vantage Point Survey, VP6	Skylark		PM
26/05/2021	Vantage Point Survey, VP6	Chaffinch		PM
26/05/2021	Vantage Point Survey, VP6	Chiffchaff		PM
26/05/2021	Vantage Point Survey, VP6	Goldfinch		PM
26/05/2021	Vantage Point Survey, VP6	Hooded Crow		PM
26/05/2021	Vantage Point Survey, VP6	Raven		PM
26/05/2021	Vantage Point Survey, VP6	Woodpigeon		PM
26/05/2021	Vantage Point Survey, VP6	Cuckoo		PM
17/06/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Song Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Robin		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
17/06/2021	Vantage Point Survey, VP4	Great Tit		PM
17/06/2021	Vantage Point Survey, VP4	Blue Tit		PM
17/06/2021	Vantage Point Survey, VP4	Sand Martin		PM
17/06/2021	Vantage Point Survey, VP4	Barn Swallow		PM
17/06/2021	Vantage Point Survey, VP4	House Martin		PM
17/06/2021	Vantage Point Survey, VP4	Hooded Crow		PM
17/06/2021	Vantage Point Survey, VP4	Raven		PM
17/06/2021	Vantage Point Survey, VP4	Woodpigeon		PM
17/06/2021	Vantage Point Survey, VP4	Starling		PM
17/06/2021	Vantage Point Survey, VP4	Chaffinch		PM
17/06/2021	Vantage Point Survey, VP4	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Whitethroat		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Mistle Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
30/06/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/06/2021	Vantage Point Survey, VP6	Barn Swallow		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
30/06/2021	Vantage Point Survey, VP6	House Martin		PM
30/06/2021	Vantage Point Survey, VP6	Skylark		PM
30/06/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/06/2021	Vantage Point Survey, VP6	Raven		PM
30/06/2021	Vantage Point Survey, VP6	Robin		PM
30/06/2021	Vantage Point Survey, VP6	Wren		PM
30/06/2021	Vantage Point Survey, VP6	Blackbird		PM
30/06/2021	Vantage Point Survey, VP6	Whitethroat		PM
30/06/2021	Vantage Point Survey, VP6	Dunnock		PM
30/06/2021	Vantage Point Survey, VP6	Starling		PM
30/06/2021	Vantage Point Survey, VP6	Willow Warbler		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jackdaw		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Linnet		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Raven		PM
27/07/2021	Vantage Point Survey, VP4	Woodpigeon		PM
27/07/2021	Vantage Point Survey, VP4	Jay		PM
27/07/2021	Vantage Point Survey, VP4	Sand Martin		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
27/07/2021	Vantage Point Survey, VP4	Barn Swallow		PM
27/07/2021	Vantage Point Survey, VP4	Song Thrush		PM
27/07/2021	Vantage Point Survey, VP4	Chaffinch		PM
27/07/2021	Vantage Point Survey, VP4	Wren		PM
27/07/2021	Vantage Point Survey, VP4	Pied Wagtail		PM
27/07/2021	Vantage Point Survey, VP4	Blackbird		PM
27/07/2021	Vantage Point Survey, VP4	Great Tit		PM
30/07/2021	Vantage Point Survey, VP6	Raven		PM
30/07/2021	Vantage Point Survey, VP6	Hooded Crow		PM
30/07/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/07/2021	Vantage Point Survey, VP6	Song Thrush		PM
30/07/2021	Vantage Point Survey, VP6	Barn Swallow		PM
30/07/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/07/2021	Vantage Point Survey, VP6	Goldfinch		PM
30/07/2021	Vantage Point Survey, VP6	Skylark		PM
19/08/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
19/08/2021	Vantage Point Survey, VP6	Raven		TRea
19/08/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
19/08/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
19/08/2021	Vantage Point Survey, VP6	Stonechat		TRea
19/08/2021	Vantage Point Survey, VP6	Whitethroat		TRea
19/08/2021	Vantage Point Survey, VP6	Sand Martin		TRea
19/08/2021	Vantage Point Survey, VP6	Willow Warbler		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
26/08/2021	Vantage Point Survey, VP4	Sand Martin		TRea
26/08/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
26/08/2021	Vantage Point Survey, VP4	Raven		TRea

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
26/08/2021	Vantage Point Survey, VP4	Dunnock		TRea
26/08/2021	Vantage Point Survey, VP4	Robin		TRea
26/08/2021	Vantage Point Survey, VP4	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
06/09/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
06/09/2021	Vantage Point Survey, VP6	Raven		TRea
06/09/2021	Vantage Point Survey, VP6	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Sand Martin		TRea
06/09/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
06/09/2021	Vantage Point Survey, VP6	Whitethroat		TRea
07/09/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
07/09/2021	Vantage Point Survey, VP4	Raven		TRea
07/09/2021	Vantage Point Survey, VP4	Robin		TRea
07/09/2021	Vantage Point Survey, VP4	Stonechat		TRea
07/09/2021	Vantage Point Survey, VP4	Wren		TRea
07/09/2021	Vantage Point Survey, VP4	Willow Warbler		TRea
07/09/2021	Vantage Point Survey, VP4	Goldfinch		TRea
07/09/2021	Vantage Point Survey, VP4	Sand Martin		TRea
07/09/2021	Vantage Point Survey, VP4	Goldcrest		TRea
07/09/2021	Vantage Point Survey, VP4	Great Tit		TRea
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jay		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Mistle Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Blue Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Long-tailed Tit		NM

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Wren		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Magpie		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Linnet		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Robin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Raven		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Woodpigeon		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pheasant		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldcrest		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Great Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Hooded Crow		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Stonechat		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pied Wagtail		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Reed Bunting		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Dunnock		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Song Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Starling		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Skylark		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Bullfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Siskin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jackdaw		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Rook		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Collared Dove		NM
22/10/2021	Vantage Point Survey, VP6	Blackbird		NM
22/10/2021	Vantage Point Survey, VP6	Raven		NM
22/10/2021	Vantage Point Survey, VP6	Wren		NM
22/10/2021	Vantage Point Survey, VP6	Stonechat		NM
22/10/2021	Vantage Point Survey, VP6	Linnet		NM
22/10/2021	Vantage Point Survey, VP6	Chaffinch		NM
22/10/2021	Vantage Point Survey, VP6	Pied Wagtail		NM
22/10/2021	Vantage Point Survey, VP6	Rook		NM
22/10/2021	Vantage Point Survey, VP6	Jackdaw		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
22/10/2021	Vantage Point Survey, VP6	Pheasant		NM
22/10/2021	Vantage Point Survey, VP6	Starling		NM
22/10/2021	Vantage Point Survey, VP6	Goldfinch		NM
22/10/2021	Vantage Point Survey, VP6	Reed Bunting		NM
22/10/2021	Vantage Point Survey, VP6	Woodpigeon		NM
22/10/2021	Vantage Point Survey, VP6	Jay		NM
22/10/2021	Vantage Point Survey, VP6	Mistle Thrush		NM
22/10/2021	Vantage Point Survey, VP6	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Chaffinch		NM
23/10/2021	Vantage Point Survey, VP3	Raven		NM
23/10/2021	Vantage Point Survey, VP3	Pied Wagtail		NM
23/10/2021	Vantage Point Survey, VP3	Robin		NM
23/10/2021	Vantage Point Survey, VP3	Blackbird		NM
23/10/2021	Vantage Point Survey, VP3	Wren		NM
23/10/2021	Vantage Point Survey, VP3	Linnet		NM
23/10/2021	Vantage Point Survey, VP3	Hooded Crow		NM
23/10/2021	Vantage Point Survey, VP3	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Woodpigeon		NM
23/10/2021	Vantage Point Survey, VP3	Collared Dove		NM
23/10/2021	Vantage Point Survey, VP3	Rook		NM
15/11/2021	Vantage Point Survey, VP3	Magpie		CR
15/11/2021	Vantage Point Survey, VP3	Linnet		CR
15/11/2021	Vantage Point Survey, VP3	Jay		CR
15/11/2021	Vantage Point Survey, VP3	Great Tit		CR
15/11/2021	Vantage Point Survey, VP3	Blue Tit		CR
15/11/2021	Vantage Point Survey, VP3	Bullfinch		CR
15/11/2021	Vantage Point Survey, VP3	Dunnock		CR
15/11/2021	Vantage Point Survey, VP3	Woodpigeon		CR

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
15/11/2021	Vantage Point Survey, VP3	Jackdaw		CR
15/11/2021	Vantage Point Survey, VP3	Rook		CR
15/11/2021	Vantage Point Survey, VP3	Robin		CR
15/11/2021	Vantage Point Survey, VP3	Pied Wagtail		CR
15/11/2021	Vantage Point Survey, VP3	Wren		CR
15/11/2021	Vantage Point Survey, VP3	Blackbird		CR
15/11/2021	Vantage Point Survey, VP3	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Jackdaw		CR
16/11/2021	Vantage Point Survey, VP4	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Linnet		CR
16/11/2021	Vantage Point Survey, VP4	Raven		CR
16/11/2021	Vantage Point Survey, VP4	Wren		CR
16/11/2021	Vantage Point Survey, VP4	Magpie		CR
16/11/2021	Vantage Point Survey, VP4	Woodpigeon		CR
16/11/2021	Vantage Point Survey, VP4	Stonechat		CR
16/11/2021	Vantage Point Survey, VP4	Starling		CR
16/11/2021	Vantage Point Survey, VP4	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Chaffinch		CR
19/11/2021	Vantage Point Survey, VP5	Hooded Crow		CR
19/11/2021	Vantage Point Survey, VP5	Magpie		CR
19/11/2021	Vantage Point Survey, VP5	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Robin		CR
19/11/2021	Vantage Point Survey, VP5	Jackdaw		CR
19/11/2021	Vantage Point Survey, VP5	Woodpigeon		CR
19/11/2021	Vantage Point Survey, VP5	Dunnock		CR
19/11/2021	Vantage Point Survey, VP5	Wren		CR
19/11/2021	Vantage Point Survey, VP5	Blue Tit		CR
19/11/2021	Vantage Point Survey, VP5	Starling		CR

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
19/11/2021	Vantage Point Survey, VP5	Bullfinch		CR
19/11/2021	Vantage Point Survey, VP5	Rook		CR
19/11/2021	Vantage Point Survey, VP5	Jay		CR
19/11/2021	Vantage Point Survey, VP5	Raven		CR
19/11/2021	Vantage Point Survey, VP5	Great Tit		CR
19/11/2021	Vantage Point Survey, VP5	Pied Wagtail		CR
19/11/2021	Vantage Point Survey, VP5	Coal Tit		CR
22/11/2021	Vantage Point Survey, VP6	Starling		CR
22/11/2021	Vantage Point Survey, VP6	Song Thrush		CR
22/11/2021	Vantage Point Survey, VP6	Blackbird		CR
22/11/2021	Vantage Point Survey, VP6	Stonechat		CR
22/11/2021	Vantage Point Survey, VP6	Chaffinch		CR
22/11/2021	Vantage Point Survey, VP6	Raven		CR
22/11/2021	Vantage Point Survey, VP6	Woodpigeon		CR
22/11/2021	Vantage Point Survey, VP6	Dunnock		CR
22/11/2021	Vantage Point Survey, VP6	Wren		CR
22/11/2021	Vantage Point Survey, VP6	Long-tailed Tit		CR
22/11/2021	Vantage Point Survey, VP6	Hooded Crow		CR
22/11/2021	Vantage Point Survey, VP6	Blue Tit		CR
22/11/2021	Vantage Point Survey, VP6	Reed Bunting		CR
22/11/2021	Vantage Point Survey, VP6	Pheasant		CR
09/12/2021	Vantage Point Survey, VP4	Blue Tit		KB
09/12/2021	Vantage Point Survey, VP4	Robin		KB
09/12/2021	Vantage Point Survey, VP4	Blackbird		KB
09/12/2021	Vantage Point Survey, VP4	Woodpigeon		KB
09/12/2021	Vantage Point Survey, VP4	Starling		KB
09/12/2021	Vantage Point Survey, VP4	Wren		KB
09/12/2021	Vantage Point Survey, VP4	Long-tailed Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
09/12/2021	Vantage Point Survey, VP4	Hooded Crow		KB
09/12/2021	Vantage Point Survey, VP4	Raven		KB
09/12/2021	Vantage Point Survey, VP4	Great Tit		KB
09/12/2021	Vantage Point Survey, VP4	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Wren		KB
15/12/2021	Vantage Point Survey, VP6	Blackbird		KB
15/12/2021	Vantage Point Survey, VP6	Starling		KB
15/12/2021	Vantage Point Survey, VP6	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Hooded Crow		KB
15/12/2021	Vantage Point Survey, VP6	Raven		KB
15/12/2021	Vantage Point Survey, VP6	Reed Bunting		KB
15/12/2021	Vantage Point Survey, VP6	Lesser Redpoll		KB
15/12/2021	Vantage Point Survey, VP6	Fieldfare		KB
15/12/2021	Vantage Point Survey, VP6	Pheasant		KB
15/12/2021	Vantage Point Survey, VP6	Stonechat		KB
15/12/2021	Vantage Point Survey, VP6	Blue Tit		KB
15/12/2021	Vantage Point Survey, VP6	Song Thrush		KB
15/12/2021	Vantage Point Survey, VP6	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Robin		KB
23/12/2021	Vantage Point Survey, VP3	Wren		KB
23/12/2021	Vantage Point Survey, VP3	Starling		KB
23/12/2021	Vantage Point Survey, VP3	Pied Wagtail		KB
23/12/2021	Vantage Point Survey, VP3	Reed Bunting		KB
23/12/2021	Vantage Point Survey, VP3	Mistle Thrush		KB
23/12/2021	Vantage Point Survey, VP3	Blackbird		KB
23/12/2021	Vantage Point Survey, VP3	Lesser Redpoll		KB
23/12/2021	Vantage Point Survey, VP3	Raven		KB
23/12/2021	Vantage Point Survey, VP3	Blue Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
23/12/2021	Vantage Point Survey, VP3	Coal Tit		KB
23/12/2021	Vantage Point Survey, VP3	Bullfinch		KB
23/12/2021	Vantage Point Survey, VP3	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Blackbird		KB
03/01/2022	Vantage Point Survey, VP5	Robin		KB
03/01/2022	Vantage Point Survey, VP5	Wren		KB
03/01/2022	Vantage Point Survey, VP5	Magpie		KB
03/01/2022	Vantage Point Survey, VP5	Rook		KB
03/01/2022	Vantage Point Survey, VP5	Coal Tit		KB
03/01/2022	Vantage Point Survey, VP5	Long-tailed Tit		KB
03/01/2022	Vantage Point Survey, VP5	Starling		KB
03/01/2022	Vantage Point Survey, VP5	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Jackdaw		KB
03/01/2022	Vantage Point Survey, VP5	Raven		KB
03/01/2022	Vantage Point Survey, VP5	Hooded Crow		KB
03/01/2022	Vantage Point Survey, VP5	Fieldfare		KB
03/01/2022	Vantage Point Survey, VP5	Song Thrush		KB
03/01/2022	Vantage Point Survey, VP5	Chaffinch		KB
03/01/2022	Vantage Point Survey, VP5	Blue Tit		KB
03/01/2022	Vantage Point Survey, VP5	Great Tit		KB
03/01/2022	Vantage Point Survey, VP5	Dunnock		KB
25/01/2022	Vantage Point Survey, VP5	Raven		ZE
25/01/2022	Vantage Point Survey, VP5	Wren		ZE
25/01/2022	Vantage Point Survey, VP5	Robin		ZE
25/01/2022	Vantage Point Survey, VP5	Blackbird		ZE
25/01/2022	Vantage Point Survey, VP5	Rook		ZE
25/01/2022	Vantage Point Survey, VP5	House Sparrow		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
25/01/2022	Vantage Point Survey, VP5	Starling	large flocks over the fields	ZE
25/01/2022	Vantage Point Survey, VP5	Song Thrush		ZE
25/01/2022	Vantage Point Survey, VP5	Great Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Magpie		ZE
25/01/2022	Vantage Point Survey, VP5	Jackdaw		ZE
25/01/2022	Vantage Point Survey, VP5	Woodpigeon		ZE
25/01/2022	Vantage Point Survey, VP5	Hooded Crow		ZE
25/01/2022	Vantage Point Survey, VP5	Goldcrest		ZE
25/01/2022	Vantage Point Survey, VP5	Blue Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Dunnock		ZE
25/01/2022	Vantage Point Survey, VP5	Chiffchaff		ZE
25/01/2022	Vantage Point Survey, VP5	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Rook		ZE
26/01/2022	Vantage Point Survey, VP3	Raven		ZE
26/01/2022	Vantage Point Survey, VP3	Magpie		ZE
26/01/2022	Vantage Point Survey, VP3	Hooded Crow		ZE
26/01/2022	Vantage Point Survey, VP3	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Woodpigeon		ZE
26/01/2022	Vantage Point Survey, VP3	Starling	large flocks over the fields	ZE
27/01/2022	Vantage Point Survey, VP4	Raven		ZE
27/01/2022	Vantage Point Survey, VP4	Rook		ZE
27/01/2022	Vantage Point Survey, VP4	Woodpigeon		ZE
27/01/2022	Vantage Point Survey, VP4	Blackbird		ZE
27/01/2022	Vantage Point Survey, VP4	Wren		ZE
27/01/2022	Vantage Point Survey, VP4	Song Thrush		ZE
27/01/2022	Vantage Point Survey, VP4	Long-tailed Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Coal Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Magpie		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Dunnock		ZE
27/01/2022	Vantage Point Survey, VP4	Blue Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Hooded Crow		ZE
27/01/2022	Vantage Point Survey, VP4	Starling	large flocks flying north	ZE
27/01/2022	Vantage Point Survey, VP4	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Great Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Raven		ZE
31/01/2022	Vantage Point Survey, VP6	Rook		ZE
31/01/2022	Vantage Point Survey, VP6	Wren		ZE
31/01/2022	Vantage Point Survey, VP6	Fieldfare		ZE
31/01/2022	Vantage Point Survey, VP6	Woodpigeon		ZE
31/01/2022	Vantage Point Survey, VP6	Robin		ZE
31/01/2022	Vantage Point Survey, VP6	Magpie		ZE
31/01/2022	Vantage Point Survey, VP6	Starling		ZE
31/01/2022	Vantage Point Survey, VP6	Goldfinch		ZE
31/01/2022	Vantage Point Survey, VP6	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Blue Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Song Thrush		ZE
31/01/2022	Vantage Point Survey, VP6	Lesser Redpoll		ZE
08/02/2022	Vantage Point Survey, VP5	Blackbird	flying	NS
08/02/2022	Vantage Point Survey, VP5	Wren	calling	NS
08/02/2022	Vantage Point Survey, VP5	Raven	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Hooded Crow	flying	NS
08/02/2022	Vantage Point Survey, VP5	Magpie	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Bullfinch	perched in hedge	NS

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
08/02/2022	Vantage Point Survey, VP5	Blue Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Dunnock	calling, flying and in hedge	NS
08/02/2022	Vantage Point Survey, VP5	Great Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Pied Wagtail	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Jackdaw	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Mistle Thrush	flying	NS
08/02/2022	Vantage Point Survey, VP5	Robin	flying	NS
08/02/2022	Vantage Point Survey, VP5	Rook	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Starling	flying and in field	NS
15/02/2022	Vantage Point Survey, VP3	Robin	flying	NS
15/02/2022	Vantage Point Survey, VP3	Wren	calling and flying	NS
15/02/2022	Vantage Point Survey, VP3	Song Thrush	calling and perched in tree	NS
15/02/2022	Vantage Point Survey, VP3	Raven	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Hooded Crow	flying	NS
15/02/2022	Vantage Point Survey, VP3	Rook	flying	NS
15/02/2022	Vantage Point Survey, VP3	Woodpigeon	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Magpie	flying	NS
16/02/2022	Vantage Point Survey, VP4	Robin	flying	NS
16/02/2022	Vantage Point Survey, VP4	Hooded Crow	flying	NS
16/02/2022	Vantage Point Survey, VP4	Raven	flying and calling	NS
16/02/2022	Vantage Point Survey, VP4	Fieldfare	flying	NS
16/02/2022	Vantage Point Survey, VP4	Blackbird	flying	NS
16/02/2022	Vantage Point Survey, VP4	Siskin	flying, calling and perched in tree	NS
17/02/2022	Vantage Point Survey, VP6	Wren	calling	NS

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
17/02/2022	Vantage Point Survey, VP6	Raven	flying and calling	NS
17/02/2022	Vantage Point Survey, VP6	Rook	flying	NS
17/02/2022	Vantage Point Survey, VP6	Great Tit	flying	NS
17/02/2022	Vantage Point Survey, VP6	Reed Bunting	flying and perched on bush	NS
17/02/2022	Vantage Point Survey, VP6	Fieldfare	flying	NS
17/02/2022	Vantage Point Survey, VP6	Goldfinch	flying	NS
17/02/2022	Vantage Point Survey, VP6	Magpie	flying	NS
17/02/2022	Vantage Point Survey, VP6	Blackbird	flying	NS
17/02/2022	Vantage Point Survey, VP6	Woodpigeon	calling	NS
17/02/2022	Vantage Point Survey, VP6	Robin	flying	NS
17/02/2022	Vantage Point Survey, VP6	Starling	flying	NS
09/03/2022	Vantage Point Survey, VP6	Hooded Crow		NS
09/03/2022	Vantage Point Survey, VP6	Magpie		NS
09/03/2022	Vantage Point Survey, VP6	Woodpigeon		NS
09/03/2022	Vantage Point Survey, VP6	Blue Tit		NS
09/03/2022	Vantage Point Survey, VP6	Long-tailed Tit		NS
09/03/2022	Vantage Point Survey, VP6	Raven		NS
09/03/2022	Vantage Point Survey, VP6	Stonechat		NS
09/03/2022	Vantage Point Survey, VP6	Wren		NS
09/03/2022	Vantage Point Survey, VP6	Dunnock		NS
09/03/2022	Vantage Point Survey, VP6	Chaffinch		NS
09/03/2022	Vantage Point Survey, VP6	Robin		NS
10/03/2022	Vantage Point Survey, VP4	Rook		NS
10/03/2022	Vantage Point Survey, VP4	Lesser Redpoll		NS
10/03/2022	Vantage Point Survey, VP4	Siskin		NS
10/03/2022	Vantage Point Survey, VP4	Wren		NS
10/03/2022	Vantage Point Survey, VP4	Hooded Crow		NS

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
10/03/2022	Vantage Point Survey, VP4	Starling	large flock c1000	NS
10/03/2022	Vantage Point Survey, VP4	Song Thrush		NS
10/03/2022	Vantage Point Survey, VP4	Raven		NS
10/03/2022	Vantage Point Survey, VP4	Stonechat		NS
10/03/2022	Vantage Point Survey, VP4	Chaffinch		NS
22/03/2022	Vantage Point Survey, VP5	Raven		ZOC
22/03/2022	Vantage Point Survey, VP5	Robin		ZOC
22/03/2022	Vantage Point Survey, VP5	Hooded Crow		ZOC
22/03/2022	Vantage Point Survey, VP5	Dunnock		ZOC
22/03/2022	Vantage Point Survey, VP5	Great Tit		ZOC
22/03/2022	Vantage Point Survey, VP5	Rook		ZOC
22/03/2022	Vantage Point Survey, VP5	Woodpigeon		ZOC
22/03/2022	Vantage Point Survey, VP5	Wren		ZOC
22/03/2022	Vantage Point Survey, VP5	Starling		ZOC
22/03/2022	Vantage Point Survey, VP5	Magpie		ZOC
22/03/2022	Vantage Point Survey, VP5	Blackbird		ZOC
23/03/2022	Vantage Point Survey, VP3	Raven		ZOC
23/03/2022	Vantage Point Survey, VP3	Jay		ZOC
23/03/2022	Vantage Point Survey, VP3	Wren		ZOC
23/03/2022	Vantage Point Survey, VP3	Hooded Crow		ZOC
23/03/2022	Vantage Point Survey, VP3	Rook		ZOC

Table 1-65 Walkover Non-target Species Data

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	07/04/2021	07:11	Grey Heron	2	wet grassland; travelling (flyover; non-breeding)	PM
	07/04/2021	07:13	Mallard	1	wet grassland; circling/travelling (flyover; non-breeding)	PM
	07/04/2021	07:16	Mallard	2	wet grassland; circling (flyover; non-breeding)	PM
	07/04/2021	09:15	Mute Swan	1	lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Mute Swan	1	cutover bog and lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:32	Mallard	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:32	Grey Heron	1	cutover bog and immature woodland; travelling (flyover; non-breeding)	PM
	07/04/2021	09:36	Mute Swan	2	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:21	Moorhen	1	cutover bog and lakes and ponds; calling (suitable nesting habitat; possible breeder)	PM
	07/04/2021	10:33	Mute Swan	3	depositing/lowland rivers; feeding, one farmyard goose present also (summering; non-breeding)	PM
	07/04/2021	10:33	Mallard	2	cutover bog; flushed, 2 males (summering; non-breeding)	PM
	07/04/2021	10:33	Lesser Black-backed Gull	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	12:38	Mallard	1	cutover bog; flushed from reeds, female (suitable nesting habitat; possible breeder)	PM
	07/04/2021		Meadow Pipit			PM
	14/05/2021	07:41	Meadow Pipit	1	cutover bog; carrying food (adult carrying food/faecal sac; confirmed breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	14/05/2021	07:59	Grey Heron	1	recently-felled woodland; travelling (flyover; non-breeding)	PM
	14/05/2021	08:05	Black-headed Gull	2	cutover bog; being mobbed by l. (flyover; non-breeding)	PM
	14/05/2021	08:18	Meadow Pipit	1	raised bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	09:23	Mallard	1	depositing/lowland rivers; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mallard	2	cutover bog; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mute Swan	1	depositing/lowland rivers; preening on bank, 2cy; with a white farmyard goose (summering; non-breeding)	PM
	14/05/2021	09:28	Meadow Pipit	1	cutover bog; perched (suitable nesting habitat; possible breeder)	PM
	14/05/2021	10:05	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:13	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:22	Mallard	2	cutover bog; flushed from drain (summering; non-breeding)	PM
	18/06/2021	05:24	Meadow Pipit	1	wet grassland; singing (singing male; possible breeder)	PM
	18/06/2021	07:20	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	07:49	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	18/06/2021	07:49	Grey Heron	1	cutover bog; feeding (summering; non-breeding)	PM
	18/06/2021	07:49	Mallard	2	cutover bog; circling; calling, 2 males (summering; non-breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	18/06/2021	07:49	Black-headed Gull	1	cutover bog; calling (summering; non-breeding)	PM
	18/06/2021	09:09	Meadow Pipit	2	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	09:54	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	23/07/2021	08:01	Grey Heron	3	cutover bog; feeding (summering; non-breeding)	PM
	23/07/2021	08:01	Mallard	5	cutover bog; flew from flood (summering; non-breeding)	PM
	23/07/2021	08:01	Little Grebe	1	cutover bog; calling (suitable nesting habitat; possible breeder)	PM
	23/07/2021	08:01	Mallard	4	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:01	Grey Heron	1	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:27	Grey Heron	1	conifer plantation and cutover bog; travelling (flyover; non-breeding)	PM
	23/07/2021	09:10	Grey Heron	2	cutover bog and depositing/lowland rivers; travelling (flyover; non-breeding)	PM
	23/07/2021	09:14	Mute Swan	5	depositing/lowland rivers; feeding, 2ad & 3 juv (fledged young; confirmed breeding)	PM
	23/07/2021	09:41	Meadow Pipit	5	cutover bog; on bog, possibly a family flock (flyover; non-breeding)	PM
	20/10/2021	10:29	Grey Heron	1	scrub and cutover bog; flying across scrubby bog fringes and wetland (wintering)	NM
	21/10/2021	09:37	Mallard	5	lakes and ponds; swimming and calling on lake, fl (wintering)	NM
	21/10/2021	11:10	Mute Swan	1	depositing/lowland rivers; swimming on river (wintering)	NM
	21/10/2021		Meadow Pipit			NM
	27/01/2022	14:55	Redwing	8	conifer plantation; fly (wintering)	AOD
	27/01/2022	13:30	Meadow Pipit	6	cutover bog; fly (wintering)	AOD

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	27/01/2022	13:40	Grey Heron	1	depositing/lowland rivers; fly, flew from inny (wintering)	AOD
	27/01/2022	14:57	Mute Swan	2	depositing/lowland rivers; foraging, pair on inny (wintering)	AOD
	28/01/2022	13:12	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	28/01/2022	15:12	Little Grebe	5	lakes and ponds; flying (wintering)	AOD
	28/01/2022	15:12	Mute Swan	1	lakes and ponds; feeding (wintering)	AOD
	28/01/2022	16:56	Mute Swan	11	lakes and ponds; foraging (wintering)	AOD
	22/02/2022	16:11	Mute Swan	2	lakes and ponds; feeding (wintering)	AOD
	22/02/2022	17:11	Mute Swan	2	cutover bog; feeding (wintering)	AOD
	22/02/2022	14:13	Meadow Pipit	4	cutover bog and wet grassland; fly (wintering)	AOD
	22/02/2022	17:13	Meadow Pipit	3	cutover bog; fly (wintering)	AOD
	23/02/2022	14:22	Redwing	30	wet grassland; fly (wintering)	AOD
	23/02/2022	14:22	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	23/02/2022	17:09	Meadow Pipit	2	cutover bog; displaying, display (courtship and display; probable breeding)	AOD
	23/02/2022	17:28	Mute Swan	2	lakes and ponds; flying (wintering)	AOD
	23/02/2022	17:28	Little Grebe	2	lakes and ponds; flying (wintering)	AOD

Table 1-66 Wildfowl Distribution Non-target Species Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH001	L. Kinale	16/09/2021	10:49	Black-headed Gull	13	mesotrophic lakes; flying and swooping over lake	NM
CM002	L. Sheelin	16/09/2021	08:49	Common Gull	5	mesotrophic lakes; swirliong and circling over lake - often diving and landing briefly on lake surface	NM
CM004	L. Kinale	16/09/2021	10:57	Common Gull	2	mesotrophic lakes; flying over lake	NM
CM003	L. Sheelin	16/09/2021	10:05	Common Gull	3	mesotrophic lakes; flying and wheeling over lake	NM
CM001		16/09/2021	08:47	Common Gull	6	mesotrophic lakes; flying across lake - numerous flyovers near s3	NM
GA001	Derragh Lough	16/09/2021	12:15	Gadwall	24	mesotrophic lakes; swimming and dabbling along lake fringes, all along s shore	NM
GG007	L. Sheelin	16/09/2021	10:00	Great Crested Grebe	15	mesotrophic lakes; swimming on lake (with juveniles present)	NM
GG004	L. Sheelin	16/09/2021	08:50	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (including 2x juveniles)	NM
GG001		16/09/2021	16:26	Great Crested Grebe	5	mesotrophic lakes; swimming on lake	NM
GG002	L. Sheelin	16/09/2021	08:34	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG003	L. Sheelin	16/09/2021	08:37	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG005	L. Sheelin	16/09/2021	08:55	Great Crested Grebe	1	mesotrophic lakes; swimming on lake	NM
GG009	L. Kinale	16/09/2021	11:28	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with 1 juvenile present)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG006	S2	16/09/2021	09:16	Great Crested Grebe	8	mesotrophic lakes; swimming and diving on lake (+ 1 juvenile)	NM
GG008	L. Kinale	16/09/2021	10:52	Great Crested Grebe	13	mesotrophic lakes; swimming and diving on lake	NM
H001	L. Bracklagh	16/09/2021	10:40	Grey Heron	1	mesotrophic lakes; wading on edge of reedbed at lake fringe	NM
H002	BN2	16/09/2021	14:23	Grey Heron	1	cutover bog; perched within bog wetland	NM
H003	R. Inny	16/09/2021	15:25	Grey Heron	1	amenity grassland (improved) and depositing/lowland rivers; perched on grassy bank of river	NM
H004	Derragh Lough	16/09/2021	12:28	Grey Heron	1	mixed broadleaved woodland and mesotrophic lakes; flying s along w side of lake	NM
H005	L. Kinale	16/09/2021	11:12	Grey Heron	1	mesotrophic lakes; flying s across reedy lake fringes	NM
H006		16/09/2021	08:33	Grey Heron	2	mesotrophic lakes; flying n along lake shore	NM
H007	L. Sheelin	16/09/2021	08:47	Grey Heron	1	mesotrophic lakes; calling within reeds along lake shore	NM
LB001		16/09/2021	16:26	Lesser Black-backed Gull	1	mixed conifer woodland; flying w	NM
LB006	L. Kinale	16/09/2021	11:31	Lesser Black-backed Gull	2	mesotrophic lakes; flying sw across lake - swooping close to surface on occasion	NM
LB001		16/09/2021	09:39	Lesser Black-backed Gull	2	immature woodland and cutover bog; flying sw across bog and woodland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LB002		16/09/2021	09:27	Lesser Black-backed Gull	1	mixed conifer woodland, hedgerows and improved agricultural grassland; flying se	NM
LB005	L. Kinale	16/09/2021	10:08	Lesser Black-backed Gull	1	mesotrophic lakes and scrub; flying s along w lake shore	NM
LB003		16/09/2021	09:48	Lesser Black-backed Gull	5	raised bog and immature woodland; flying over land just to s of lake	NM
LB004	S1	16/09/2021	09:47	Lesser Black-backed Gull	2	mesotrophic lakes, immature woodland and mixed broadleaved woodland; flying e along lake shore	NM
LB002		16/09/2021	08:46	Lesser Black-backed Gull	3	mesotrophic lakes; flying across lake	NM
LG003		16/09/2021	13:24	Little Grebe	3	dystrophic lakes and cutover bog; swimming on diving on flooded bog - bog pool	NM
LG002		16/09/2021	16:30	Little Grebe	2	depositing/lowland rivers; swimming and diving on river	NM
LG008	L. Sheelin	16/09/2021	10:03	Little Grebe	9	mesotrophic lakes; swimming and diving on lake - close to reed bed border	NM
LG001	L. Bracklagh	16/09/2021	10:40	Little Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
LG004	Derragh Lough	16/09/2021	12:23	Little Grebe	11	mesotrophic lakes; calling within reedbeds	NM
LG006	S1	16/09/2021	10:07	Little Grebe	3	mesotrophic lakes; calling and swimming within edge reeds	NM
LG005	L. Sheelin	16/09/2021	09:17	Little Grebe	3	mesotrophic lakes; calling and diving within overhanging boughs of willow and ashe	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG007	L. Sheelin	16/09/2021	09:47	Little Grebe	4	mesotrophic lakes and reed and large sedge swamps; calling along lake shore	NM
MA001	L. Sheelin	16/09/2021	09:17	Mallard	7	mesotrophic lakes; swimming on lake and around weedy fringes	NM
MA002		16/09/2021	17:00	Mallard	12	mesotrophic lakes; swimming on lake	NM
MA003	L. Kinale	16/09/2021	11:32	Mallard	11	mesotrophic lakes; swimming and dabbling within reeds and floating vegetation	NM
MA004	BN2	16/09/2021	14:12	Mallard	6	cutover bog; roosting on bare peat within flooded bog area	NM
MA005	Derragh Lough	16/09/2021	12:15	Mallard	49	mesotrophic lakes; dabbling on lake, throughout lake	NM
MA006	L. Sheelin	16/09/2021	08:50	Mallard	4	mesotrophic lakes; calling and frequent noise from reedy fringes	NM
MH001	L. Bracklagh	16/09/2021	10:40	Moorhen	6	mesotrophic lakes; wading within reedbed at lake fringe, most likely a lot more individuals around reedbed perimeter of lake	NM
MH002	L. Sheelin	16/09/2021	08:37	Moorhen	7	reed and large sedge swamps and mesotrophic lakes; wading at reedy fringes of lake	NM
MH003	R. Inny - Carnagh Br.	16/09/2021	15:25	Moorhen	3	depositing/lowland rivers; swimming on weedy river	NM
MH004		16/09/2021	16:30	Moorhen	2	depositing/lowland rivers; swimming on river	NM
MH005		16/09/2021	16:27	Moorhen	18	mesotrophic lakes; swimming at reedbed fringe on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH006	BN2	16/09/2021	14:21	Moorhen	2	cutover bog; calling within reedy part of bog wetland	NM
MH007	L. Sheelin	16/09/2021	09:19	Moorhen	3	mesotrophic lakes; calling within reedy fringes of lake	NM
MH008	L. Sheelin	16/09/2021	10:12	Moorhen	5	mesotrophic lakes; calling within reeds and overhanging trees at edge of lake	NM
MH009	L. Sheelin	16/09/2021	08:30	Moorhen	3	mesotrophic lakes and reed and large sedge swamps; calling within reeds	NM
MH010	L. Sheelin	16/09/2021	09:57	Moorhen	13	mesotrophic lakes; calling from lakes edge + swimming amongst reed beds	NM
MH011	L. Sheelin	16/09/2021	09:50	Moorhen	3	mesotrophic lakes; calling from edge of lake	NM
MH012	Derragh Lough	16/09/2021	12:17	Moorhen	26	mesotrophic lakes; calling and wading within reedy lake fringes, throughout lake	NM
	R. Inny	16/09/2021	16:10	Mute Swan	3	depositing/lowland rivers; swimming on river - 2 adults + 1 juvenile	NM
	R. Inny	16/09/2021	15:53	Mute Swan	5	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	16/09/2021	09:58	Mute Swan	8	mesotrophic lakes; swimming on lake and around small islands	NM
	Derrach Lough	16/09/2021	12:14	Mute Swan	88	mesotrophic lakes; swimming on lake + social calls (+ with 4 juveniles), throughout lake	NM
	L. Bracklagh	16/09/2021	10:41	Mute Swan	9	mesotrophic lakes; swimming on lake, 5 adults + 4 juveniles	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		16/09/2021	16:27	Mute Swan	19	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:34	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:40	Mute Swan	37	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:51	Mute Swan	6	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:45	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:54	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:18	Mute Swan	29	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:27	Mute Swan	3	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	10:23	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	10	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	63	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:52	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:28	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:45	Mute Swan	2	mesotrophic lakes; noisily taking off from lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA001	BN2	16/09/2021	14:16	Water Rail	1	cutover bog; pig calls coming from far side of bog wetland	NM
WA002	L. Sheelin	16/09/2021	08:43	Water Rail	2	reed and large sedge swamps and mesotrophic lakes; pig calls coming from edge reeds	NM
BH012	L. D'varagh	17/09/2021	15:45	Black-headed Gull	12	mesotrophic lakes; swirling over n side of lake	NM
BH011	L. D'varagh	17/09/2021	15:54	Black-headed Gull	8	mesotrophic lakes; swirling over lake + diving to surface on occasion	NM
BH015	L. D'varagh	17/09/2021	15:58	Black-headed Gull	7	mesotrophic lakes; swirling over lake	NM
BH017	L. D'varagh	17/09/2021	13:04	Black-headed Gull	2	mesotrophic lakes; swirling over lake	NM
BH009	L. Iron	17/09/2021	18:34	Black-headed Gull	5	mesotrophic lakes; swirling and swooping over nw side of lake before flying away n	NM
BH007		17/09/2021	14:45	Black-headed Gull	49	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge - some individuals flying low and chasing each other near	NM
BH016		17/09/2021	16:00	Black-headed Gull	23	mesotrophic lakes; flying over lake, numerous flyovers throughout	NM
BH018	L. D'varagh	17/09/2021	13:50	Black-headed Gull	3	mesotrophic lakes; flying low over edge of lake - perching on pontoon and landing on water (+ calling)	NM
BH004	L. D'varagh	17/09/2021	13:00	Black-headed Gull	1	mesotrophic lakes; flying across lake	NM
BH010	L. D'varagh	17/09/2021	15:45	Black-headed Gull	17	mesotrophic lakes; flying across lake, numerous flyovers	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH013	L. D'varagh	17/09/2021	15:54	Black-headed Gull	25	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH014	L. D'varagh	17/09/2021	15:43	Black-headed Gull	9	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH003	L. D'varagh	17/09/2021	13:02	Black-headed Gull	5	mesotrophic lakes; circling over narrow end of lake	NM
BH006		17/09/2021	14:54	Black-headed Gull	6	mesotrophic lakes, reed and large sedge swamps and scrub; circling over lake and adjacent land	NM
BH005	L. D'varagh	17/09/2021	13:11	Black-headed Gull	3	mesotrophic lakes; circling over lake	NM
BH002	L. D'varagh	17/09/2021	13:35	Black-headed Gull	2	mesotrophic lakes; circling low over small floating jetty - landing briefly on water and on jetty	NM
BH008	L. D'varagh	17/09/2021	14:32	Black-headed Gull	4	mesotrophic lakes; circling and diving over lake	NM
CA001	L. D'varagh	17/09/2021	13:21	Cormorant	1	mesotrophic lakes; swimming and diving on lake	NM
CA002	L. D'varagh	17/09/2021	15:53	Cormorant	1	mesotrophic lakes; flying e across lake	NM
CA003	L. D'varagh	17/09/2021	13:19	Cormorant	1	mesotrophic lakes; flying along lake	NM
CM005		17/09/2021	13:58	Common Gull	2	improved agricultural grassland and treelines; flying nw along far side of lake	NM
GA002	L. Iron	17/09/2021	19:00	Gadwall	24	mesotrophic lakes; swimming and foraging on lake	NM
GG018	L. D'varagh	17/09/2021	15:41	Great Crested Grebe	23	mesotrophic lakes; swimming on lake (+ with present juveniles)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG023	L. D'varagh	17/09/2021	13:16	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (+ constant calling by juvenile)	NM
GG017	L. D'varagh	17/09/2021	14:40	Great Crested Grebe	16	mesotrophic lakes; swimming on lake - n section of lake	NM
GG011	L. D'varagh	17/09/2021	12:58	Great Crested Grebe	2	mesotrophic lakes; swimming on lake	NM
GG012	L. D'varagh	17/09/2021	13:03	Great Crested Grebe	9	mesotrophic lakes; swimming on lake	NM
GG015	L. D'varagh	17/09/2021	13:09	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG016	L. D'varagh	17/09/2021	13:22	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG019	L. D'varagh	17/09/2021	16:10	Great Crested Grebe	14	mesotrophic lakes; swimming on lake	NM
GG020	L. D'varagh	17/09/2021	16:14	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG022	L. D'varagh	17/09/2021	13:10	Great Crested Grebe	4	mesotrophic lakes; swimming on lake	NM
GG024	L. D'varagh	17/09/2021	13:56	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG025	L. Iron	17/09/2021	19:17	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG010	L. D'varagh	17/09/2021	12:55	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with young calling)	NM
GG021	L. D'varagh	17/09/2021	13:07	Great Crested Grebe	3	mesotrophic lakes; swimming (resting) on lake	NM
GG013	L. D'varagh	17/09/2021	13:21	Great Crested Grebe	2	mesotrophic lakes; resting on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG014	L. D'varagh	17/09/2021	13:35	Great Crested Grebe	4	mesotrophic lakes; adults and young on lake - constant chirping from juveniles	NM
H008	L. D'varagh	17/09/2021	12:56	Grey Heron	1	mesotrophic lakes; perched on floating jetty	NM
H009	L. D'varagh	17/09/2021	14:59	Grey Heron	1	mesotrophic lakes and reed and large sedge swamps; calling from edge of lake	NM
LB008		17/09/2021	14:45	Lesser Black-backed Gull	23	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge	NM
LB009		17/09/2021	18:47	Lesser Black-backed Gull	2	improved agricultural grassland and hedgerows; flying nw over farmland	NM
LB007		17/09/2021	14:35	Lesser Black-backed Gull	1	mesotrophic lakes; flying ne across w edge of lake	NM
LB010	L. D'varagh	17/09/2021	15:51	Lesser Black-backed Gull	2	mesotrophic lakes; flying ne across lake	NM
LG009		17/09/2021	12:38	Little Grebe	1	cutover bog; swimming on flooded bog pool	NM
LG012	L. Iron	17/09/2021	19:00	Little Grebe	23	mesotrophic lakes; swimming and foraging on lake	NM
LG010	L. D'varagh	17/09/2021	15:40	Little Grebe	15	mesotrophic lakes; swimming and calling within reedy islets on lake	NM
LG011	L. D'varagh	17/09/2021	16:32	Little Grebe	4	mesotrophic lakes; calling and diving on lake	NM
MA007	L. Iron	17/09/2021	19:10	Mallard	46	mesotrophic lakes; swimming and foraging on lake	NM
MA008	L. D'varagh	17/09/2021	16:35	Mallard	2	mesotrophic lakes; flushed from edge reeds	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH013	L. Iron	17/09/2021	19:15	Moorhen	38	mesotrophic lakes and reed and large sedge swamps; wading along reedy edges and amonsgt weedy floating vegetation, most likely an underestimate of numbers	NM
MH014	L. D'varagh	17/09/2021	16:03	Moorhen	27	mesotrophic lakes; calling within fringe reed beds, most likely an underestimate	NM
MH015	L. D'varagh	17/09/2021	13:21	Moorhen	15	mesotrophic lakes; calling within edge reed beds (throughout narrow part of lake)	NM
MH016	L. D'varagh	17/09/2021	15:47	Moorhen	16	mesotrophic lakes; calling and waqding within reed islets on lake fringe	NM
MH017	L. D'varagh	17/09/2021	14:43	Moorhen	6	mesotrophic lakes and reed and large sedge swamps; calling and wading within fringe reedbeds	NM
MH018	L. D'varagh	17/09/2021	16:33	Moorhen	3	mesotrophic lakes; calling and ading in reedy lake fringes	NM
	L. D'varagh	17/09/2021	12:59	Mute Swan	6	mesotrophic lakes; swimming on lake and along reed fringes (2 adults + 4 juveniles)	NM
	L. D'varagh	17/09/2021	16:35	Mute Swan	5	mesotrophic lakes; swimming on lake (+ 2 juveniles)	NM
	Bracklagh Lough	17/09/2021	12:30	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	30	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	17	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. D'varagh	17/09/2021	15:49	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:39	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. D'vaagh	17/09/2021	16:09	Mute Swan	4	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	13:06	Mute Swan	2	mesotrophic lakes; swimming on lake	NM
	L. Iron	17/09/2021	19:15	Mute Swan	38	mesotrophic lakes; swimming and foraging on lake	NM
WA003	L. D'varagh	17/09/2021	15:52	Water Rail	2	mesotrophic lakes; pig calls from lake fringes	NM
BH023	L. D'varagh	29/09/2021	15:58	Black-headed Gull	12	mesotrophic lakes; swirling and swooping over lake	NM
BH021	L. D'varagh	29/09/2021	15:38	Black-headed Gull	2	mesotrophic lakes and mixed broadleaved woodland; flying over sw of lake and adjacent woodland	NM
BH019	Bracklagh Lough	29/09/2021	09:25	Black-headed Gull	3	mesotrophic lakes; flying over and swimming on lake	NM
BH020	L. Kinale	29/09/2021	10:04	Black-headed Gull	6	mesotrophic lakes; flying and swooping over lake	NM
BH022	L' D'varagh	29/09/2021	16:00	Black-headed Gull	1	mesotrophic lakes; flying and swooping over lake	NM
BH024	L. Sheelin	29/09/2021	08:07	Black-headed Gull	5	lakes and ponds; flying across lake	NM
BH026	L. Sheelin	29/09/2021	08:16	Black-headed Gull	6	lakes and ponds; flying across lake	NM
BH028	L. Sheelin	29/09/2021	08:45	Black-headed Gull	4	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH027		29/09/2021	08:36	Black-headed Gull	2	raised bog and scrub; flying across bog and scrub	NM
BH025	L. Sheelin	29/09/2021	08:17	Black-headed Gull	16	lakes and ponds; circlng and swooping over lake	NM
CA004	L. Sheelin	29/09/2021	08:11	Cormorant	1	lakes and ponds; flying low across lake	NM
CA005	L. Sheelin	29/09/2021	08:20	Cormorant	2	lakes and ponds; flying low across lake	NM
GA003	Derragh Lough	29/09/2021	11:04	Gadwall	35	mesotrophic lakes; swimming and foraging on lake	NM
GG031	L. Sheelin	29/09/2021	08:03	Great Crested Grebe	3	lakes and ponds; swimming on lake (w/ 2x juveniles)	NM
GG030	L. Sheelin	29/09/2021	08:12	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG033	L. Sheelin	29/09/2021	08:45	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG027	L. D'varagh	29/09/2021	15:56	Great Crested Grebe	3	mesotrophic lakes; swimming at lake fringes (+ 2 juveniles calling)	NM
GG026	L. Kinale	29/09/2021	10:16	Great Crested Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
GG028	L. D'varagh	29/09/2021	15:58	Great Crested Grebe	3	mesotrophic lakes; swimming and diving on lake	NM
GG029	L. Sheelin	29/09/2021	08:00	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG032	L. Sheelin	29/09/2021	08:19	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM
GG034	L. Sheelin	29/09/2021	08:53	Great Crested Grebe	1	lakes and ponds; swimming and diving on lake	NM
H010		29/09/2021	09:24	Grey Heron	1	mesotrophic lakes; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H011	L. Kinale	29/09/2021	12:10	Grey Heron	1	mesotrophic lakes; calling from lake edge	NM
LB012	L. Sheelin	29/09/2021	08:10	Lesser Black-backed Gull	3	lakes and ponds; flying over lake	NM
LB011		29/09/2021	16:02	Lesser Black-backed Gull	1	mesotrophic lakes; flying across lake	NM
LG014	L. D'varagh	29/09/2021	15:58	Little Grebe	13	mesotrophic lakes; swimming and diving within reedy fringes	NM
LG015	Derragh Lough	29/09/2021	10:57	Little Grebe	38	mesotrophic lakes; swimming and diving on lake	NM
LG017	L. Sheelin	29/09/2021	08:13	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG013		29/09/2021	13:10	Little Grebe	3	cutover bog; swimming and diving on bog pool	NM
LG018	L. Sheelin	29/09/2021	08:46	Little Grebe	8	lakes and ponds; swimming and diving near lake edge	NM
LG016	L. Sheelin	29/09/2021	08:12	Little Grebe	6	lakes and ponds; calling within reedy margins of lake	NM
MA009	L. Sheelin	29/09/2021	08:24	Mallard	5	lakes and ponds; swimming on lake	NM
MA010	L. Sheelin	29/09/2021	08:46	Mallard	7	lakes and ponds; swimming on lake	NM
MA011	L. D'varagh	29/09/2021	16:17	Mallard	19	mesotrophic lakes; swimming and foraging on lake	NM
MA012	Derragh Lough	29/09/2021	10:55	Mallard	57	mesotrophic lakes; swimming and foraging on lake	NM
MA013	L. D'varagh	29/09/2021	15:42	Mallard	24	mesotrophic lakes; swimming and dabbling on lake	NM
MA014	L. D'varagh	29/09/2021	16:15	Mallard	9	mesotrophic lakes; swimming and dabbling in weedy edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA015	L. Kinale	29/09/2021	10:03	Mallard	23	mesotrophic lakes; swimming and dabbling along lake fringes	NM
MA016	Derragh Lough	29/09/2021	12:45	Mallard	7	mesotrophic lakes; flying over lake	NM
MA017		29/09/2021	12:43	Mallard	18	mesotrophic lakes; flying in wide circles over w of derragh lough	NM
MA018	L. D'varagh	29/09/2021	15:09	Mallard	2	mesotrophic lakes; calling within reeds	NM
MA019	L. Kinale	29/09/2021	12:15	Mallard	2	mesotrophic lakes; calling from lake edge	NM
MA020	L. Sheelin	29/09/2021	08:13	Mallard	5	lakes and ponds; calling and swimming within reedy edges of lake	NM
MH019	L. Sheelin	29/09/2021	08:18	Moorhen	3	lakes and ponds; wading on edge of reedbed	NM
MH020	Derragh Lough	29/09/2021	11:00	Moorhen	22	mesotrophic lakes; swimming and wading within reedy fringes, approx. count - likely that some were missed	NM
MH021	L. Sheelin	29/09/2021	08:02	Moorhen	7	lakes and ponds; calling within reedy margins of lake	NM
MH022	L. Sheelin	29/09/2021	08:23	Moorhen	3	lakes and ponds; calling within reedy edges of lake	NM
MH023	Bracklagh Lough	29/09/2021	09:34	Moorhen	1	mesotrophic lakes and reed and large sedge swamps; calling within reeds along fringes of lake	NM
MH024	L. Kinale	29/09/2021	12:16	Moorhen	2	mesotrophic lakes; calling from lake edge	NM
	L. D'varagh	29/09/2021	16:06	Mute Swan	6	mesotrophic lakes; swimming within reedy lake fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	29/09/2021	10:00	Mute Swan	6	mesotrophic lakes; swimming on lake and within reedy fringes	NM
	L. Kinale	29/09/2021	10:02	Mute Swan	56	mesotrophic lakes and reed and large sedge swamps; swimming on lake + roosting within reedy edges	NM
	L. Sheelin	29/09/2021	08:20	Mute Swan	29	lakes and ponds; swimming on lake (n shore)	NM
	Bracklagh Lough	29/09/2021	09:25	Mute Swan	16	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:06	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:32	Mute Swan	17	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:55	Mute Swan	28	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	16:16	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	29/09/2021	07:57	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:05	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	07:04	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:15	Mute Swan	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	29/09/2021	08:45	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:50	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:57	Mute Swan	46	lakes and ponds; swimming on lake	NM
	Derragh Lough	29/09/2021	10:56	Mute Swan	155	mesotrophic lakes; swimming and foraging on lake, approx count	NM
	L. Sheelin	29/09/2021	08:22	Mute Swan	8	lakes and ponds; swimmiming on lake	NM
WA004	L. Sheelin	29/09/2021	08:19	Water Rail	3	lakes and ponds; calling from within reedy margins	NM
BH029	L. Iron	30/09/2021	17:51	Black-headed Gull	6	lakes and ponds, reed and large sedge swamps and scrub; flying around lake perimeter	NM
GG035	L. Iron	30/09/2021	18:12	Great Crested Grebe	6	lakes and ponds; swimming on lake	NM
LG019	L. Iron	30/09/2021	18:27	Little Grebe	21	lakes and ponds; swimming and diving on lake	NM
MA021	L. Iron	30/09/2021	18:30	Mallard	79	lakes and ponds; swimming and dabbling on lake	NM
	L. Iron	30/09/2021	18:30	Mute Swan	28	lakes and ponds; swimming on lake	NM
H012	L. Iron	11/10/2021	17:02	Grey Heron	1	lakes and ponds and reed and large sedge swamps; flying low and calling along lake shore	NM
LG020	L. Iron	11/10/2021	17:30	Little Grebe	14	lakes and ponds; swimming on lake	NM
MA022	L. Iron	11/10/2021	17:30	Mallard	56	lakes and ponds; swimming and dabbling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Iron	11/10/2021	17:30	Mute Swan	24	lakes and ponds; swimming on lake	NM
BH035	L. D'varagh	12/10/2021	16:33	Black-headed Gull	9	lakes and ponds; swirling over lake	NM
BH031	L. Sheelin	12/10/2021	08:06	Black-headed Gull	7	lakes and ponds; roosting near lake edge + flying around spot	NM
BH032	L. Sheelin	12/10/2021	08:16	Black-headed Gull	32	lakes and ponds; flying out over open water - not as open group but as frequent individuals	NM
BH030	Bracklagh Lough	12/10/2021	08:57	Black-headed Gull	7	lakes and ponds; flying and diving over lake and around fringes	NM
BH033	L. Sheelin	12/10/2021	08:20	Black-headed Gull	2	lakes and ponds and scrub; flying along s shore	NM
BH034	L. D'varagh	12/10/2021	16:20	Black-headed Gull	25	lakes and ponds; flying across lake - not as one large group but as frequent individuals	NM
CA006	Derragh Lough	12/10/2021	11:08	Cormorant	3	lakes and ponds; swimming and flying over lake	NM
CA007	L. D'varagh	12/10/2021	16:35	Cormorant	2	lakes and ponds; flying low across lake	NM
CA008		12/10/2021	09:25	Cormorant	1	depositing/lowland rivers and mixed broadleaved woodland; flying	NM
CA009		12/10/2021	09:29	Cormorant	1	mixed broadleaved woodland and lakes and ponds; flying	NM
GG036	L. Kinale	12/10/2021	10:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG037	L. Kinale	12/10/2021	12:02	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG038	L. Sheelin	12/10/2021	08:03	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG039	L. Sheelin	12/10/2021	08:06	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG040	L. Sheelin	12/10/2021	08:12	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG041	L. Sheelin	12/10/2021	08:15	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG042	L. Sheelin	12/10/2021	08:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG043	L. D'varagh	12/10/2021	16:05	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG045	L. D'varagh	12/10/2021	16:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG044	L. D'varagh	12/10/2021	16:17	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
H013	R. Inny	12/10/2021	09:21	Grey Heron	1	depositing/lowland rivers; perched on bridge	NM
H014		12/10/2021	09:26	Grey Heron	1	depositing/lowland rivers and mixed broadleaved woodland; perched in tree along river	NM
H015		12/10/2021	09:30	Grey Heron	1	lakes and ponds; foraging within reeds	NM
H016	L. D'varagh	12/10/2021	16:57	Grey Heron	1	lakes and ponds; flying across lake and calling	NM
H017	L. Sheelin	12/10/2021	08:18	Grey Heron	2	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H018	L. D'varagh	12/10/2021	16:15	Grey Heron	1	lakes and ponds; flying across lake	NM
H019	L. D'varagh	12/10/2021	16:12	Grey Heron	2	lakes and ponds and scrub; flushed from edges of lake	NM
H020	L. Sheelin	12/10/2021	08:20	Grey Heron	1	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
LB013	L. Sheelin	12/10/2021	08:09	Lesser Black-backed Gull	2	lakes and ponds; flying across sw corner of lake	NM
LB014	L. D'varagh	12/10/2021	16:21	Lesser Black-backed Gull	3	lakes and ponds; flying across lake	NM
LG029	L. D'varagh	12/10/2021	16:12	Little Grebe	4	lakes and ponds; swimming and diving with complex of reedy islets	NM
LG024	Derragh Lough	12/10/2021	11:10	Little Grebe	18	lakes and ponds; swimming and diving on lake (+ calling)	NM
LG023	L. Kinale	12/10/2021	10:18	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG027	L. Sheelin	12/10/2021	08:26	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG028	L. D'varagh	12/10/2021	16:05	Little Grebe	14	lakes and ponds; swimming and diving on lake	NM
LG030	L. D'varagh	12/10/2021	16:18	Little Grebe	6	lakes and ponds; swimming and diving near lake shore	NM
LG022	L. Kinale	12/10/2021	10:06	Little Grebe	5	lakes and ponds; swimming and diving along reedy fringes	NM
LG031	L. D'varagh	12/10/2021	16:09	Little Grebe	8	lakes and ponds; calling within reedy margins of lake	NM
LG025	L. Sheelin	12/10/2021	08:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG026	L. Sheelin	12/10/2021	08:20	Little Grebe	6	lakes and ponds; calling within reedy margins	NM
LG021	L. Kinale	12/10/2021	09:51	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
MA023	L. Kinale	12/10/2021	12:06	Mallard	6	lakes and ponds; swimming on lake	NM
MA024	L. D'varagh	12/10/2021	16:04	Mallard	12	lakes and ponds; swimming on lake	NM
MA025	L. D'varagh	12/10/2021	16:30	Mallard	6	lakes and ponds; swimming on lake	NM
MA026	L. Kinale	12/10/2021	10:12	Mallard	7	lakes and ponds; swimming and dabbling on lake	NM
MA027	Derragh Lough	12/10/2021	11:10	Mallard	18	lakes and ponds; swimming and dabbling mostly along lake fringes	NM
MA028	L. D'varagh	12/10/2021	16:07	Mallard	5	lakes and ponds; flushed from lake edge	NM
MA029	L. Sheelin	12/10/2021	08:23	Mallard	12	lakes and ponds; calling within reedy fringes of lake	NM
MH025	L. Sheelin	12/10/2021	08:26	Moorhen	2	lakes and ponds; swimming near reedy lake edges	NM
MH026	L. Sheelin	12/10/2021	08:18	Moorhen	7	lakes and ponds; swimming and calling near lake edge - around r. inny exit	NM
MH027	L. Sheelin	12/10/2021	08:02	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH028	L. Sheelin	12/10/2021	08:07	Moorhen	1	lakes and ponds; calling within reedy margins of lake	NM
MH029	Derragh Lough	12/10/2021	11:10	Moorhen	29	lakes and ponds; calling within reedy margins, all over lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH030	L. Sheelin	12/10/2021	08:21	Moorhen	3	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH031		12/10/2021	10:08	Moorhen	9	lakes and ponds; calling within reedy lake margins	NM
MH032	L. D'varagh	12/10/2021	16:31	Moorhen	3	lakes and ponds; calling within reedy edges	NM
MH033		12/10/2021	09:51	Moorhen	4	lakes and ponds; calling with reedy margins of lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	6	lakes and ponds; swimming within reedbeds	NM
	L. D'varagh	12/10/2021	16:14	Mute Swan	6	lakes and ponds; swimming within complex of reedy islets	NM
	L. Sheelin	12/10/2021	08:20	Mute Swan	27	lakes and ponds; swimming on lake - n side	NM
	L. Kinale	12/10/2021	10:05	Mute Swan	9	lakes and ponds; swimming on lake	NM
	Derragh Lough	12/10/2021	11:10	Mute Swan	156	lakes and ponds; swimming on lake, all over lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:03	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:04	Mute Swan	63	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	17:11	Mute Swan	39	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:05	Mute Swan	3	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	12/10/2021	08:05	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:08	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:14	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:08	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:06	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:10	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:24	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:20	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:29	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:32	Mute Swan	5	lakes and ponds; swimming on lake	NM
	R. Inny	12/10/2021	15:24	Mute Swan	2	watercourses; swimming and feeding on river	NM
	Bracklagh Lough	12/10/2021	08:54	Mute Swan	16	lakes and ponds; swimming and feeding on lake	NM
	L. D'varagh	12/10/2021	15:36	Mute Swan	29	lakes and ponds; swimmimg on lake	NM
	L. Sheelin	12/10/2021	08:09	Mute Swan	3	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA005		12/10/2021	10:15	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from wet reedy margins	NM
WA006	L. Sheelin	12/10/2021	08:07	Water Rail	3	lakes and ponds; pig calls from reedy margins	NM
BH036	L. Iron	25/10/2021	17:35	Black-headed Gull	15	lakes and ponds and reed and large sedge swamps; swirling over lake and adjacent wetland	NM
GG046	L. Iron	25/10/2021	17:50	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG032	L. Iron	25/10/2021	17:08	Little Grebe	20	lakes and ponds; swimming and diving on lake, ideal lg habitat	NM
MA030	L. Iron	25/10/2021	17:30	Mallard	59	lakes and ponds; swimming on lake	NM
MH034	L. Iron	25/10/2021	17:30	Moorhen	12	lakes and ponds and reed and large sedge swamps; calling and wading within wetland margins of lake	NM
	L. Iron	25/10/2021	17:32	Mute Swan	57	lakes and ponds; swimming on lake	NM
BH037		26/10/2021	09:16	Black-headed Gull	3	lakes and ponds; flying and swirling low over lake	NM
BH038	L. Sheelin	26/10/2021	14:18	Black-headed Gull	2	lakes and ponds; flying across lake	NM
CA010		26/10/2021	15:08	Cormorant	2	lakes and ponds; soaring over lake	NM
CA011	L. Sheelin	26/10/2021	14:02	Cormorant	6	lakes and ponds; roosting on buoys	NM
CA012	L. Sheelin	26/10/2021	15:01	Cormorant	1	lakes and ponds; perched on rock	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA013		26/10/2021	15:59	Cormorant	1	improved agricultural grassland and hedgerows; flying s across farmland	NM
CA014		26/10/2021	09:23	Cormorant	1	lakes and ponds; flying low across lake	NM
CA015		26/10/2021	09:35	Cormorant	2	lakes and ponds; flying high across lake	NM
CA016		26/10/2021	11:27	Cormorant	1	lakes and ponds, semi-natural grassland and mixed broadleaved woodland; flying high across lake	NM
GG050		26/10/2021	09:46	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG051	Derragh Lough	26/10/2021	11:23	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG052	L. Sheelin	26/10/2021	14:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG053	L. Sheelin	26/10/2021	14:52	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG054	L. Sheelin	26/10/2021	14:57	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG055	L. Sheelin	26/10/2021	14:56	Great Crested Grebe	7	lakes and ponds; swimming on lake	NM
GG056	L. Sheelin	26/10/2021	15:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG057	L. Sheelin	26/10/2021	15:13	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG058		26/10/2021	15:20	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG047		26/10/2021	09:11	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG048		26/10/2021	09:14	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG049		26/10/2021	09:15	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM
GG059	L. Kinale	26/10/2021	16:09	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H021		26/10/2021	12:47	Grey Heron	1	cutover bog; perched on flooded bog	NM
H022	Bracklagh Lough	26/10/2021	16:19	Grey Heron	1	lakes and ponds; perched along lake shore	NM
H023	Derragh Lough	26/10/2021	11:20	Grey Heron	1	lakes and ponds; flying across lake	NM
H024		26/10/2021	10:16	Grey Heron	1	depositing/lowland rivers; flushed from river	NM
H025		26/10/2021	12:45	Grey Heron	1	scrub; calling within wet scrub	NM
H026		26/10/2021	15:14	Grey Heron	1	lakes and ponds; calling from reedy fringes	NM
H027	L. Sheelin	26/10/2021	14:26	Grey Heron	1	lakes and ponds; calling from lake margin	NM
LG035	Derragh Lough	26/10/2021	11:24	Little Grebe	47	lakes and ponds; swimming and diving on lake + calling within reedy fringes	NM
LG037	L. Sheelin	26/10/2021	14:15	Little Grebe	13	lakes and ponds; swimming and diving on lake	NM
LG039	L. Sheelin	26/10/2021	14:18	Little Grebe	7	lakes and ponds; swimming and diving on lake	NM
LG038	L. Sheelin	26/10/2021	14:23	Little Grebe	2	lakes and ponds; diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG036		26/10/2021	12:15	Little Grebe	1	lakes and ponds and cutover bog; diving on bog drainage pond	NM
LG034		26/10/2021	09:33	Little Grebe	6	lakes and ponds; calling within reedy islets	NM
LG040		26/10/2021	14:54	Little Grebe	6	lakes and ponds; calling within reedy fringes	NM
LG033		26/10/2021	09:11	Little Grebe	7	lakes and ponds; calling within reed islets + diving	NM
MA031		26/10/2021	15:09	Mallard	6	lakes and ponds; swimming within reeds	NM
MA032		26/10/2021	09:45	Mallard	6	lakes and ponds; swimming on lake	NM
MA033		26/10/2021	09:47	Mallard	4	lakes and ponds; swimming on lake	NM
MA034		26/10/2021	10:21	Mallard	17	lakes and ponds; swimming and dabbling on lake	NM
MA035	Derragh Lough	26/10/2021	11:25	Mallard	15	lakes and ponds; swimming and dabbling on lake	NM
MA036	Lough Bane	26/10/2021	13:19	Mallard	16	lakes and ponds; swimming and calling on lake	NM
MA037	L. Sheelin	26/10/2021	14:01	Mallard	4	lakes and ponds; swimming and calling on lake	NM
MA038		26/10/2021	09:41	Mallard	12	lakes and ponds; flying n across lake	NM
MA039		26/10/2021	11:41	Mallard	2	lakes and ponds and mixed broadleaved woodland; flying across lake and woodland fringes	NM
MA040		26/10/2021	08:45	Mallard	2	lakes and ponds; calling within reedy fringes of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH035	Derragh Lough	26/10/2021	11:25	Moorhen	4	lakes and ponds; wading within reedy fringes	NM
MH036		26/10/2021	14:53	Moorhen	6	lakes and ponds; calling within reedy fringes of lake	NM
MH037		26/10/2021	09:18	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH038		26/10/2021	09:51	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH039		26/10/2021	15:10	Moorhen	8	lakes and ponds; calling and swimming within reeds	NM
		26/10/2021	09:39	Mute Swan	16	lakes and ponds; wading and foraging along grassy fringe	NM
		26/10/2021	15:08	Mute Swan	1	lakes and ponds; swimming within reeds	NM
		26/10/2021	09:17	Mute Swan	12	lakes and ponds; swimming on lake	NM
		26/10/2021	09:36	Mute Swan	28	lakes and ponds; swimming on lake	NM
		26/10/2021	09:42	Mute Swan	19	lakes and ponds; swimming on lake	NM
		26/10/2021	09:48	Mute Swan	6	lakes and ponds; swimming on lake	NM
		26/10/2021	09:47	Mute Swan	36	lakes and ponds; swimming on lake	NM
		26/10/2021	09:45	Mute Swan	2	lakes and ponds; swimming on lake	NM
	Derragh Lough	26/10/2021	11:23	Mute Swan	202	lakes and ponds; swimming on lake	NM
	Lough Bane	26/10/2021	13:21	Mute Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	26/10/2021	14:05	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:13	Mute Swan	8	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:51	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:59	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	15:03	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Kinale	26/10/2021	16:08	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	26/10/2021	16:17	Mute Swan	24	lakes and ponds; swimming on lake	NM
		26/10/2021	09:35	Mute Swan	4	lakes and ponds; swimming near campsite	NM
		26/10/2021	09:10	Mute Swan	2	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	10:21	Mute Swan	34	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	14:14	Mute Swan	39	lakes and ponds; swimming along lake edge + grazing on shore	NM
WA007		26/10/2021	15:15	Water Rail	2	lakes and ponds; pig calls from reedy fringes	NM
BH039	L. D'varagh	08/11/2021	12:30	Black-headed Gull	56	lakes and ponds and mixed broadleaved woodland; swirling over lower narrow part of lake	NM
CA017	L. D'varagh	08/11/2021	12:31	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA018	L. D'varagh	08/11/2021	12:56	Cormorant	2	lakes and ponds; flying se low across lake	NM
GG060	L. D'varagh	08/11/2021	12:33	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG061	Bracklagh Lough	08/11/2021	14:34	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG041	L. D'varagh	08/11/2021	12:31	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
	Bracklagh Lough	08/11/2021	14:33	Mute Swan	26	lakes and ponds; swimming on lake	NM
BH040	L. Sheelin	09/11/2021	09:37	Black-headed Gull	13	lakes and ponds; circling over lake - wheeling and descending regularly towards water	NM
CA019	L. Sheelin	09/11/2021	10:02	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA020		09/11/2021	11:48	Cormorant	2	improved agricultural grassland and hedgerows; flyinfg n along adjacent area	NM
GA004	Derragh Lough	09/11/2021	11:32	Gadwall	9	lakes and ponds; swimming and feeding along lake edge	NM
GG063	L. Sheelin	09/11/2021	09:24	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG062	L. Sheelin	09/11/2021	09:14	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
LB015	L. Sheelin	09/11/2021	09:38	Lesser Black-backed Gull	4	lakes and ponds; flying high across lake	NM
LB016		09/11/2021	10:12	Lesser Black-backed Gull	3	bogs and scrub; flying across bog and scrub to s of lake	NM
LG042	L. Iron	09/11/2021	16:21	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG044	Derragh Lough	09/11/2021	11:32	Little Grebe	4	lakes and ponds; swimming and diving on lake	NM
LG043	L. Sheelin	09/11/2021	09:23	Little Grebe	5	lakes and ponds; calling within reedy fringes of lake	NM
MA041	L. Iron	09/11/2021	10:56	Mallard	45	lakes and ponds; swimming on lake	NM
MA042	Derragh Lough	09/11/2021	09:35	Mallard	14	lakes and ponds; swimming and dabbling along reedy edges of lake	NM
MA043	L. Sheelin	09/11/2021	09:12	Mallard	5	lakes and ponds; swimming along reedy lake edge	NM
MA044	L. Sheelin	09/11/2021	09:21	Mallard	4	lakes and ponds; calling within reedy fringes of lake	NM
MH040	L. Iron	09/11/2021	16:32	Moorhen	5	lakes and ponds; swimming and calling within reedy margins	NM
	R. Inny	09/11/2021	14:02	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	09/11/2021	09:12	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:13	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:34	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:57	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Derragh Lough	09/11/2021	11:35	Mute Swan	68	lakes and ponds; swimming on lake	NM
	L. Iron	09/11/2021	16:30	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:26	Mute Swan	7	lakes and ponds; swimming along reedy edges of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		09/11/2021	09:58	Mute Swan	7	lakes and ponds; flying nw across lake	NM
WA008	L. Sheelin	09/11/2021	09:30	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from within reedy lake margins	NM
BH041		22/11/2021	16:05	Black-headed Gull	58	improved agricultural grassland and hedgerows; swirling and flying over farmland in large group - landing occasionally. ~45mins continuously	NM
MA045	L. Iron	22/11/2021	16:02	Mallard	24	lakes and ponds; swimming on lake	NM
MH041	L. Sheelin	22/11/2021	08:40	Moorhen	3	lakes and ponds; calling within reedy boundaries	NM
	L. Iron	22/11/2021	16:00	Mute Swan	27	lakes and ponds; swimming on lake	NM
BH045	L. Sheelin	23/11/2021	09:32	Black-headed Gull	7	lakes and ponds; wheeling and circling over lake	NM
BH042		23/11/2021	10:11	Black-headed Gull	2	improved agricultural grassland; flying sw across farmland	NM
BH043	L. D'varagh	23/11/2021	15:41	Black-headed Gull	5	lakes and ponds; flying and swirling over lake	NM
BH044	L. Sheelin	23/11/2021	09:07	Black-headed Gull	6	lakes and ponds; flying across lake	NM
CA021	L. Kinale	23/11/2021	09:52	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA022	Bracklagh Lough	23/11/2021	10:15	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA023	L. Sheelin	23/11/2021	09:26	Cormorant	5	lakes and ponds; perched on tree	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA024	Derragh Lough	23/11/2021	11:18	Cormorant	2	lakes and ponds; flying low across lake	NM
CA025	L. Sheelin	23/11/2021	09:31	Cormorant	2	lakes and ponds; flying low across lake	NM
CA026		23/11/2021	10:36	Cormorant	1	depositing/lowland rivers and highly modified/non-native woodland; flying high along r. inny	NM
CA027		23/11/2021	10:51	Cormorant	1	bogs; flying across bog	NM
GA005	L. Bane	23/11/2021	14:21	Gadwall	6	lakes and ponds; swimming on lake	NM
GG064	L. Kinale	23/11/2021	09:47	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG065	L. Kinale	23/11/2021	10:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG066	L. D'varagh	23/11/2021	15:42	Great Crested Grebe	13	lakes and ponds; swimming on lake	NM
GG067	L. D'varagh	23/11/2021	15:40	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG068	L. Sheelin	23/11/2021	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG069	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG071	L. Sheelin	23/11/2021	08:58	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG073	L. Sheelin	23/11/2021	09:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG070	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG072	L. Sheelin	23/11/2021	09:07	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
H028		23/11/2021	11:05	Grey Heron	1	semi-natural grassland; wading in wet reedy grassland	NM
H029	BN2	23/11/2021	14:04	Grey Heron	1	cutover bog; flying low across wetland	NM
H030		23/11/2021	13:45	Grey Heron	1	cutover bog and scrub/transitional woodland; flying low across bog + perching in adjacent scrubby woodland	NM
LB017		23/11/2021	15:41	Lesser Black-backed Gull	1	lakes and ponds; flying over lake	NM
LG045	Derragh Lough	23/11/2021	11:10	Little Grebe	21	lakes and ponds; swimming and diving on lake + calling within reedy margins	NM
LG046		23/11/2021	15:45	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG047	L. D'varagh	23/11/2021	15:48	Little Grebe	6	lakes and ponds; swimming and diving on lake	NM
LG049	L. Sheelin	23/11/2021	09:27	Little Grebe	3	lakes and ponds; swimming and diving near to sheltered lake shore	NM
LG048	L. Sheelin	23/11/2021	09:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA046	L. D'varagh	23/11/2021	15:39	Mallard	5	lakes and ponds; swimming on lake	NM
MA047	L. D'varagh	23/11/2021	15:50	Mallard	8	lakes and ponds; swimming on lake	NM
MA048	L. Sheelin	23/11/2021	09:27	Mallard	9	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA049	L. Bane	23/11/2021	14:20	Mallard	46	lakes and ponds; swimming and dabbling on lake	NM
MA050	L. Kinale	23/11/2021	09:48	Mallard	3	lakes and ponds; flying low across lake and fringes	NM
MA051	L. Sheelin	23/11/2021	08:45	Mallard	5	lakes and ponds; calling within reedy margins	NM
MA052	L. Sheelin	23/11/2021	09:08	Mallard	3	lakes and ponds; calling within reedy margins	NM
MH042	R. Inny	23/11/2021	13:06	Moorhen	1	depositing/lowland rivers; wading along river	NM
MH043	L. Kinale	23/11/2021	10:55	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH044	L. Kinale	23/11/2021	09:50	Moorhen	2	lakes and ponds and reed and large sedge swamps; calling within reedy lake fringes	NM
MH045	L. D'varagh	23/11/2021	15:51	Moorhen	3	lakes and ponds; calling within lake fringes	NM
	L. D'varagh	23/11/2021	15:40	Mute Swan	12	lakes and ponds; swimming on lake + roosting on slipway	NM
	Derragh Lough	23/11/2021	11:10	Mute Swan	177	lakes and ponds; swimming on lake (+ juveniles)	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	32	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	22	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:55	Mute Swan	8	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	23/11/2021	10:15	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	23/11/2021	10:55	Mute Swan	15	lakes and ponds; swimming on lake	NM
		23/11/2021	15:22	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:44	Mute Swan	27	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:52	Mute Swan	58	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:35	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:46	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:47	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:55	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:58	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:14	Mute Swan	11	lakes and ponds; flying across lake	NM
WA009	L. Sheelin	23/11/2021	08:45	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reedy margins	NM
BH046	BN2	10/12/2021	15:34	Black-headed Gull	7	cutover bog; swirling over bog wetland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA028		10/12/2021	09:43	Cormorant	2	improved agricultural grassland; flying ne across farmland	NM
GG075	L. Sheelin	10/12/2021	09:04	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG076		10/12/2021	14:06	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG074	L. Sheelin	10/12/2021	08:35	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
H031	L. Bane	10/12/2021	16:04	Grey Heron	2	lakes and ponds and transition mire and quaking bog; perched on wet boggy margins of lake	NM
H032	R. Inny	10/12/2021	10:45	Grey Heron	1	highly modified/non-native woodland and depositing/lowland rivers; perched in tree along river	NM
H033	L. Kinale	10/12/2021	09:57	Grey Heron	1	lakes and ponds, semi-natural grassland and reed and large sedge swamps; calling from wet lake margins	NM
LB018	L. Sheelin	10/12/2021	08:37	Lesser Black-backed Gull	3	lakes and ponds; flying and swirling over lake	NM
LG050	L. Sheelin	10/12/2021	09:02	Little Grebe	6	lakes and ponds; swimming and diving close to lake shore	NM
LG051	Derragh Lough	10/12/2021	10:55	Little Grebe	12	lakes and ponds; calling within reedy margins	NM
MA053	L. Sheelin	10/12/2021	09:04	Mallard	12	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA054	Derragh Lough	10/12/2021	10:51	Mallard	16	lakes and ponds; swimming and dabbling along reedy margins of lake	NM
MA055	L. Sheelin	10/12/2021	08:36	Mallard	6	lakes and ponds; swimming along reedy shores	NM
MA056	BN2	10/12/2021	15:40	Mallard	7	cutover bog; foraging on rushy bare peat within bog wetland	NM
MA057	Bracklagh Lough	10/12/2021	09:26	Mallard	3	lakes and ponds; feeding near to reedy lake edges	NM
MH046	R. Inny	10/12/2021	12:07	Moorhen	3	depositing/lowland rivers; swimming on river	NM
MH047	L. Kinale	10/12/2021	09:54	Moorhen	7	lakes and ponds; swimming and calling along lake edges	NM
MH048	L. Sheelin	10/12/2021	08:41	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
	L. Sheelin	10/12/2021	08:35	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:40	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:59	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Kinale	10/12/2021	10:03	Mute Swan	9	lakes and ponds; swimming on lake	NM
		10/12/2021	14:06	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	10/12/2021	09:24	Mute Swan	12	lakes and ponds; swimming and feeding on lake	NM
	Derragh Lough	10/12/2021	10:50	Mute Swan	76	lakes and ponds; swimming and feeding on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA010	L. Kinale	10/12/2021	09:52	Water Rail	3	lakes and ponds and reed and large sedge swamps; pig calls from lake margins	NM
BH050	L. Sheelin	22/12/2021	13:45	Black-headed Gull	2	lakes and ponds; wheeling over lake	NM
BH047	L. D'varagh	22/12/2021	08:45	Black-headed Gull	5	lakes and ponds; swirling and swooping over lake	NM
BH048		22/12/2021	12:14	Black-headed Gull	6	improved agricultural grassland, hedgerows and lakes and ponds; flying s over farmland	NM
BH049		22/12/2021	13:35	Black-headed Gull	26	lakes and ponds; flying high and sw across lake	NM
CA029	Bracklagh Lough	22/12/2021	12:04	Cormorant	1	lakes and ponds; swimming on lake	NM
CA030	L. Sheelin	22/12/2021	13:40	Cormorant	1	lakes and ponds; flying low across lake	NM
GG077		22/12/2021	08:43	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG078	Deragh Lough	22/12/2021	11:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG080	L. Sheelin	22/12/2021	13:38	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG081	L. Sheelin	22/12/2021	13:41	Great Crested Grebe	23	lakes and ponds; swimming on lake	NM
GG082	L. Sheelin	22/12/2021	14:09	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG079	L. Kinale	22/12/2021	12:24	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H034	L. Sheelin	22/12/2021	13:35	Grey Heron	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H035		22/12/2021	15:47	Grey Heron	1	lakes and ponds and transition mire and quaking bog; perched on saturated lake fringes	NM
H036	R. Inny	22/12/2021	10:36	Grey Heron	1	semi-natural grassland and depositing/lowland rivers; perched along river	NM
H037	L. Sheelin	22/12/2021	13:10	Grey Heron	1	lakes and ponds; flying low and calling across lake	NM
H038		22/12/2021	13:47	Grey Heron	1	bogs and scrub; flying and calling across bog	NM
H039	L. Sheelin	22/12/2021	13:54	Grey Heron	1	lakes and ponds; flying across reedy lake fringes	NM
H040		22/12/2021	16:07	Grey Heron	1	cutover bog and scrub; flying across bog	NM
H041	L. Kinale	22/12/2021	12:21	Grey Heron	2	reed and large sedge swamps and lakes and ponds; calling from lake edge	NM
LB019	L. Sheelin	22/12/2021	13:37	Lesser Black-backed Gull	2	lakes and ponds; swooping over lake	NM
LG053	L. D'varagh	22/12/2021	08:35	Little Grebe	3	lakes and ponds; swimming close to shore	NM
LG058	L. Sheelin	22/12/2021	13:57	Little Grebe	3	lakes and ponds; swimming and diving within reedy margins	NM
LG057	Deragh Lough	22/12/2021	11:00	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM
LG055		22/12/2021	08:42	Little Grebe	3	lakes and ponds; swimming and calling within reedy margins	NM
LG054	L. D'varagh	22/12/2021	08:43	Little Grebe	7	lakes and ponds; swimming and calling within emergent reedy islets	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG052	L. D'varagh	22/12/2021	08:31	Little Grebe	3	lakes and ponds; calling within reedy margins of lake	NM
LG056	L. Kinale	22/12/2021	11:23	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA058	L. D'varagh	22/12/2021	08:34	Mallard	3	lakes and ponds; swimming on lake	NM
MA059	L. Kinale	22/12/2021	12:20	Mallard	5	lakes and ponds; swimming on lake	NM
MA060	L. Bane	22/12/2021	15:46	Mallard	41	lakes and ponds; swimming on lake	NM
MA061	BN2	22/12/2021	15:34	Mallard	7	cutover bog; swimming and foraging on bog wetland	NM
MA062	L. Sheelin	22/12/2021	13:36	Mallard	5	lakes and ponds; swimming along edge of reedy fringes	NM
MA063	Bracklagh Lough	22/12/2021	12:16	Mallard	2	lakes and ponds; flying low across lake	NM
MA064		22/12/2021	09:21	Mallard	2	watercourses; flushed from wet drain	NM
MA065		22/12/2021	09:32	Mallard	2	lakes and ponds; calling within reedy margins	NM
MH049	L. D'varagh	22/12/2021	08:32	Moorhen	4	lakes and ponds and highly modified/non-native woodland; wading within flooded willow margins	NM
MH050		22/12/2021	09:31	Moorhen	3	scrub and reed and large sedge swamps; calling within wetland / wet willow scrub	NM
MH051	L. Kinale	22/12/2021	11:23	Moorhen	2	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH052	L. Kinale	22/12/2021	12:14	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH053	L. Sheelin	22/12/2021	13:32	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH054	L. Sheelin	22/12/2021	13:55	Moorhen	5	lakes and ponds; calling within reedy margins	NM
	L. Sheelin	22/12/2021	13:05	Mute Swan	3	lakes and ponds; swimming within reedy corners of lake	NM
	L. D'varagh	22/12/2021	08:30	Mute Swan	46	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	11:25	Mute Swan	5	lakes and ponds; swimming on lake	NM
	Deragh Lough	22/12/2021	11:00	Mute Swan	128	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	22/12/2021	12:03	Mute Swan	13	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:18	Mute Swan	35	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:35	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:43	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	7	lakes and ponds; swimming on lake	NM
		22/12/2021	08:40	Mute Swan	7	lakes and ponds; swimming and foraging near lake edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		22/12/2021	09:30	Mute Swan	29	lakes and ponds; swimming and feeding on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	15	lakes and ponds; swimming and feeding along reedy lake fringes	NM
		22/12/2021	08:54	Mute Swan	5	lakes and ponds; roosting on lake edge	NM
	L. Bane	22/12/2021	15:44	Mute Swan	3	lakes and ponds; foraging within saturated edges of lake	NM
	R. Inny	22/12/2021	10:19	Mute Swan	3	depositing/lowland rivers; foraging along river edge (juveniles)	NM
WA011		22/12/2021	11:23	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reeds	NM
BH051	L. Iron	23/12/2021	15:16	Black-headed Gull	12	lakes and ponds; swimming on lake + flying along edges	NM
H042		23/12/2021	16:18	Grey Heron	1	lakes and ponds; flying low and calling adjacenet to lake	NM
MH055	L. Iron	23/12/2021	15:32	Moorhen	16	lakes and ponds; swimming within weedy edges of lake	NM
		23/12/2021	16:29	Mute Swan	3	improved agricultural grassland and hedgerows; flying sw across farmland	NM
BH054	L. D'varagh	04/01/2022	13:34	Black-headed Gull	8	lakes and ponds; flying and swooping over lake	NM
BH053	L. D'varagh	04/01/2022	10:10	Black-headed Gull	2	lakes and ponds, improved agricultural grassland and scrub; flying along lake shore	NM
BH052	L. D'varagh	04/01/2022	09:08	Black-headed Gull	34	lakes and ponds; circling and soaring over se end of lake	NM
CA031	L. D'varagh	04/01/2022	09:16	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA032	L. D'varagh	04/01/2022	10:05	Cormorant	2	lakes and ponds; swimming on lake	NM
CA033	L. D'varagh	04/01/2022	13:41	Cormorant	2	lakes and ponds; flyinglow across lake	NM
CA034	L. D'varagh	04/01/2022	09:21	Cormorant	2	lakes and ponds; flying low across lake	NM
CA035	L. D'varagh	04/01/2022	10:10	Cormorant	1	lakes and ponds; flying low across lake	NM
GG083	L. D'varagh	04/01/2022	09:10	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG084	L. D'varagh	04/01/2022	13:30	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
LB020	L. D'varagh	04/01/2022	13:37	Lesser Black-backed Gull	2	lakes and ponds; flying over lake	NM
LG061	L. D'varagh	04/01/2022	10:00	Little Grebe	7	lakes and ponds; swimming on lake	NM
LG063	L. D'varagh	04/01/2022	13:25	Little Grebe	5	lakes and ponds; swimming on lake	NM
LG065	L. D'varagh	04/01/2022	13:37	Little Grebe	6	lakes and ponds; swimming on lake	NM
LG060	L. D'varagh	04/01/2022	09:10	Little Grebe	9	lakes and ponds; swimming and diving on lake	NM
LG062	L. D'varagh	04/01/2022	13:30	Little Grebe	7	lakes and ponds; swimming and diving near edge of lake	NM
LG064	L. D'varagh	04/01/2022	13:31	Little Grebe	6	lakes and ponds; swimming and calling within tangled margins	NM
LG066	L. D'varagh	04/01/2022	14:47	Little Grebe	9	lakes and ponds; swimming and calling within reedbed boundary	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG059	L. Iron	04/01/2022	15:40	Little Grebe	37	lakes and ponds; swimming and calling on lake and within reedy boundaries	NM
MA066	L. D'varagh	04/01/2022	11:23	Mallard	18	other artificial lakes and ponds; swimming on pond	NM
MA067	L. Iron	04/01/2022	15:40	Mallard	32	lakes and ponds; swimming and foraging on lake and within reedy fringes	NM
MH056	L. D'varagh	04/01/2022	09:10	Moorhen	3	lakes and ponds; wading within flooded margins	NM
MH057	L. D'varagh	04/01/2022	11:40	Moorhen	3	other artificial lakes and ponds; swimming on pond	NM
MH058	L. D'varagh	04/01/2022	13:25	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH059	L. D'varagh	04/01/2022	14:45	Moorhen	6	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH060	L. D'varagh	04/01/2022	14:17	Moorhen	2	lakes and ponds; calling from lake edge	NM
	L. D'varagh	04/01/2022	10:48	Mute Swan	2	other artificial lakes and ponds; swimming on pond	NM
	L. Iron	04/01/2022	15:40	Mute Swan	43	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:35	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:27	Mute Swan	2	lakes and ponds; swimming and foraging in tangled margins of lake	NM
	L. D'varagh	04/01/2022	14:45	Mute Swan	7	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG085	L. D'varagh	05/01/2022	13:27	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
H043	BN2	05/01/2022	09:32	Grey Heron	2	cutover bog; flying low across bog wetland	NM
LG067	Derragh Lough	05/01/2022	10:35	Little Grebe	21	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG068	L. D'varagh	05/01/2022	13:21	Little Grebe	16	lakes and ponds; swimming and calling within reedy edges	NM
	Derragh Lough	05/01/2022	10:34	Mute Swan	115	lakes and ponds; swimming on lake	NM
	L. D'varagh	05/01/2022	13:21	Mute Swan	50	lakes and ponds; swimming on lake	NM
BH057	L. Sheelin	17/01/2022	09:47	Black-headed Gull	4	lakes and ponds; swirling over lake	NM
BH061	L. D'varagh	17/01/2022	13:13	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH063	L. Sheelin	17/01/2022	08:45	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH058	Bracklagh Lough	17/01/2022	10:56	Black-headed Gull	6	lakes and ponds; swimming and swirling over lake	NM
BH056	L. Sheelin	17/01/2022	09:50	Black-headed Gull	19	lakes and ponds; flying and swooping over lake - spread out over s of lake	NM
BH055	L. Sheelin	17/01/2022	09:46	Black-headed Gull	6	lakes and ponds; flying and swooping over lake	NM
BH059		17/01/2022	15:54	Black-headed Gull	2	lakes and ponds, transition mire and quaking bog and semi-natural grassland; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH060	L. D'varagh	17/01/2022	13:00	Black-headed Gull	4	lakes and ponds; flying across lake	NM
BH062	L. Sheelin	17/01/2022	08:34	Black-headed Gull	3	lakes and ponds; flying across lake	NM
CA036	Derragh Lough	17/01/2022	11:20	Cormorant	1	lakes and ponds; swimming on lake	NM
CA037	L. Sheelin	17/01/2022	09:50	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA038	L. Sheelin	17/01/2022	08:38	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA039	L. Sheelin	17/01/2022	08:46	Cormorant	14	scrub and lakes and ponds; perched in tree along lake	NM
CA040	L. Sheelin	17/01/2022	08:47	Cormorant	24	lakes and ponds; flying low across lake - not as one group but as numerous pairs and solitary individuals	NM
CA041	L. Sheelin	17/01/2022	09:49	Cormorant	1	lakes and ponds; flying high across sw area of lake	NM
GA006	L. Kinale N	17/01/2022	10:37	Gadwall	8	lakes and ponds; swimming on lake	NM
GA007	L. Bane	17/01/2022	15:50	Gadwall	6	lakes and ponds; swimming on lake	NM
GD002	L. Sheelin	17/01/2022	08:47	Goosander	28	lakes and ponds; swimming on lake	NM
GD001	L. Kinale	17/01/2022	10:35	Goosander	6	lakes and ponds and reed and large sedge swamps; flying s across lake	NM
GE001	BN2	17/01/2022	16:10	Green Sandpiper	1	cutover bog; flying rapidly across bog wetland + foraging + piercing call	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG087	Derragh Lough	17/01/2022	11:21	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG088	L. D'varagh	17/01/2022	13:02	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG090	L. D'varagh	17/01/2022	13:04	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG091	L. Sheelin	17/01/2022	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG093	L. Sheelin	17/01/2022	08:48	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG086	L. Kinale	17/01/2022	10:38	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG089	L. D'varagh	17/01/2022	13:10	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GG092	L. Sheelin	17/01/2022	08:45	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
H044	L. Bane	17/01/2022	15:50	Grey Heron	1	transition mire and quaking bog; perched on fringes	NM
H045	L. Sheelin	17/01/2022	09:50	Grey Heron	1	lakes and ponds; flying lowvand calling across lake	NM
H046	L. D'varagh	17/01/2022	13:07	Grey Heron	1	scrub and reed and large sedge swamps; flying low across scrub and wetland	NM
H047	L. Kinale	17/01/2022	10:40	Grey Heron	1	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H048	BN2	17/01/2022	16:20	Grey Heron	1	cutover bog and scrub; flying and calling across bog wetland	NM
H049	L. D'varagh	17/01/2022	13:17	Grey Heron	2	lakes and ponds; flying across lake	NM
H050	BN2	17/01/2022	16:24	Grey Heron	1	cutover bog; flying across bog + harried by rn	NM
LB021	L. Sheelin	17/01/2022	09:48	Lesser Black-backed Gull	2	lakes and ponds; flying across lake	NM
LG069	L. Sheelin	17/01/2022	10:26	Little Grebe	6	lakes and ponds and scrub; swimming close to and within flooded scrubby shore	NM
LG075	L. Sheelin	17/01/2022	08:53	Little Grebe	13	lakes and ponds; swimming and diving in sheltered area of lake	NM
LG071	L. D'varagh	17/01/2022	12:59	Little Grebe	5	lakes and ponds; swimming and diving close to lake shore	NM
LG072	L. D'varagh	17/01/2022	13:12	Little Grebe	12	lakes and ponds; swimming and calling within reedy islets close to lake shore	NM
LG074	L. Sheelin	17/01/2022	08:30	Little Grebe	6	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG073	L. D'varagh	17/01/2022	13:12	Little Grebe	7	lakes and ponds; swimming and calling on lake	NM
LG070	Derragh Lough	17/01/2022	11:20	Little Grebe	32	lakes and ponds; calling and swimming on lake and within reeds	NM
MA068	L. D'varagh	17/01/2022	13:10	Mallard	18	lakes and ponds; swimming on lake	NM
MA069	L. Sheelin	17/01/2022	08:46	Mallard	6	lakes and ponds; swimming on lake	NM
MA070	L. D'varagh	17/01/2022	13:52	Mallard	7	lakes and ponds; swimming and calling along reedy fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA071	L. D'varagh	17/01/2022	13:04	Mallard	4	lakes and ponds; flying low across lake	NM
MA072	L. Sheelin	17/01/2022	08:52	Mallard	4	lakes and ponds; calling within reedy margins of lake	NM
MH061	R. Inny	17/01/2022	14:38	Moorhen	3	depositing/lowland rivers; wading along river banks	NM
MH062	L. Sheelin	17/01/2022	08:45	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
MH063	L. D'varagh	17/01/2022	13:53	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH064	L. D'varagh	17/01/2022	13:08	Moorhen	6	lakes and ponds; calling within reedy margins	NM
MH065	L. D'varagh	17/01/2022	13:06	Moorhen	4	lakes and ponds and scrub; calling within flooded wooded margins of lake	NM
MH066	L. D'varagh	17/01/2022	13:14	Moorhen	6	lakes and ponds; calling and wading within reedy margins of lake	NM
MH067	Derragh Lough	17/01/2022	11:21	Moorhen	25	lakes and ponds and reed and large sedge swamps; calling and wading within reedy fringed	NM
	BN2	17/01/2022	16:09	Mute Swan	3	cutover bog; wading on bog wetland	NM
	L. Sheelin	17/01/2022	08:35	Mute Swan	7	lakes and ponds; swimminmg on lake	NM
	L. D'varagh	17/01/2022	13:23	Mute Swan	7	lakes and ponds; swimming within sw corner of lake	NM
	L. Sheelin	17/01/2022	09:56	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	09:45	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	17/01/2022	10:22	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Kinale N	17/01/2022	10:40	Mute Swan	220	lakes and ponds; swimming on lake	NM
	L. Kinale	17/01/2022	10:41	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	17/01/2022	10:56	Mute Swan	12	lakes and ponds; swimming on lake	NM
	Derragh Lough	17/01/2022	11:20	Mute Swan	76	lakes and ponds; swimming on lake	NM
	L. Kinale S	17/01/2022	11:46	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:51	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Bane	17/01/2022	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	12:58	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:15	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:05	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:18	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:30	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:43	Mute Swan	14	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:39	Mute Swan	5	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
	L. Sheelin	17/01/2022	09:53	Mute Swan	17	lakes and ponds; swimming close to s shore	NM
	L. D'varagh	17/01/2022	13:06	Mute Swan	15	scrub and lakes and ponds; swimming and foraging along lake fringes and within edges of flooded woodland	NM
	L. Sheelin	17/01/2022	09:50	Mute Swan	18	lakes and ponds; swimming along n shore	NM
		17/01/2022	13:53	Mute Swan	2	improved agricultural grassland and semi-natural grassland; roosting on edge of flooding	NM
	R. Inny	17/01/2022	14:05	Mute Swan	61	improved agricultural grassland and depositing/lowland rivers; grazing on grassland along river (+5 swimming on river	NM
	R. Inny	17/01/2022	14:00	Mute Swan	14	improved agricultural grassland and depositing/lowland rivers; grazing on grassland adjacent to river (4 swimming on river)	NM
	BN2	17/01/2022	16:40	Mute Swan	2	cutover bog and scrub; flying sw across bog wetland and adjacent cutover bog	NM
		17/01/2022	11:16	Mute Swan	6	lakes and ponds and mixed broadleaved woodland; flying sw	NM
WA012	BN2	17/01/2022	16:46	Water Rail	3	cutover bog; pig calls within bog wetland	NM
WA013	L. Sheelin	17/01/2022	08:41	Water Rail	3	lakes and ponds; pig calls from within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH067		18/01/2022	11:15	Black-headed Gull	28	improved agricultural grassland; swirling and swooping over grassland	NM
BH064	L. Iron	18/01/2022	16:23	Black-headed Gull	6	improved agricultural grassland, semi-natural grassland and scrub; soaring over swollen lake fringes	NM
BH065		18/01/2022	10:18	Black-headed Gull	4	improved agricultural grassland and lakes and ponds; roosting and foraging beside flooded hollow of field	NM
BH066		18/01/2022	10:23	Black-headed Gull	1	improved agricultural grassland and hedgerows; flying across farmland	NM
CA042	L. D'varagh	18/01/2022	13:45	Cormorant	2	lakes and ponds; flying across lake	NM
LG076	L. Iron	18/01/2022	16:00	Little Grebe	17	lakes and ponds; swimming on lake	NM
MA073		18/01/2022	10:31	Mallard	2	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
MA074	L. Iron	18/01/2022	16:00	Mallard	67	lakes and ponds; swimming on lake	NM
		18/01/2022	10:30	Mute Swan	1	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
	L. Iron	18/01/2022	16:00	Mute Swan	34	lakes and ponds; swimming on lake and within swollen edges	NM
BH068	Lough Sheelin west	14/02/2022	11:45	Black-headed Gull	65	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH069	Bracklagh Lough	14/02/2022	12:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH070	Robinstown pond	14/02/2022	14:32	Black-headed Gull	7	lakes and ponds; foraging	KB
CA043	Lough Sheelin west	14/02/2022	11:45	Cormorant	3	lakes and ponds; foraging	KB
GG094	Lough Sheelin west	14/02/2022	11:45	Great Crested Grebe	17	lakes and ponds; foraging	KB
GG095	Bracklagh Lough	14/02/2022	12:20	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG096	Derragh Lough	14/02/2022	13:26	Great Crested Grebe	2	lakes and ponds; foraging	KB
H051	Lough Sheelin west	14/02/2022	11:45	Grey Heron	1	lakes and ponds; foraging	KB
HG001	Lough Sheelin west	14/02/2022	11:45	Herring Gull	1	lakes and ponds; foraging	KB
LG077	Lough Sheelin west	14/02/2022	11:45	Little Grebe	5	lakes and ponds; foraging	KB
LG078	Derragh Lough	14/02/2022	13:26	Little Grebe	4	lakes and ponds; foraging	KB
MA075	Derragh Lough	14/02/2022	13:26	Mallard	1	lakes and ponds; roosting	KB
MA076	Bracklagh Lough	14/02/2022	12:20	Mallard	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA077	Derragh Lough	14/02/2022	13:26	Mallard	2	lakes and ponds; foraging	KB
MH068	Lough Sheelin west	14/02/2022	11:45	Moorhen	2	lakes and ponds; foraging	KB
MH069	Bracklagh Lough	14/02/2022	12:20	Moorhen	3	lakes and ponds; foraging	KB
MH070	Lough Kinale south	14/02/2022	13:40	Moorhen	2	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	12	lakes and ponds; roosting	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	7	lakes and ponds; roosting	KB
	Lough Sheelin east	14/02/2022	10:40	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin centre	14/02/2022	11:00	Mute Swan	1		KB
	Lough Sheelin west	14/02/2022	11:45	Mute Swan	43	lakes and ponds; foraging	KB
	Bracklagh Lough	14/02/2022	12:20	Mute Swan	9	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	89	lakes and ponds; foraging	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	37	lakes and ponds; foraging	KB
	River Inny	14/02/2022	13:35	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	14/02/2022	13:40	Mute Swan	5	lakes and ponds; foraging	KB
SU001	Robinstown pond	14/02/2022	14:32	Shelduck	2	lakes and ponds; foraging	KB
CA044	Lough Derravaragh north	15/02/2022	13:13	Cormorant	2	lakes and ponds; foraging	KB
GG097	Lough Derravaragh south	15/02/2022	12:20	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG098	Lough Derravaragh north	15/02/2022	13:13	Great Crested Grebe	2	lakes and ponds; foraging	KB
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
LG079	Lough Derravaragh south	15/02/2022	12:20	Little Grebe	4	lakes and ponds; foraging	KB
LG080	Lough Derravaragh north	15/02/2022	13:13	Little Grebe	11	lakes and ponds; foraging	KB
MH071	Lough Derravaragh north	15/02/2022	13:13	Moorhen	1	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	4	lakes and ponds; roosting	KB
	Lough Derravaragh north	15/02/2022	13:13	Mute Swan	1		KB
	Lough Iron	15/02/2022	09:40	Mute Swan	12	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	15/02/2022	11:47	Mute Swan	8	watercourses and lakes and ponds; foraging	KB
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	24	lakes and ponds; foraging	KB
	River Inny and lake off Lough Derravaragh	15/02/2022	12:50	Mute Swan	4	lakes and ponds; foraging	KB
	Clonave, river Inny	15/02/2022	12:56	Mute Swan	19	improved agricultural grassland and watercourses; foraging	KB
	River Inny	15/02/2022	12:58	Mute Swan	4	improved agricultural grassland and watercourses; foraging	KB
	Derrycrave	15/02/2022	15:30	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
BH071	Bracklagh Lough	26/02/2022	09:00	Black-headed Gull	108	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH072	Lough Sheelin west	26/02/2022	09:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH073	Lough Kinale	26/02/2022	10:26	Black-headed Gull	56	lakes and ponds; foraging	KB
CA045	Lough Sheelin west	26/02/2022	09:20	Cormorant	2	lakes and ponds; foraging	KB
CA046	Lough Sheelin east	26/02/2022	10:14	Cormorant	1	lakes and ponds; foraging	KB
GG099	Bracklagh Lough	26/02/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG100	Lough Sheelin west	26/02/2022	09:20	Great Crested Grebe	22	lakes and ponds; foraging	KB
GG101	Lough Sheelin centre	26/02/2022	09:53	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG102	Lough Kinale	26/02/2022	10:26	Great Crested Grebe	9	lakes and ponds; foraging	KB
GG103	Derragh Lough	26/02/2022	11:04	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG104	Lough Kinale south	26/02/2022	11:28	Great Crested Grebe	1	lakes and ponds; foraging	KB
H052	Lough Sheelin west	26/02/2022	09:20	Grey Heron	2	lakes and ponds; foraging	KB
H053	Lough Kinale	26/02/2022	10:26	Grey Heron	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H054	Derragh Lough	26/02/2022	11:04	Grey Heron	3	lakes and ponds; foraging	KB
LG081	Lough Sheelin west	26/02/2022	09:20	Little Grebe	8	lakes and ponds; foraging	KB
LG082	Derragh Lough	26/02/2022	11:04	Little Grebe	4	lakes and ponds; foraging	KB
MA078	Derragh Lough	26/02/2022	11:04	Mallard	5	lakes and ponds; foraging	KB
MA079	Derrycrave	26/02/2022	13:28	Mallard	5	lakes and ponds and cutover bog; foraging	KB
MH072	Derragh Lough	26/02/2022	11:04	Moorhen	1	lakes and ponds; foraging	KB
MH073	Lough Kinale south	26/02/2022	11:28	Moorhen	1	lakes and ponds; foraging	KB
	Bracklagh Lough	26/02/2022	09:00	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin west	26/02/2022	09:20	Mute Swan	19	lakes and ponds; foraging	KB
	Lough Sheelin centre	26/02/2022	09:53	Mute Swan	5	lakes and ponds; foraging	KB
	Lough Kinale	26/02/2022	10:26	Mute Swan	218	lakes and ponds; foraging	KB
	Derragh Lough	26/02/2022	11:04	Mute Swan	35	lakes and ponds; foraging	KB
	Inny River	26/02/2022	11:22	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	26/02/2022	11:28	Mute Swan	8	lakes and ponds; foraging	KB
	Flooded cutaway bog on site	26/02/2022	12:58	Mute Swan	2	cutover bog; foraging	KB
	Derrycrave	26/02/2022	13:28	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
SU002	Robinstown pond	26/02/2022	13:42	Shelduck	2	lakes and ponds; foraging	KB
BH074	Lough Derravaragh south	28/02/2022	11:45	Black-headed Gull	28	lakes and ponds; foraging	KB
BH075	lake off Lough Derravaragh	28/02/2022	12:28	Black-headed Gull	8	lakes and ponds; foraging	KB
BH076	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Black-headed Gull	3	lakes and ponds and watercourses; foraging	KB
GG105	Lough Derravaragh south	28/02/2022	11:45	Great Crested Grebe	10	lakes and ponds; foraging	KB
GG106	lake off Lough Derravaragh	28/02/2022	12:28	Great Crested Grebe	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG107	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Great Crested Grebe	3	lakes and ponds and watercourses; foraging	KB
LG083	Lough Derravaragh south	28/02/2022	11:45	Little Grebe	6	lakes and ponds; foraging	KB
LG084	Lough Derravaragh north	28/02/2022	13:31	Little Grebe	3	lakes and ponds; foraging	KB
MH074	lake off Lough Derravaragh	28/02/2022	12:28	Moorhen	2	lakes and ponds; foraging	KB
MH075	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Moorhen	2	lakes and ponds and watercourses; foraging	KB
MH076	River Inny	28/02/2022	14:00	Moorhen	2	watercourses; foraging	KB
	Lough Derravaragh south	28/02/2022	11:45	Mute Swan	11	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	28/02/2022	12:28	Mute Swan	5	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava island	28/02/2022	13:13	Mute Swan	36	improved agricultural grassland and watercourses; foraging	KB
	Clonava island	28/02/2022	13:21	Mute Swan	14	improved agricultural grassland and watercourses; foraging	KB
	Lough Derravaragh north	28/02/2022	13:31	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Iron - piercefield fields	28/02/2022	15:20	Mute Swan	3	improved agricultural grassland; foraging	KB
BH077	Brackagh Lough	07/03/2022	09:00	Black-headed Gull	12	lakes and ponds; foraging	KB
BH078	Lough Kinale	07/03/2022	10:20	Black-headed Gull	8	lakes and ponds; foraging	KB
CA047	Lough Sheelin west	07/03/2022	09:16	Cormorant	8	lakes and ponds; roosting	KB
GG108	Brackagh Lough	07/03/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG109	Lough Sheelin west	07/03/2022	09:16	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG110	Lough Kinale	07/03/2022	10:20	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG111	Derragh Lough	07/03/2022	10:51	Great Crested Grebe	3	lakes and ponds; foraging	KB
LG085	Brackagh Lough	07/03/2022	09:00	Little Grebe	6	lakes and ponds; foraging	KB
LG086	Lough Sheelin west	07/03/2022	09:16	Little Grebe	4	lakes and ponds; foraging	KB
LG087	Derragh Lough	07/03/2022	10:51	Little Grebe	4	lakes and ponds; foraging	KB
LG088	Lough Kinale south	07/03/2022	11:08	Little Grebe	1	lakes and ponds; foraging	KB
LG089	Robinstown pond	07/03/2022	12:39	Little Grebe	2	lakes and ponds; foraging	KB
MH077	Brackagh Lough	07/03/2022	09:00	Moorhen	4	lakes and ponds; foraging	KB
MH078	Lough Sheelin west	07/03/2022	09:16	Moorhen	2	lakes and ponds; foraging	KB
MH079	Derragh Lough	07/03/2022	10:51	Moorhen	2	lakes and ponds; foraging	KB
MH080	Robinstown flooded fields	07/03/2022	12:50	Moorhen	2	wet grassland; foraging	KB
	Brackagh Lough	07/03/2022	09:00	Mute Swan	2	lakes and ponds; roosting	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	5	lakes and ponds; roosting	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Brackagh Lough	07/03/2022	09:00	Mute Swan	16	lakes and ponds; foraging	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	23	lakes and ponds; foraging	KB
	Lough Sheelin centre	07/03/2022	19:42	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin east	07/03/2022	10:05	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	07/03/2022	10:20	Mute Swan	42	lakes and ponds; foraging	KB
	Derragh Lough	07/03/2022	10:51	Mute Swan	31	lakes and ponds; foraging	KB
	Lough Kinale south	07/03/2022	11:08	Mute Swan	4	lakes and ponds; foraging	KB
	Robinstown pond	07/03/2022	12:39	Mute Swan	1	lakes and ponds; foraging	KB
	Robinstown flooded fields	07/03/2022	12:50	Mute Swan	2	wet grassland; foraging	KB
BH079	Lough Derravaragh south	08/03/2022	12:01	Black-headed Gull	33	lakes and ponds; foraging	KB
BH080	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	143	improved agricultural grassland; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH081	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	61	lakes and ponds; foraging	KB
CM006	Lough Derravaragh south	08/03/2022	12:01	Common Gull	1	lakes and ponds; foraging	KB
GG112	Lough Derravaragh south	08/03/2022	12:01	Great Crested Grebe	13	lakes and ponds; foraging	KB
GG113	Lake off Lough Derravaragh	08/03/2022	12:37	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG114	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Great Crested Grebe	4	lakes and ponds and watercourses; foraging	KB
GG115	Lough Derravaragh north	08/03/2022	13:32	Great Crested Grebe	2	lakes and ponds; foraging	KB
LG090	Lough Derravaragh south	08/03/2022	12:01	Little Grebe	4	lakes and ponds; foraging	KB
LG091	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Little Grebe	2	lakes and ponds and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA080	Lake off Lough Derravaragh	08/03/2022	12:37	Mallard	7	lakes and ponds; foraging	KB
MA081	Lough Derravaragh north	08/03/2022	13:32	Mallard	20	lakes and ponds; foraging	KB
MA082	Lough Bane	08/03/2022	15:30	Mallard	2	lakes and ponds; foraging	KB
MA083	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mallard	1	lakes and ponds; foraging	KB
	Lough Derravaragh south	08/03/2022	12:01	Mute Swan	8	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	2	improved agricultural grassland; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	4	lakes and ponds; foraging	KB
	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava	08/03/2022	13:22	Mute Swan	38	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny	08/03/2022	13:24	Mute Swan	17	watercourses; foraging	KB
	Lough Derravaragh north	08/03/2022	13:32	Mute Swan	5	lakes and ponds; foraging	KB
	Flooded bog on site	08/03/2022	15:24	Mute Swan	1	cutover bog; foraging	KB
	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mute Swan	2	lakes and ponds; foraging	KB
BH082	Brackagh Lough	31/03/2022	08:00	Black-headed Gull	3	lakes and ponds; foraging	KB
BH083	Lough Sheelin west	31/03/2022	08:20	Black-headed Gull	32	lakes and ponds; foraging	KB
BH084	Derragh Lough	31/03/2022	09:32	Black-headed Gull	2	lakes and ponds; foraging	KB
BH086	Lough Derravaragh south	31/03/2022	15:27	Black-headed Gull	16	lakes and ponds; foraging	KB
BH085	River Inny	31/03/2022	10:24	Black-headed Gull	3	watercourses and cutover bog; flying over	KB
GG116	Lough Sheelin west	31/03/2022	08:20	Great Crested Grebe	15	lakes and ponds; foraging	KB
GG117	Lough Kinale	31/03/2022	09:07	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG118	Derragh Lough	31/03/2022	09:32	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG119	Lough Kinale south	31/03/2022	09:50	Great Crested Grebe	1	lakes and ponds; foraging	KB
GG120	Lough Derravaragh north	31/03/2022	13:41	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG121	Lake off Lough Derravaragh	31/03/2022	15:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG122	Lough Derravaragh south	31/03/2022	15:27	Great Crested Grebe	13	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB
H055	Lough Sheelin west	31/03/2022	08:20	Grey Heron	1	lakes and ponds; foraging	KB
H056	Derragh Lough	31/03/2022	09:32	Grey Heron	1	lakes and ponds; foraging	KB
LG092	Derragh Lough	31/03/2022	09:32	Little Grebe	2	lakes and ponds; foraging	KB
LG093	Lough Kinale south	31/03/2022	09:50	Little Grebe	1	lakes and ponds; foraging	KB
LG094	Lough Derravaragh north	31/03/2022	13:41	Little Grebe	3	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG095	Lough Derravaragh south	31/03/2022	15:27	Little Grebe	1	lakes and ponds; foraging	KB
MA084	Brackagh Lough	31/03/2022	08:00	Mallard	2	lakes and ponds; foraging	KB
MA085	Lough Kinale	31/03/2022	09:07	Mallard	2	lakes and ponds; foraging	KB
MA086	Derragh Lough	31/03/2022	09:32	Mallard	3	lakes and ponds; foraging	KB
MA087	Flooded bog on site	31/03/2022	11:20	Mallard	1	cutover bog; foraging	KB
MA088	Lough Bane	31/03/2022	11:25	Mallard	1	lakes and ponds; foraging	KB
MA089	Lough Derravaragh north	31/03/2022	13:41	Mallard	10	lakes and ponds; foraging	KB
MA090	Lake off Lough Derravaragh	31/03/2022	15:00	Mallard	4	lakes and ponds; foraging	KB
MA091	Lough Derravaragh south	31/03/2022	15:27	Mallard	6	lakes and ponds; foraging	KB
MH081	Lough Sheelin east	31/03/2022	08:45	Moorhen	1	lakes and ponds; foraging	KB
MH082	River Inny	31/03/2022	09:40	Moorhen	1	watercourses; foraging	KB
MH083	Robinstown flooded fields	31/03/2022	13:16	Moorhen	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH084	Lough Derravaragh north	31/03/2022	13:41	Moorhen	2	lakes and ponds; foraging	KB
	Brackagh Lough	31/03/2022	08:00	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin west	31/03/2022	08:20	Mute Swan	11	lakes and ponds; foraging	KB
	Lough Sheelin centre	31/03/2022	08:32	Mute Swan	21	lakes and ponds; foraging	KB
	Lough Sheelin east	31/03/2022	08:45	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	31/03/2022	09:07	Mute Swan	214	lakes and ponds; foraging	KB
	Derragh Lough	31/03/2022	09:32	Mute Swan	34	lakes and ponds; foraging	KB
	Lough Kinale south	31/03/2022	09:50	Mute Swan	7	lakes and ponds; foraging	KB
	Flooded bog on site	31/03/2022	11:20	Mute Swan	1	cutover bog; foraging	KB
	Lough Bane	31/03/2022	11:25	Mute Swan	1	lakes and ponds; foraging	KB
	Lough Derravaragh north	31/03/2022	13:41	Mute Swan	11	lakes and ponds; foraging	KB
	River Inny	31/03/2022	14:02	Mute Swan	7	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Mute Swan	5	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	31/03/2022	15:00	Mute Swan	3	lakes and ponds; foraging	KB
	Lough Derravaragh south	31/03/2022	15:27	Mute Swan	32	lakes and ponds; foraging	KB
SU003	Robinstown pond	31/03/2022	13:10	Shelduck	2	lakes and ponds; foraging	KB

Table 1-67 Incidental Non-target Species Observations

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Walkover Survey, onsite	07/04/2021	08:21	Hare	1	mixed broadleaved/conifer woodland; feeding	PM
	Breeding Walkover Survey, 500m survey radius	07/04/2021	09:21	Hare	1	cutover bog; walking	PM
	Breeding Raptor Survey, rvp6	29/04/2021	13:21	Mallard	1	wet grassland; travelling	PM
	Breeding Raptor Survey, rvp6	29/04/2021	14:35	Mallard	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:06	Black-Headed Gull	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:41	Grey Heron	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2	30/04/2021	08:16	Mallard	1	improved agricultural grassland and short rotation coppice; travelling; landed	PM
	Breeding Raptor Survey, rvp1	30/04/2021	12:45	Mallard	2	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:29	Ringed Plover	2	cutover bog; landed and began territorial behaviour, either m&f displaying or 2m posturing	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Black-Headed Gull	1	improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:23	Black-Headed Gull	3	cutover bog; travelling; landed	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Grey Heron	1	cutover bog; flew and landed on bog	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:47	Grey Heron	1	depositing/lowland rivers and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Mallard	3	cutover bog; one flew and landed beside pair	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:50	Mallard	3	cutover bog; flew in to join other ma	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:03	Moorhen	1	cutover bog; feeding	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Mute Swan	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:01	Ringed Plover	1	cutover bog; flying; landedand began feeding	PM
	Breeding Walkover Survey, on site	14/05/2021	08:27	Hare	1	cutover bog; running	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Walkover Survey, on site	14/05/2021	05:53	Red Fox	1	improved agricultural grassland; carrying prey (chicken)	PM
	Breeding Walkover Survey, on site	14/05/2021	07:23	Red Squirrel	1	conifer plantation; ran across track	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:12	Grey Heron	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:48	Grey Heron	1	mixed broadleaved/conifer woodland; travelling	PM
	Vantage Point Survey, vp4	21/05/2021	06:37	Hare	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	19:21	Black-Headed Gull	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	18:02	Grey Heron	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:10	Black-Headed Gull	3	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Grey Heron	1	cutover bog; circling before landing	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:30	Irish Hare	1	cutover bog; travelling	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	03/06/2021	18:09	Mallard	5	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:18	Mallard	20	conifer plantation and cutover bog; coming into roost, all males	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:24	Mallard	43	cutover bog; flying to other lake	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Ringed Plover	1	cutover bog; preening	PM
	Breeding Raptor Survey, rvp6	04/06/2021	19:26	Grey Heron	1	depositing/lowland rivers; travelling	PM
	Breeding Raptor Survey, rvp6	04/06/2021	18:47	Mallard	1	cutover bog; travelling, male	PM
	Breeding Woodcock Survey, t3 coole	04/06/2021	21:45	Mink	1	conifer plantation; travelling	TRea
	Breeding Raptor Survey, rvp2	28/06/2021	21:10	Black-Headed Gull	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:10	Black-Headed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:56	Black-Headed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling, juvenile	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:23	Great Spotted Woodpecker	1	conifer plantation; on tree	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp2	28/06/2021	19:52	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	20:24	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, coole brvp5	13/07/2021	14:20	Pine Martin	1	bogs and highly modified/non-native woodland; travelling	TRea
	Breeding Raptor Survey, rvp1 coole	19/07/2021	10:29	Meadow Pipit	2	bogs; display	TRea
	Breeding Walkover Survey, 500m survey radius	23/07/2021	08:01	Irish Hare	1	cutover bog; travelling	PM
	Vantage Point Survey, coole vp6	19/08/2021	15:44	Meadow Pipit	6	cutover bog; flying, calling, present through duration of survey	TRea
GL001	Wildfowl Distribution Survey, r. inny	12/10/2021	15:04	Grey Wagtail	1	depositing/lowland rivers; flying along river	NM
GL002	Wildfowl Distribution Survey,	23/11/2021	13:12	Grey Wagtail	2	depositing/lowland rivers and hedgerows; flitting under bridge	NM
RE001	Vantage Point Survey, clonrobert	25/01/2022	14:07	Redwing	1	improved agricultural grassland and treelines; flying	ZE

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	Vantage Point Survey, coole vp6	08/03/2022	13:13	Mallard	2	cutover bog; flying, 2 ma seen flying in route to site	NS

APPENDIX 3

CONFIDENTIAL DATA

This data has been removed from the public files for confidentiality reasons in the interest of the protected species

APPENDIX 4

FIGURES

Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

N

Drawing Title	
Vantage Point Locations	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 1
Scale: 1:25000	Date: 05/07/2022

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Website: www.mkoireland.ie

Map Legend

Wind Farm Site

Vantage Point Locations

N

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Drawing Title	
Viewshed analysis (20m swept Height)	
Project Title	
Coole Wind Farm	
Drawn By: IH	Checked By: PC
Project No.: 200445g	Drawing No.: Fig. 1.A
Scale: 1:48707	Date: 27.10.2022

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Map Legend

Wind Farm Site

Vantage Point Locations

N

Drawing Title Viewshed analysis (25m swept Height)	
Project Title Coole Wind Farm	
Drawn By IH	Checked By PC
Project No. 200445g	Drawing No. Fig. 1.B
Scale 1:48707	Date 27.10.2022

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Map Legend

Wind Farm Site

Vantage Point Locations

Drawing Title: Viewshed analysis (26m Swept Height)	
Project Title: Coole Wind Farm	
Drawn By: IH	Checked By: PC
Project No.: 200445g	Drawing No.: Fig. 1.C
Scale: 1:48707	Date: 27.10.2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Vantage Point Location

Flightline

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N

Drawing Title

Golden Plover Observations. Vantage Point Surveys

Project Title

Coole Wind Farm

Drawn By	Checked By
P. Manley	P. Cregg
Project No. 200445g	Drawing No. Fig. 1.1
Scale 1:45000	Date 05/07/2022

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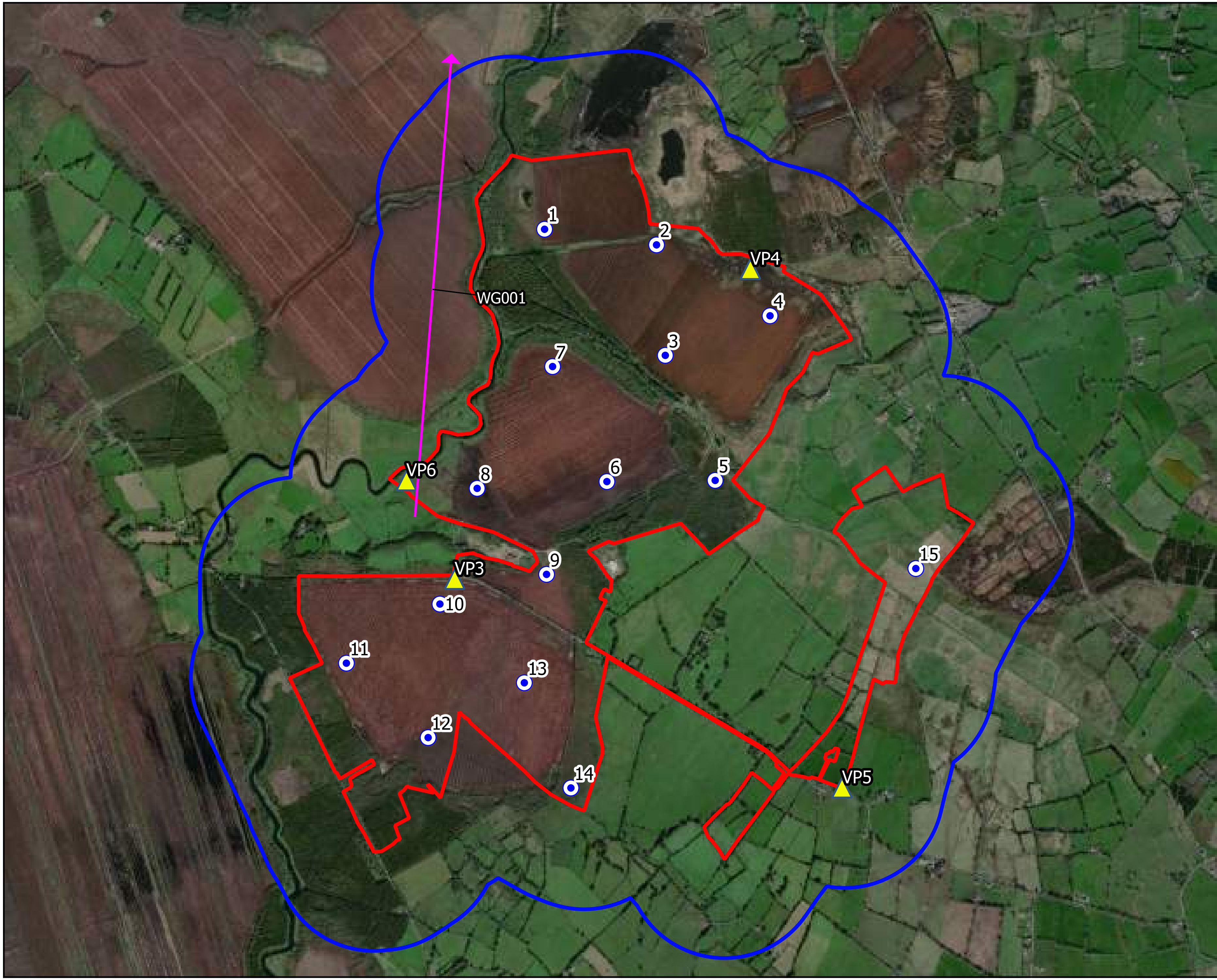

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: White-fronted Goose Obs. Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.2
Scale: 1:25000	Date: 05/07/2022

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Drawing Title
Hen Harrier Observations Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No. 200445g	Drawing No. Fig. 1.3
Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline
- Non-flight observations

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Drawing Title: Kingfisher Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.4
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

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Drawing Title	Merlin Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 1.5
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: Peregrine Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.6
Scale: 1:25000	Date: 05/07/2022

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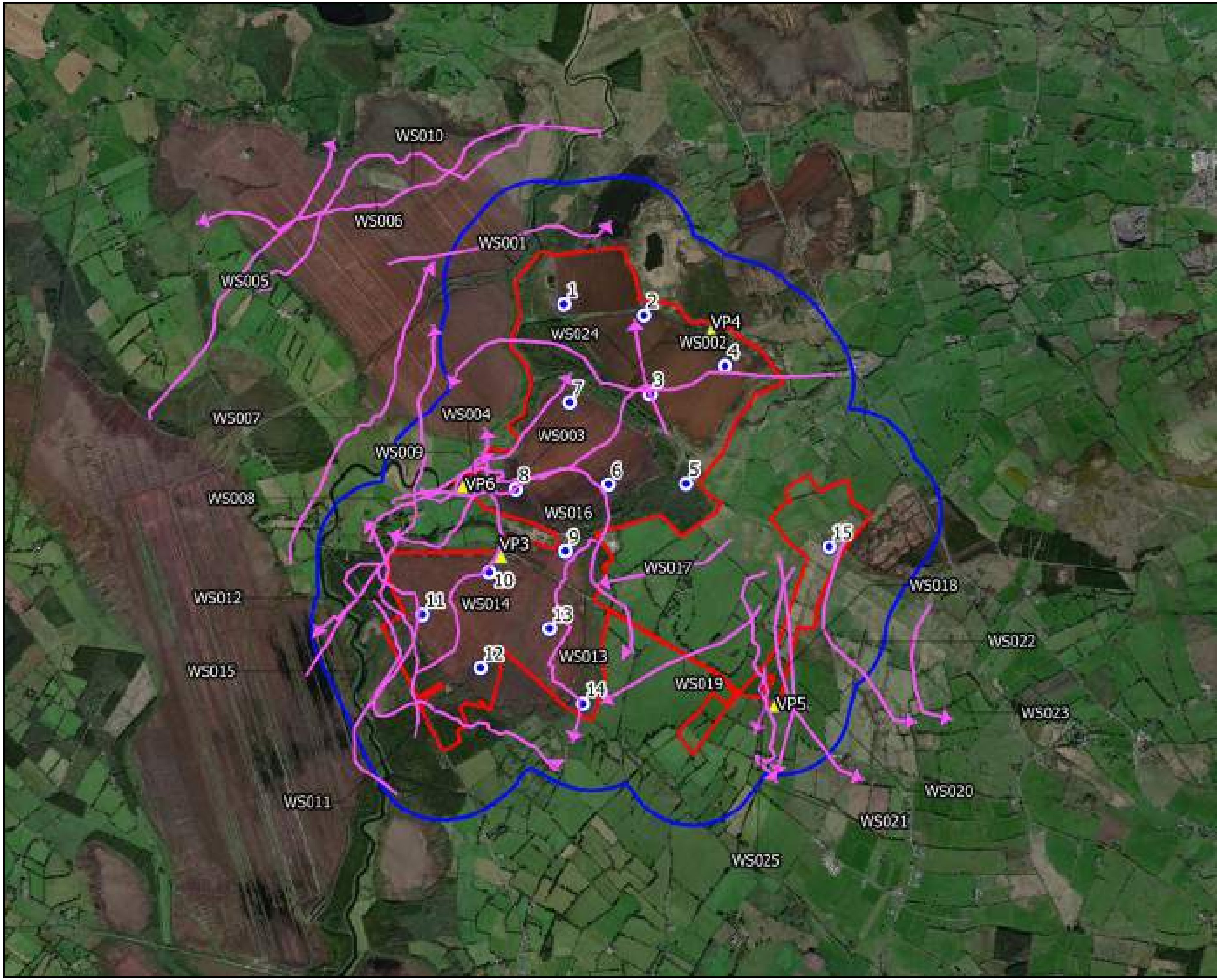

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: Whooper Swan Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.7
Scale: 1:35000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

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Drawing Title: Coot Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.8
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: Curlew Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.9
Scale: 1:25000	Date: 05/07/2022

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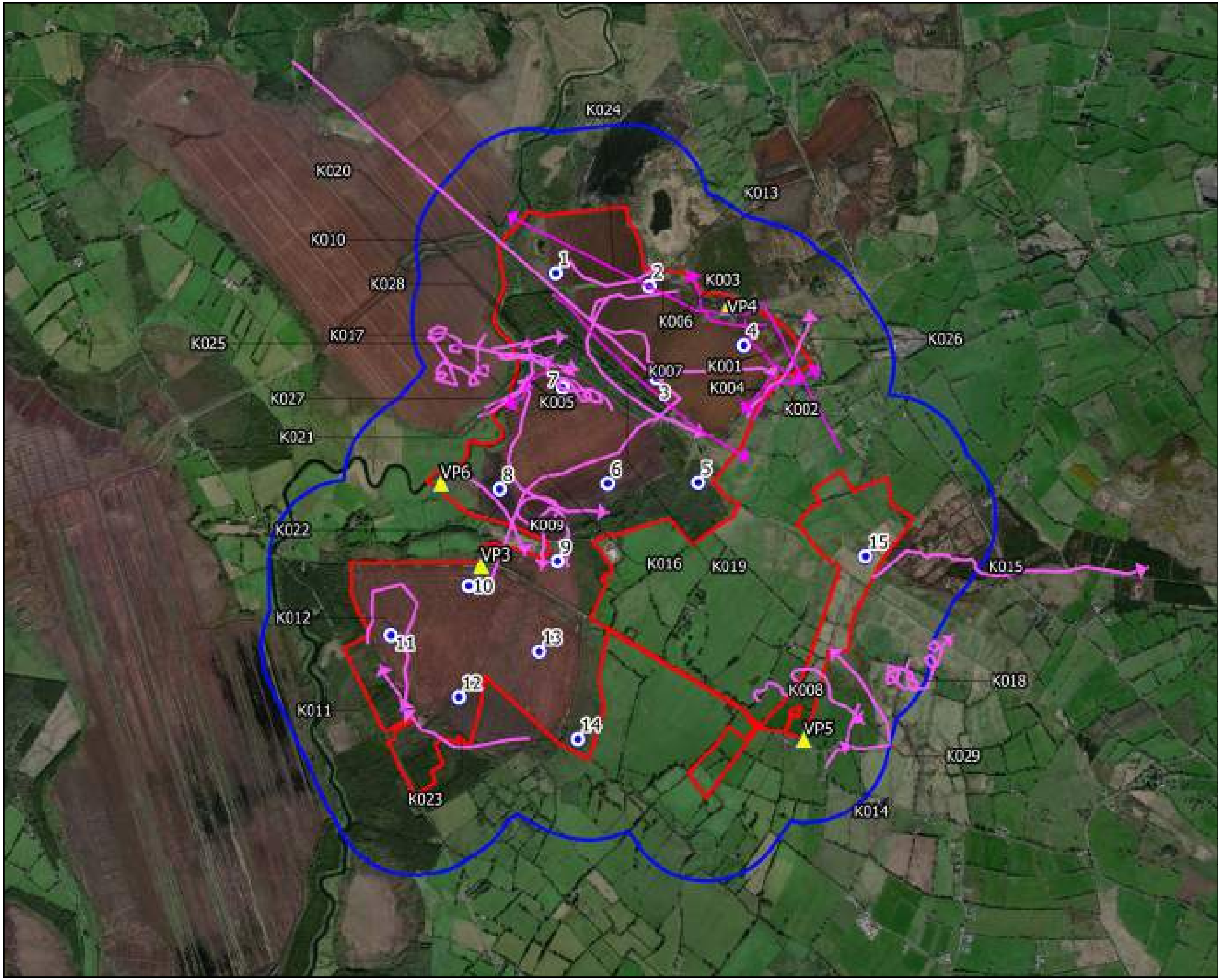

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title	
Kestrel Observations Vantage Point Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I. Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.10
Scale: 1:30000	Date: 05/07/2022

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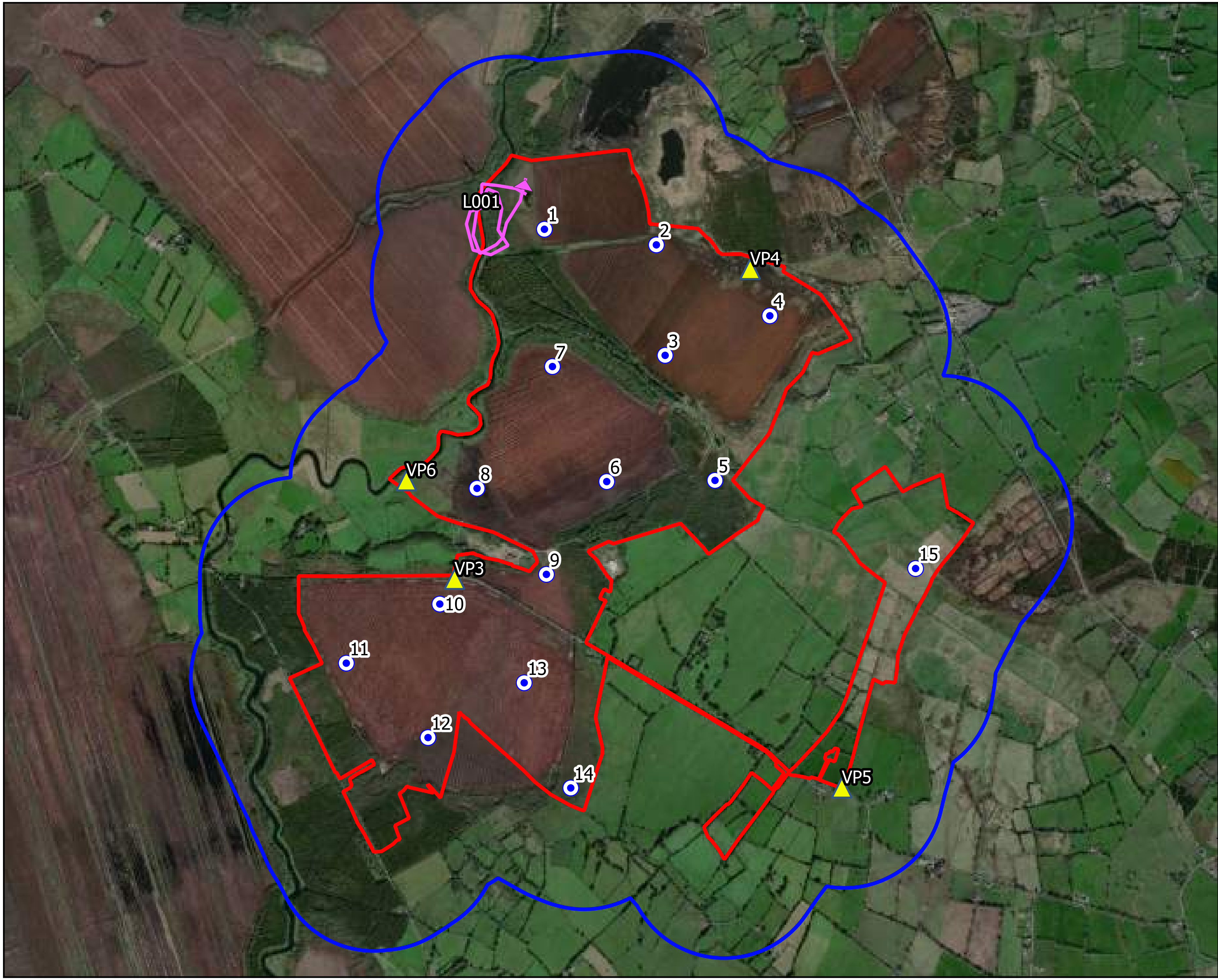

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title	Lapwing Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I. Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.11
Scale: 1:25000	Date: 05/07/2022

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Map Legend
- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline
- Non-flight observations

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Drawing Title
Snipe Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I. hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 1.12
Scale 1:25000	Date 05/07/2022

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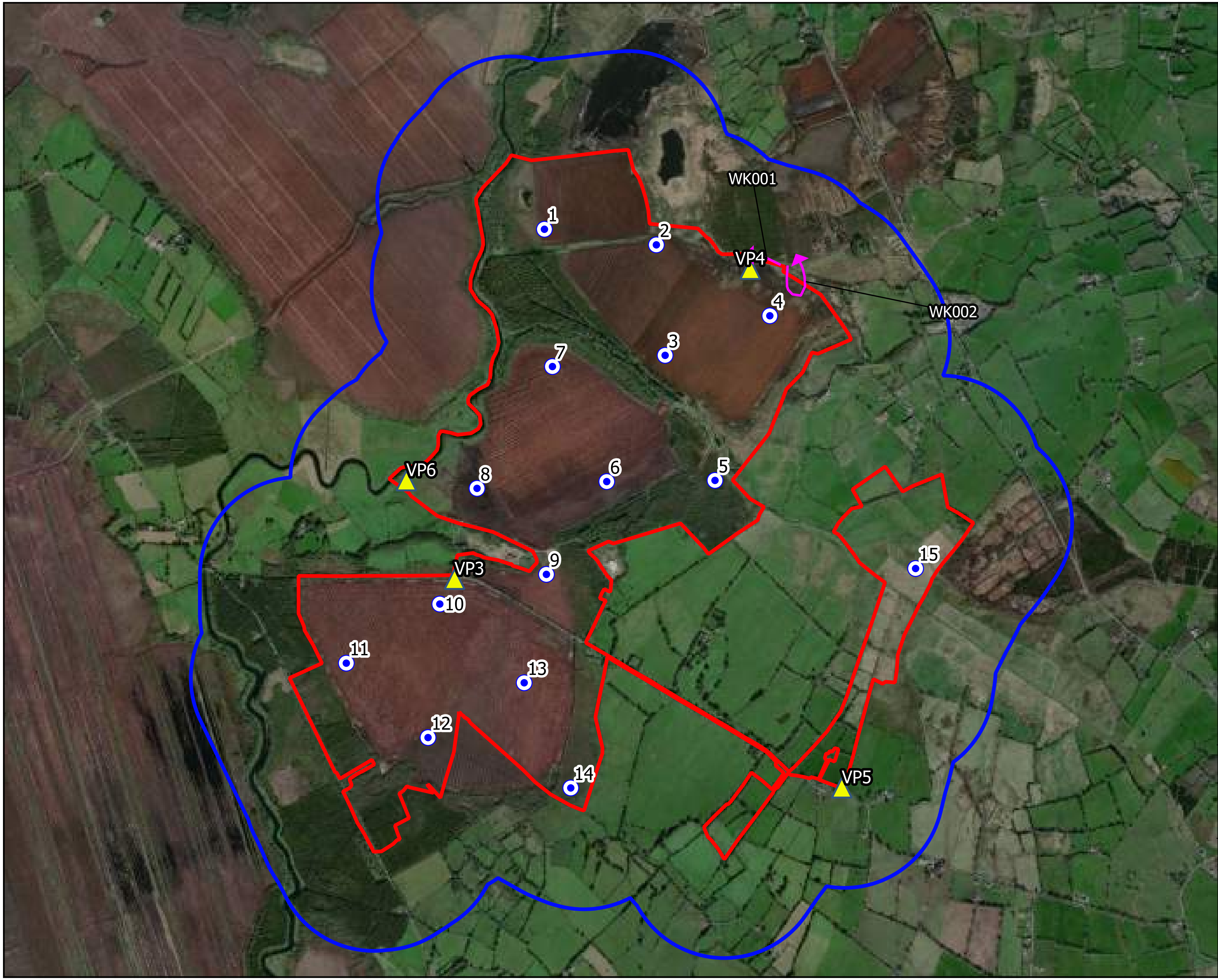

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title: Woodcock Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I. Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.13
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title	Buzzard Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.14
Scale: 1:45000	Date: 05/07/2022

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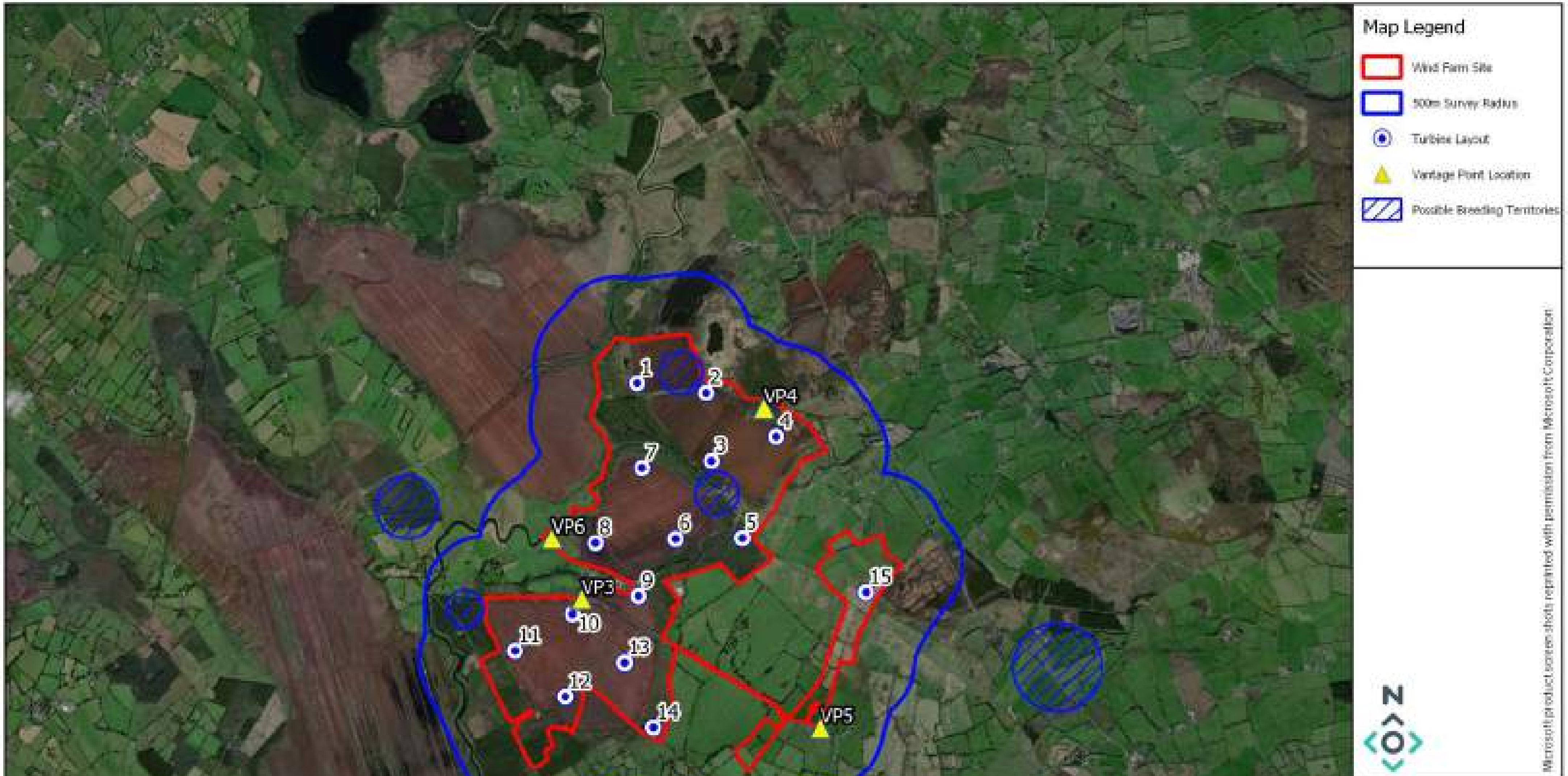

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Drawing Title	
Buzzard Breeding Territories Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 1.14.1
Scale: 1:45000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

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Drawing Title: Sparrowhawk Observations Vantage Point Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.15
Scale: 1:25000	Date: 05/07/2022

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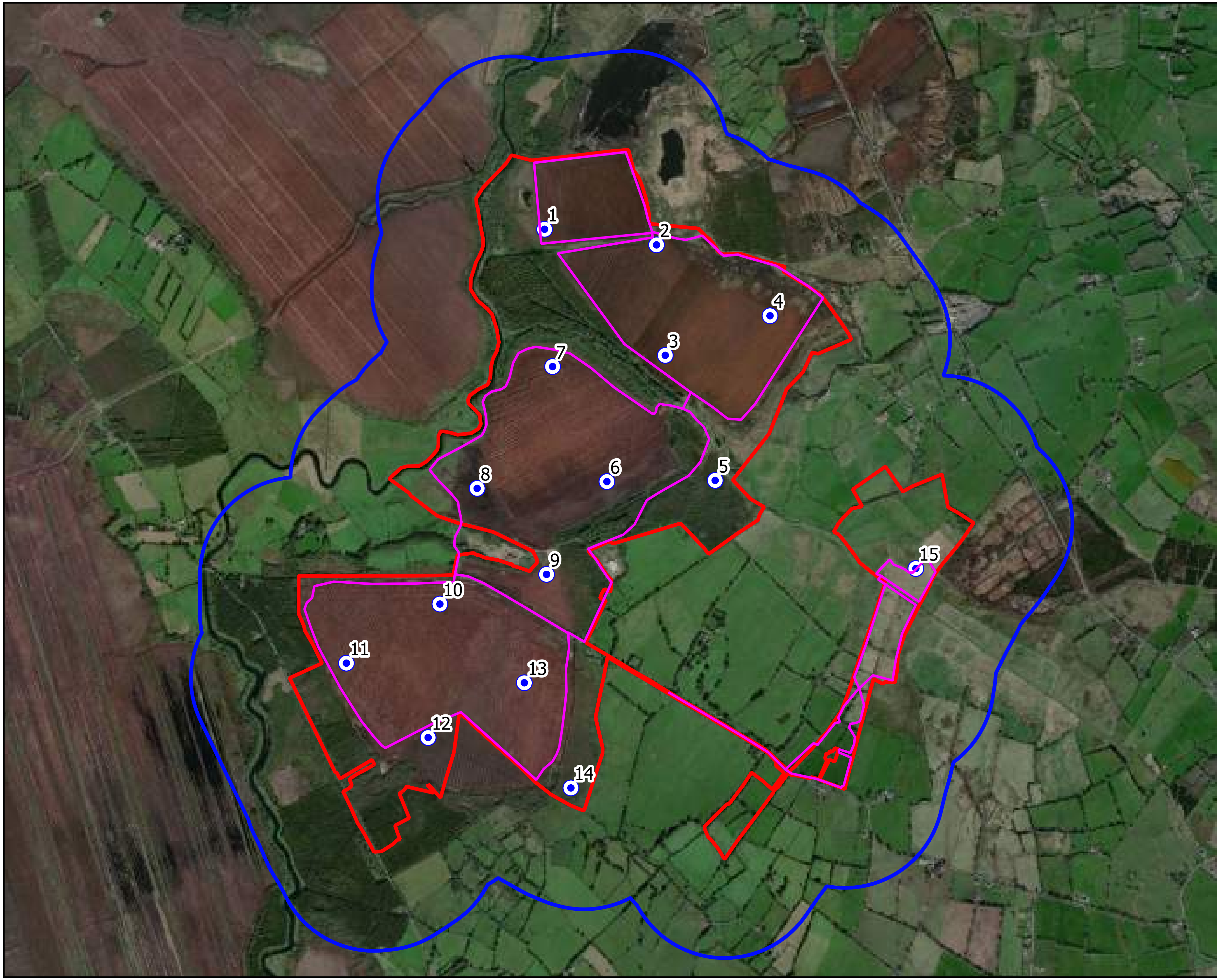

Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Walkover Transects

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N

Drawing Title
Breeding Walkover Transects

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No. 200445g	Drawing No. Fig. 2
Scale 1:25000	Date 05/07/2022

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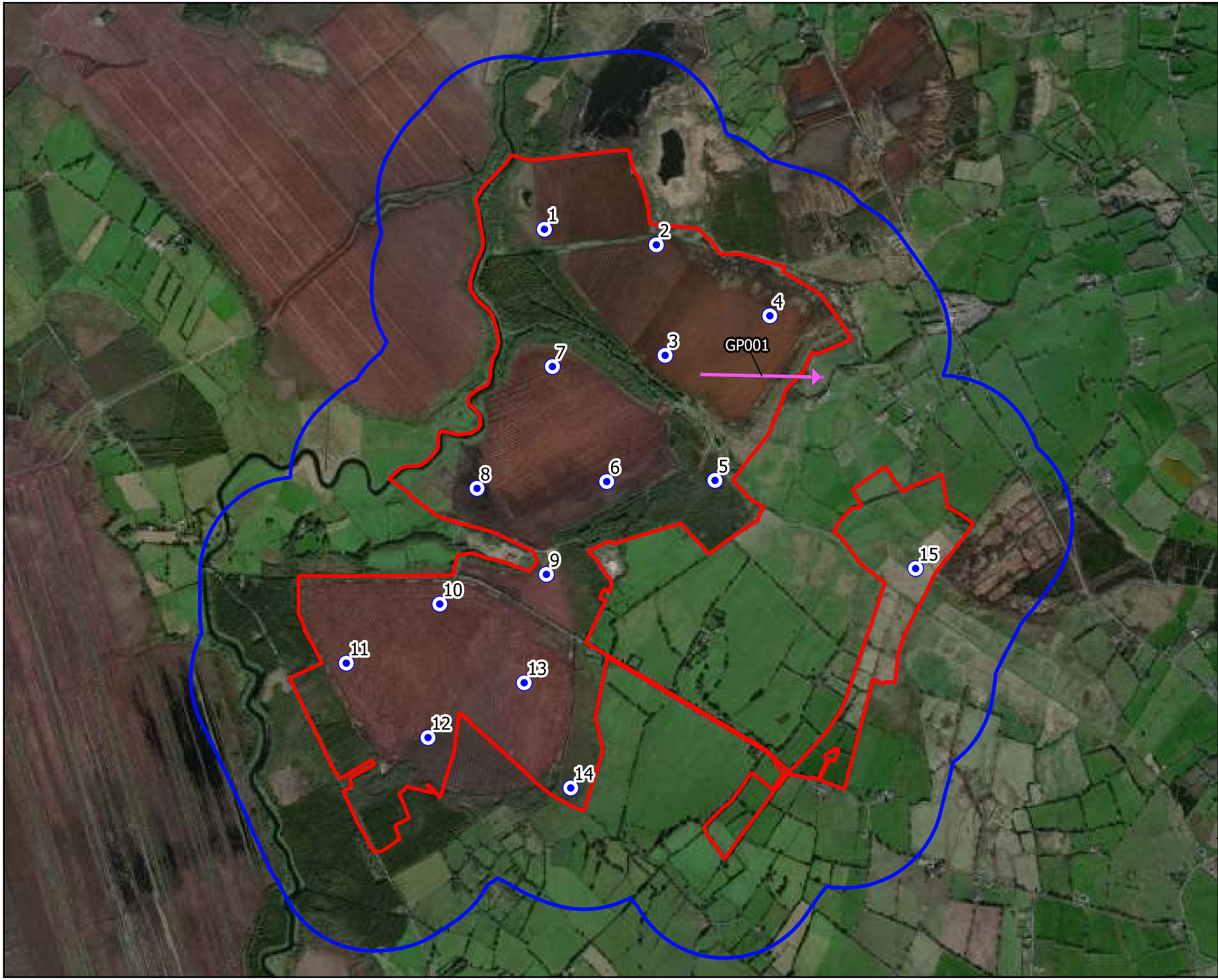

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title	Golden Plover Observations Breeding Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 2.1
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title Snipe Observations Breeding Walkover Surveys	
Project Title Coole Wind Farm	
Drawn By I.Hynes	Checked By P. Cregg
Project No. 200445g	Drawing No. Fig. 2.3
Scale 1:45000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Probable Territory

N

Drawing Title	
Snipe Breeding Territories	
Project Title	
Coole Wind Farm	
Drawn By: P. Manley	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 6.2
Scale: 1:45000	Date: 05/07/2022

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Drawing Title
Buzzard Observations
Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 2.4
Scale 1:45000	Date 05/07/2022

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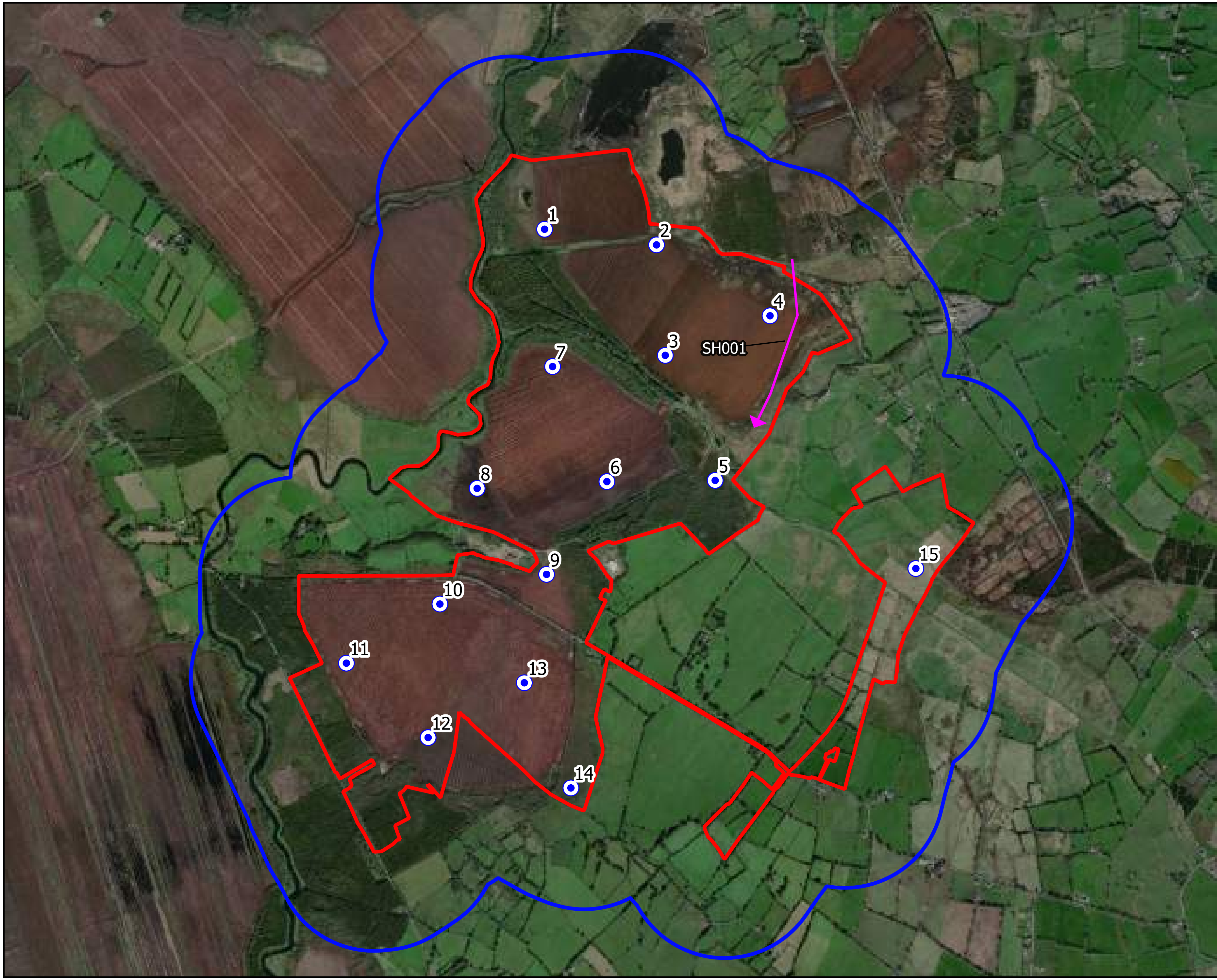

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title
Sparrowhawk Observations Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 2.5
Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Confirmed Territory

N

Drawing Title Sparrowhawk Breeding Territory	
Project Title Coole Wind Farm	
Drawn By I.Hynes	Checked By P. Cregg
Project No. 200445g	Drawing No. Fig. 2.5.1
Scale 1:25000	Date 05/07/2022

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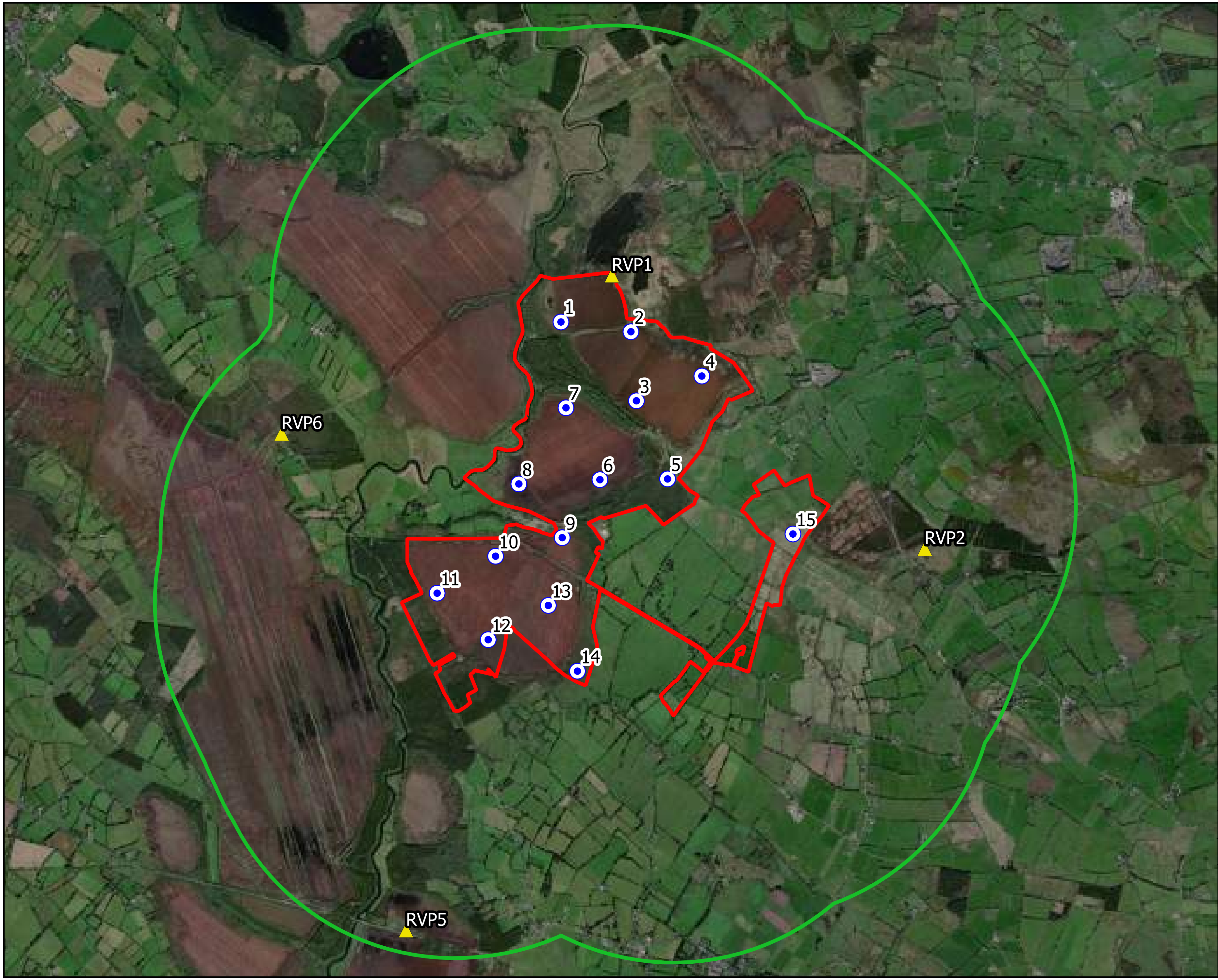

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations

N

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Drawing Title Breeding Raptor Vantage Point Locations	
Project Title Coole Wind Farm	
Drawn By I.Hynes	Checked By P. Cregg
Project No. 200445g	Drawing No. Fig. 3
Scale 1:40000	Date 05/07/2022

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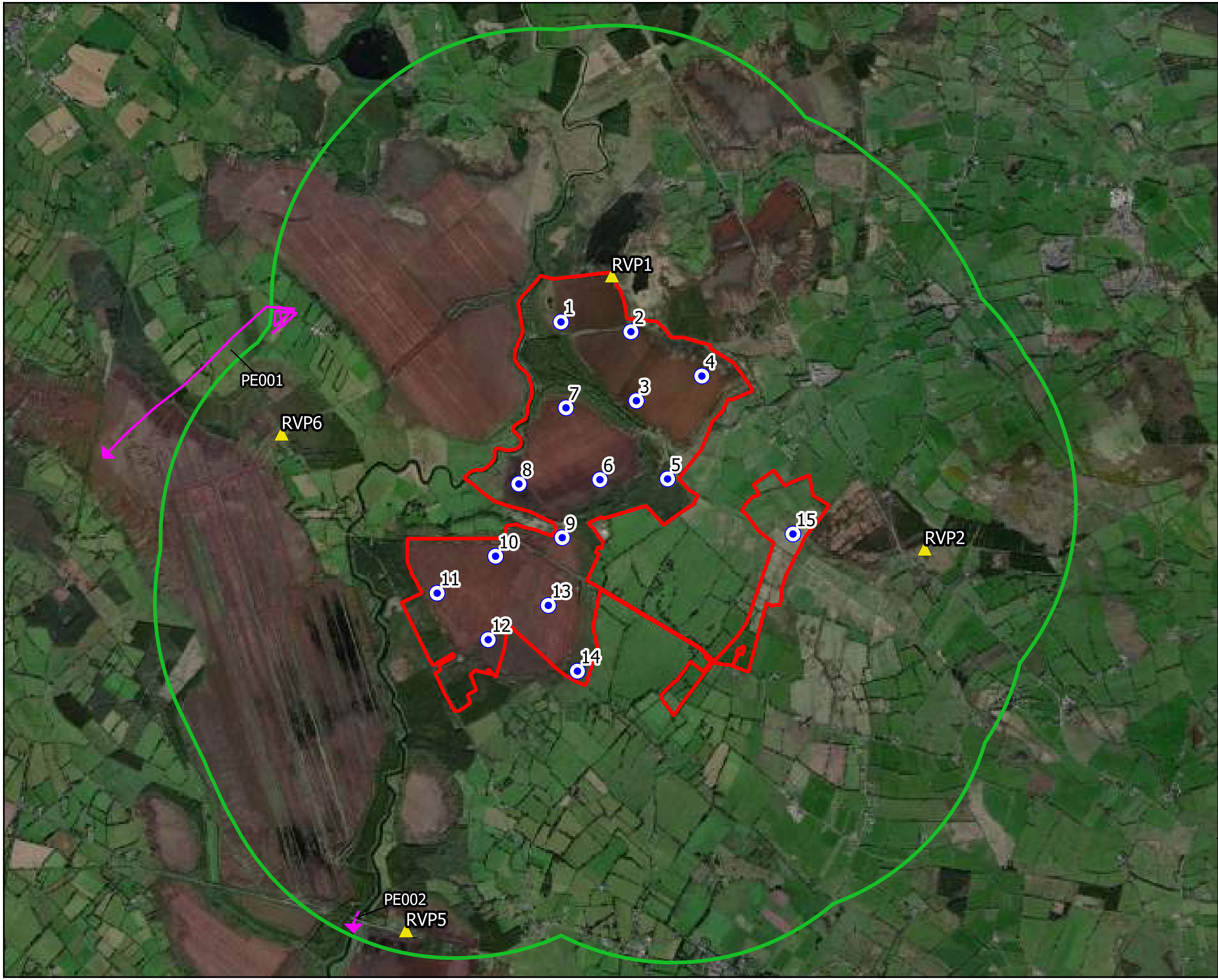

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

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Drawing Title	Peregrine Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.1
Scale: 1:40000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title: White-tailed Eagle Obs. Breeding Raptor Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.2
Scale: 1:40000	Date: 05/07/2022

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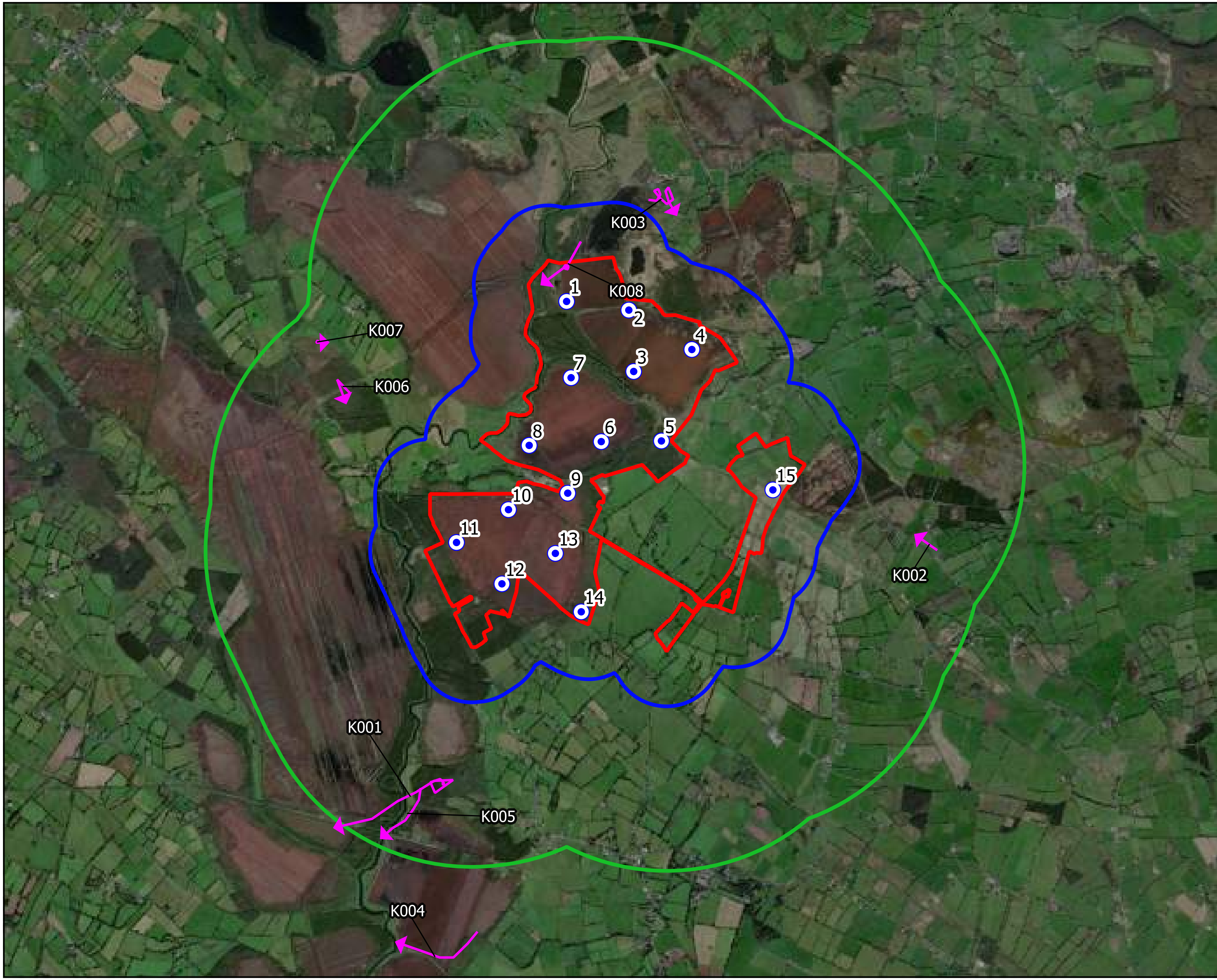

Map Legend

Wind Farm Site
2km Survey Radius
Turbine Layout
Breeding Raptor Vantage Point Locations
Flightline

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Drawing Title	Kestrel Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.3
Scale: 1:45000	Date: 05/07/2022

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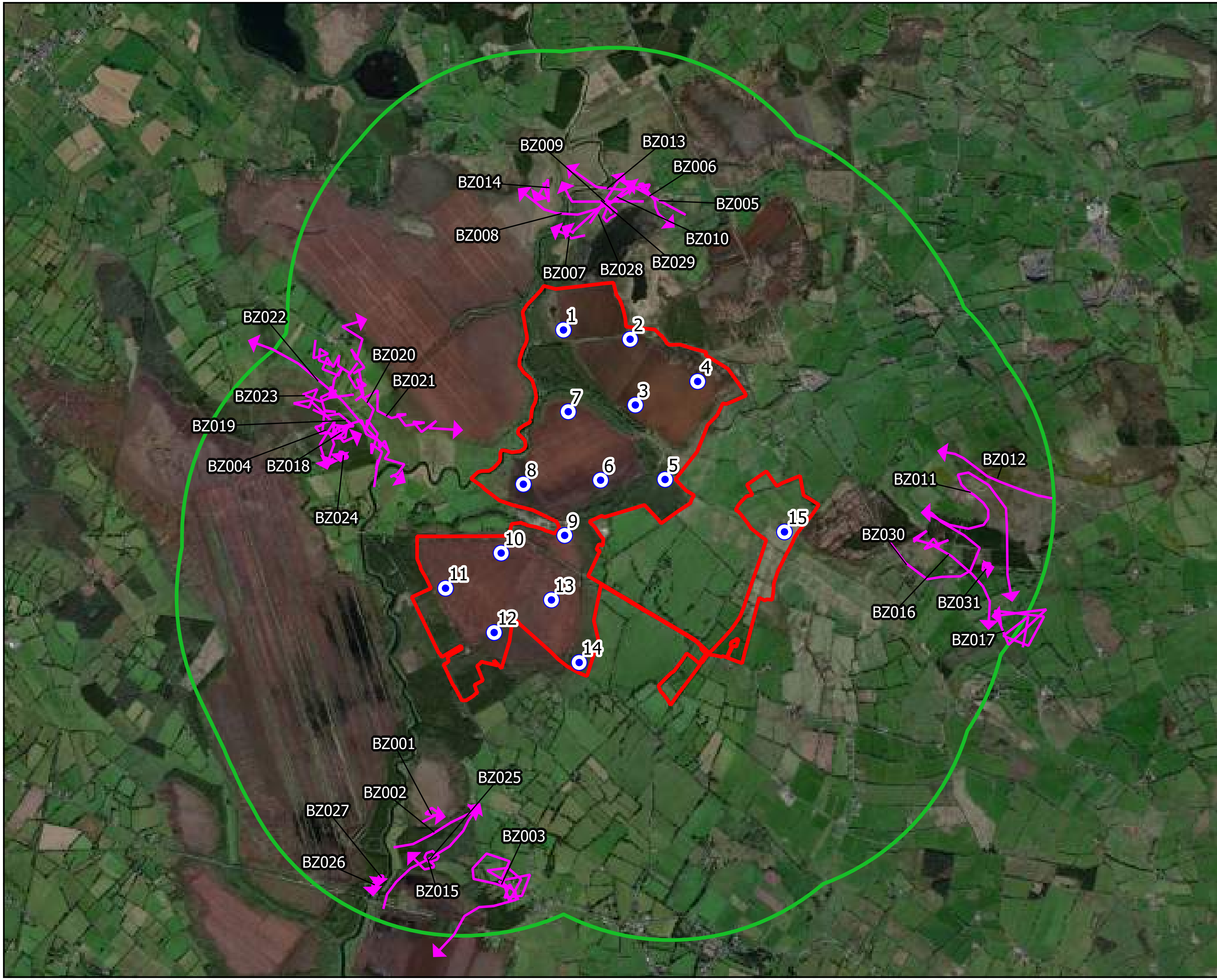

Map Legend

Wind Farm Site

2km Survey Radius

Turbine Layout

Breeding Raptor Vantage Point Locations

Flightline

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Drawing Title: Buzzard Observations Breeding Raptor Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 3.4
Scale: 1:42000	Date: 05/07/2022

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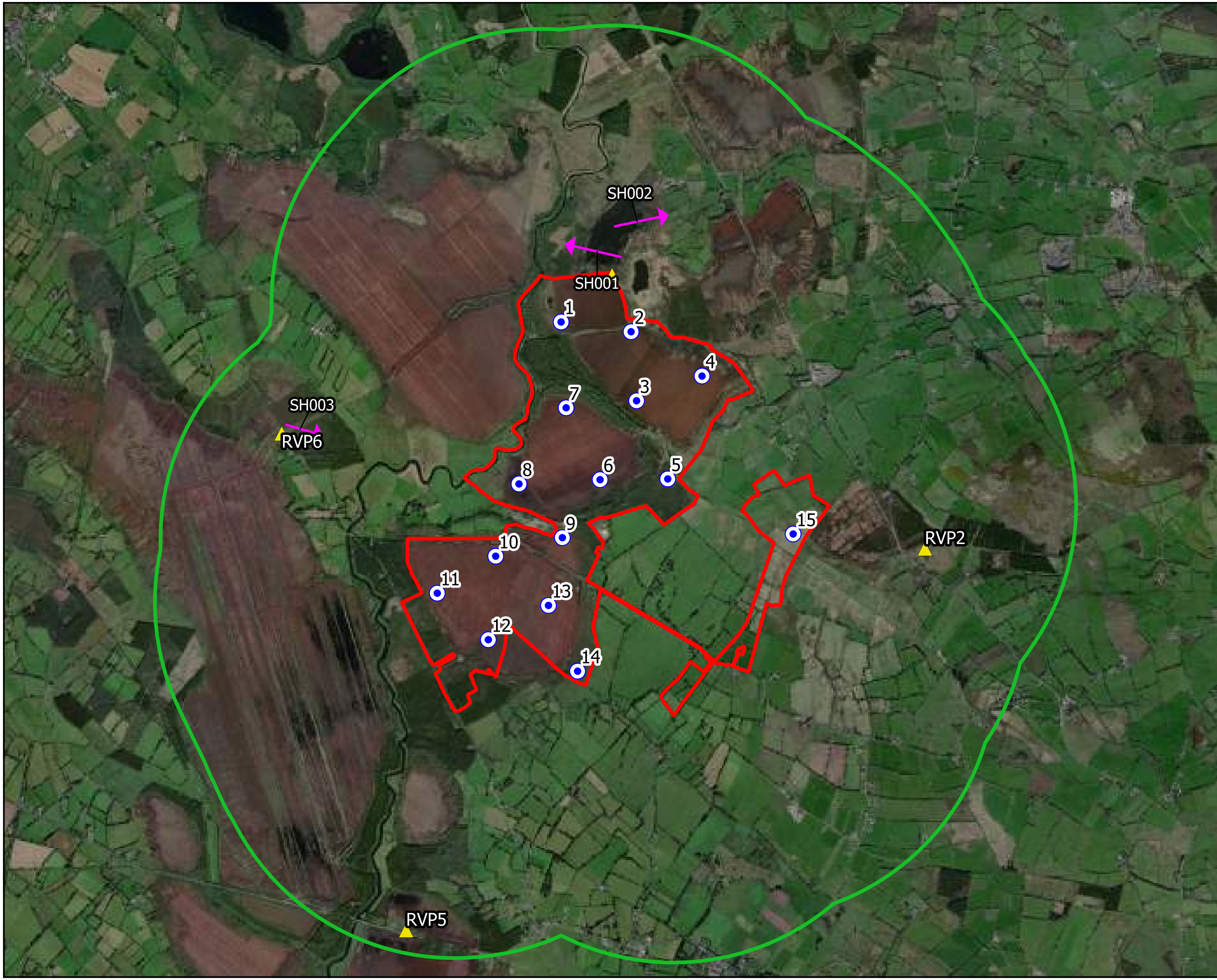

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

Drawing Title	Sparrowhawk Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By	I.Hynes
Checked By	P. Cregg
Project No.	200445g
Drawing No.	Fig. 3.5
Scale	1:40000
Date	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Woodcock Transects

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N

Drawing Title: Breeding Woodcock Transects	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 4
Scale: 1:25000	Date: 05/07/2022

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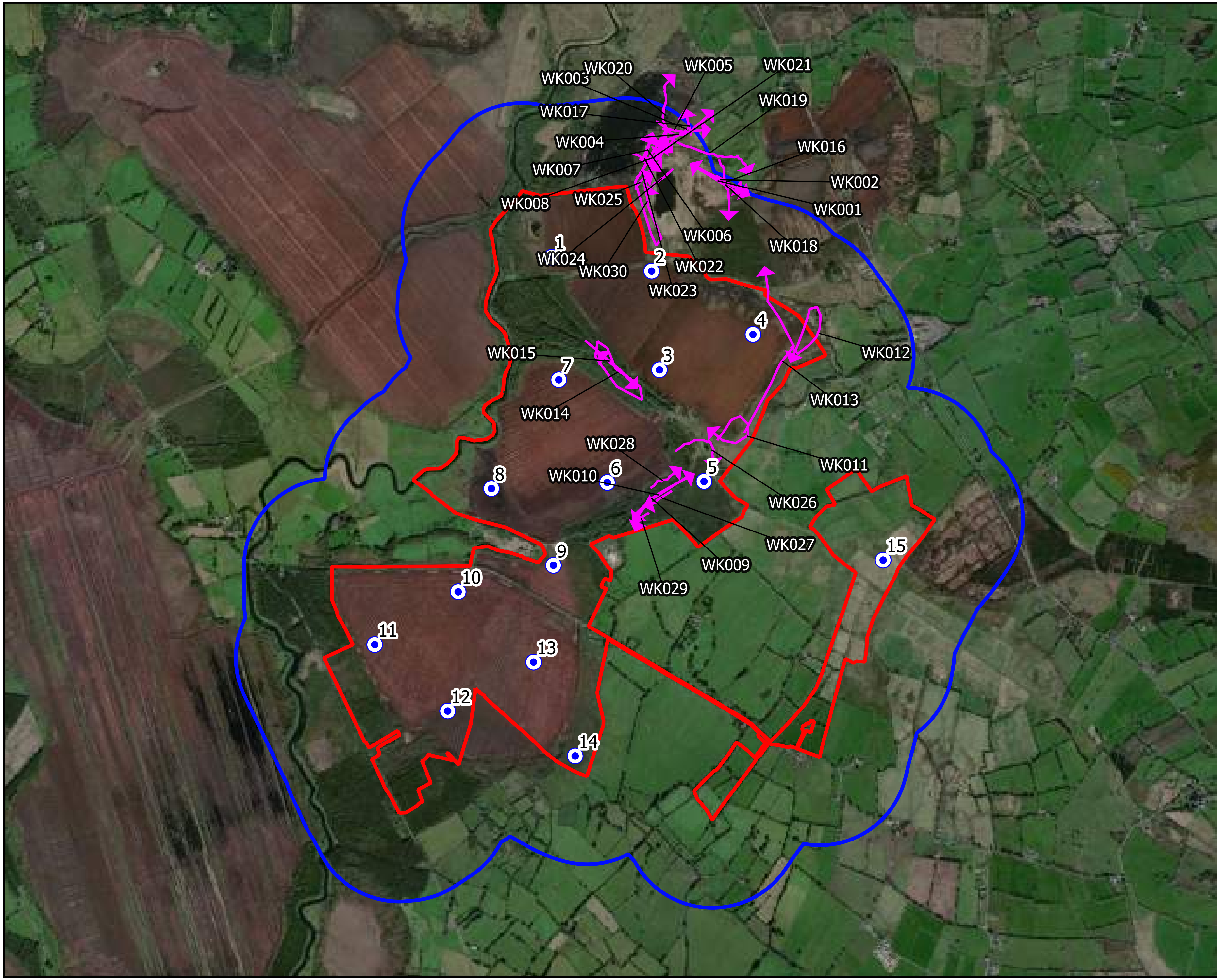

Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

Drawing Title Woodcock Observations Breeding Woodcock Surveys	
Project Title Coole Wind Farm	
Drawn By I.Hynes	Checked By P. Cregg
Project No. 200445g	Drawing No. Fig. 4.1
Scale 1:28000	Date 05/07/2022

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Map Legend
Wind Farm Site
500m Survey Radius
Turbine Layout
Possible Breeding Territory
1
2
3
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N
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Woodcock Territories
Breeding Woodcock Surveys
Coole Wind Farm
I.Hynes
P.Cregg
200445g
Fig. 4.1.1
1:28000
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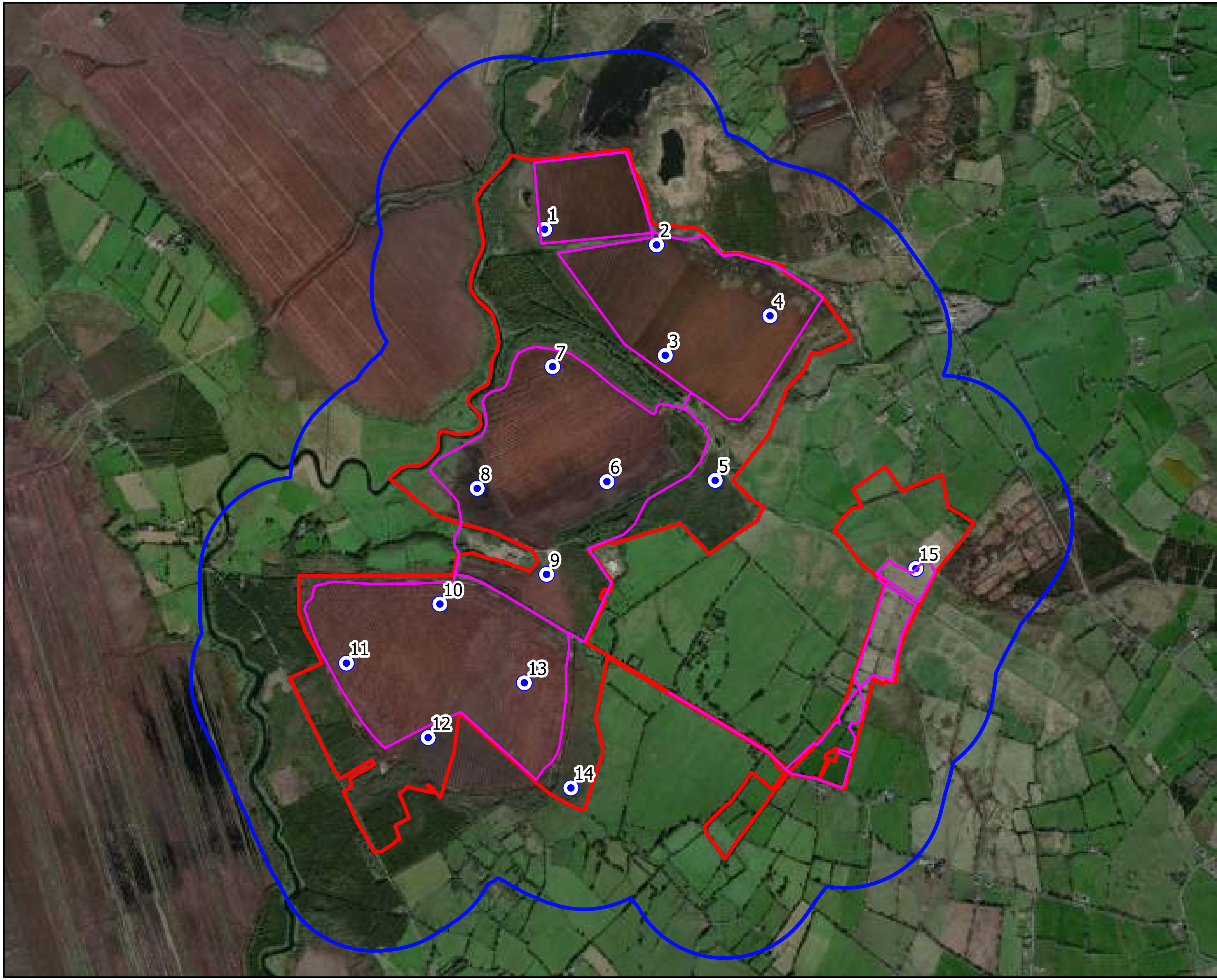

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Walkover Transects

Drawing Title	Winter Walkover Transects
Project Title	Coole Wind Farm
Drawn By	I.Hynes
Checked By	P. Cregg
Project No.	200445g
Drawing No.	Fig. 5
Scale	1:25000
Date	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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Drawing Title: Golden Plover Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.1
Scale: 1:25000	Date: 05/07/2022

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Drawing Title
Greenland white-fronted goose Obs. Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No. 200445g	Drawing No. Fig. 5.2
Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title: Kingfisher Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 5.3
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	
Teal Observations Winter Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 5.4
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title: Wigeon Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.5
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title	
Kestrel Observations Winter Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By	**Checked By**
I.Hynes	P. Cregg
Project No.	**Drawing No.**
200445g	Fig. 5.6
Scale	**Date**
1:25000	05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

N

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Drawing Title: Lapwing Observations Winter Walkover Surveys	
Project Title: Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P.Cregg
Project No.: 200445g	Drawing No.: Fig. 5.7
Scale: 1:25000	Date: 05/07/2022

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Map Legend

Wind Farm Site

500m Survey Radius

Turbine Layout

Flightline

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Drawing Title	
Snipe Observations Winter Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.8
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

Drawing Title	
Buzzard Observations Winter Walkover Surveys	
Project Title	
Coole Wind Farm	
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.9
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
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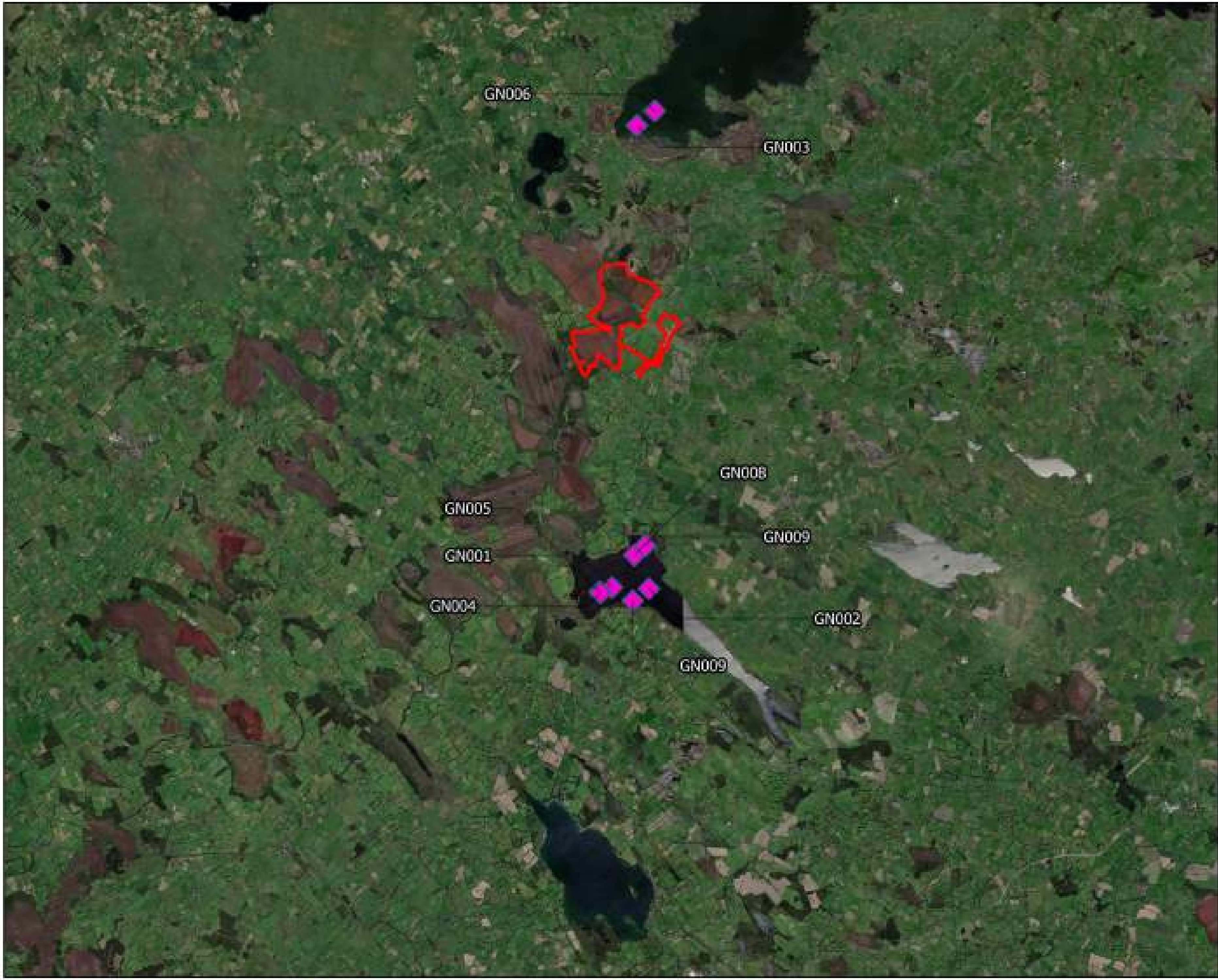

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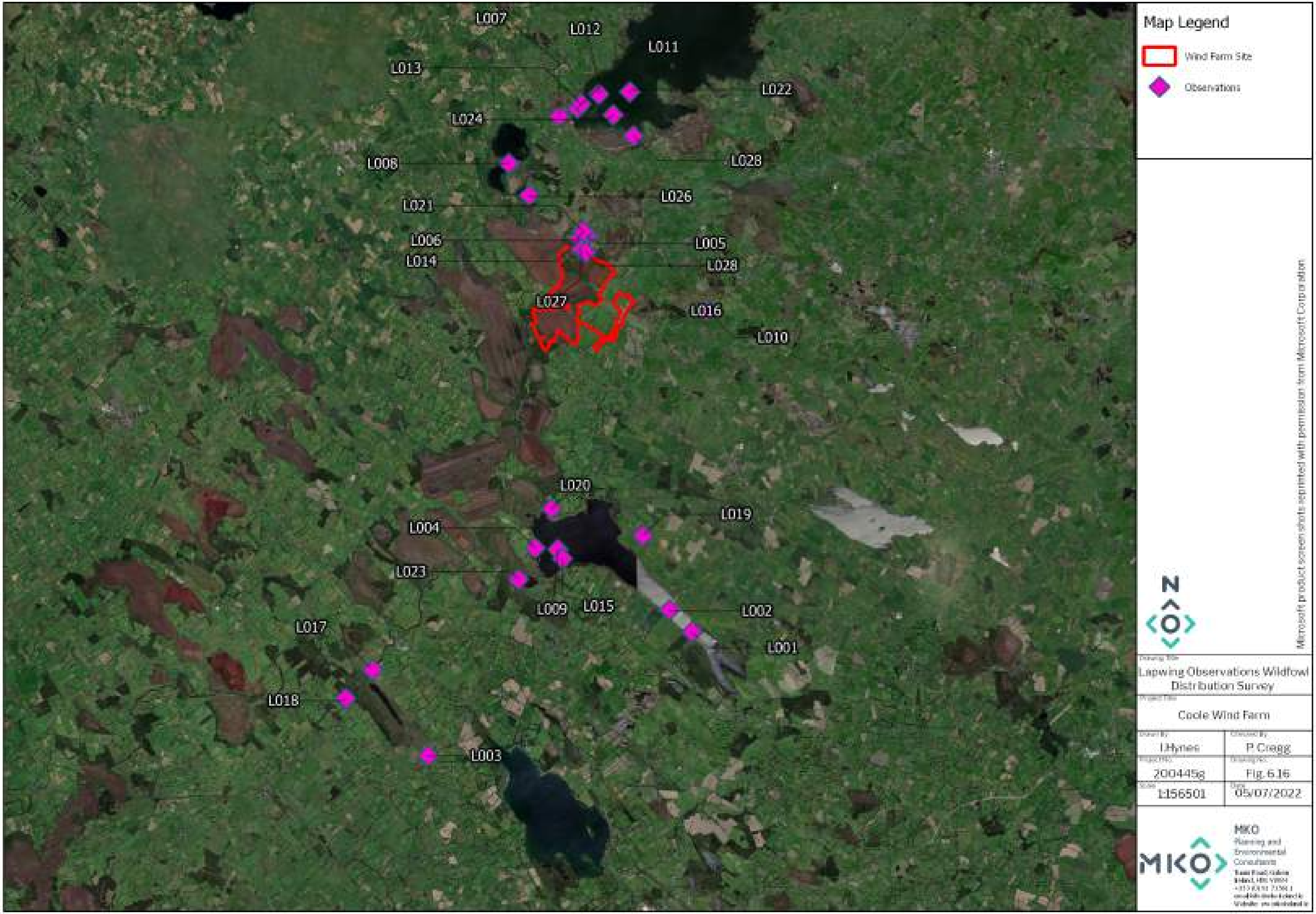
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Map Legend

Wind Farm Site

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Flightline

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White-tailed eagle Incidental Observations

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Turbine Layout

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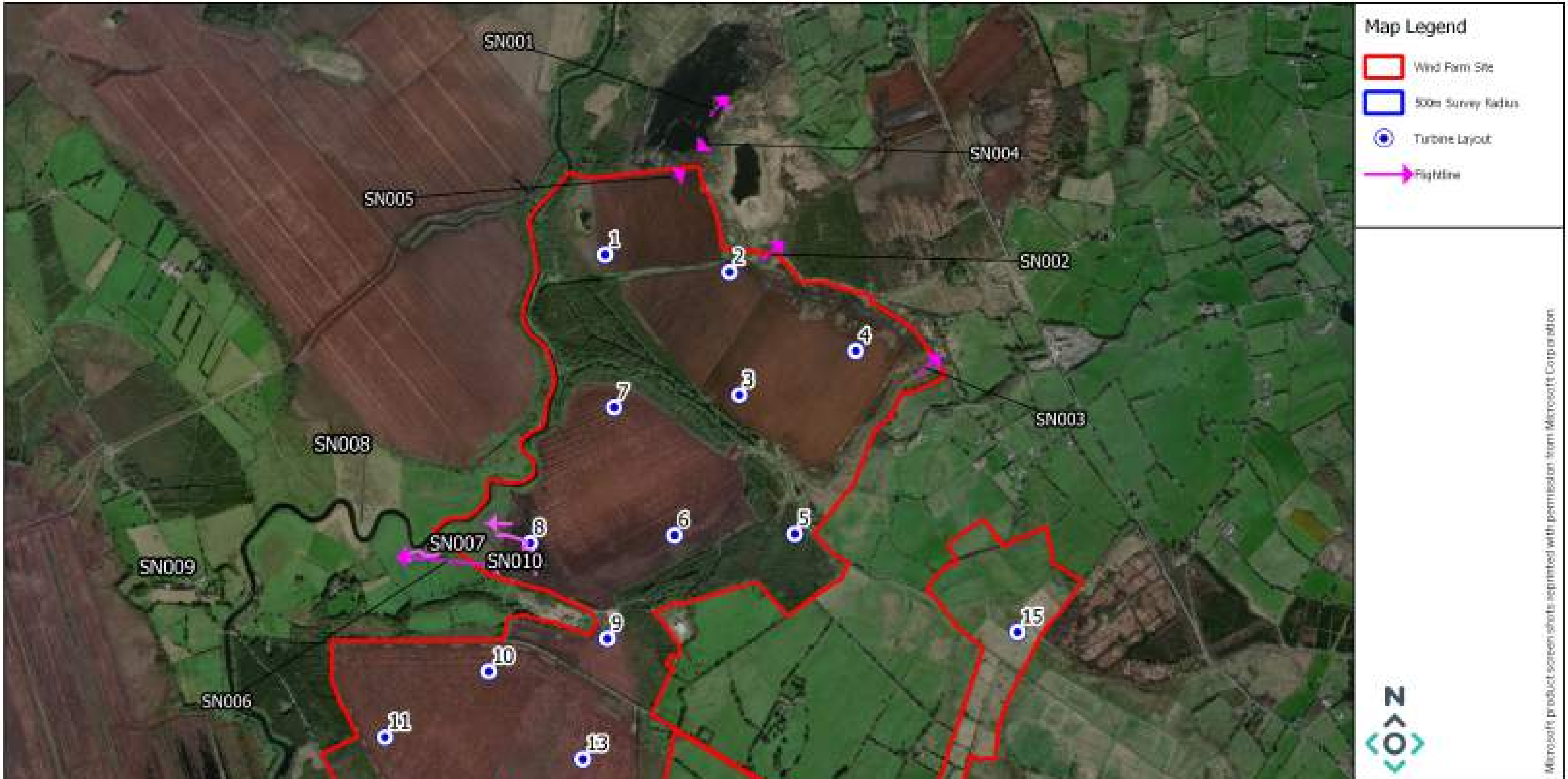

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Map Legend
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Wind Farm Site

500m Survey Radius

Turbine Layout

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APPENDIX 5

COLLISION RISK ASSESSMENT

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Appendix 5 – Collision Risk Assessment

Coole Wind Farm

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1. INTRODUCTION

This document outlines the methodology used to assess the collision risk for birds at the proposed Coole wind farm, Co. Westmeath. The collision risk assessment is based on vantage point surveys undertaken at the wind farm site from October 2015 up to, and including, September 2017; from April 2018 up to, and including, March 2020; and from March 2021 up to, and including, March 2022. This represents two 24-month survey periods and a 13-month survey period, consisting of five breeding seasons and five non-breeding seasons, which is in full compliance with Scottish Natural Heritage guidance (SNH, 2017). Surveys were undertaken from four fixed Vantage Point (VP) Locations: VP3/VP4 between October 2015 to September 2017, VP3/VP5 between April 2018 to March 2020, VP4/VP6 between March 2021 to March 2022 and VP3/VP5 between October 2021 and March 2022.

Collision risk is calculated using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation is known as the Band Model (Band *et al.,* 2007) and has been used in a number of studies on bird collision with wind turbines (e.g. Chamberlain *et al.,* 2006; Drewitt and Langston, 2006; Fernley *et al.,* 2006; Madders and Whitfield, 2006). Note that these are theoretical predictions, therefore results must be interpreted with a degree of caution.

Two stages are involved in the Band Model. First, the number of bird transits through the air space swept by the rotor blades of the wind turbines per year is estimated. Then the collision risk for a bird passing through the rotor blades is calculated using a mathematical formula. The product of these provides a theoretical annual collision mortality rate. Finally, a bird avoidance rate is applied to the collision mortality rate to account for birds attempting to avoid collision. This final collision mortality rate informs the assessment of impacts of the wind farm development on key ornithological receptors (KORs) in the EIAR.

To ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios are outlined in further detail in Section 2.3 below.

2. METHODOLOGY

2.1 The Band Model

The Band Model is used to predict the number of bird collisions that might be caused by a wind farm development. It uses species-specific information on bird biometrics, flight characteristics and the expected amount of flight activity, along with turbine-specific information on hub height, rotor diameter, pitch and rotational speed. The 15 No. turbines will be between 97.5m and 100.5 at hub height, with 3 blades with a diameter of between 149m and 155m, giving a maximum rotor height of 175m and a minimum rotor height of 20m. The model makes a number of assumptions on the turbine design and on biometrics of birds:

1. Birds are assumed to be of a simple cruciform shape.
2. Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
3. Birds fly through turbines in straight lines.
4. Bird flight is not affected by the slipstream of the turbine blade.

- Because the model assumes that no action is taken by a bird to avoid collision, it is recognised that the collision risk figures derived are purely theoretical and represent worst case estimates

Two forms of collision risk modelling are outlined by Band *et al.* (2007): a **"Regular Flight Model"** and the **"Random Flight Model"**. A Regular Flight Model is generally applied to situations where flightlines form a regular pattern. This may occur, for example, when birds are using the wind farm site as a commuting corridor between roosting and feeding grounds or migratory routes, as is often observed in geese and swans. The Random Flight Model generally applied to situations where flightlines form no discernible patterns or routes. This is often observed, for example when raptors are in foraging or hunting flights.

The Regular Flight Model predicts the number of transits through a cross-sectional area of the wind farm which represents the width of the commuting corridor. A "risk window" is identified: a 2-dimensional line the width of the wind farm to a 500m buffer of the turbines, multiplied by the rotor diameter. All commuting flights which pass through this risk window within the rotor swept height (potential collision height; PCH) are included in collision risk modelling. Any regular flights more than 500m from the turbine layout can be excluded from analysis. There are a number of key assumptions and limitations:

- The turbine rotor swept area is 2-dimensional, i.e. there is a single row of turbines in the windfarm. This represents all turbines within the commuting corridor accounted for by a single straight-line.
- Bird activity is spatially explicit.
- Birds in an observed flight only cross the turbine area once and do not pass through the cross-section a second time (or multiple times).
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

The Random Flight Model predicts the number of transits through the wind farm while assuming that all flights within the vantage point viewshed are randomly occurring, ie. any observed flight could just as easily occur within the wind farm site as outside it. All flights within PCH inside the viewshed are included in the model. There are a number of key assumptions and limitations:

- Bird activity is not spatially explicit, i.e. activity is equal throughout the viewshed area and this is equal to activity in the windfarm area.
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

More detail on both the Random and Regular Flight Model calculations are available from SNH: https://www.nature.scot/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action.

In the case of Coole wind farm, for all species recorded in flight in the wind farm study area, flights were randomly distributed. Therefore, a **Random Flight Model** conducted for these species.

2.2 Modelling Process

The steps used in the Band Model to derive the collision mortality rate for each species observed at the wind farm site are outlined below.

- Stage 1: Estimate the number of bird transits through the air space swept by the rotor blades of the wind turbines. Transits are calculated using either the "Regular" or "Random" flight model (Band *et al.,* 2007), depending on flight distribution and behaviour.
- Stage 2: Calculate the collision risk for an individual bird flying through a rotating turbine blade. Collision risk is calculated using a formula which incorporates the number of bird transits (Stage 1), individual species' biometrics, individual species' flight speed and style, and the proposed turbine parameters. This formula is publicly available on the SNH website: https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision. Biometrics are available from the British Trust of Ornithology (BTO, 2021) and flight speeds are available from Alerstam *et al.* (2007). For species that can both flap and glide, the mean of the collision risk for flapping and for gliding flight is taken.
- The product of the number of birds transits per year multiplied by the collision risk provides an annual collision mortality rate. Note that this is the unrealistic/worst-case scenario for collision mortality, as it assumes that birds flying towards the turbines make no attempt to avoid them.
- To account for birds attempting to avoid a collision, an avoidance factor is applied to the annual collision mortality rate. This corrects for the ability of the birds to detect and manoeuvre around the turbines. Avoidance rates are available from SNH (2018). Bird avoidance rates are generally 98-99% or higher for most species, based on empirical evidence, targeted studies and literature reviews, and continue to be updated following further studies of bird behaviour and mortality rates at wind farm sites.

The final annual collision risk corrected for avoidance is a "real-world" estimation of the number of collisions that may occur at the wind farm, based on observed bird activity during the vantage point survey period.

2.3 Turbine specifications

As previously outlined to ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios were as follows:

- Maximum rotor diameter and minimum hub height: 20-175m
- Median rotor diameter and median hub height: 25-175m
- Minimum rotor diameter and maximum hub height: 26-175m

Birds in flight within the viewshed at heights between 15-200m above ground level have been included in the collision risk model, as relevant. The candidate turbine specifications are available in Table 1.

Table 1 Turbine specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Candidate turbine model	Nordex 149[1]
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	155
Rotor radius (m)	77.5
Hub height (m)	97.5
Swept height (m)	20-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

The above candidate turbine parameters were used for the 15 No. turbines with a blade diameter of 155m, giving a maximum rotor height of 175 and a minimum rotor height of 20m are assessed in the analysis.

To ensure that the full range of possible turbine dimensions are assessed, two alternative turbine dimensions were considered. Collision risk models was run to assess the minimum rotor diameter of the range of turbine dimensions (i.e. rotor diameter of 149m) and the median turbine dimensions (i.e. rotor diameter of 150m) considered in this application. The second model assesses the swept path between 26-175m and the third model accesses the swept path between 25-175m. Appendix 1 shows the collision risk assessment based on alternative dimension turbines. These three collision risk assessments allow for the full range of possible turbine dimensions to be assessed (20-175m, 25-175m and 26-175m).

Please note:

Taking a precautionary approach, the highest predicted collision risk (from the three analyses, i.e. at 20-175m, 25-175m and 26-175m) for each species was considered to be the collision risk in the impact assessment.

2.4 Key Ornithological Receptors

[1] *A candidate turbine is used to calculate the maximum chord and the rotational period for the modelling scenario. The best fit turbine model is used, in this case, a 149m Nordex turbine was the closed to the proposed turbine specifications.*

The key ornithological receptors (KORs) recorded within PCH during surveys at Coole were:

- Greenland White-fronted Goose
- Golden Plover
- Hen Harrier
- Merlin
- Peregrine
- Whooper Swan
- Kestrel
- Lapwing
- Snipe
- Woodcock
- Buzzard
- Sparrowhawk

A CRM was conducted for each of these species. It is acknowledged that the predicted number of transits, and hence predicted rate of collision, for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature (during twilight) while the VP survey sample predominantly consists of hours during daylight period when visibility is not an issue. It is assumed that waterbirds (including snipe) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model.

2.5 Calculation Parameters (20-175m)

The calculation parameters for the vantage point are outlined in Table 2. Bird biometrics are presented in Table 3. Table 4 presents the model input values: bird seconds in flight at PCH (random model) or the number of birds crossing the risk window (regular models) observed from the vantage point during the relevant survey period. Bird seconds in flight at PCH is calculated by multiplying the number of birds observed per flight by the duration of the flight spent within PCH.

Table 2 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 20m	Risk Area	Turbines visible	Total Survey Effort (hrs)
VP3	562.4	257.354	6	332.5
VP4	230.057	163.302	4	230.5
VP5	458.258	134.672	2	181
VP6	442.394	175.627	4	72

Table 3 Bird biometrics

Species	Body Length(m)	Wingspan(m)	Flight Speed(m/s)
Greenland White-fronted Goose	0.72	1.48	16.1
Golden Plover	0.28	0.72	17.9
Merlin	0.28	0.56	12.6
Peregrine Falcon	0.42	1.02	20.7
Whooper Swan	1.52	2.3	17.3
Kestrel	0.34	0.76	10.1
Lapwing	0.3	0.84	11.9
Snipe	0.26	0.46	17.1
Woodcock	0.34	0.58	17.1
Buzzard	0.54	1.2	13.3
Sparrowhawk	0.33	0.62	10

Table 4 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	471,229
Merlin	random	All	80
Peregrine	random	All	1,315
Whooper Swan	random	Winter	17,204
Kestrel	random	All	13,505
Lapwing	random	Winter	3,625
Snipe	random	All	1,751
Woodcock	random	Breeding	40
Buzzard	random	All	34,448
Buzzard	random	Breeding	22,219
Sparrowhawk	random	All	1,493

The avoidance rates applied to the collision risk were: 99.8% for Greenland white-fronted goose, 99.6% for golden plover[2]; 99.5% for whooper swan, 95% for kestrel and 98% for the remaining species.

[2] *Please see Appendix 2 for the rationale for the avoidance rate of golden plover.*

3. RESULTS (20-175M)

The predicted number of transits per year and the collision risk is presented in Table 5, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 5 Results of CRM

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	340.5304	5.92%	N/A	5.92%	20.15	99.8%	0.040	1.21 birds	24.81 years
Golden Plover	Winter	random	59,385.08	4.45%	N/A	4.45%	2645.53	99.6%	10.582	317.46 birds	0.09 years
Merlin	All	random	11.8707	4.61%	4.53%	4.57%	0.54	98.0%	0.011	0.33 birds	92.13 years
Peregrine Falcon	All	random	209.7564	4.81%	4.52%	4.67%	9.79	98.0%	0.196	5.87 birds	5.11 years
Whooper Swan	Winter	random	1,987.359	7.98%	N/A	7.98%	158.53	99.5%	0.793	23.78 birds	1.26 years
Kestrel	All	random	975.2979	5.17%	5.07%	5.12%	49.93	95.0%	2.497	74.90 birds	0.40 years
Lapwing	Winter	random	390.1192	4.86%	N/A	4.86%	18.95	98.0%	0.379	11.37 birds	2.64 years
Snipe	All	random	208.2588	4.29%	N/A	4.29%	8.93	98.0%	0.179	5.36 birds	5.60 years
Woodcock	Breeding	random	10.43266	4.53%	N/A	4.53%	0.47	98.0%	0.009	0.28 birds	105.90 years
Buzzard	All	random	3,371.563	5.63%	5.42%	5.52%	186.28	98.0%	3.726	111.77 birds	0.27 years
Buzzard	Breeding	random	2163.464	5.63%	5.42%	5.52%	119.53	98.0%	2.391	71.72 birds	0.42 years
Sparrowhawk	All	random	90.56372	5.09%	5.03%	5.06%	4.59	98.0%	0.092	2.75 birds	10.90 years

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CRA APPENDIX 1

COLLISION RISK ASSESSMENT – ALTERNATIVE TURBINE DIMENSIONS

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3.1 Alternative Turbine 1 Inputs (26-175m)

Table 6 Alternative turbine 1 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	149
Rotor radius (m)	74.5
Hub height (m)	100.5
Swept height (m)	26-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 7 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 26m	Risk Area	Turbines visible	Total Survey Effort
VP3	629.362	258.187	6	332.5
VP4	304.978	210.577	5	230.5
VP5	506.478	157.376	3	181
VP6	512.943	239.32	5	72

Table 8 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

3.2 Alternative Turbine 2 Inputs (25-175m)

Table 9 Alternative turbine 2 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	150
Rotor radius (m)	75
Hub height (m)	100
Swept height (m)	25-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 10 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 25m	Risk Area	Turbines visible	Total Survey Effort
VP3	627.494	256.887	6	332.5
VP4	292.392	201.662	5	230.5
VP5	497.208	154.51	3	181
VP6	505.53	232.92	5	72

Table 11 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

4. ALTERNATIVE TURBINE DIMENSIONS RESULTS

The predicted number of transits per year and the collision risk for the alternative turbine dimensions are presented in Tables 12 and 13 below, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 12 Results of CRM for Alternative Turbine 1 (26-175m)

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	288.1648	6.09%	N/A	6.09%	17.54	99.8%	0.035	1.05 birds	28.51 years
Golden Plover	Winter	random	43507.54	4.62%	N/A	4.62%	2008.25	99.6%	8.033	240.99 birds	0.12 years
Merlin	All	random	8.607914	4.76%	4.68%	4.72%	0.41	98.0%	0.008	0.24 birds	123.08 years
Peregrine Falcon	All	random	104.7015	4.98%	4.66%	4.82%	5.05	98.0%	0.101	3.03 birds	9.90 years
Whooper Swan	Winter	random	802.4748	8.15%	N/A	8.15%	65.39	99.5%	0.327	9.81 birds	3.06 years
Kestrel	All	random	444.1574	5.32%	5.22%	5.27%	23.40	95.0%	1.170	35.10 birds	0.85 years
Lapwing	Winter	random	85.05496	5.01%	N/A	5.01%	4.26	98.0%	0.085	2.56 birds	11.72 years
Snipe	All	random	147.3097	4.43%	N/A	4.43%	6.53	98.0%	0.131	3.92 birds	7.65 years
Buzzard	All	random	1882.868	5.79%	5.58%	5.68%	107.01	98.0%	2.140	64.20 birds	0.47 years
Buzzard	Breeding	random	1286.294	5.79%	5.58%	5.68%	73.10	98.0%	1.462	43.86 birds	0.68 years
Sparrowhawk	All	random	53.84197	5.24%	5.18%	5.21%	2.80	98.0%	0.056	1.68 birds	17.83 years

Table 13 Results of CRM for Alternative Turbine 2 (25-175m)

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Greenland White-fronted Goose	Winter	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Golden Plover	Winter	random	44742.13	4.62%	N/A	4.62%	2065.24	99.6%	8.261	247.83 birds	0.12 years
Merlin	All	random	9.0387	4.76%	4.68%	4.72%	0.43	98.0%	0.009	0.26 birds	117.22 years
Peregrine Falcon	All	random	108.004	4.98%	4.66%	4.82%	5.21	98.0%	0.104	3.13 birds	9.60 years
Whooper Swan	Winter	random	822.1859	8.15%	N/A	8.15%	66.99	99.5%	0.335	10.05 birds	2.99 years
Kestrel	All	random	458.9188	5.32%	5.22%	5.27%	24.18	95.0%	1.209	36.26 birds	0.83 years
Lapwing	Winter	random	89.31155	5.01%	N/A	5.01%	4.48	98.0%	0.090	2.69 birds	11.16 years
Snipe	All	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Buzzard	All	random	1947.209	5.79%	5.58%	5.68%	110.66	98.0%	2.213	66.40 birds	0.45 years
Buzzard	Breeding	random	1309.816	5.79%	5.58%	5.68%	74.44	98.0%	1.489	44.66 birds	0.67 years
Sparrowhawk	All	random	54.82305	5.24%	5.18%	5.21%	2.86	98.0%	0.057	1.71 birds	17.51 years

Table 14 Comparison of collision risk for turbine dimensions and the alternative turbine dimensions

Species	Collision Risk – 155m rotor diameter		Collision Risk – 149m rotor diameter		Collision Risk – 150m rotor diameter	
	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm
Greenland White-fronted Goose	0.040	1.21 birds	0.035	1.05 birds	0.036	1.07 birds
Golden Plover	10.582	317.46 birds	8.033	240.99 birds	8.261	247.83 birds
Merlin	0.011	0.33 birds	0.008	0.24 birds	0.009	0.26 birds
Peregrine Falcon	0.196	5.87 birds	0.101	3.03 birds	0.104	3.13 birds
Whooper Swan	0.793	23.78 birds	0.327	9.81 birds	0.335	10.05 birds
Kestrel	2.497	74.90 birds	1.170	35.10 birds	1.209	36.26 birds
Lapwing (Winter)	0.379	11.37 birds	0.085	2.56 birds	0.090	2.69 birds
Snipe	0.179	5.36 birds	0.131	3.92 birds	0.036	1.07 birds
Woodcock	0.009	0.28 birds	0	0 birds	0	0 birds
Buzzard	3.726	111.77 birds	2.140	64.20 birds	2.213	66.40 birds
Buzzard (Breeding)	2.391	71.72 birds	1.462	43.86 birds	1.489	44.66 birds
Sparrowhawk	0.092	2.75 birds	0.056	1.68 birds	0.057	1.71 birds

CRA APPENDIX 2

GOLDEN PLOVER AVOIDANCE RATE CALCULATION

COOLE WIND FARM: GOLDEN PLOVER AVOIDANCE RATES

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REPORT NUMBER: 2226-F1
STATUS OF REPORT: Revision 1
DATE OF REPORT: 19 October 2022

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SUMMARY

This report assesses the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and makes recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance. This guidance includes two types of avoidance rates: species-specific avoidance rates; and a default avoidance rate that should be applied to all other species. Based on the latest version of the guidance, the default avoidance rate of 98% applies to wintering Golden Plover populations. However, review of the development of the SNH avoidance rate guidance shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

There are reports for four UK wind farms that provide data that can be used to estimate avoidance rates, or which provide their own estimates of avoidance rates, for wintering Golden Plover populations. For three of these wind farms, the collision monitoring methodologies are robust and generally comply with best practice guidance, so the collision fatality estimates can be regarded as reliable. The avoidance rates calculated for the wintering Golden Plover populations at these wind farms range from 99.87-99.98%. For the fourth wind farm, the available information on the collision monitoring methodology was limited, but there may have been some issues with the methodology and results. The avoidance rate for the wintering Golden Plover population given in the relevant reports for this wind farm was 99.6%.

The highest avoidance rate currently recommended by Scottish Natural Heritage / Natural Scotland is 99.8% for geese. The narrow range of the avoidance rate values for wintering Golden Plover populations at the three wind farms with reliable collision fatality estimates would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at the other wind farm is lower than this value, although there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

1. INTRODUCTION

This report was commissioned by MKO.

The objective of the report was to assess the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and, if appropriate, make recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance (referred to hereafter as the SNH avoidance rate guidance). The latest version of this guidance (SNH, 2018) does not include a species-specific avoidance rate for wintering Golden Plover populations. Therefore, following the SNH avoidance rate guidance would mean that the default 98% avoidance rate should be applied to wintering Golden Plover populations. However, there is apparently robust data available from post-construction monitoring that indicates that a much higher avoidance rate should be applied to wintering Golden Plover populations.

In this report, I first review the development of the SNH avoidance rate guidance and consider whether the history of its development affects the interpretation of the fact that it does not include a species-specific avoidance rate for wintering Golden Plover populations. I then review the methods and results of four post-construction monitoring studies, and use the data from these studies to derive empirical avoidance rates for the wintering Golden Plover population in each study. I then assess the overall weight of evidence for applying a species-specific avoidance rate to wintering Golden Plover populations and make recommendations for avoidance rate values that should be used in collision risk modelling for such populations.

2. THE SNH AVOIDANCE RATE GUIDANCE

2.1. TYPES OF AVOIDANCE RATES

The SNH avoidance rate guidance includes two types of avoidance rates: specific avoidance rates for individual species, or groups of closely-related species (e.g., swans or geese); and a default avoidance rate that should be applied to all other species.

2.2. THE EVOLUTION OF THE SNH AVOIDANCE RATES

The latest version of the SNH avoidance rate guidance (SNH, 2018) includes a default 98% avoidance rate for species not listed in their guidance. However, this default avoidance rate does not appear to have any empirical basis.

In 2000, the first guidance from Scottish Natural Heritage on avoidance rates recommended a precautionary avoidance rate of 95%, which was "based solely on expert opinion and has little or no empirical basis, as no sound, relevant data were available at the time" (SNH, 2010). In 2010, Scottish Natural Heritage updated their guidance on avoidance rates to included species-specific avoidance rates where relevant data was available (SNH, 2010). They also updated the default avoidance rate for other species to 98% because "in the majority of cases where avoidance rates have been derived from empirical data, the avoidance rates are higher than 95%" (SNH, 2010). Further revisions of the SNH avoidance rate guidance were published in 2016 and 2018 (SNH, 2016; 2018). Comparison of the first species-specific avoidance rates published by Scottish Natural Heritage with the latest species-specific avoidance rates (Table 2.1) shows that as the knowledge base has developed there has been an increase in the recommended avoidance rates. Most species-specific avoidance rates are 99% or higher. The only species with species-specific avoidance rates of less than 99% are White-tailed Eagle and Kestrel.

Table 2.1. Species-specific avoidance rates defined in SNH guidance

Species	SNH Guidance	
	2010	2018
Divers	98%	99.5%
Swans	98%	99.5%
Geese	99%	99.8%
Red Kite	98%	99%
Hen Harrier	99%	99%
Golden Eagle	99%	99%
White-tailed Eagle	95%	95%
Kestrel	95%	95%
Skuas	98%	99.5%

Sources: SNH (2010, 2018). Divers: the 2010 guidance gives a species-specific avoidance rate for Red-throated Diver and a default avoidance rate for Black-throated Diver. Swans: the 2010 guidance gives a species-specific avoidance rate for Whooper Swan, and does not provide avoidance rates for other swan species, while the 2018 guidance gives a species-specific avoidance rate for all swan species. Geese: the 2010 guidance gives separate (but identical) species-specific avoidance rates for Greylag, Pink-footed, Greenland White-fronted and Barnacle Geese, while the 2018 guidance gives a single species-specific avoidance rate for all geese species. Skuas: the 2010 guidance gives a single default avoidance rate for all skua species, while the 2018 guidance gives separate (but identical) species-specific avoidance rates for Great Skua and Arctic Skua.

2.3. EXAMPLES OF SPECIES-SPECIFIC AVOIDANCE RATES IN THE SNH AVOIDANCE RATE GUIDANCE

The 95% avoidance rate for White-tailed Eagle is described as being based on: "sufficient evidence from flight behaviour and collision monitoring studies in Norway for vulnerability to collisions; see May *at al.* (2011)" (SNH, 2018). However, this appears to include a citation error as May *at al.* (2011) provides an estimate for a year-round avoidance rate of 98%, with a confidence interval of 95-99%, based on satellite telemetry data. Presumably, the intended citation was May *at al.* (2010), which included an estimated avoidance rate of 95.8%, based on VP survey data, corrected for the observed wind speed distribution at the study site. This latter reference also included avoidance rates of 97.8% and 97.9% for fixed rotation speeds, and an avoidance rate of 92.5% when the collision risk was modelled using uncertainty levels. The SNH avoidance rate guidance on avoidance rates does not discuss these differing estimates of White-tailed Eagle avoidance rates, and the recommended 95% avoidance rate has remained unchanged since 2010 without any caveats added to reflect the various avoidance rates indicated by the May *at al.* (2010 and 2011) studies.

The 95% avoidance rate for Kestrel is described as being based on: "sufficient evidence from flight behaviour (including hovering) and collision monitoring studies for vulnerability to collisions" (SNH, 2018). The cited source (Whitfield and Madders, 2006) is, in fact, a review of avoidance rates for Red Kite. The information on Kestrel is derived from an analysis which finds a significant correlation between the "numbers of individuals seen" against numbers of carcasses found for 16 raptor species at a single wind farm in Spain. Kestrel is a large outlier above the regression line, and this appears to be the only empirical evidence that has been used by SNH to support the 95% avoidance rate for Kestrel. However, even taken at face value, all this analysis does is indicate that Kestrel has a lower avoidance rate than other raptor species, but it does not provide any quantitative data that can be used to estimate the avoidance rate. More seriously, this analysis does not account for behavioural and ecological differences between species that may affect the relationship between recorded bird activity and collisions. It is also subject to the perennial problem with analyses of collision rates: the small absolute numbers of collisions which means that random sampling error may have significant effects.

These two examples show that the species-specific avoidance rates in the SNH avoidance rate guidance do not necessarily reflect all the available evidence (White-tailed Eagle) and can be based on rather sketchy evidence (Kestrel).

2.4. UPDATING THE SNH AVOIDANCE RATE GUIDANCE

The SNH avoidance rate guidance states that "it is updated when robust new information becomes available" (SNH, 2018). However, while this may be an aspiration, it may not necessarily happen quickly. For example, the SNH avoidance rate guidance currently does not give species-specific avoidance rates for gulls, so the default avoidance rate of 98% applies to all gull species. This guidance refers specifically to onshore wind farms, while separate guidance has been developed for offshore wind farms (JNCC *at al.*, 2014). The latter guidance recommends an avoidance rate of 99.5% for large gulls, based on a review by Cook *at al.* (2014). The discrepancy between the recommended avoidance rates for large gulls between offshore and onshore wind farms, was not addressed until a review by Furness (2019), which was commissioned by SNH. This review recommended that the 99.5% avoidance rate for large gulls at offshore wind farms should also be adopted for onshore wind farms. The review also recommended an avoidance rate of 99.2% for small gulls, which was also based on the data in Cook *at al.* (2014). However, as of June 2022, Scottish Natural Heritage / NatureScot have not updated their guidance on avoidance rates for onshore wind farms to reflect the robust evidence that has been available about species-specific avoidance rates for gulls since at least 2014.

2.5. CONCLUSIONS

The above analysis of the development of the SNH avoidance rate guidance and its treatment of avoidance rates for White-tailed Eagle, Kestrel and gulls, shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

3. REVIEW OF GOLDEN PLOVER AVOIDANCE RATES

3.1. SOURCES

I found post-construction monitoring reports for three UK wind farms that provide robust data on Golden Plover collision fatality rates, and, for which, there was appropriate data available that could be used to estimate avoidance rates. These reports were for the Blood Hill Wind Farm (Percival *at al.*, 2008), the Goole Fields I Wind Farm (Percival *at al.*, 2018a) and the Goole Fields II Wind Farm (Percival *at al.*, 2018b, 2019). In addition, information on Golden Plover collision fatality rates and avoidance rates is included in the Habitats Regulations Assessment reports for another UK wind farm site (Haverigg II and III[1]; Percival, 2020a, 2020b), although the reports do not contain sufficient detail to allow full review of the collision monitoring methods and results. Unless otherwise stated, all information and data used in this report for each wind farm was taken from the relevant references cited above.

The characteristics of these wind farms are summarised in Table 3.1.

Table 3.1. Characteristics of the wind farms.

Wind farm	Location	Commissioned	Number of turbines	Hub height (m)	Turbine dimeter (m)
Blood Hill Wind Farm	Norfolk	1992	10	30	27
Goole Fields I	Yorkshire	2014	16	80	92
Goole Fields II	Yorkshire	2016	17	80	92
Haverigg II	Cumbria	1998	4	62.5	42
Haverigg III	Cumbria	2005	4	76	52

Sources: Percival (2020a, 2020 b); Percival *at al.* (2008, 2018a, 2018b, 2019).

3.2. COLLISION MONITORING

3.2.1. Methods

The post-construction monitoring for the Blood Hill and Goole Fields I and II wind farms were carried out by the same consultancy and used the similar methodology for collision monitoring. These included weekly searches for carcasses, and searcher efficiency trials and carcass removal trials (Table 3.2). The weekly carcass searches included detailed searches of radii of 100 m (Blood Hill and Goole Fields I), or 130 m (Goole Fields II) around each turbine, with an additional 250 m scanned for large carcasses (Goole Fields I and Goole Fields II). The carcasses found were left in situ to provide data on searcher efficiency and removal rates. In addition, dedicated searcher efficiency, and carcass removal, trials were carried out at all three wind farms. These involved putting out a number of carcasses. A separate observer then tried to locate these carcasses the same day, while the carcasses were also monitored by trail cameras to investigate removal rates.

Table 3.2. Collision monitoring methods.

Wind farm	Seasons	Search frequency	Search radius	Searcher efficiency / carcass removal trials
Blood Hill	2006/07-2007/08	weekly	100 m	67 carcasses
Goole Fields I	2015/16-2018/19	weekly	100 m detailed search 250 m large carcass search	18 carcasses
Goole Fields II	2017/18-2018/19	weekly	130 m detailed search 250 m large carcass search	48 carcasses

Sources: Percival *at al.* (2008, 2018a, 2018b, 2019).

[1] Haverigg I and II are separate, but adjacent, wind farms. However, the reports combine the data for the two wind farms to calculate a single avoidance rate.

The post-construction monitoring for the Haverigg II and III wind farms was carried out between September 2018 and February 2019, with approximately monthly visits. Detailed information about the methodology of this monitoring was not available to me for this review. However, it included searcher efficiency and carcass removal trials.

3.2.2. Results

No Golden Plover fatalities were recorded at the Blood Hill Wind Farm, single fatalities were recorded at the Goole Fields I and Goole Fields II Wind Farms, and one probable Golden Plover fatality and another probable wader fatality were recorded at the Haverigg II and III Wind Farms (Table 3.3). At Blood Hill, searcher efficiency was very high, and the report notes that conditions were good for searching with winter cereals or bare ploughed ground under the turbines. At Goole Fields I and Goole Fields II, crop growth prevented full coverage of the search area on each visit, with overall coverage levels of 60-88% across the five winters covered at these two wind farms. Searcher efficiency was lower than at Blood Hill but still relatively high.

Table 3.3. Collision monitoring results.

Wind farm	Seasons	Golden Plover / wader fatalities recorded	Coverage	Searcher efficiency	% of carcasses missed due to scavengers
Blood Hill	2006/07 2007/08	0 0	100% 100%	> 99%	38%
Goole Fields I	2015/16 2016/17 2018/19	1 0 0	60% 81% 79%	82%	14%
Goole Fields II	2017/18 2018/19	1 0	81% 88%	91%	17%
Haverigg II and III	2018/19	2	no data	93%	33%

All data taken from the relevant reports cited in Section 3.1. The fatalities at Goole Fields I and Goole Fields II were confirmed Golden Plover fatalities. The fatalities at Haverigg II and III were one probable Golden Plover and one probable wader.

3.3. DERIVATION OF AVOIDANCE RATES

3.3.1. Avoidance rate calculations

Table 3.4 shows the predicted number of collisions using the SNH default 98% avoidance rate, the estimated number of collision fatalities, and the empirical avoidance rates for each site. The estimated number of collision fatalities are the actual number of collision fatalities recorded adjusted for coverage, searcher efficiency and carcass removal. Note that the data for Haverigg II and III is a combined estimate for Golden Plover and Curlew. At Blood Hill, Goole Fields I and Goole Fields II, the estimated numbers of collision fatalities were 30-90 times lower than the predicted collisions. The difference was lower at Haverigg II and III, but the estimated numbers of collision fatalities number of collision fatalities was still around six times lower than the predicted collisions. The empirical avoidance rates vary from 99.6% to 99.98%.

For the Blood Hill Wind Farm, there does not appear to be any pre-construction collision risk estimates available. Instead, collision risk estimates were obtained from post-construction vantage point surveys. The reports for the Haverigg II and III Wind Farms were for lifetime extension applications, so the collision risk estimates were also obtained from post-construction vantage point surveys. As noted in the reports, comparison of these estimates with the collision monitoring results may underestimate the avoidance rate, as birds avoiding the wind farm (macro-avoidance) will not be included in the collision risk predictions. However, the monitoring data does not indicate any significant displacement impacts to Golden Plover, so macro-avoidance may not be a significant factor for this species. For the Goole Fields I and Goole Fields II Wind Farms, the post-construction monitoring reports include the pre-construction collision risk predictions from the Environmental Statements for the projects.

No Golden Plover fatalities were recorded in the post-construction monitoring at Blood Hill. However, it would be incorrect to assume a 100% avoidance rate as, where collision rates are low, zero fatalities will be expected in some years ("false negatives"; SNH, 2009). The study by Fijn et al. (2012), which was used by Whitfield and Urquhart (2015) to derive an avoidance rate for Whooper Swan, also did not record any fatalities. To derive an avoidance rate, they assumed that one swan had been killed, and Whitfield and Urquhart (2015) followed that assumption. Therefore, to obtain an avoidance rate estimate for Blood Hill, I used a nominal value of 0.7 Golden Plover fatalities at Blood Hill (equal to one Golden Plover carcass found over two years, corrected for the expected percentage of carcasses missed due to scavenger removal).

Table 3.4. Comparison of collision risk predictions with collision monitoring results.

Wind farm	Predicted collisions (98% avoidance rate) per year	Golden Plover / wader fatalities per year	Avoidance rate
Blood Hill	62	0.7	99.98%
Goole Fields I	56	0.6	99.98%
Goole Fields II	53	1.7	99.94%
Haverigg II and III	28	5.0	99.6%

The data in this table for Haverigg II and III are combined calculations for Golden Plover and Curlew.

The predicted collisions were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the predicted collisions were calculated from post-construction vantage point survey data for Blood Hill and Haverigg II and III, and from pre-construction vantage point survey data for Goole Fields I and Goole Fields II. For Blood Hill, the post-construction monitoring report includes the predicted collisions with an avoidance rate of 0% and the predicted collisions with a 98% avoidance rate were calculated from this figure. For Goole Fields I and Goole Fields II, the post-construction monitoring reports include the predicted collisions with a 99% avoidance rate, and the predicted collisions with a 98% avoidance rate were calculated from these figures.

The Golden Plover / wader fatalities (excluding Blood Hill) were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the Golden Plover / wader fatalities are estimated figures that were calculated from the recorded collisions, adjusted for coverage, searcher efficiency and carcass removal. For Blood Hill, as no Golden Plover fatalities were recorded, a nominal value of 0.7 Golden Plover fatalities is used here to calculate the avoidance rate (see text). For Haverigg II and III, the recorded collisions used for the calculations comprised one probable Golden Plover and one probable wader.

The avoidance rates for Blood Hill, Goole Fields I and Goole Fields II were calculated from the predicted collisions and Golden Plover fatality data provided in the relevant post-construction monitoring reports (see Section 3.1). The avoidance rate for Haverigg II and III is the avoidance rate figure provided in the relevant reports (see Section 3.1).

3.3.2. Correction factors

There are some complicating factors that need to be taken into account in assessing the reliability of the avoidance rate estimates in Table 3.4.

The maps of Golden Plover flightlines in the Blood Hill post-construction monitoring report show a concentration of flightlines in the western section of the 500 m buffer used for the collision risk model, with relatively few flightlines actually crossing the central part of the buffer where the turbines are located. This pattern suggests that the assuming random distribution of flight activity within the 500 m buffer will overestimate the actual collision risk.

For the Goole Fields I and Goole Fields II Wind Farms, the use of pre-construction vantage point survey data for the collision risk predictions means that the accuracy of the avoidance rate estimates is dependent on the pre-construction Golden Plover flight activity being representative of the post-construction Golden Plover flight activity (allowing for any macro-avoidance effects). At Goole Fields II, the mean Golden Plover bird-days/km^2 were around 2.1 times higher in the pre-construction surveys, compared to the post-construction surveys (Figure 15 in Percival *at al.*, 2019), while the mean Golden Plover count within the 600 m buffer zone was around 2.2 times higher during the pre-construction surveys, compared to the post-construction surveys (Table 22 in Percival *at al.*, 2019). These differences seem unlikely to be due to macro-avoidance effects as any displacement impacts to wintering Golden Plover would be likely to be contained within the 600 m buffer zone (and the mean Golden Plover bird-days/km^2 included counts outside the 600 m buffer zone).

The collision risk predictions used for the avoidance rate calculation for the Haverigg II and III Wind Farms used post-construction vantage point survey data. However, this was from a different winter (2014/15) than the winter used for the collision monitoring (2018/19). Therefore, the accuracy of the avoidance rate estimates is dependent on the Golden Plover flight activity patterns being similar in the two winters.

To allow for the above issues, I have used correction factors of 2.0 for the Blood Hill non-avoidance rate estimate, and 2.15 for the Goole Fields II non-avoidance rate estimate. The correction factor of 2.0 for the Blood Hill non-avoidance rate estimate is based on a visual estimate of differences in flightline densities in the western section of the buffer, compared to the central and eastern sections. The correction factor of 2.15 for the Goole Fields II non-avoidance rate estimate is the mean of the pre-construction / post-construction ratio of Golden Plover bird-days/km^2 and the pre-construction / post-construction ratio of Golden Plover counts within the 600 m buffer zone.

Applying correction factors of 2.0 to the Blood Hill non-avoidance rate estimate, and 2.15 to the Goole Fields II non-avoidance rate estimate, gives corrected avoidance rate estimates of 99.87-99.98%, while sufficient information is not available to assess whether a correction factor should be applied to the 99.6% avoidance rate for Haverigg II and III (Table 3.5).

Table 3.5. Corrected avoidance rate estimates.

Wind farm	Avoidance rate		Correction factor	Reason
	original	corrected		
Blood Hill	99.98%	99.96%	2.0	Uneven distribution of flight activity relative to turbine locations
Goole Fields I	99.98%	99.98%	1.0	-
Goole Fields II	99.94%	99.87%	2.15	Reduction in Golden Plover numbers
Haverigg II and III	99.6%	-	-	No data available to assess whether correction factor is needed (see text)

Note that the correction factor is applied to the non-avoidance rate. See text for further details of the reasons for the avoidance rate correction factors.

4. CONCLUSIONS

The collision monitoring methodologies used in the Blood Hill, Goole Fields I and Goole Fields II post-construction monitoring studies are robust and generally comply with best practice guidance (SNH, 2009). Therefore, I consider that the Golden Plover collision fatality estimates for the Goole Fields I and Goole Fields II Wind Farms from these studies are reliable. The reported zero collision fatality estimate for the Blood Hill Wind Farm does not include any correction for “false negatives” (cf., SNH, 2009), but I have allowed for this by using a nominal estimate in my calculations of avoidance rates.

The avoidance rates derived from these studies are very high, and even when I corrected two of them by doubling the non-avoidance rate to reflect uneven distribution of flight activity (Blood Hill) and apparent reductions in Golden Plover numbers (Goole Fields II), they remain around, or higher than, 99.9%. However, a degree of caution is necessary in applying these figures. Due to the low collision rate, very few collision fatalities are found. This means that random variation in the number of collision fatalities found can cause significant changes in the avoidance rate estimate. For example, if a second fatality had been found at Goole Fields II, then the corrected avoidance rate estimate would decrease from 99.87%-99.74%. While this change may seem small, it would cause a doubling in the predicted collision risk.

Detailed information about the collision monitoring methodology used for the Haverigg II and III Wind Farms post-construction monitoring study was not available to me for this review. However, I note that there was a lower frequency of monitoring (approximately monthly) compared to the other studies (weekly). This will have made the collision fatality estimate less reliable. The avoidance rate calculation for this wind farm used combined data for Golden Plover and Curlew, while the two collision fatalities were a probable Golden Plover and a probable wader. Also, the avoidance rate calculations used flight activity and collision fatality data from different winters, and, unlike with Goole Fields I and Goole Fields II it was not possible for me to assess whether differences in Golden Plover flight activity patterns between the winters could have affected the calculations[2]. Therefore, it is possible that the significantly lower avoidance rate calculated for this wind farm, compared to the avoidance rates for Blood Hill, Goole Fields I and Goole Fields II, reflects methodological issues.

These avoidance rates are only derived from four studies, with two of these studies carried out at adjoining wind farms. However, these still represent a much stronger evidence base for a species-specific avoidance rate than the evidence used for Kestrel in the SNH avoidance rate guidance (see Section 2.3). Also, other species-specific avoidance rates in the SNH avoidance rate guidance are based on data from limited numbers of sites: e.g., both the White-tailed Eagle avoidance rate (see Section 2.3) and the Whooper Swan avoidance rate (Whitfield and Urquhart, 2015) are based on data from single sites. Therefore, the evidence base for a species-specific avoidance rate is relatively strong for Golden Plover compared to some of the species for which the SNH avoidance rate guidance does include species-specific avoidance rates. The lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance may reflect the fact that the conservation concern about Golden Plover and wind farms in Scotland is focussed on breeding populations. Data from wintering populations (such as in the studies reviewed here) may not be applicable to breeding populations due to the differences in their behaviour and ecology.

The highest avoidance rate currently recommended by SNH (2018) is 99.8% for geese. The narrow range of the corrected avoidance rates for Blood Hill, Goole Fields I and Goole Fields II (99.87-99.98%) would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at Haverigg II and III is lower than this value, although

[2] Note that, while my assessment of this issue for the Goole Fields II Wind Farm resulted in an increase in the corrected avoidance rate, compared to the original value, it is equally plausible that differences in flight activity between winters could cause a decrease in the corrected avoidance rate, compared to the original value.

there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

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APPENDIX 6

FI LVIA RESPONSE

Appendix 6

FI LVIA Response

DOCUMENT DETAILS

Client:	**StatKraft**
Project Title:	**FI LVIA Response**
Project Number:	**200445-g**
Document Title:	**Appendix 6**
Document File Name:	**Appendix 6 - FI LVIA Response - 2022.10.26 - F -200445-g**
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Rev	Status	Date	Author(s)	Approved By
01	Draft	24/08/2022	SF	JS (internal MKO)
02	Draft	15/09/2022	SF & JS	SK
F	Final	26/10/2022		

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1. LANDSCAPE & VISUAL RESPONSES

This Appendix includes responses to two items of the Request for Further Information as they relate to the topic of Landscape and Visual Impact:

- Item 1 - Particulars and Documentation
- Item 6 - Submissions and Observations

2. ITEM 1.0 PARTICULARS AND DOCUMENTATION

Item 1 of the Request for Further Information requests clarification on the range of turbine envelope configurations sought for planning permission. As detailed in Section 2.1.2 of the main Further Information Response (FIR) document, the applicant is seeking planning permission for a range of turbine envelope configurations. The applicant has produced new photomontage visuals in order to present this range. For consistency and context, these new photomontage visuals are incorporated as additions to the Volume 2 Photomontage Booklet that was previously submitted as part of the EIAR (ABP Ref No. 309770-21). The new photomontage booklet is included as Appendix-7 of this FIR. The following text discusses the new additions to the photomontage booklet and how the range of turbine envelope configurations relate to potential landscape and visual impacts.

2.1 Turbine Envelope Range: Photomontage

The dimensions presented below are the range of hub height, rotor diameter and overall tip height which constitute a ‘reasonably limited range’ and are included in the Photomontage Booklet – *Appendix 7*:

- Turbine Tip Height – Maximum height 175m, Minimum height 175m
- Hub Height – Maximum height 100.5m, Minimum height 97.5m
- Rotor Diameter – Maximum length 155m, Minimum length 149m

A rotor diameter of 155m and a hub height of 97.5m was considered throughout the landscape and visual assessments included in the EIAR and is considered a good representative illustration of the Proposed Development. This turbine configuration (blade length of 77.5m and a hub height of 97.5m) of the reasonably limited range is termed as the ‘Maximum Rotor Diameter and Minimum Hub’:

- **Maximum Rotor Diameter and Minimum Hub Height –** Presented for All 22 No. Viewpoints in the Appendix 7 - Photomontage Booklet (and was presented in Volume 2 of the EIAR).
  - Maximum Tip Height – 175 metres
  - Minimum Hub Heght – 97.5 metres
  - Maximum Rotor Diameter – 155 metres

It is emphasised that **irrespective of which turbine model (combination of hub height and rotor diameter) within the range outlined above is installed on site, the significance of residual landscape and visual effects will not be altered.** However, for the avoidance of doubt, 2 No. alternative turbine configurations (other than the configuration presented throughout the booklet) are presented for three selected viewpoints included in the Appendix 7 photomontage booklet accompanying this document under title pages ‘Turbine Envelope Range’. These configurations include ‘Minimum Rotor Diameter & Maximum Hub Height’ and ‘Median Rotor Diameter & Median Hub Height’. The 3 No. viewpoints selected are representative of short-range views (Viewpoint 07 - 1.26 km from the Proposed Development), medium-range views (Viewpoint 21 - 5.32 km from the Proposed Development) and long-range views (Viewpoints 14 - 16.5 km from the Proposed Development). The following summarises the 'Minimum Rotor Diameter & Maximum Hub Height' and 'Median Rotor Diameter & Median Hub Height' that is presented:

- **Minimum Rotor Diameter & Maximum Hub Height** – 3 Photomontage Viewpoints (VP07, VP14 and VP21)
  - Maximum Tip Height – 175metres
  - Maximum Hub Height – 100.5 metres
  - MinimumRotor Diameter– 149 metres

- **Median Rotor Diameter & Median Hub Height** – 3 Photomontage Viewpoints
  - Maximum Tip Height – 175metres
  - Median Hub Height – 100 metres
  - Median Rotor Diameter – 150 metres

As is shown by the 'Turbine Envelope Range' visuals within the Appendix 7 photomontage booklet, it is extremely difficult to determine any difference that would arise from the use of differing turbine configurations within the range of dimensions proposed. Any difference is only identifiable in the wireframe visuals accompanying the photomontages, and these differences are only really distinguishable with the use of magnification. Irrespective of which turbine model is utilised within the proposed range, the residual landscape and visual impacts reported in the EIAR will not be altered.

3. ITEM 6.0 SUBMISSIONS AND OBSERVATIONS

Item 6 of the RFI requests a response to "*matters pertaining raised in submissions and observations received by the Board from members of the public and prescribed bodies"*. All matters within these submissions pertaining to the topic of landscape and visual impacts of the Proposed Coole Wind Farm are addressed in the following text.

3.1 Landscape and Visual Effects: Photomontages

Several 3rd party submissions relate to the technical production of the photomontages and selection of viewpoints used in the Landscape and Visual Impact Assessment (LVIA) in Chapter 12 of the EIAR. The following section comprises a comprehensive response to these 3rd party critiques, demonstrating that the photomontages have been produced correctly, selection of viewpoints was appropriate and that the LVIA included in the EIAR was both rigorous and robust. However, it is noted that all of the points made below and any critiques made are in the first instance, immaterial to the determination of residual visual effects. It is submitted that even if all of the submissions were valid then this would not have any material impact on the determination of the significance of visual effects conducted. An important point to be emphasised, prior to any discussion of the submissions made and before any consideration is given to this discussion, is that the specific critiques made do not, in the professional judgement of the Landscape and Visual Team at MKO, constitute any meaningful or fundamental critique such that a determination of significance in the visual impact assessment would be altered as a result. It is important to state that no submissions from the Council or 3rd party individuals disagree with the significance ratings of visual effects in the EIAR. Submissions made by 3rd party individuals are solely based on the technical elements of the photomontages.

Scale of The Proposed Turbines in the Photomontages

Several submissions address the scale of the proposed turbines within the photomontages in relation to local landscape features: One such submission states:

> *"In photomontage no 5 the image comes from the townland of Ballywillan which overlooks the bogland and the beautiful Hill of Mael and Rock of Curry, two local landmark and some of the highest landmasses in the area. In this photoshopped Image the turbine are clear1y visible in the landscape. They look to be almost the height of the local landmarks, tower above the bogland and break the otherwise unbroken skyline dramatically. This is bad enough. But this image is not at all accurate. Firstly the turbines themselves are 175m high situated on bogland 75m above sea level, making a combined total of 250m above sea level. The Hill of Mael is 240m above sea level. The turbines are to the fore of the Hill, therefore should appear larger than the hill. They do not Secondly the turbines are a light white–grey colour not a dull light brown as portrayed in these photomontage images. This makes them appear less distinct against the winter landscape in the background."*

Several similar submissions were made in relation to the height of the turbines relative to surrounding topography or similar height. The photomontages presented in the EIAR are verified photomontages. They have been modelled and scaled and presented correctly. As stated in Appendix 12-1 of the EIAR, "*the visibility of the turbines will decrease with the distance from which they are viewed."* In Figure 3-1 (also presented in Appendix 12-1 of the EIAR) below all turbines are modelled to the same size specification, but with distance they appear smaller. The verified photomontages and wireframes are accurately scaled in each viewpoint.

Figure 3-1 The effect of distance on visibility of wind turbines (Illustrative Purposes Only)
Figure 3-2 below shows the base elevation of the landscape of the Proposed Development site and the elevation of several topographical features surrounding the site to the east and north-east; the Hill of Mael, Rock of Curry and Mullaghmeen. Chapter 4 of the EIAR states each turbines foundation elevation, the table of elevations is replicated in

Table 3-1 below. The foundation elevation for Turbine 12 is the highest at 69m above sea level, combined with the turbine tip height this would give the turbine a height of 244m above sea level, 4 meters higher than the Hill of Mael.

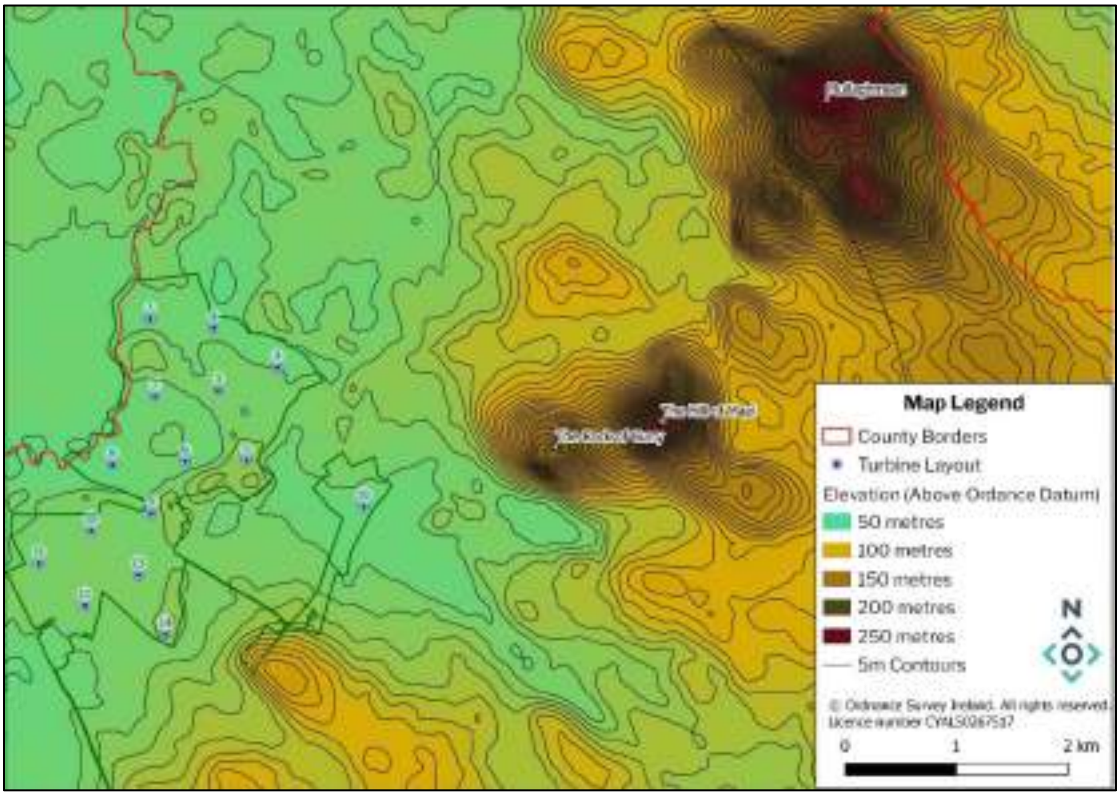


Figure 3-2 Map displaying the elevation of the Coole Wind Farm site and surrounding Topography features

Table 3-1 Proposed Wind Turbine Locations and Elevations

Turbine	ITM Coordinates		Top of Foundation Elevation (m OD)
	Easting	Northing	
1	640852	777346	64
2	641419	777267	64
3	641463	776708	66
4	641994	776908	65
5	641716	776074	63
6	641168	776069	65
7	640893	776651	65
8	640511	776034	62
9	640862	775599	66
10	640322	775448	68
11	639849	775149	67
12	640263	774772	69

13	640750	775050	68
14	640986	774517	67
15	642772	775661	62

Figure 3-3 below shows the wireframe image extracted from Photomontage 05 of the Photomontage Booklet. The Hill of Mael and Rock of Curry are clearly visible as two topographical features to the left of the Proposed Development. From the perspective of Photomontage 05, the Proposed Development is located in closer proximity to the viewpoint than the Hill of Mael and the Rock of Curry, and therefore the proposed turbines are seen to be of larger scale. The red line indicates that the turbines full tip height does appear taller than the Hill of Mael. As stated previously the visibility of the turbines will decrease with the distance from which they are viewed. The closest turbine (T1) is approximately 5.65km from this viewpoint location, below in Figure 3-3 it appears relatively larger than T15 which is 8.1km away from the viewpoint. The Hill of Mael and Rock of Curry are over 8.5km away from this viewpoint and are both seen as smaller than the turbines.

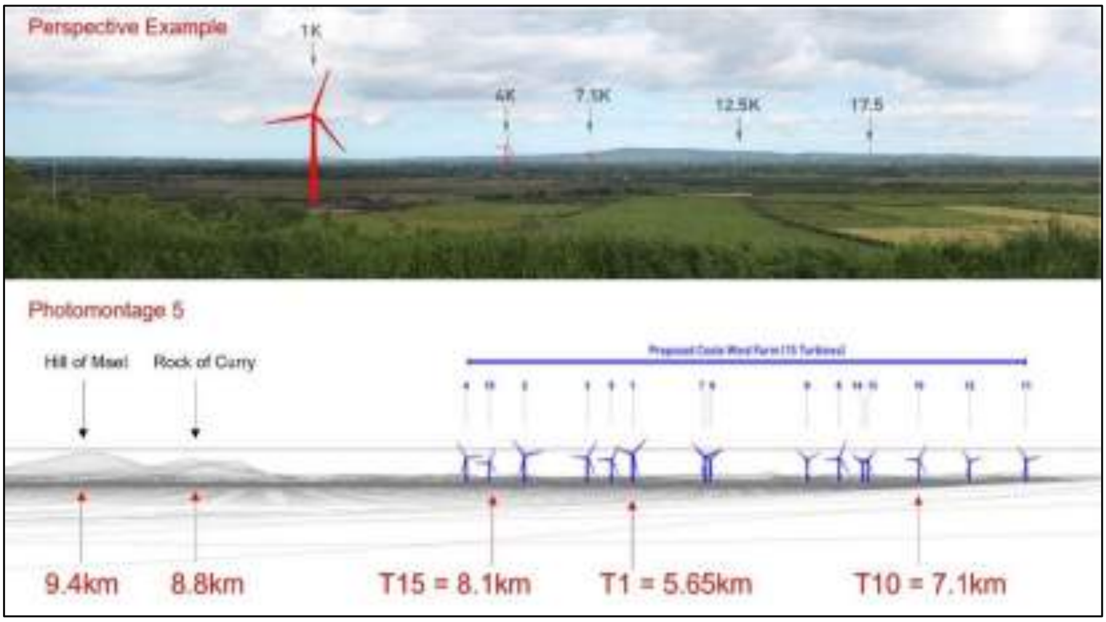


Figure 3-3 Photomontage and Wireframe for VP05

A similar submission made by a 3rd party individual states:

> *"The photomontage 10 in Volume 2 Photomontage Booklet depicts the wind turbines in the same picture as the Hill of Mael on the left at 240m and Mullaghmeen on the right at 258m above sea level. The ground where Coole Wind Farm Ltd is applying to build the turbines is 75m above sea level so the tip of the blades will reach 250m above sea level. Thus they will be higher than the Hill of Mael and only 8m below the top Mullaghmean which is not at all how the turbines are depicted as they are all lower than the Hill of Mael, Photomontage 10 is very misleading. This wind farm will dominate these two landmarks of North Westmeath."*

Contrary to Photomontage 5, Photomontage 10 was taken from the east and so the Hill of Mael is located in closer proximity to the viewpoint location (6.68km) than the Proposed Development. The turbines are located further away from the viewpoint and so the Hill of Mael appears to be larger than the turbines. The closest turbine (T15) is approximately 8.13km from this viewpoint location and appears to be the largest turbine in Figure 3-4. It appears relatively larger than T1 and T10 which are over 10km away from the viewpoint.

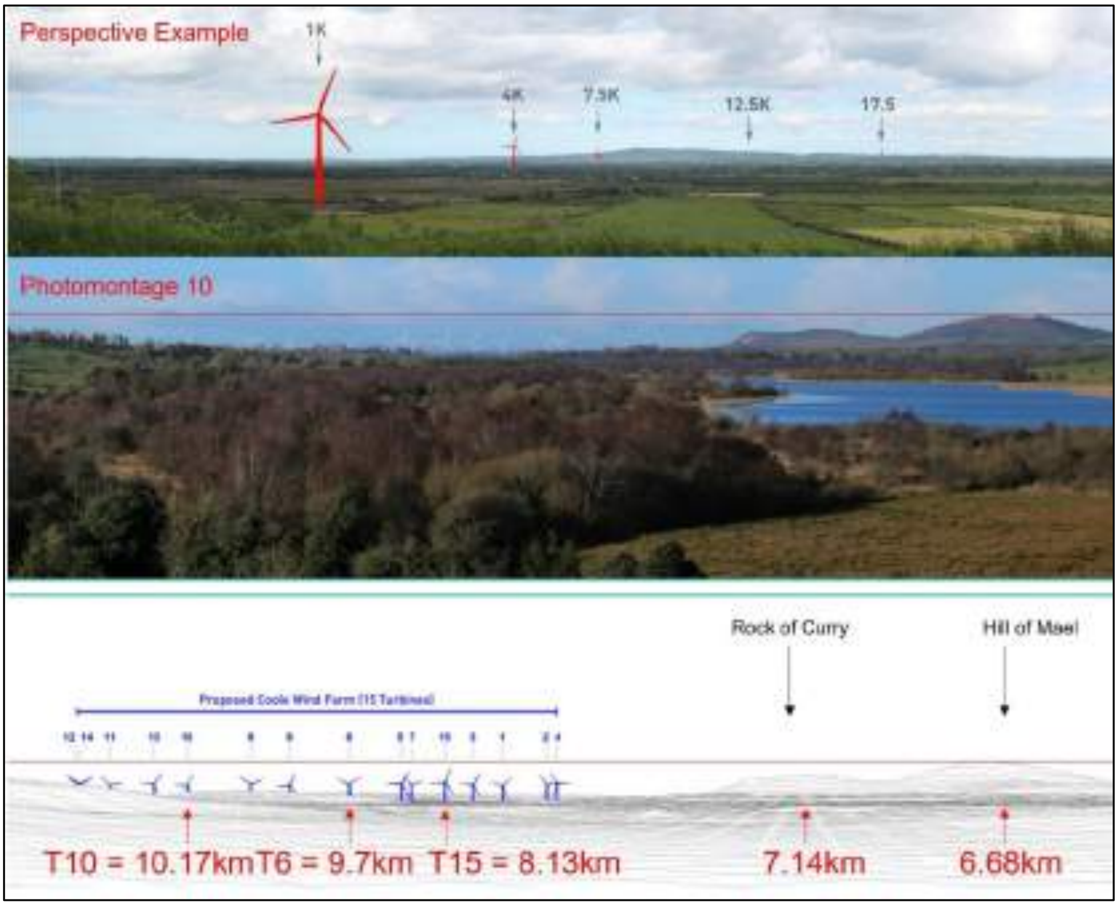


Figure 3-4 Photomontage and Wireframe for VP10

The same style of submission has been made about Photomontage 21:

> *"Photomontage 21 shows how the proposed Wind Farm will dominate the view from Mullaghmean and that is looking down on the turbines whereas they will actually be much higher. Mullaghmean is the largest beech forest in Ireland, a major tourist attraction with many walks all kept in very good condition. It is a very important community asset and so building adjacent to this is outrageous."*

The location of VP21 is located 3.2km from the Hill of Mael and 5.32km from closest turbine (T4). Figure 3-5 below shows the photomontage and wireframe for Photomontage 21, the red line displayed in the Photomontage and wireframe show that, at full tip height, the turbines are taller than the Hill of Mael. The closest turbine (T4) appears largest as it is located 5.32k away from VP21, however T12, that is located 7.92km from VP21, appears shorter than T4.

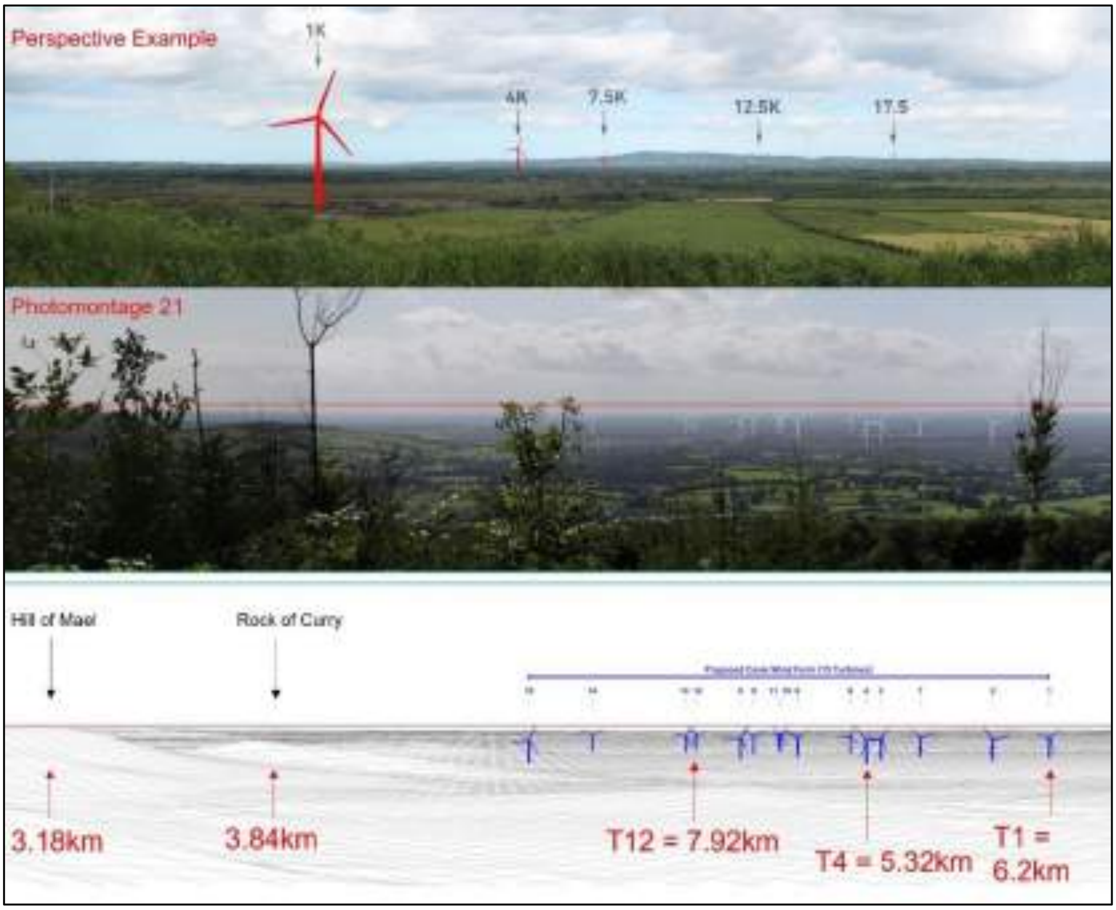


Figure 3-5 Photomontage and Wireframe for VP21

> *"The photomontages are wrong and based on the narrower blade width turbines planned to be used for the non SID Coole Wind Farm. In the turbines planned for Coole Wind Farm SID 88.5% of the full turbine height consists of the diameter of the blade The blade size in these images is based on the narrower turbine where 80% of the full height of the turbine consisted of the diameter of the blade. All of the photomontages are Inaccurate and do not show the full Impact of the turbines as the width of the turbines has increased by over 11 % from 140m to 155m in diameter. To prove my point take a look at any of the wire frame images. The 13 turbine Coole Wind Farm Images are drawn in green and the 15 turbine Coole Wind Farm images are drawn in blue. The proportions of the blades should have increased by over 11 % from the green to the blue wireframe images. They have not."*

In relation to this critique, Figure 3-6 below shows a comparison of the wireframes of both turbine layouts for Photomontage 7. Both layouts have a turbine tip height of 175m. The hub height presented in the photomontages for the original 13 turbine layout for Coole Wind farm was 105m with a turbine blade diameter of 140m. For the new 15 turbine layout, the hub height presented in the photomontages was shorter at 97.5m but with a larger rotor diameter of 155m. As shown below in Figure 3-6, the turbines of the 13 turbine layout (represented in green) have taller hub heights than those of the 15 turbine layout (represented in blue). The blade length of the 15 turbine layout (blue) are longer than those of the 13 turbine layout (green) giving both turbine layouts the same full tip height of 175m.

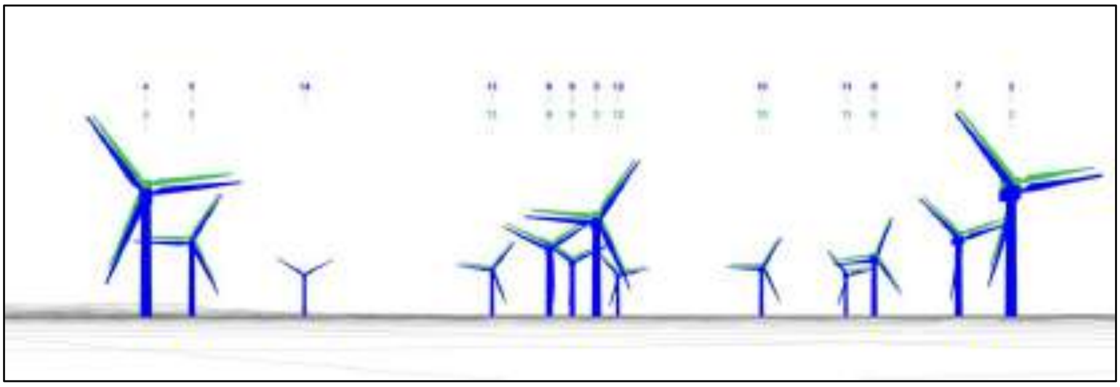


Figure 3-6 Comparative wireframe for photomontage 7

Another submission states:

> *"The photoshopped images of turbines on the photomontage are not in keeping with the genuine width of the turbine blades and towers. For example in Photomontage 7, images 39-44 the image of the turbines in the photoshopped images are noticeably narrower than in the wire framed images. This is a deliberate attempt to fool people into thinking the turbines will have less of a visual impact on the landscape".*

In relation to this critique, the wireframes used to accompany the rendered images for the photomontages are only used for model purposes. The thicker turbine is sometimes used within the wireframe to make the location of each individual turbine clearer. The rendered image (displaying the photoshopped turbines) represents the actual view of the turbines. Figure 3-7 below shows the photomontage and wireframe for Photomontage 7. The **rendered images** in the photomontage give the **most accurate representation** of the view and the turbines. As shown in Figure 3-8 below, the view in Photomontage 2 towards the Proposed Development is heavily screened so the rendered turbines are not fully visible, the wireframe below gives an indication of the turbine layout behind the screening.

Figure 3-7 Photomontage 7 with accompanying wireframe

Figure 3-8 Photomontage 2 and accompanying wireframe

In relation to submissions regarding the visibility of the Proposed Development outside of 20km, one submission states:

> *"The proposed wind farm will be visible from beyond the 20km radius assessed through ZTV and some photomontages."*

As stated in Appendix 12-1 of the original EIAR, the LVIA Study Area is set at 20km: "*Effects on visual receptors beyond a 20 km radius from the proposed development, where it is judged that potential significant effects are unlikely to occur".* It is noted in this regard that views of the proposed turbines from locations outside of 20km from the Proposed Development are unlikely to be substantial in terms of the scale of the proposed turbines. The turbines appear smaller the further from the Proposed Development that they are viewed and are highly unlikely to result in significant landscape and visual effects at this distance. As a result, and in conjunction with other factors including the increased likelihood of complete screening of the proposed turbines with increased distance, significant landscape and visual effects are deemed unlikely to arise in this area beyond 20km from the Proposed Development. The Draft Revised Wind Energy Guidelines (2019, DoHPLG) also state that *"For blade tips in excess of 100m, a Zone of Theoretical Visibility radius of 20km would be adequate".* In consideration of the above discussion, it is submitted that the 20km radius for the LVIA study area was appropriate and sufficient in in the assessment of any likely significant landscape and visual effects.

3.2 Scenic Views

One 3rd party submission states:

> *"The first photomontage in the EIAR shows photoshopped images, wireframe images and a map of the location of the Protected View from Coole, taken from Burkes bar, Coole. Coole is the village most adversely affected by this proposed Windfarm. The image should show the Protected View from this site but it looks north, away from the view. The real visual impact on the landscape in this part of Coole should show the view from Mayne Bog towards the turbines. The montage is misleading. As discussed below, Mayne Bog and the Bronze Age wooden road in Mayne Bog, with much potential for tourism and heritage, will be adversely impacted."*

Westmeath County Council state that *'Mayne bog is not accessible to visitors and the surviving stretch of the trackway cannot be seen because it lies between 1.5m to 2m below the surface of the uncut 'high bog'* (Source: http://whahs.ie/mayne-bog-trackway/). Photomontage 01 was taken from Protected View 49. The Westmeath County Development Plan (WCDP) 2014-2020 describe Protected View 49 as a *'Panoramic view of countryside from top of hill on Regional Road R-395 at Coole'.* In the new Westmeath County Development Plan 2021-27, the numbering of the protected views has changed. In the New WCDP Protected View 49 (now numbered as Protected View 27) states *"This is a panoramic view of the landscape to the west of Coole, much of which is bogland."* The Proposed Coole wind farm is located north of this Protected View and will not impact on the focus of the Protected View of the boglands to the west. The Protected View is directed towards the bog, not originating from the bog itself. Due to the lack of access and consequently the lack of visual receptors likely to experience views from the bog, it is not deemed that the Proposed Development will have a significant visual impact on the area. The focus of this designated Protected View is towards Mayne Bog, in the opposite direction of the Proposed Development. In Plate 3-1 below a 180-degree field of view can be seen towards the Mayne Bog. The proposed Coole Wind Farm turbines will not be visible within this view.

Plate 3-1 View towards Mayne Bog from VP01 (Protected View 49, WCDP 2014-2020, now numbered Protected View 27, WCDP 2021-2027)

In relation to a concern highlighted in a 3rd Party Submission that *"Photomontage no 8 is not taken in the actual location of Protected View no 51, but in the vicinity of the view, this is highly inaccurate and deliberately misleading."* The WCDP 2014-2020 describes Protected View 51 as *'Sporadic views (both sides of roadway) of "Hill of Mael" to the west and "Mullaghmeen" to the north-east from Local Road L-1759 which runs through the intervening valley.*' Figure 3-9 below shows a map of Protected View 51 and the photomontage location with zones of theoretical visibility. The ZTV indicated that there was no visibility along a large portion of the section of the L1759 Local Road designated as part of the Protected View. VP08 is the closest point to this Protected View where there is theoretical visibility. Protected View 51 is directed towards the Hill of Mael and Mullaghmeen (as stated in the description from the WCDP) and not in the direction of the proposed turbines. Further south along the view from VP08, the Hill of Mael screens the turbines from view.

The new county development plan WCDP 2021-27 acknowledges that there are limited views from this scenic view due to vegetation. The WCDP 2021-27 describes Protected View 51 (re numbered to Protected View 32 in the new WCDP) as *'The focus of this view is the Hill of Mael and Mullaghmeen on either side of the road. It should be noted that there are stretches of the road which have no clear line of sight due to tall road-side vegetation.'*.

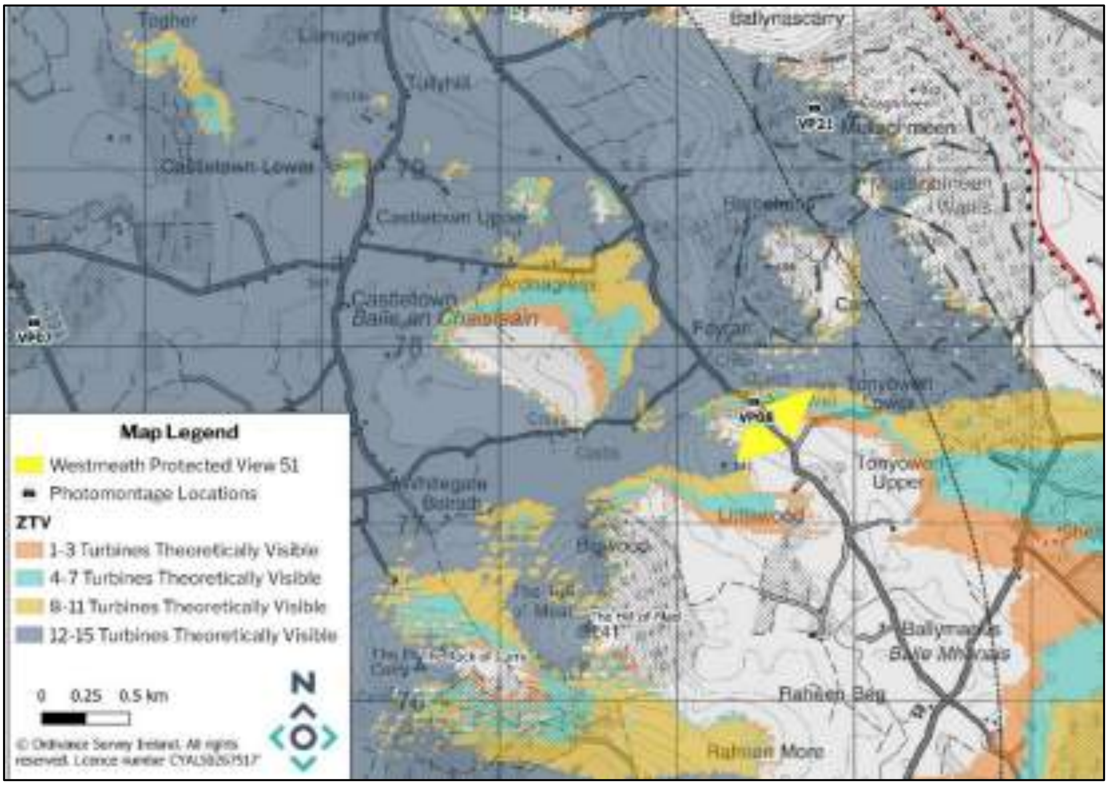


Figure 3-9 ZTV of area surrounding VP08.

"CWF acknowledge that the views from Lough Crew, Frewin Hill and Mullaghmeen and views of the lakelands have high aesthetic quality and are designated scenic amenity in the relevant County development plans. Coole Wind Farm if built will have a permanent detrimental effect on those and other science view in our landscape and will hugely damage the potential of North Westmeath as a tourism industry."

The original EIAR provides a comprehensive assessment in relation to landscape and visual effects on the scenic amenity discussed in the above quote from a 3rd party submission. It is noted that Appendix 12-3 from the EIAR contains detailed viewpoint assessment tables for each of the viewpoints. VP11, VP14 and VP21 show views from Lough Crew, Frewin Hill, and Mullaghmeen, each of these viewpoints were discussed in detail and assessed. In terms of the effect the wind farm will have on each of these views, Lough Crew (VP11) and Frewin Hill (VP14) were deemed to have a Slight residual effect on the view. The residual effect from Mullaghmeen (VP21) was deemed to be Moderate. No significant visual effects were deemed to arise as a result of the Proposed Development at these locations.

3.3 Receptors in Close Proximity

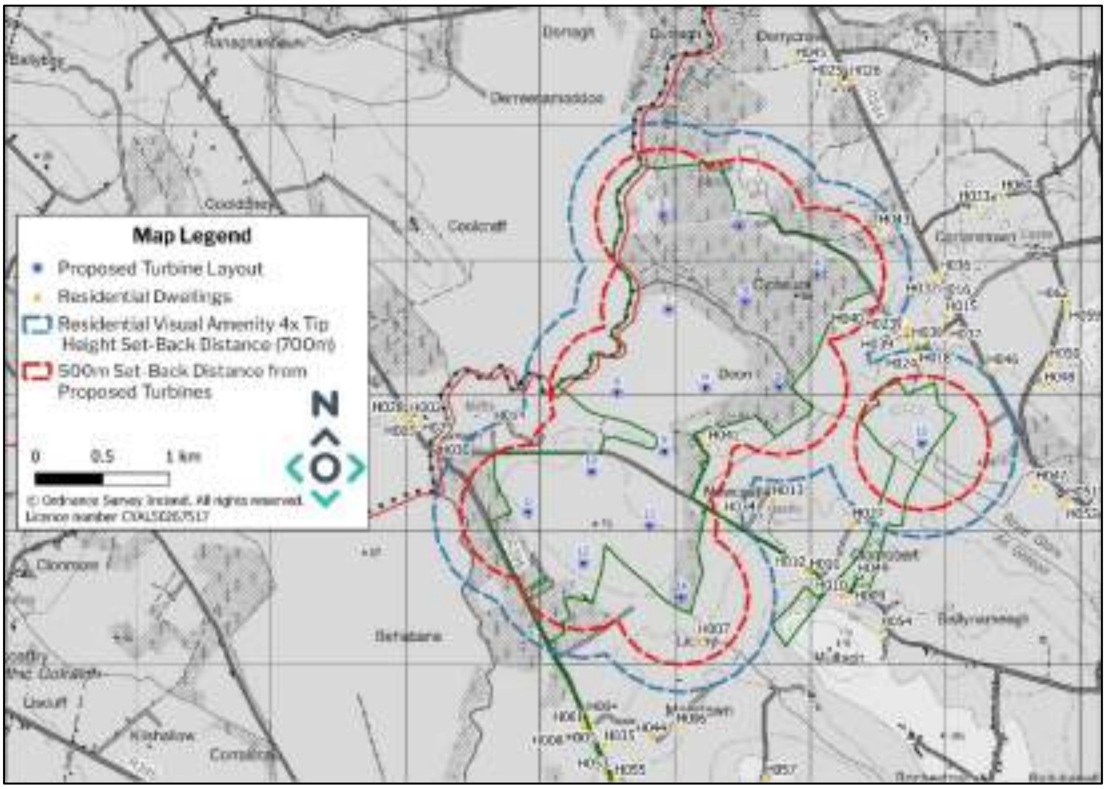


Figure 3-10 Residential Receptors within 1.55km of a proposed turbine

A number of 3rd party submissions raise concerns relating to the residential dwellings in close proximity to the site. These concerns highlight the setback distance set out by the Draft Revised Wind Energy Development Guidelines (2019, DoHPLG) for visual amenity. Potential for impacts on sensitive residential receptors has been kept to the fore throughout the iterative design process adopted for the Proposed Development and has been considered in full within the EIAR. The Draft Revised Wind Energy Development Guidelines (2019, DoHPLG) contain Specific Planning Policy Requirements (SPPRs). Of specific relevance here in relation to appropriate setback distances is SPPR 2 which states:

> ***SPPR2***
>
> *"With the exception of applications where reduced setback requirements have been agreed with relevant owner(s) as outlined at 6.18.2 below, planning authorities and An Bord Pleanála (where relevant), shall, in undertaking their development planning and development management functions, ensure that a setback distance for visual amenity purposes of 4 times the tip height of the relevant wind turbine shall apply between each wind turbine and the nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a mandatory minimum setback of 500 metres from that residential property. Some discretion applies to planning authorities when agreeing separation distances for small scale wind energy developments generating energy primarily for onsite usage."*

In December 2019, the Draft Revised Wind Energy Development Guidelines were published for consultation and have yet to be finalised. As illustrated in Figure 1-11 above, the Proposed Development has a 700m setback distance from residential receptors, which is compliant with a 4 times tip height set-back distance.

Figure 3-10 above displays a map of the residential receptors within 1.5km of a proposed turbine. As stated in Chapter 5 (Population and Human Health) of the EIAR *"There are 18 no. occupied dwellings* *located within one kilometre of the proposed turbine locations. The closest occupied dwelling H14 (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine T11. There are two dwellings, H18 & H24 which are located at distances of 638m and 679m from T15 respectively however these are individuals involved with the Proposed Development."* As stated above all occupied residential dwellings comply with the mandatory setback distance of 500m. Any other dwellings within the set-back distances area are either commercial/agricultural dwellings (H041 and H040) or derelict (H043, H034, H07). Therefore, it is emphasised (as stated within the EIAR) that the Proposed Development is compliant with the required set-back distances for residential visual amenity.

Photomontages Representing visual amenity

Another 3rd party concern highlighted by several individuals was that there were no photomontages taken or route screening analysis completed from roads close to the Proposed Development where a number of residents are situated. Potential for impact on sensitive residential receptors has been kept to the fore throughout the iterative design process adopted for the Proposed Development and has been considered in full within the EIAR. In relation to the selection of Viewpoint locations, the GLVIA (2013) states:

> *"The emphasis must always be on proportionality in relation to the scale and nature of the development proposal and nature of the development proposal and its likely significant effects."*

During the LVIA conducted as part of the EIAR and reported in Chapter 12 (Landscape and Visual) a rigorous and robust scoping exercise, desk study and baseline study was conducted. The scoping exercises including the ZTV, site visits and viewpoint selection resulted in a widespread final selection of 22 no. photomontages in total. Photomontages are just one of the tools employed during the LVIA that was conducted in order to inform the assessment of landscape and visual effects. It would be a disproportionate measure to include an individual photomontage from every residential dwelling and this is not required to conduct a thorough and robust assessment of landscape and visual effects. In line with the guidance laid out in the GLVIA (2013), the viewpoints selected for the LVIA conducted were informed by a range of factors including the *"ZTV analysis, by fieldwork, and by desk research"* (para 6.18, GLVIA 2013). Furthermore, the GLVIA (2013) states that representative viewpoints are *"selected to represent the experience of different types of visual receptor, where larger numbers of viewpoints cannot all be included individually and where the significant effects are unlikely to differ"* (para 6.19 GLVIA, 2013). It is submitted that the large number of viewpoints used in the conduct of the LVIA are sufficient to represent the visual receptors within the LVIA study area, including the *"distribution of population"* (para 6.18, GLVIA 2013). 11 of the 22 total photomontages produced are located within 5km of the Proposed Development, and in fact 7 of these are located within 3 km of the Proposed Development, and these viewpoints are located at varying geographic perspectives and orientation, enabling a sufficient and appropriate number of Photomontages for the assessment of landscape and visual effects.

3.4 Landscape Character

Several 3rd party submissions address the suitability of the landscape character of the Proposed Development site and surrounding area. In relation to these concerns, the proposed turbines are subject to extensive discussion, relating to the landscape, landscape type, and landscape character of the site and surrounds in a number of sections within the EIAR (see Section 12.4, Section 12.5, and Section 12.8). A comprehensive assessment of each Landscape Character Area within the wider LVIA study area was detailed in Appendix 12-2 and no significant effects on landscape character were recorded. The Northern Hills and Lakes LCA were deemed to experience a Slight residual effect on landscape character. It is comprehensively demonstrated within the EIAR that the landscape of the Proposed Development Site is suitable for a wind energy development of the scale proposed in the case of the Proposed Development. It is also apparent throughout the entire range of Photomontages presented that the Proposed Development is effectively absorbed within the landscape within which it is viewed, particularly from locations where the Proposed Development is viewed from long-range views (see Appendix 12-3 for a comprehensive discussion of this).

Similar 3rd party submissions argue that the area designated as 'Low Capacity' in terms of wind energy development, within the Westmeath County Development Plan (2014-2020), is not suitable for industrial wind farms. This point is comprehensively addressed within the landscape and visual chapter (Chapter 12) within the EIAR, for example see the following quote:

> *"It is noted that while the Wind Energy Development Capacity Map (Map 5) in the current WCDP indicates that this LCA has a Low Capacity for wind energy development, the LCA is described as having extensive areas of cutaway bog. With reference to the Regional Planning Guidelines for the Midland Region, flat peatlands are considered the preferred location for wind energy developments in County Westmeath."*

In relation to wind energy development capacity in the WCDP, the policy context remains largely unchanged. The Wind Energy Development Capacity Map in the current Westmeath County Development Plan 2021-2027 still indicates that the LCA has a Low Capacity for wind energy development. The current WCDP (2021-27) also acknowledges the LCA as having *"extensive areas of cutaway bog".* The policy regarding the sitting of wind farms on cutaway peatland sites also remains unchanged. The WCDP 2021-27 states "*The preferred locations for large scale energy production, in the form of windfarms, is onto cutover cutaway peatlands in the County*".

The Midlands Regional Planning Guidelines and the Wind Energy Development Guidelines state that the flat peatland and cut away bog landscapes are suitable landscapes for accommodating wind energy developments. The Midland Regional Guidelines state that

> *"The Midland Region is well placed for the development of renewable energy such as wind and biomass/biofuels given the predominantly rural nature of the landscape which includes large expanses of worked out peatland."*

In addition, the Proposed Development aligns well with the guidelines on siting and design (Wind Energy Development Guidelines (2006, DoEHLG) and the Draft Revised Wind Energy Development Guidelines (2019, DoHPLG)), as covered in full in Section 12.4.5 within the EIAR. It is stated within the Wind Energy Development Guidelines that "*aesthetically, tall turbines would be most appropriate*" in flat peatland sites. The proposed turbines of the Proposed Development are consistent with this guidance (again as addressed in greater detail in Section 12.4.5). By using this turbine height (175m Tip Height), it allows for fewer, taller turbines within the site, improving the visual congruency of the Proposed Development within the landscape type within which it is located, as detailed in full within the assessment of Photomontages contained within Appendix 12-3 and the assessment of landscape and visual effects contained within Section 12.9. In conclusion, in relation to the 3rd party submissions addressing the suitability of the landscape character of the site and surrounds for the Proposed Development it is submitted that the lengthy and comprehensive discussion within the sections of the EIAR referenced above clearly demonstrate that the landscape of the site is suitable for the Proposed Development and that Significant landscape effects will not arise in relation to the Proposed Development.

APPENDIX 7

VOLUME 2 PHOTOMONTAGE BOOKLET (ENCLOSED SEPARATELY)

Appendix 7 - Environmental Impact Assessment Report
Proposed Coole Wind Farm, Co. Westmeath
Volume 2

PHOTOMONTAGE BOOKLET

Planning and
Environmental
Consultants

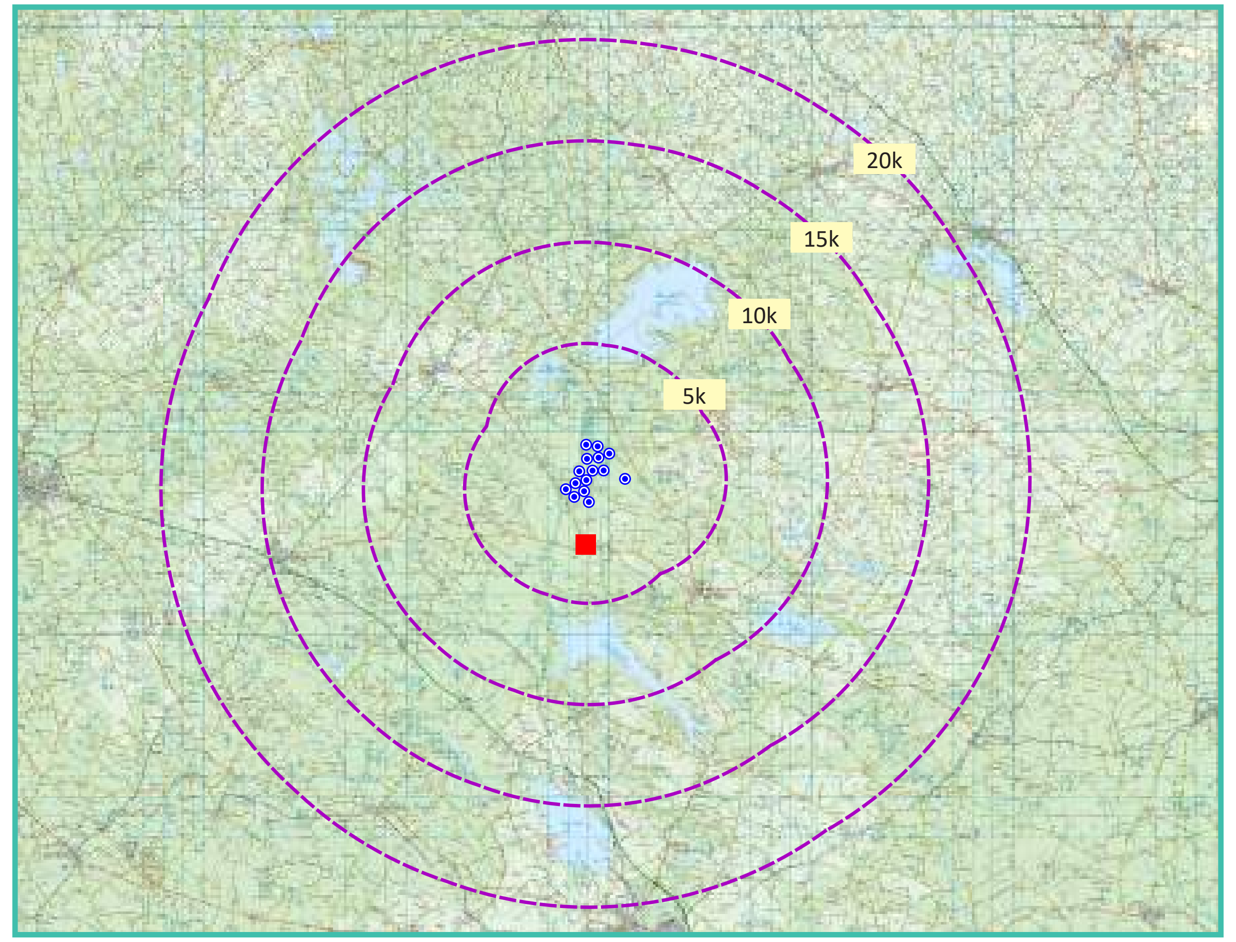
View Point 1

Coole Village

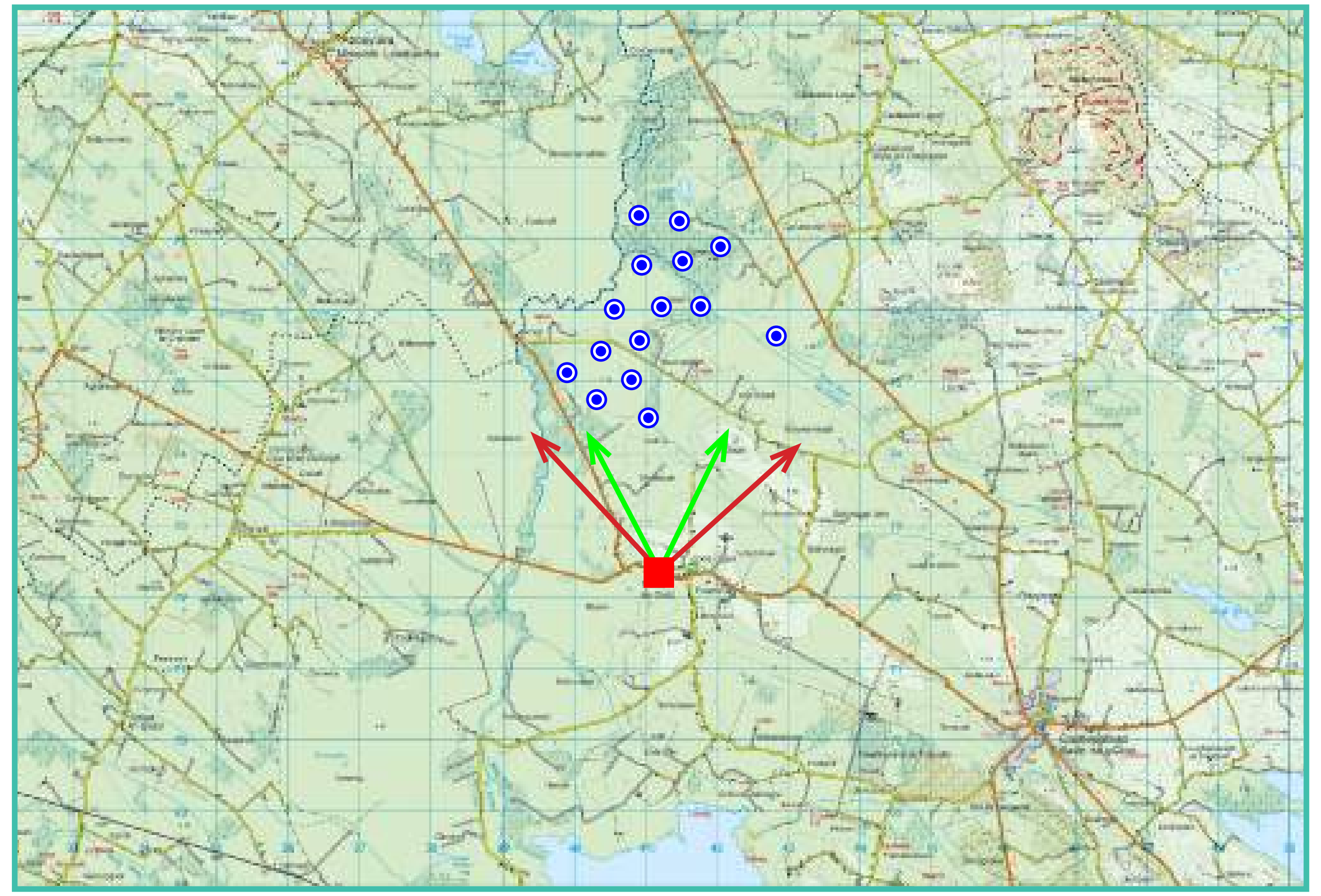
Photomontage 1

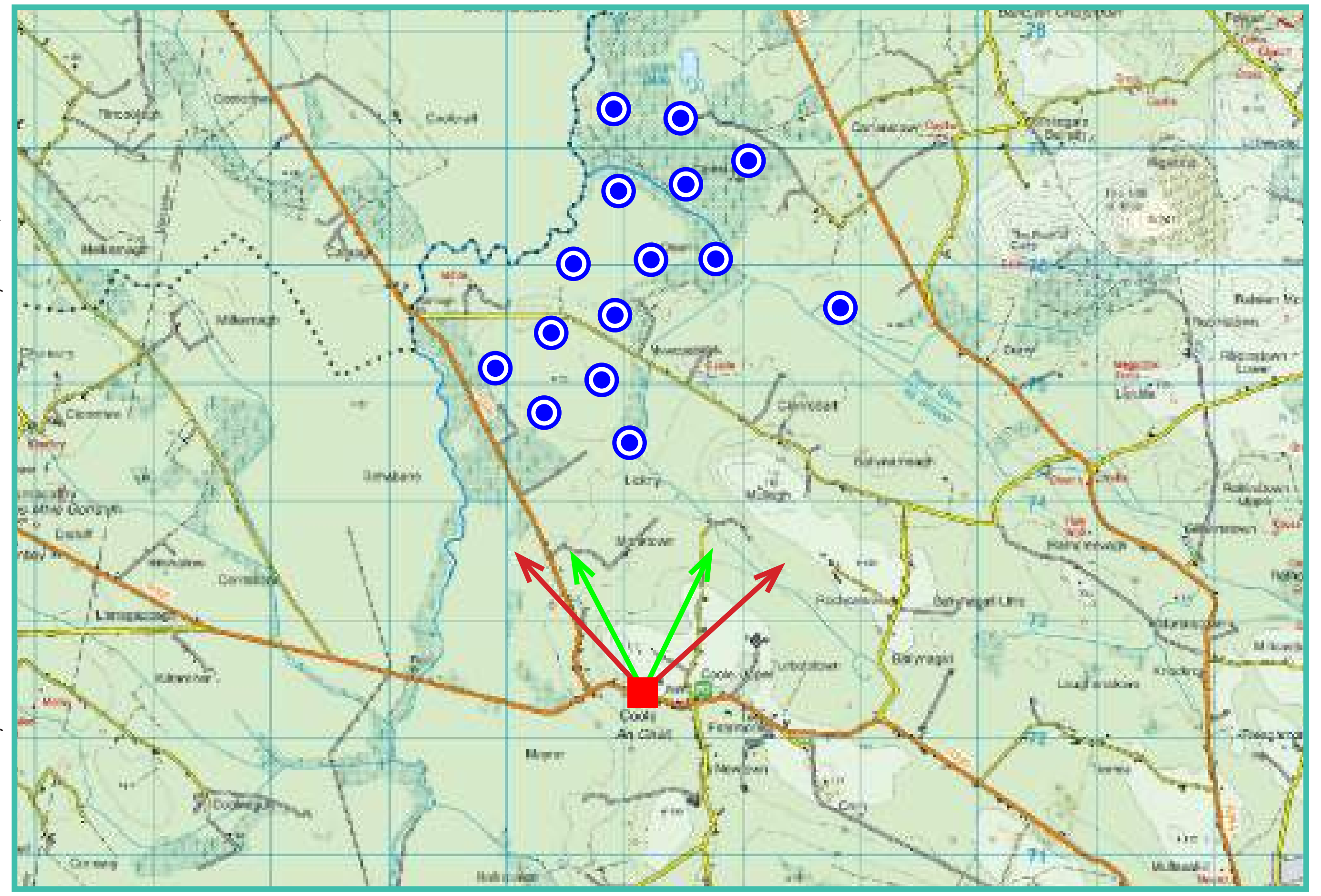
View Point: View from protected view on the R395 Regional Road through Coole village, approximately 2.1 kilometres south of the nearest proposed turbine location.

View point grid reference	241,070(E); 272,405(N)
Date of image taken	17.02.2016
Time of image taken	1.54pm
View point elevation	96m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	2°
Horizontal extent of proposed turbines	307°
Distance to nearest proposed turbine	2.1km (T14)
Number of proposed turbines visible	0/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

317° Direction (Degrees) 2° 47°

0° Included Angle (Degrees) 45° 90°

317° Direction (Degrees) 2° 47°

0° Included Angle (Degrees) 26.5° 53.5°

335° Direction (Degrees) 2° 29°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

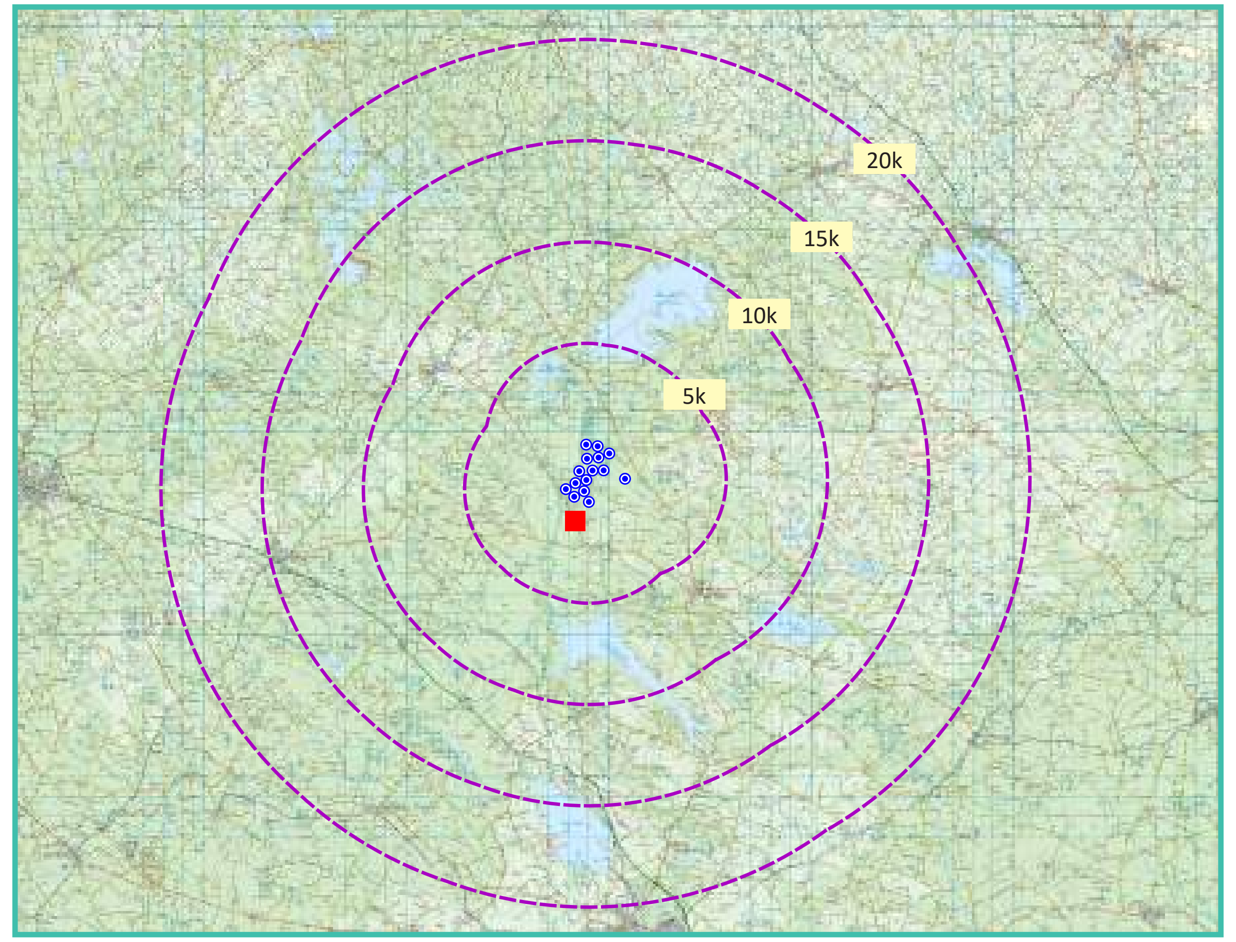
View Point 2

Coole

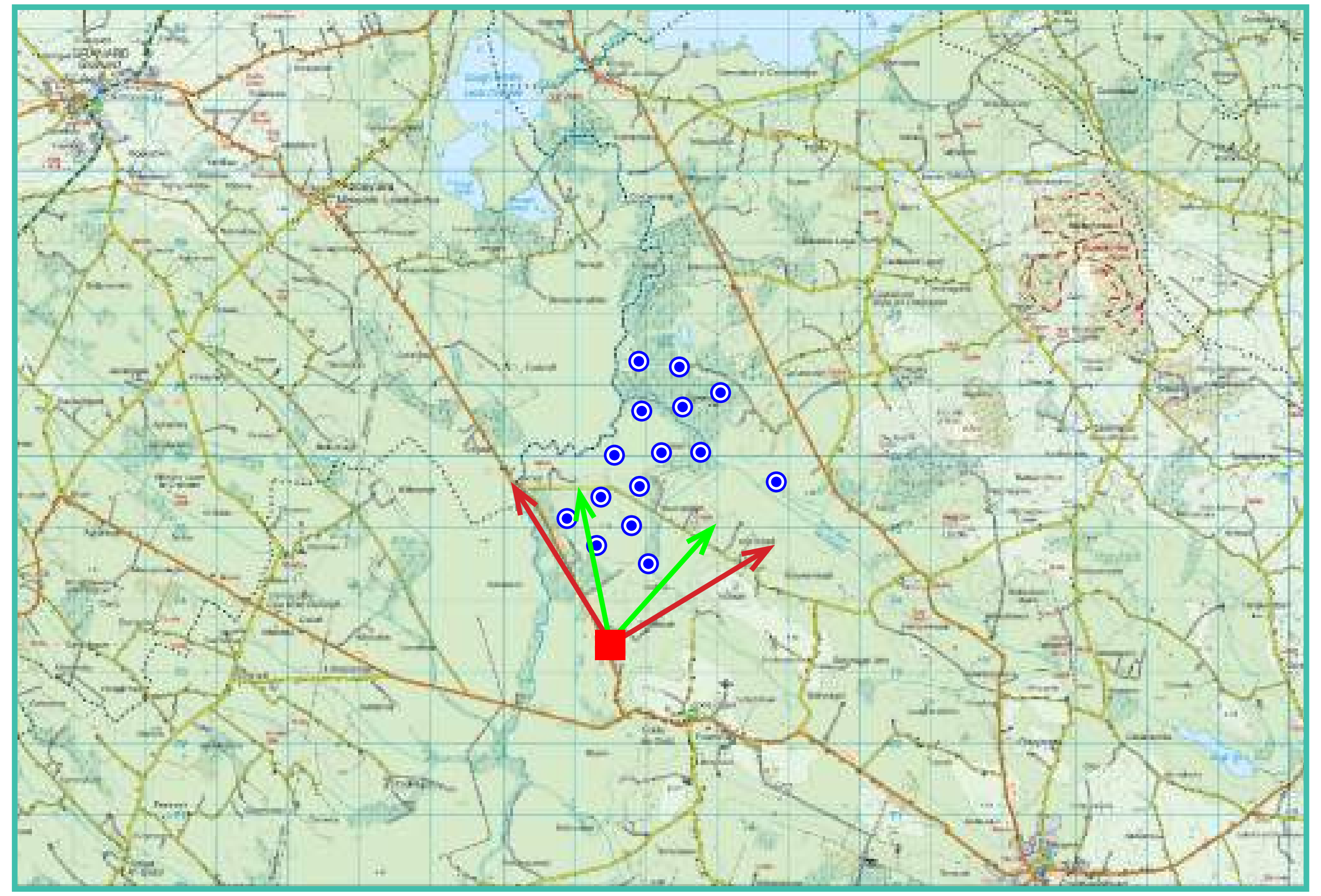
Photomontage 2

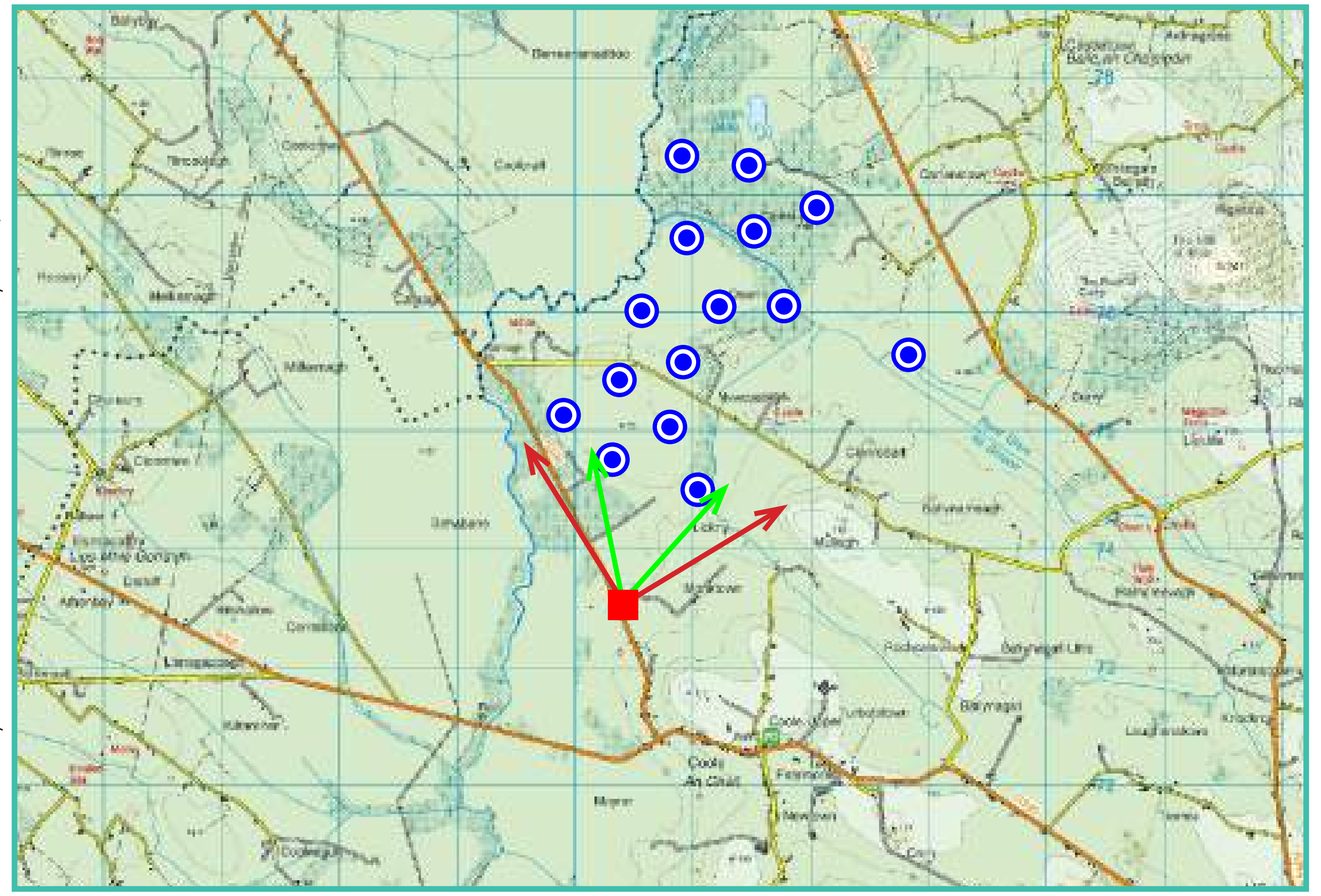
View Point: View from theR396 Regional Road in the townland of Coole, approximately 1.2 kilometres south of the nearest proposed turbine location.

View point grid reference	240,398(E); 273,456(N)
Date of image taken	17.02.2016
Time of image taken	2.07pm
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	13°
Horizontal extent of proposed turbines	296°
Distance to nearest proposed turbine	1.2km (T14)
Number of proposed turbines visible	8/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

328° Direction (Degrees) 13° 58°

0° Included Angle (Degrees) 45° 90°

328° Direction (Degrees) 13° 58°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

346° Direction (Degrees) 13° 40°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
12
10
8
1
7
9
13
2
6
3
4
5
14
Existing Ballyjamesduff Wind Farm
(Not visible due to topography & screening)
346° Direction (Degrees)
13°
40°

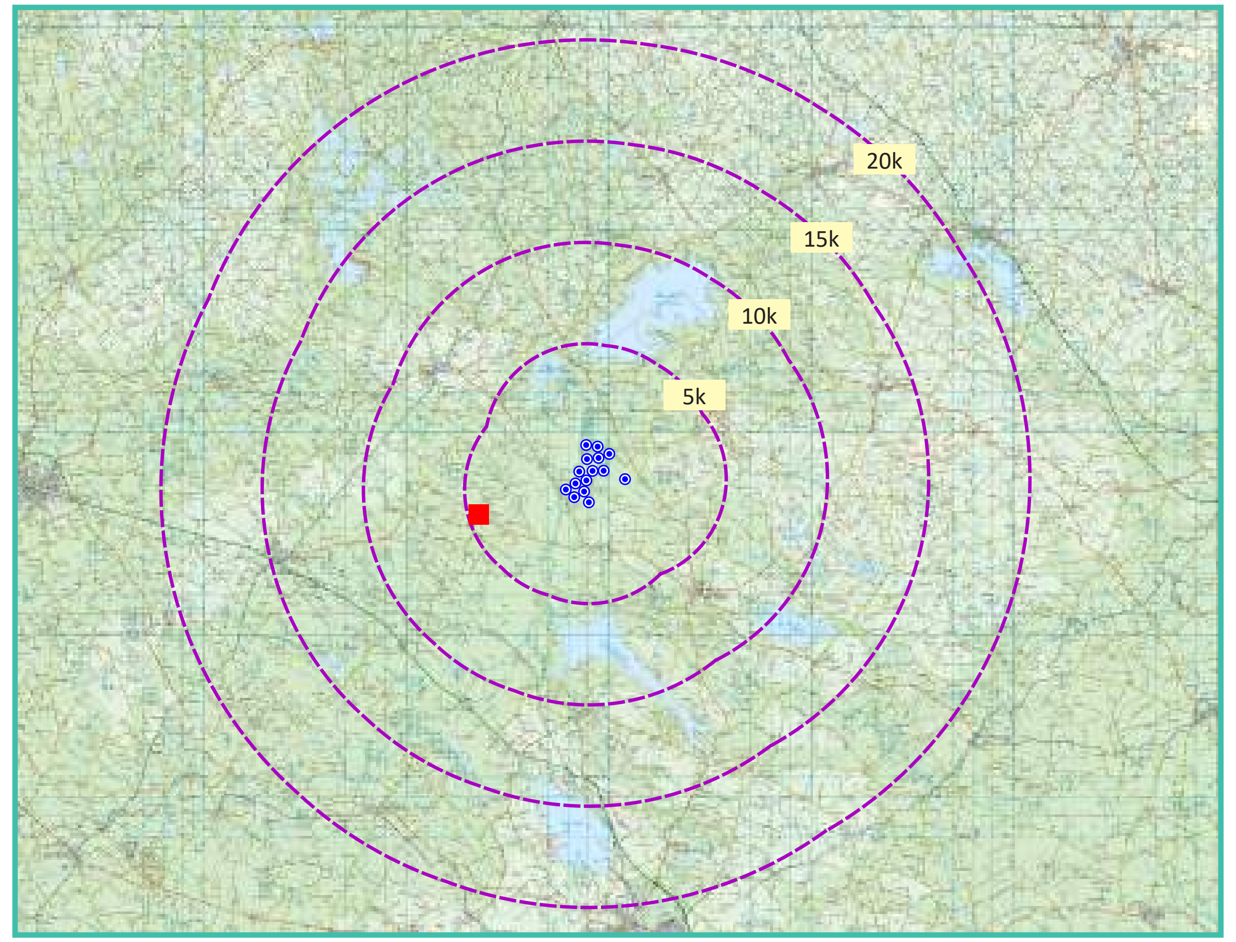
View Point 3

Lismacaffrey

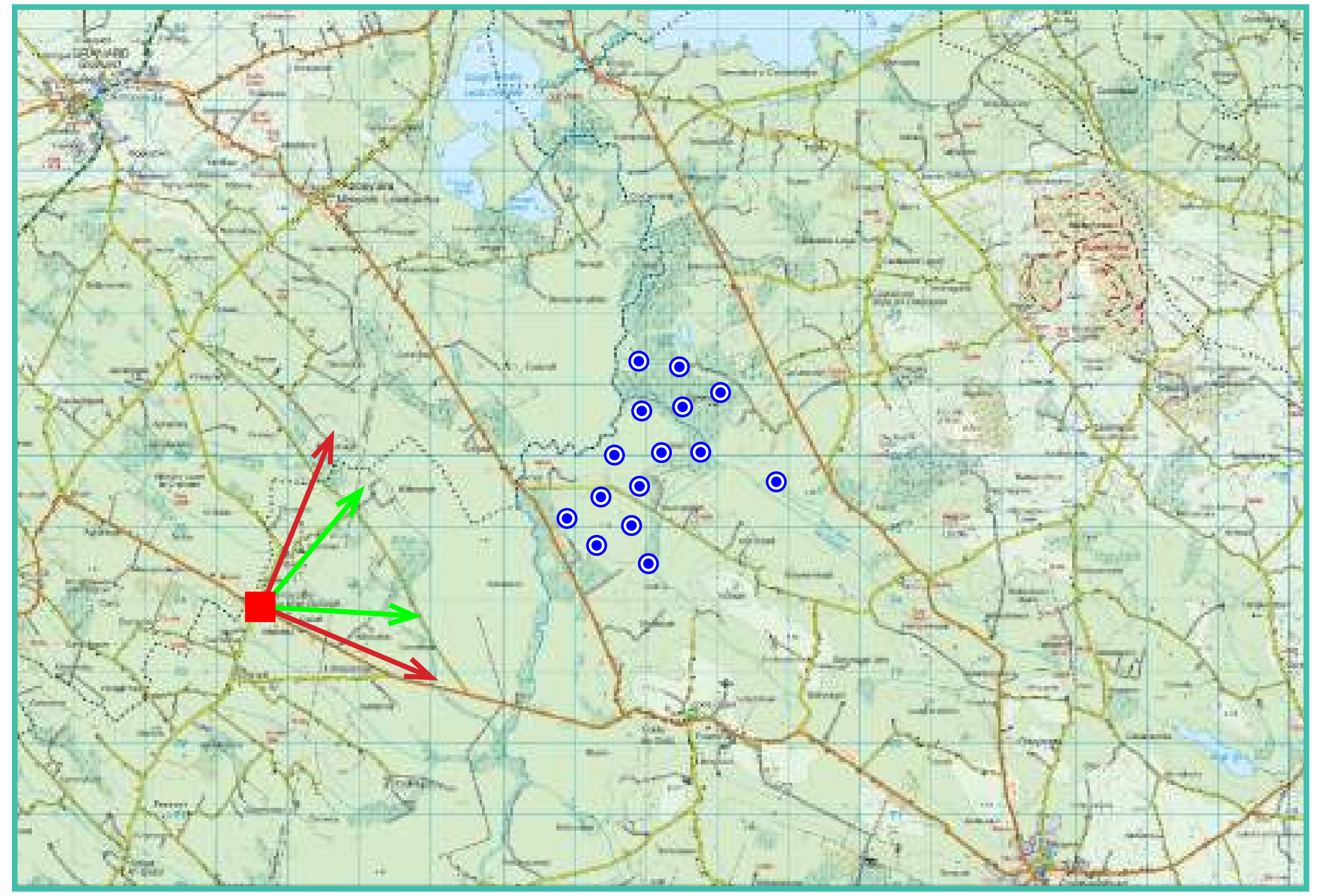
Photomontage 3

View Point: View from Regional Road at Lismacaffrey approximately 4.4.km west of the nearest turbine.

View point grid reference	235,625(E); 273,874(N)
Date of image taken	19.01.2017
Time of image taken	14.34pm
View point elevation	79m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	67°
Horizontal extent of proposed turbines	26°
Distance to nearest proposed turbine	4.4km (T11)
Number of proposed turbines visible	14/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.



View point relative to wind farm site

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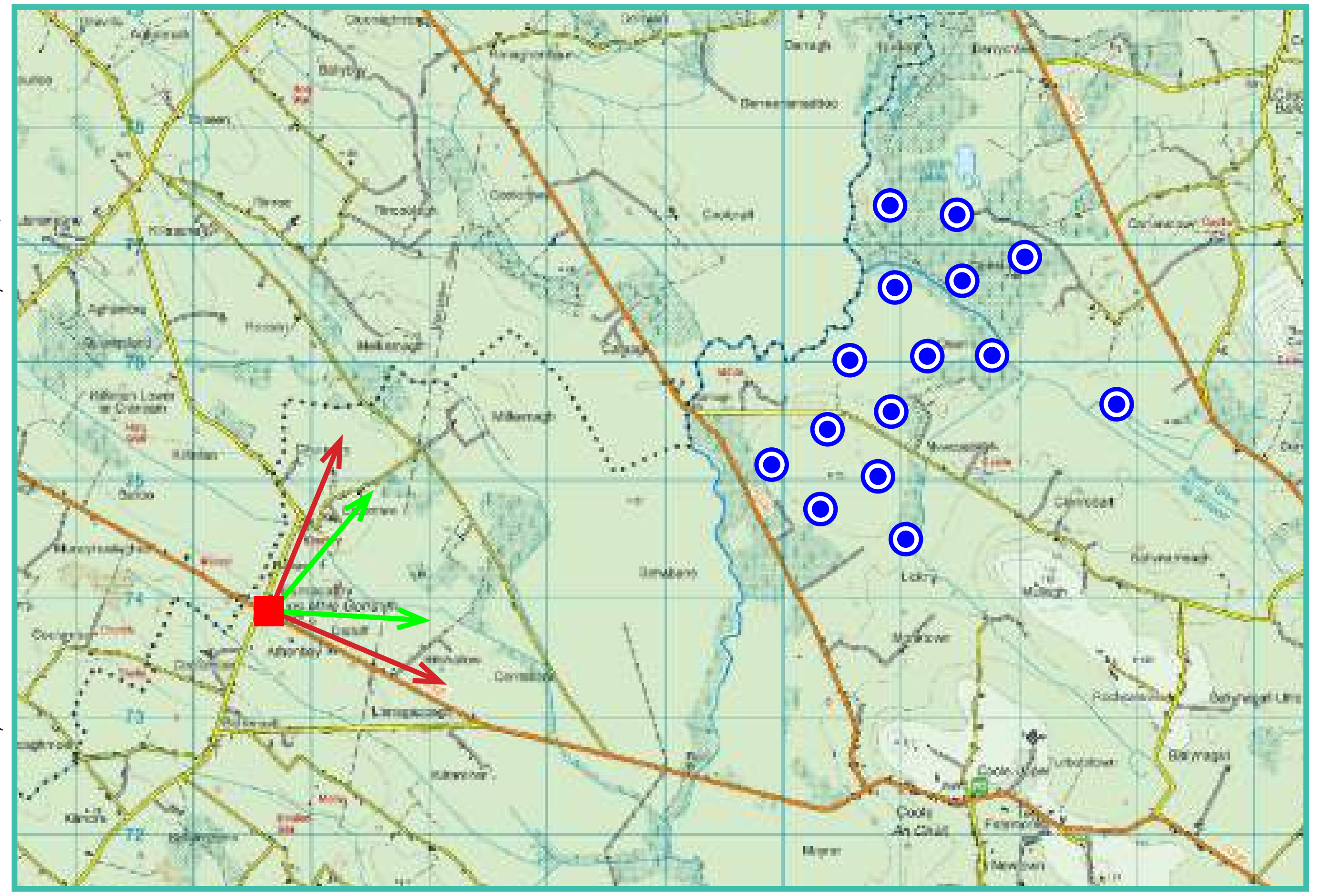


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) | 45° | 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

22° Direction (Degrees) | 67° | 112°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

22° Direction (Degrees) 67° 112°

0° Included Angle (Degrees) 26.5° 53.5°

40° Direction (Degrees) 67° 94°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

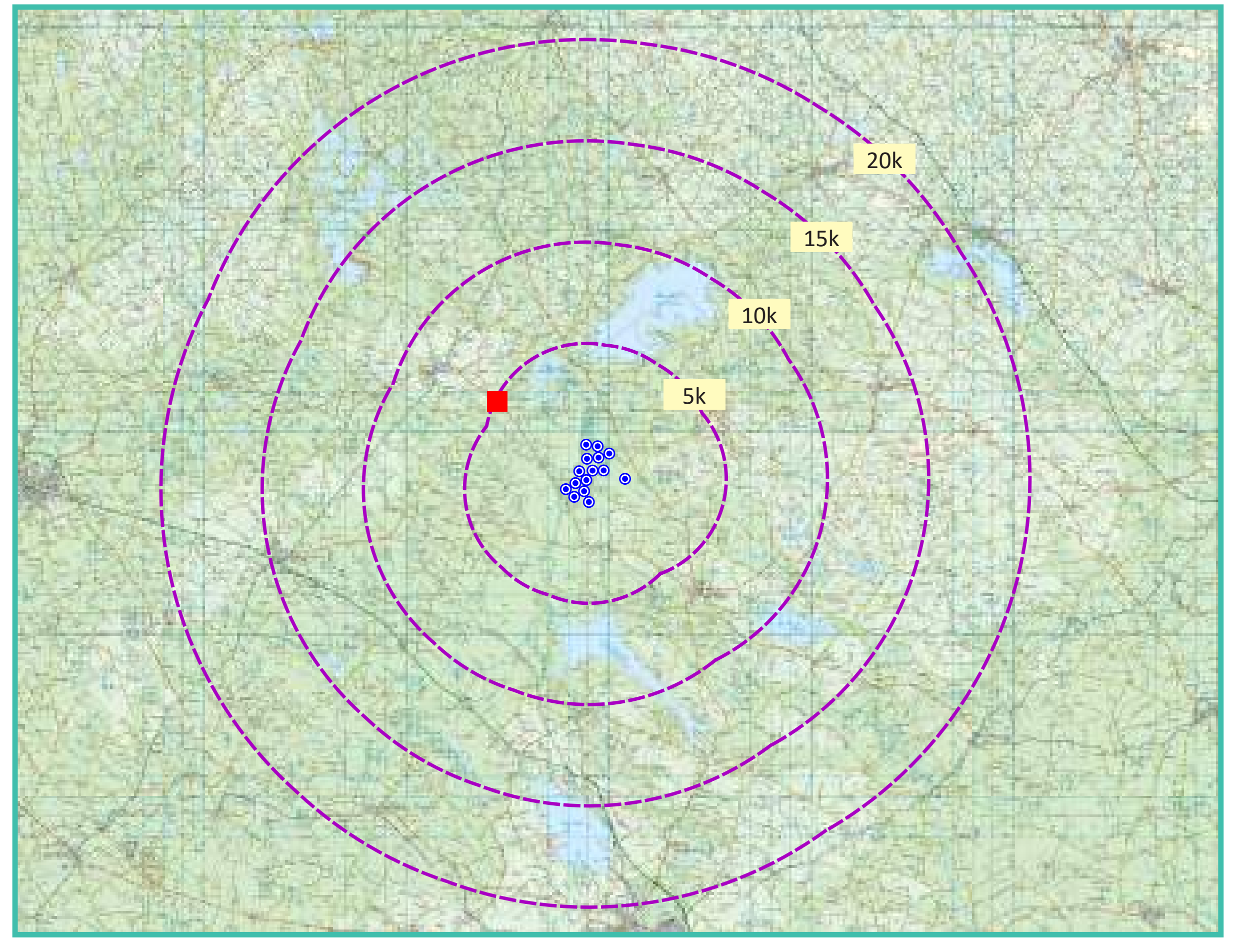
View Point 4

Cloonaghmore

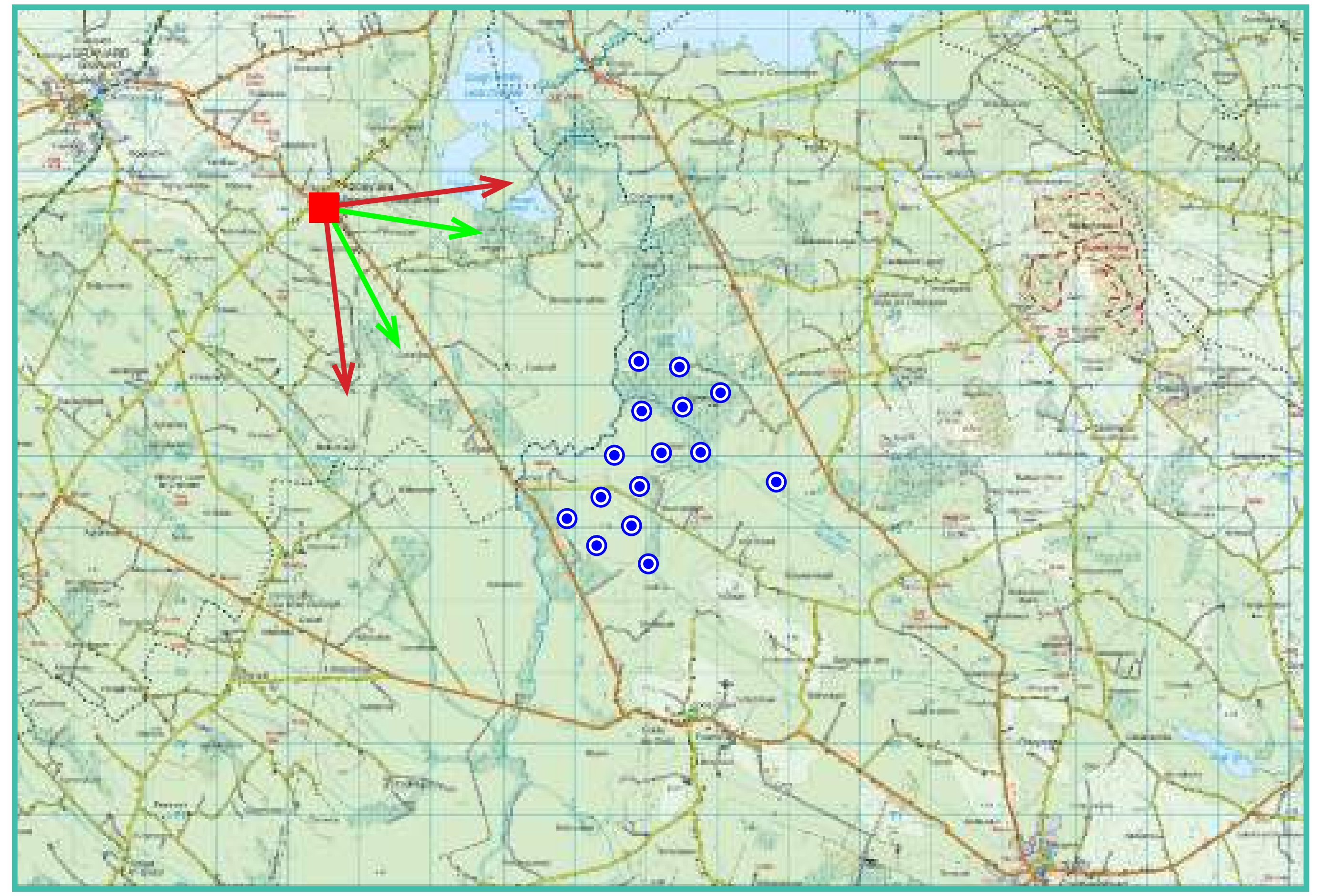
Photomontage 4

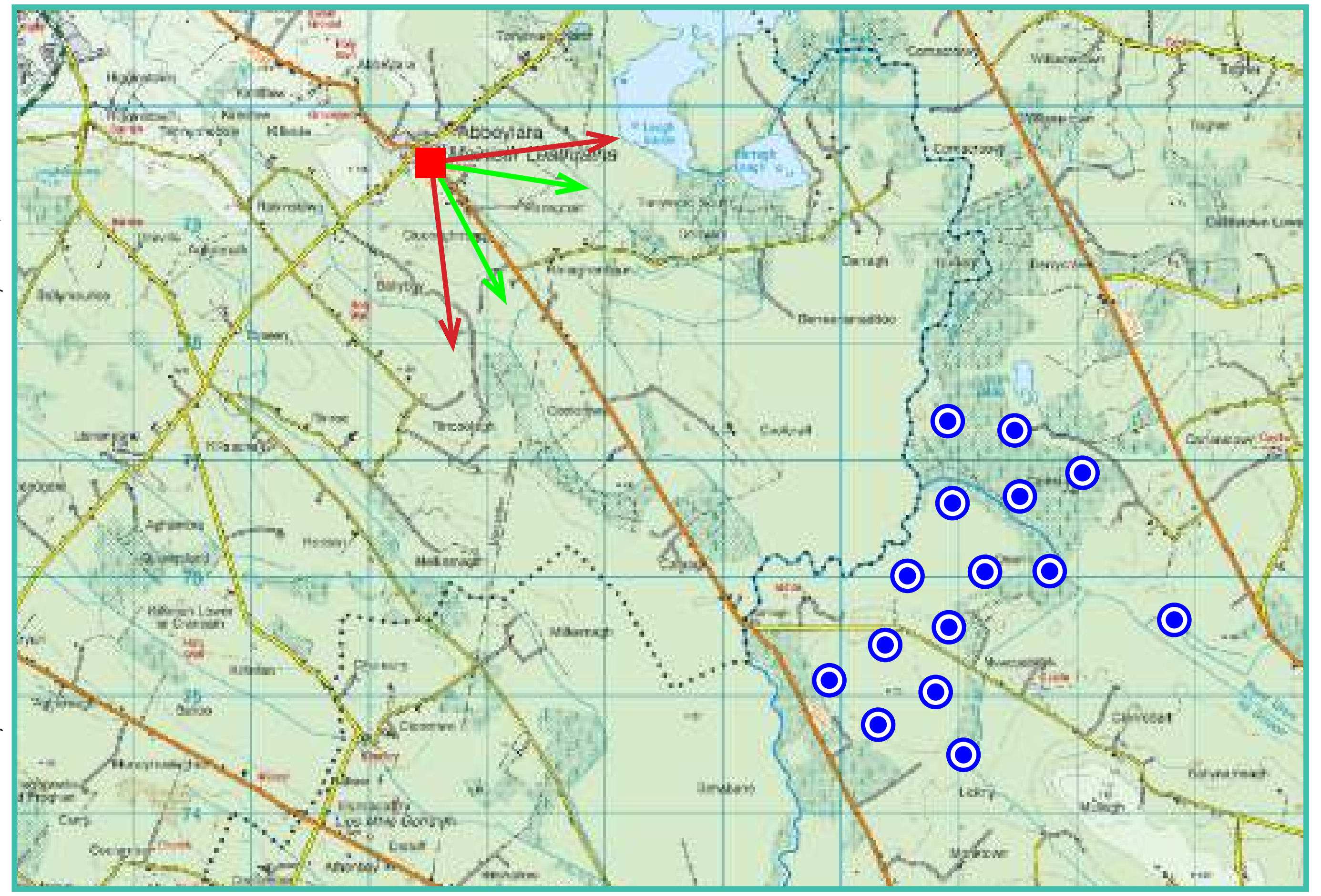
View Point: View from the Regional Road R396 in the townland of Cloonaghmore, approximately 4.6 kilometres northwest of the nearest turbine.

View point grid reference	236,642(E); 279,402(N)
Date of image taken	22.01.2021
Time of image taken	1:59pm
View point elevation	83m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	127°
Horizontal extent of proposed turbines	28°
Distance to nearest proposed turbine	4.6km (T1)
Number of proposed turbines visible	9/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

82° Direction (Degrees) 127° 172°

0° Included Angle (Degrees) 45° 90°

82° Direction (Degrees) 127° 172°

0° Included Angle (Degrees) 26.5° 53.5°

100° Direction (Degrees) 127° 154°

0° Included Angle (Degrees) 26.5° 53.5°

100° Direction (Degrees) 127° 154°

View Point 5

Ballywillin

Photomontage 5

View Point: View from the Regional Road R194 in the townland of Ballywillin, approximately 5.6 kilometres northwest of the nearest turbine.

View point grid reference	238,055(E); 282,208(N)
Date of image taken	17.02.2016
Time of image taken	3.52pm
View point elevation	80m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	158°
Horizontal extent of proposed turbines	22°
Distance to nearest proposed turbine	5.6km (T1)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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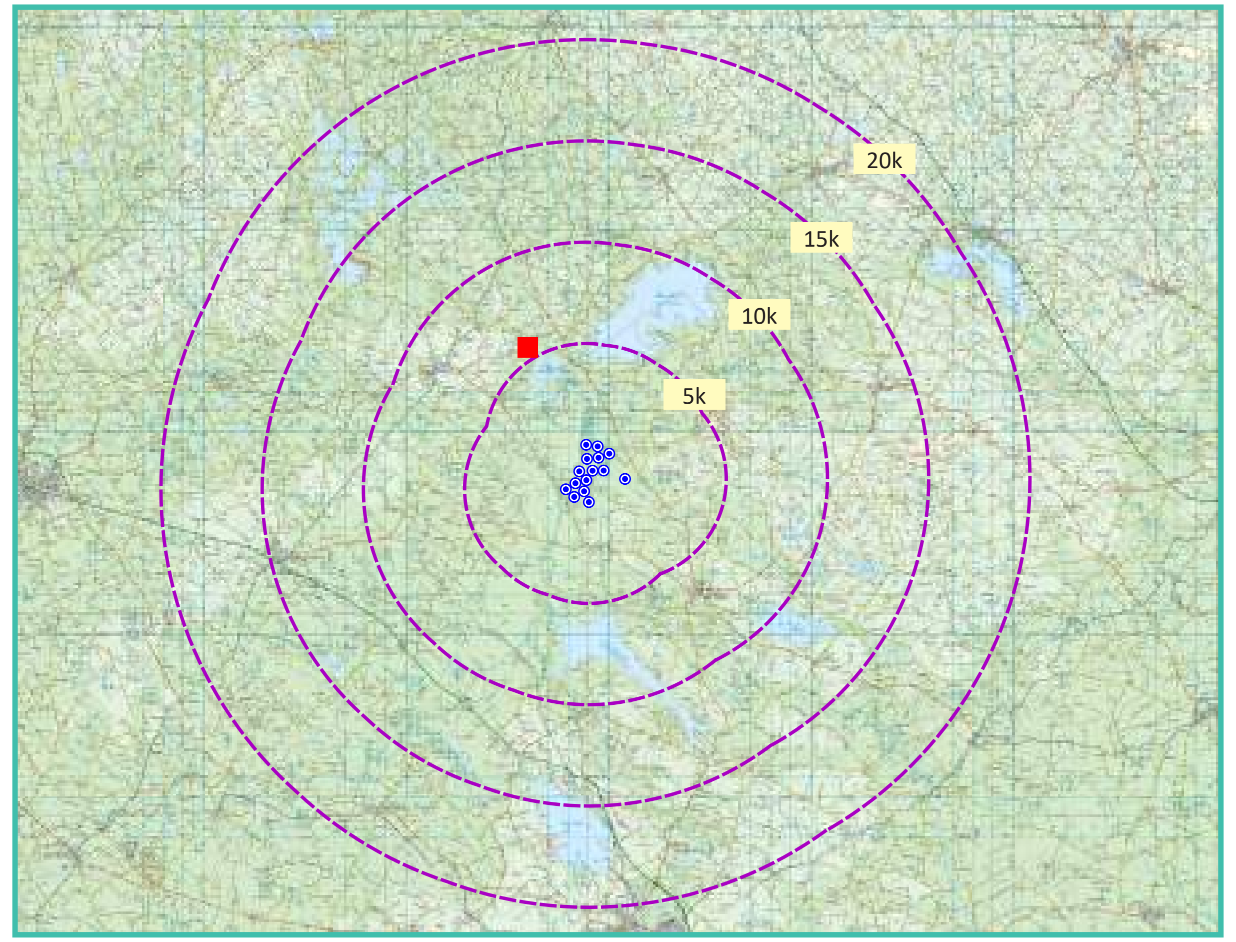
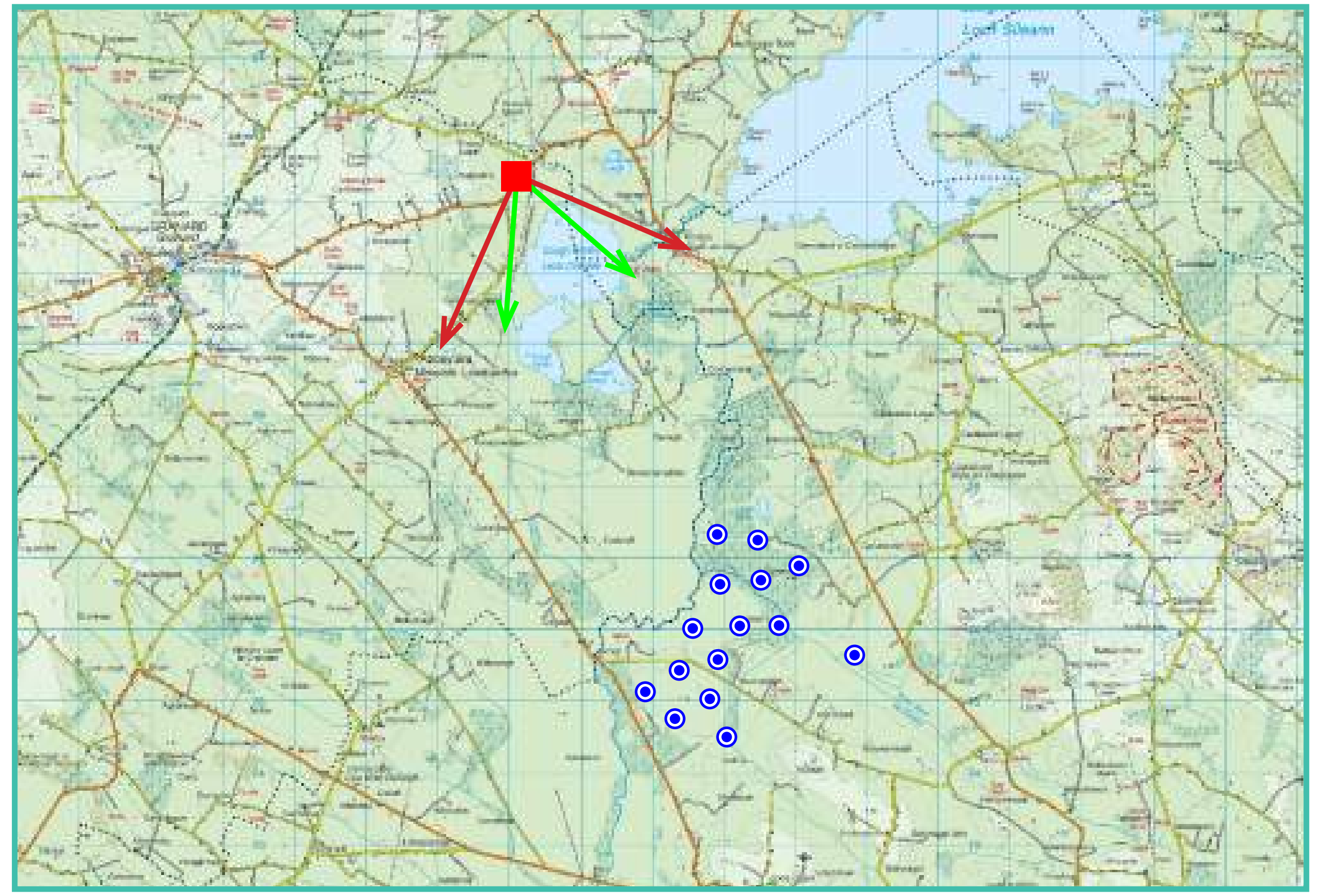
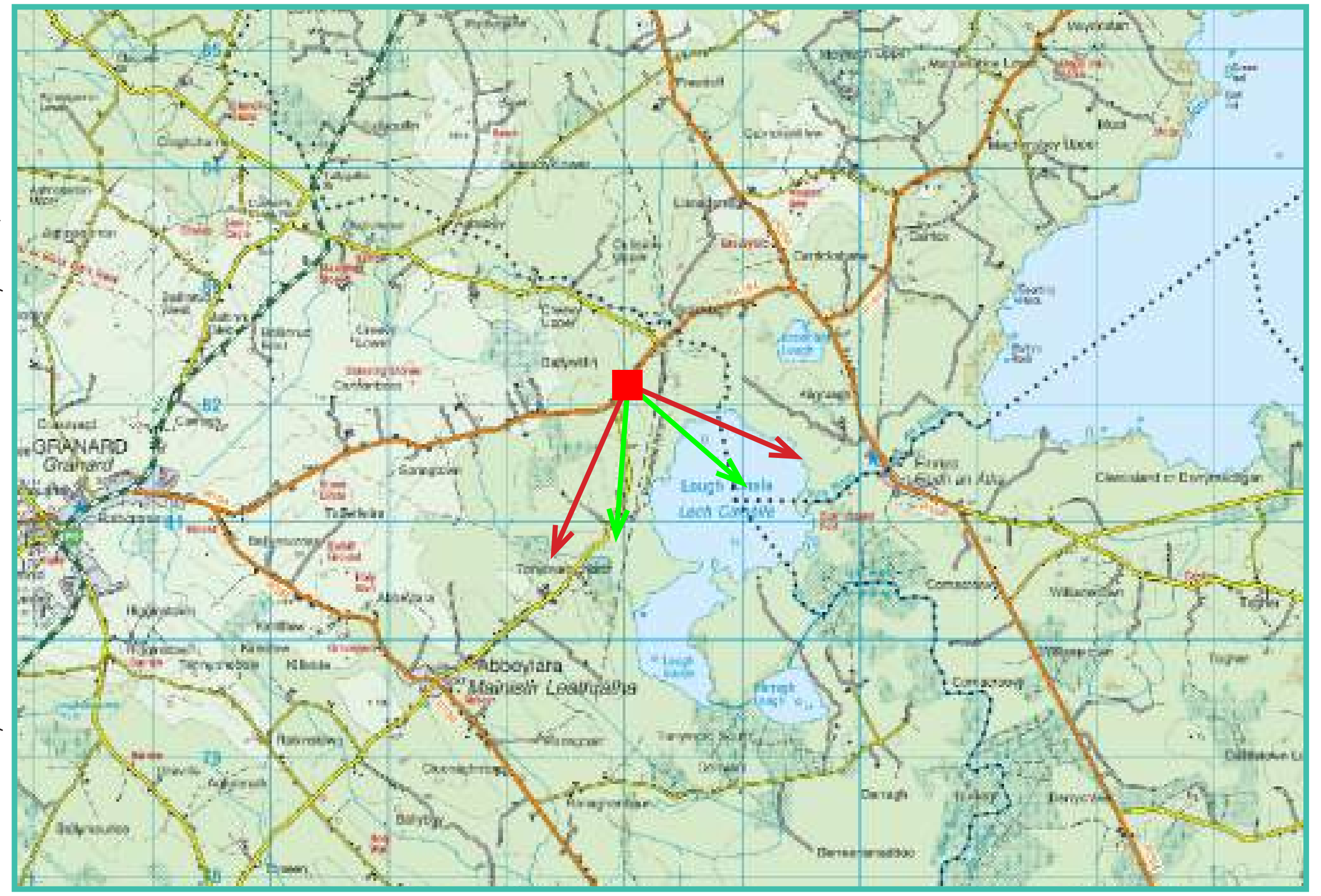


View point relative to 20km radius.



View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

113° Direction (Degrees) 158° 203°

0° Included Angle (Degrees) 45° 90°

113° Direction (Degrees) 158° 203°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

131° Direction (Degrees) 158° 185°

0° Included Angle (Degrees) 26.5° 53.5°

131° Direction (Degrees) 158° 185°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 6

Finnea

Photomontage 6

View Point: View from the R394 Regional Road in the townland of Finnea, approximately 3.8 kilometres north of thenearest proposed turbine.

View point grid reference	240,842(E); 281,128(N)
Date of image taken	17.02.2016
Time of image taken	12.01pm
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	175°
Horizontal extent of proposed turbines	28°
Distance to nearest proposed turbine	3.8km (T1)
Number of proposed turbines visible	10/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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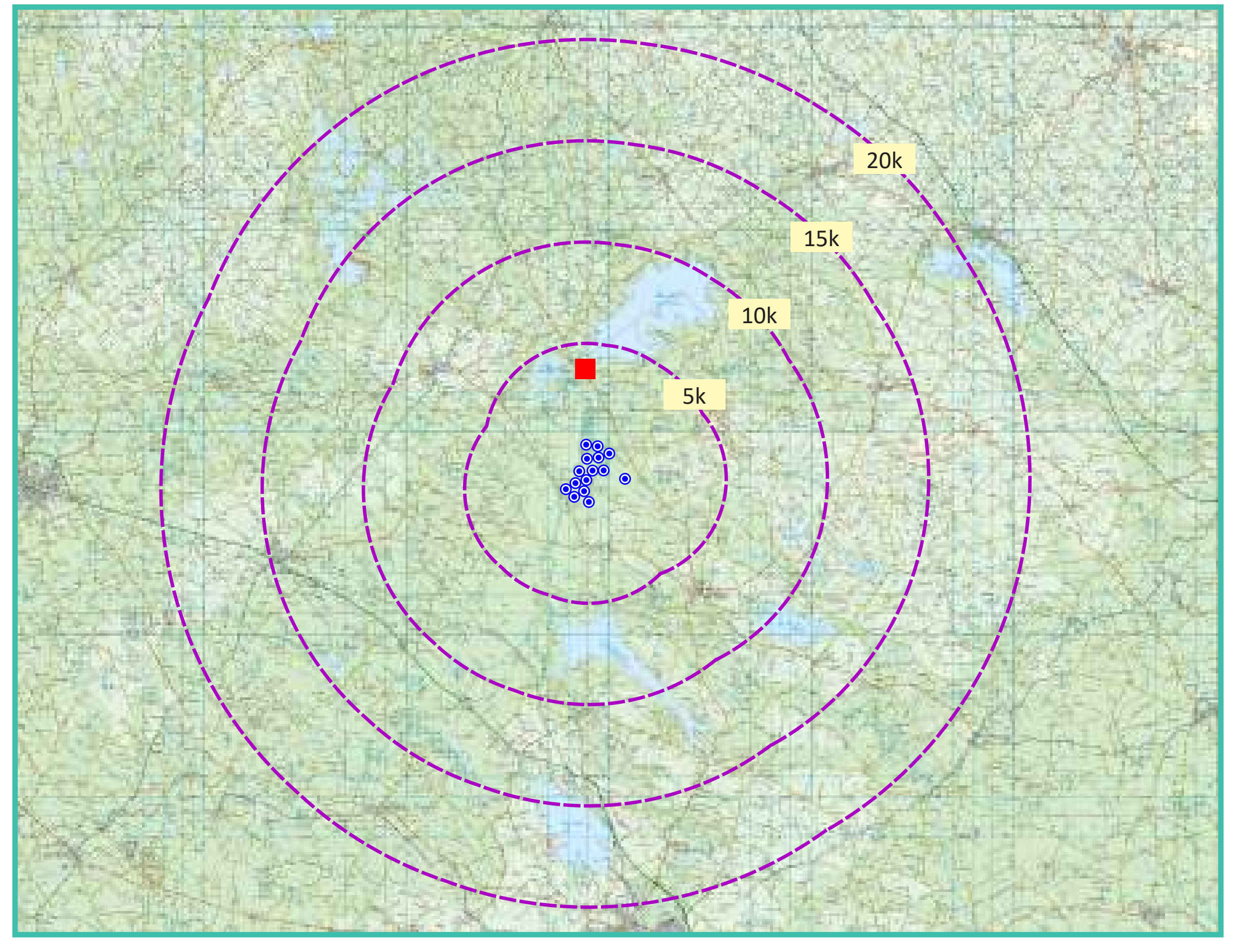
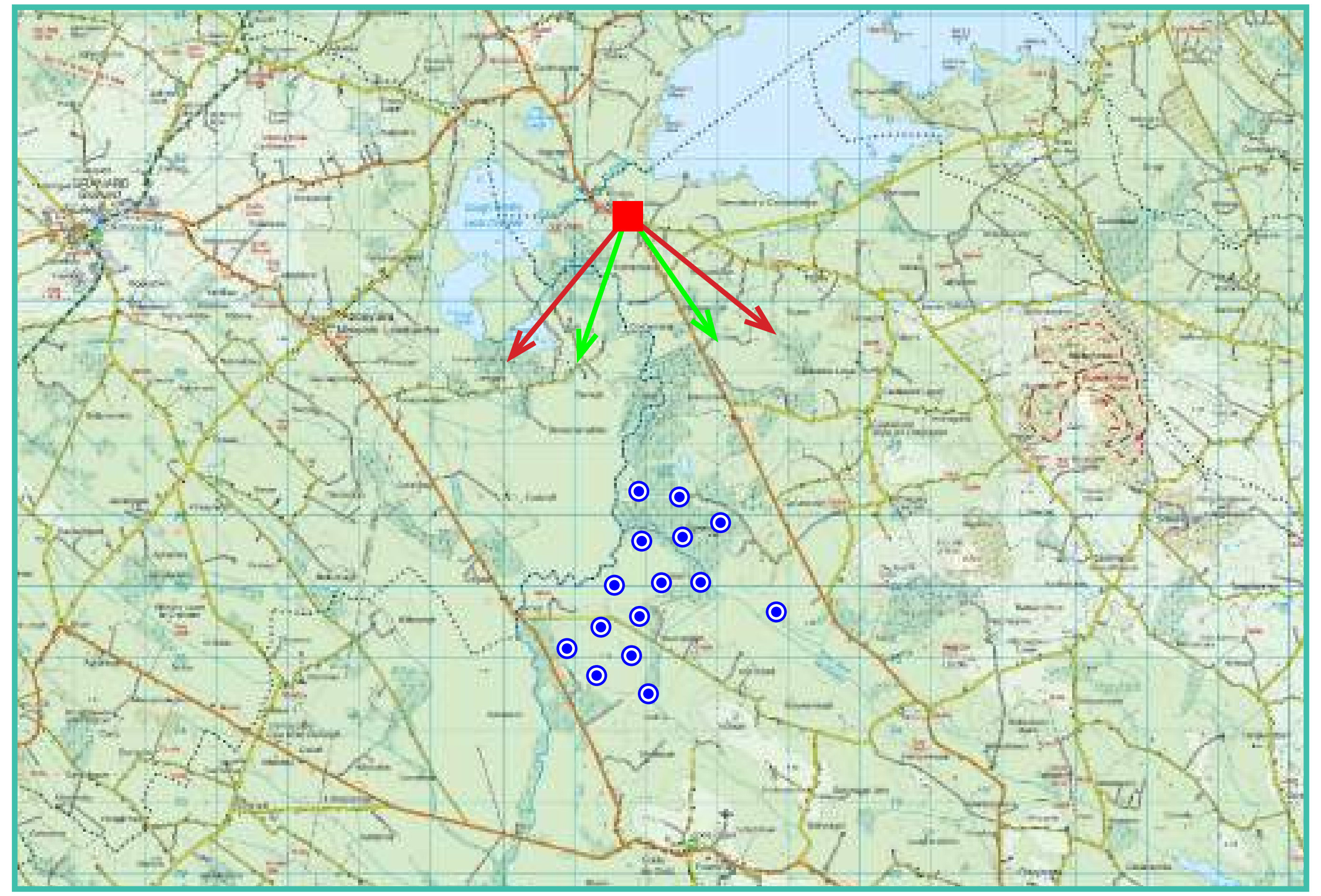


View point relative to 20km radius.



View point relative to wind farm site

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

130° Direction (Degrees) 175° 220°

0° Included Angle (Degrees) 45° 90°

130° Direction (Degrees) 175° 220°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 26.5° 53.5°

148° Direction (Degrees) 175° 202°


0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
15
4
5
2
3
6
14
7
1
9
13
8
10
12
11
148° Direction (Degrees)
175°
202°

View Point 7

Carlanstown

Photomontage 7

View Point: View from Regional Road R394 in the townland of Carlanstown approximately 1.27 kilometres northeast of the nearest turbine.

View point grid reference	242,372(E); 278,137(N)
Date of image taken	05.02.2017
Time of image taken	11.16pm
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	205°
Horizontal extent of proposed turbines	73°
Distance to nearest proposed turbine	1.27km (T2)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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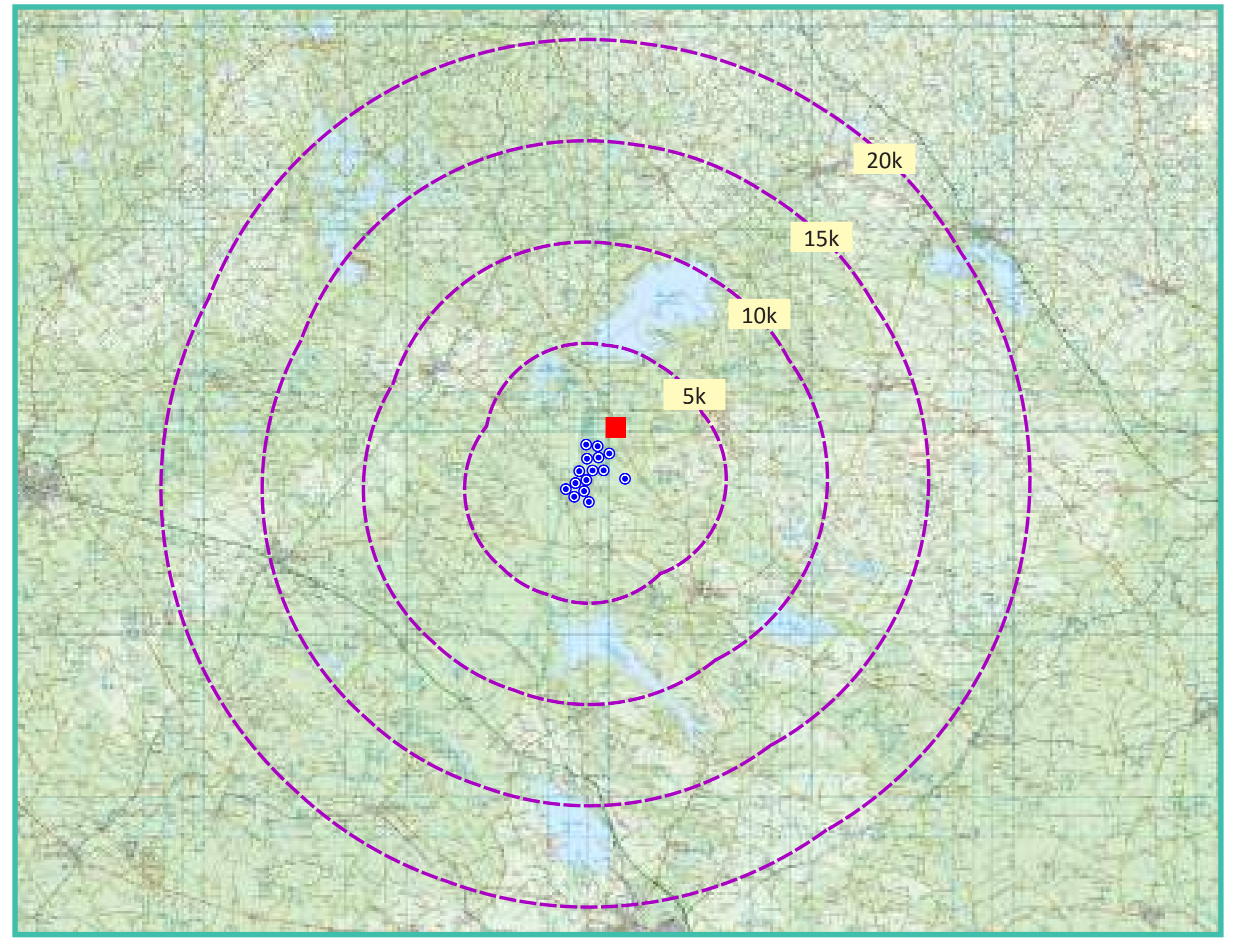
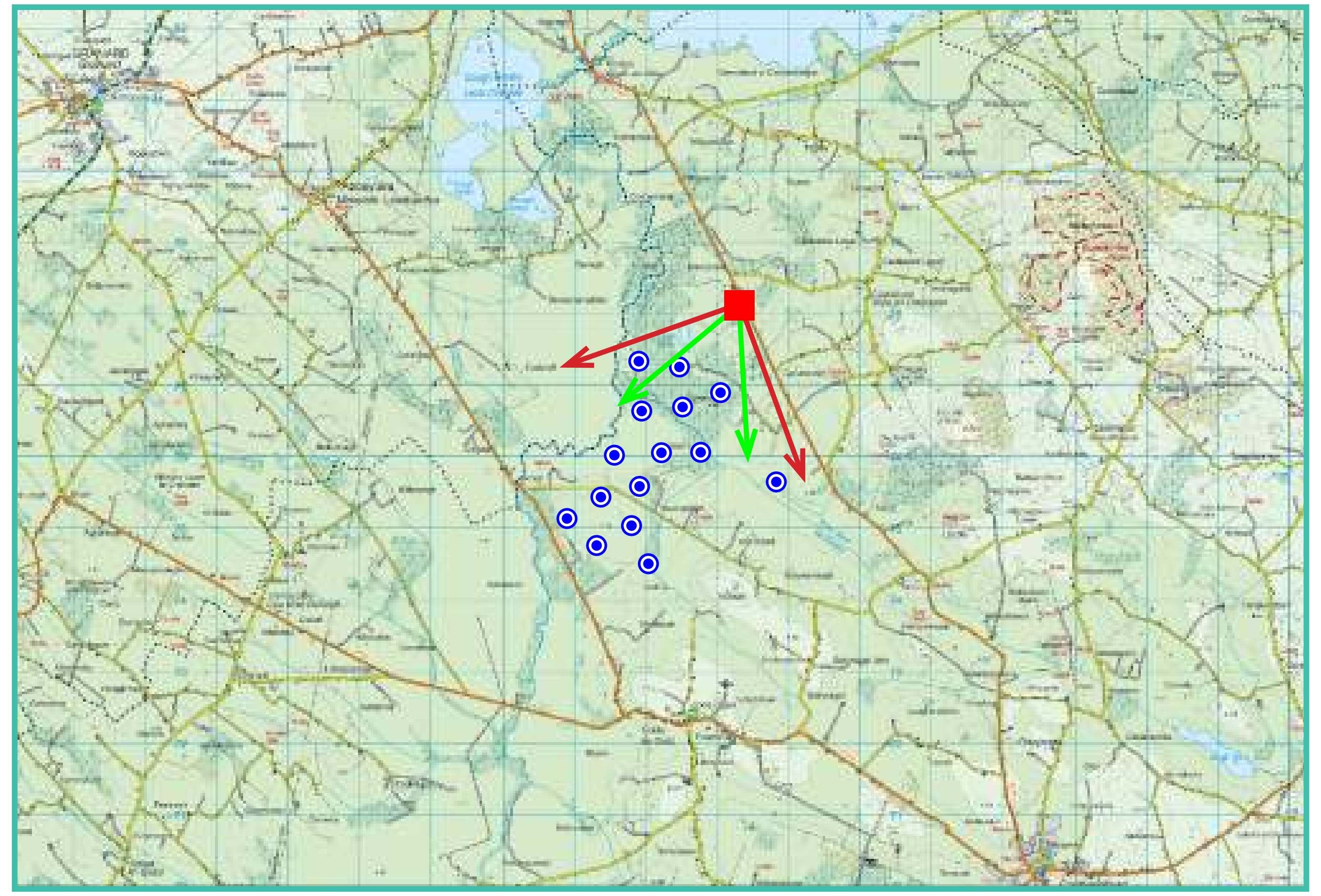


View point relative to 20km radius.



View point relative to wind farm site

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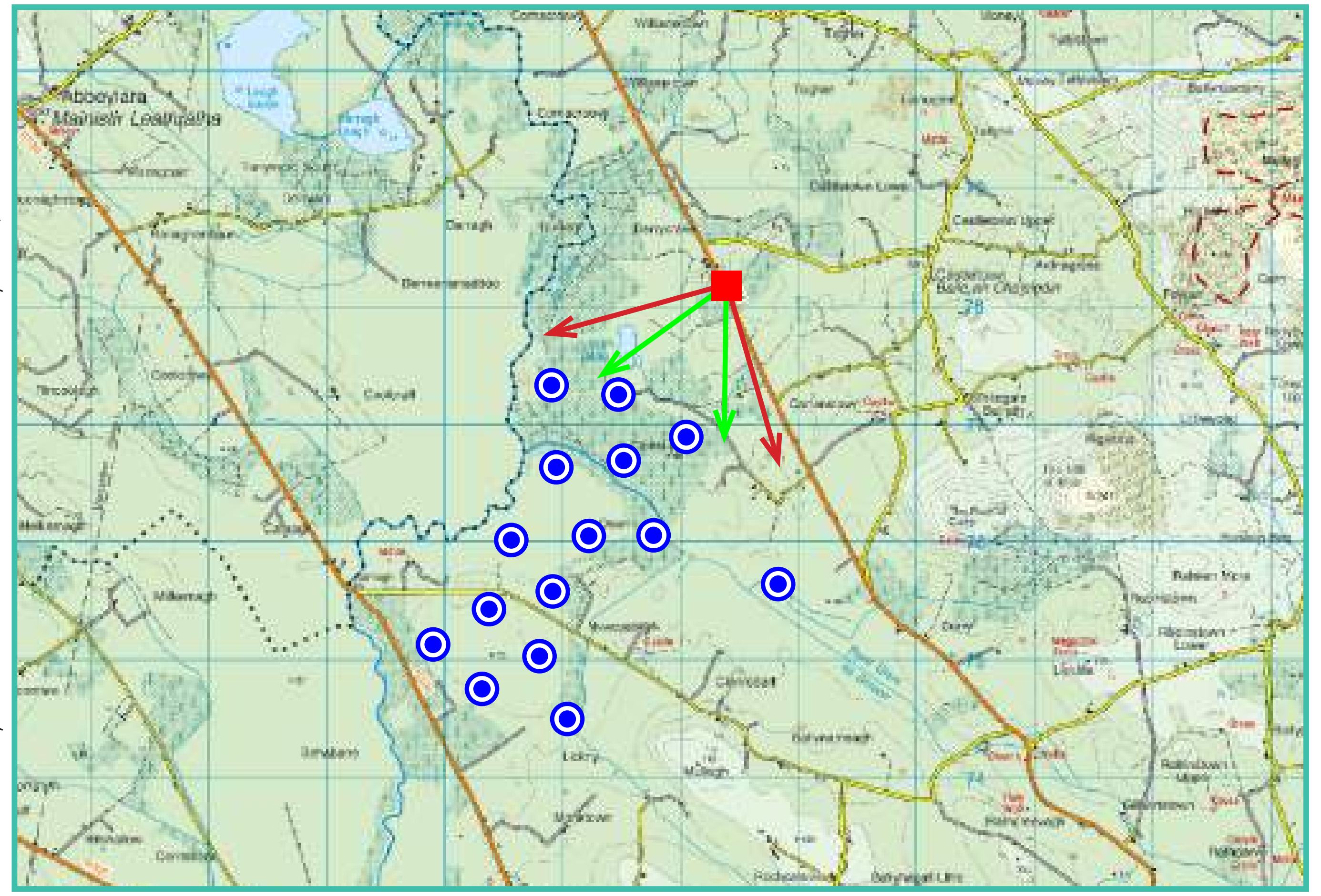

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

160° Direction (Degrees) 205° 250°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

160° Direction (Degrees) 205° 250°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

178° Direction (Degrees) 205° 232°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

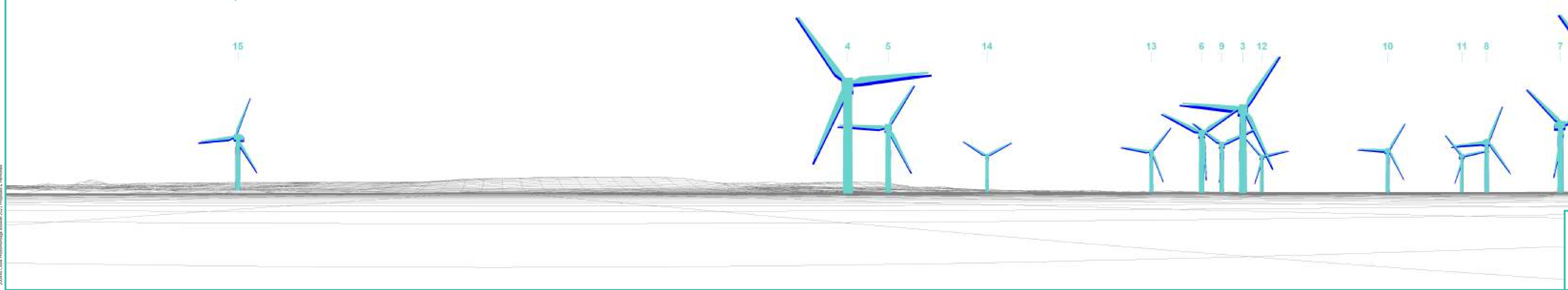
TURBINE ENVELOPE RANGE

VP07 - Minimum Rotor Diameter & Maximum Hub Height

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90° - Minimum Rotor Diameter & Maximum Hub Height

Matching Wireframe



Minimum Rotor Diameter (149m)
Maximum Hub Height (100.5m)
Envelope Range Variant - 3 No. Viewpoints

Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints

160° Direction (Degrees) 205° 250°

0° Included Angle (Degrees) 26.5° 53.5°

178° Direction (Degrees) 205° 232°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines) - Minimum Rotor Diameter (149m) & Maximum Hub Height (100.5m)
4
5
14
13
6
9
3
12
10
11
8
7
2
Minimum Rotor Diameter (149m)
Maximum Hub Height (100.5m)
Envelope Range Variant - 3 No. Viewpoints
Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints
178° Direction (Degrees)
205°
232°
200445 Coole Photomontage Booklet 2021 Proposed & Permitted

TURBINE ENVELOPE RANGE

VP07 - Median Rotor Diameter & Median Hub Height

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90° - Median Rotor Diameter & Median Hub Height

Matching Wireframe

160° Direction (Degrees) 205° 250°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5° - Median Rotor Diameter & Median Hub Height

178° Direction (Degrees) 205° 232°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 8

Littlewood

Photomontage 8

View Point: View from the local road in the townland of Littlewood, in the vicinity of Protected view 51, approximately 4.1 km east of the nearest turbine.

View point grid reference	246,436(E); 277,686(N)
Date of image taken	14.11.2016
Time of image taken	17.03pm
View point elevation	97m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	257°
Horizontal extent of proposed turbines	27°
Distance to nearest proposed turbine	4.1km (T15)
Number of proposed turbines visible	2/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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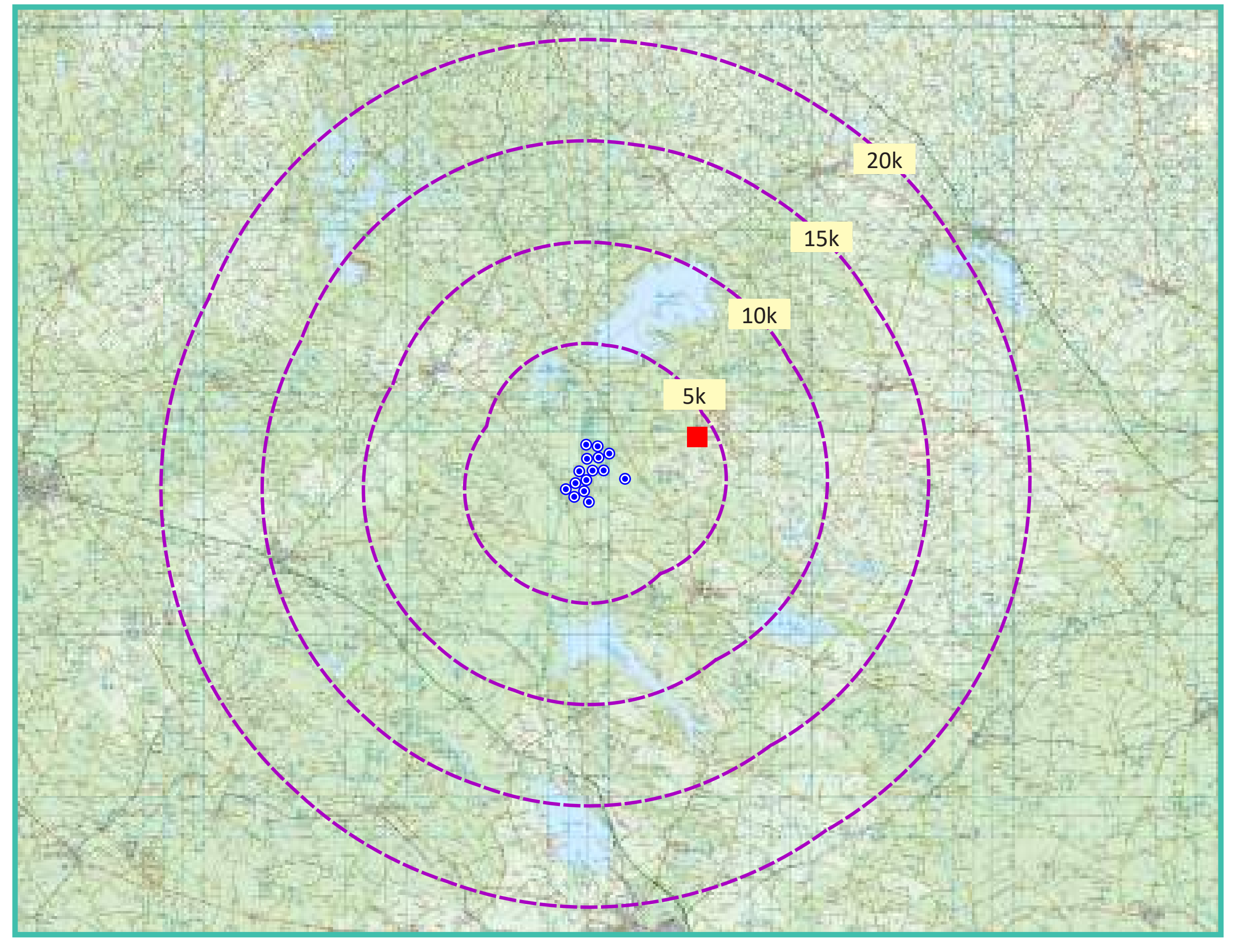
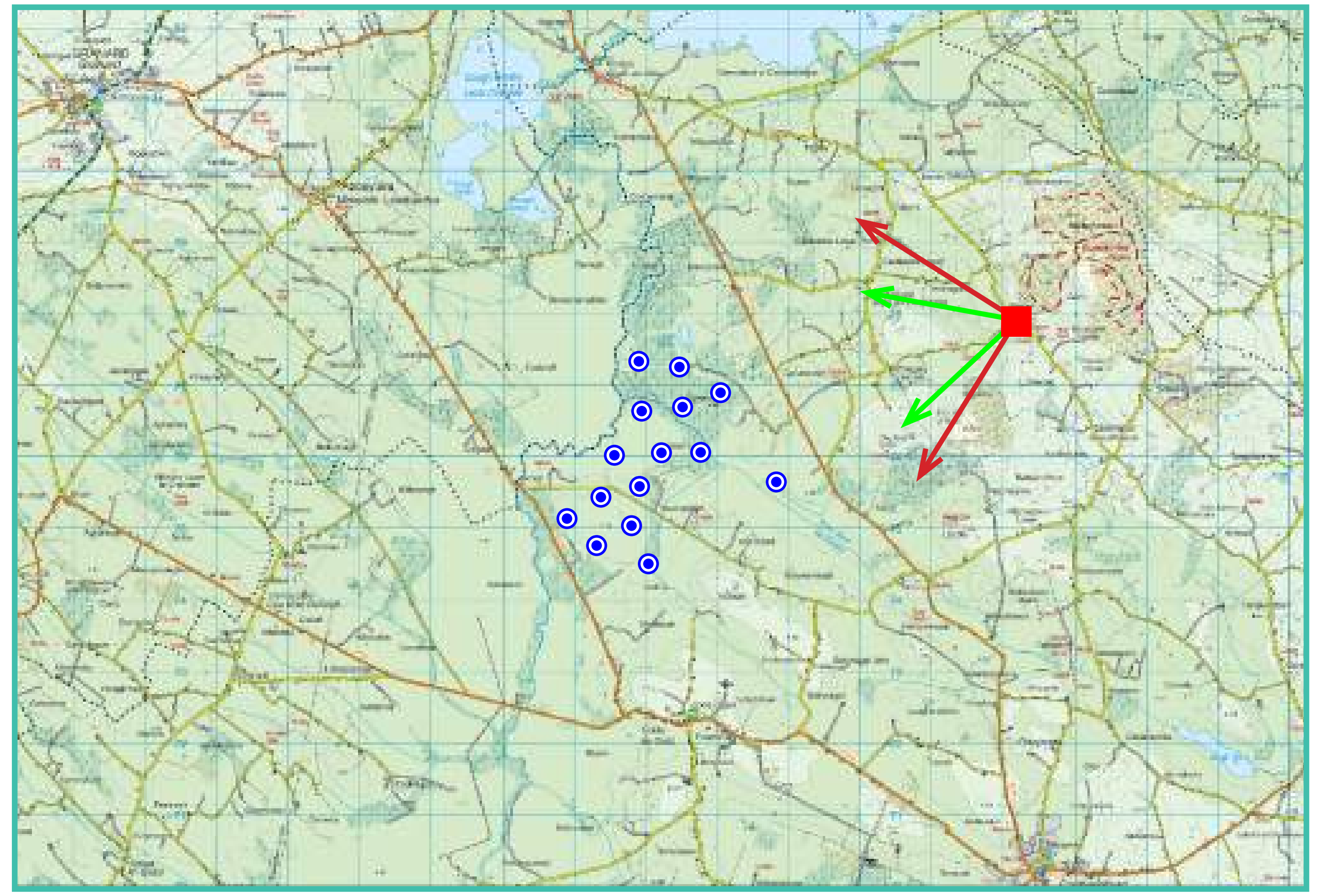


View point relative to 20km radius.



View point relative to wind farm site

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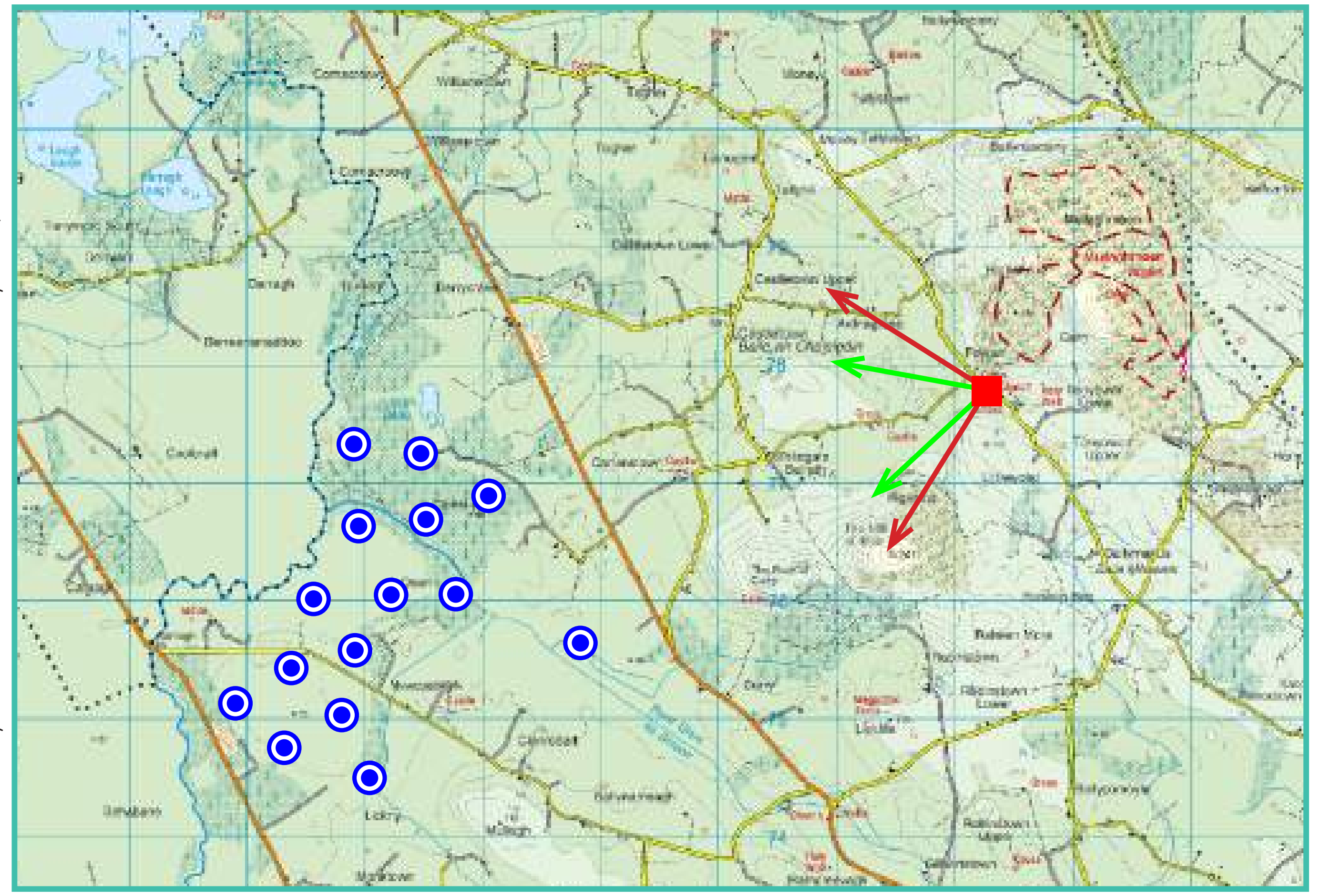

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

212° Direction (Degrees) 257° 302°

0° Included Angle (Degrees) 45° 90°

212° Direction (Degrees) 257° 302°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

230° Direction (Degrees) 257° 284°

0° Included Angle (Degrees) 26.5° 53.5°

230° Direction (Degrees) 257° 284°

View Point 9

Ramonan

Photomontage 9

View Point: View from the local road in the townland of Ramonan, approximately 16.5 km north of the nearest turbine.

View point grid reference	251,631(E); 290,279(N)
Date of image taken	17.02.2021
Time of image taken	9.38am
View point elevation	111m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	215°
Horizontal extent of proposed turbines	9°
Distance to nearest proposed turbine	16.5km (T4)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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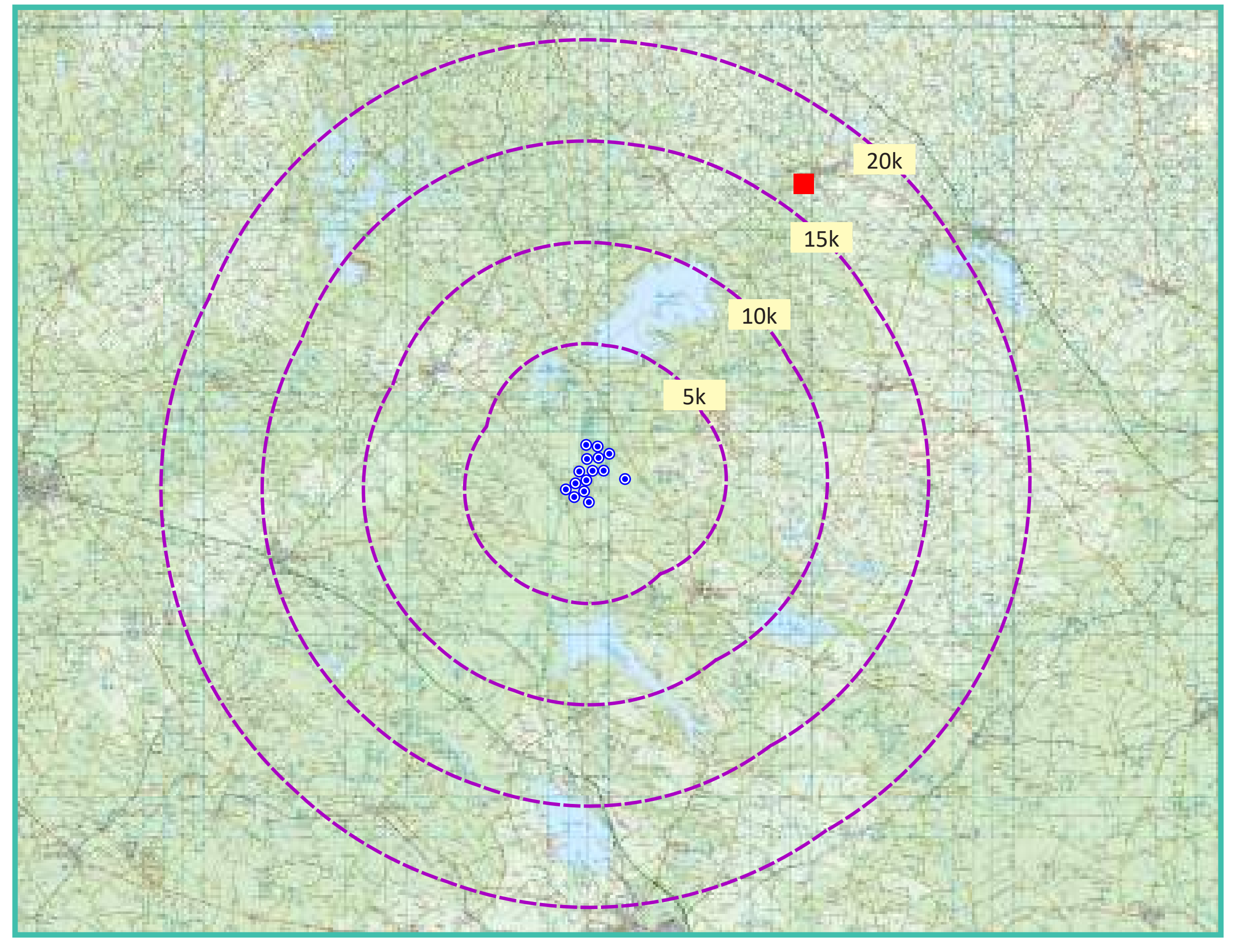
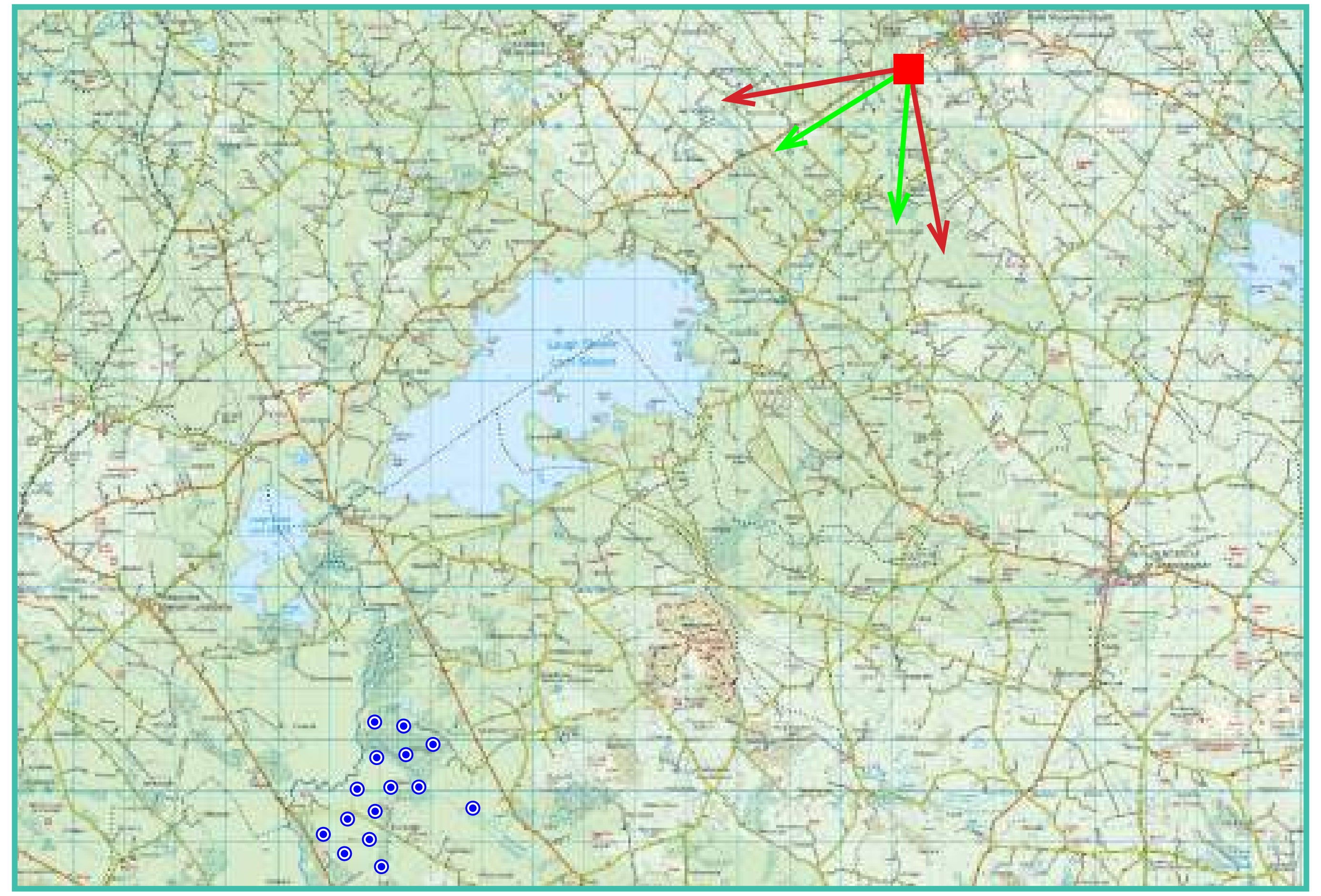


View point relative to 20km radius.


View point relative to wind farm site

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

170° Direction (Degrees) 215° 260°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

170° Direction (Degrees) 215° 260°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

188° Direction (Degrees) 215° 242°

0° Included Angle (Degrees) 26.5° 53.5°

188° Direction (Degrees) 215° 242°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 10

Lakill

Photomontage 10

View Point: View from protected view on Regional road R195 in the townland of Lakill, looking towards Lough Glore, approximately 8.1km southeast of the nearest turbine.

View point grid reference	249,639(E); 271,186(N)
Date of image taken	22.01.2021
Time of image taken	1:03pm
View point elevation	101m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	299°
Horizontal extent of proposed turbines	16°
Distance to nearest proposed turbine	8.1km (T15)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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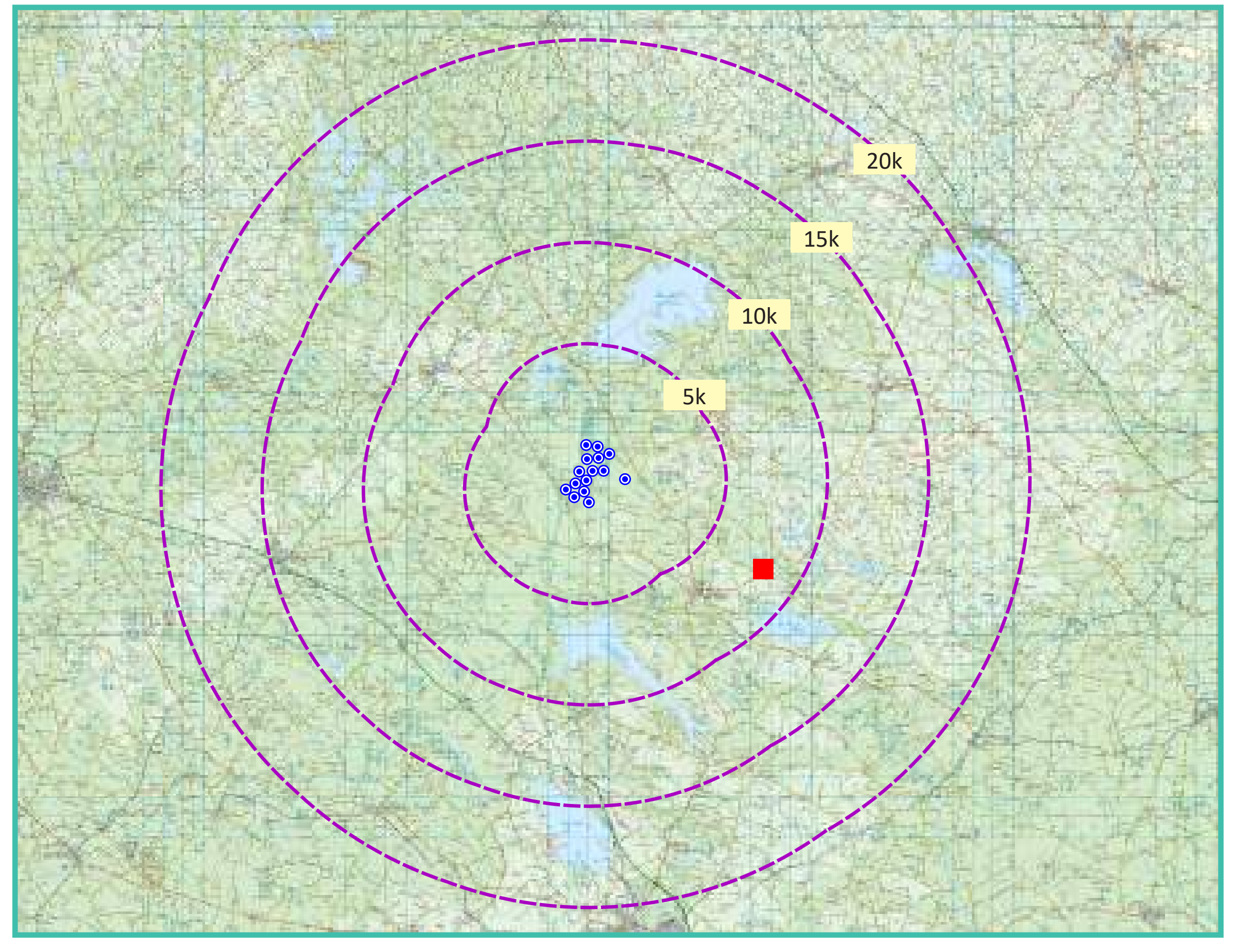
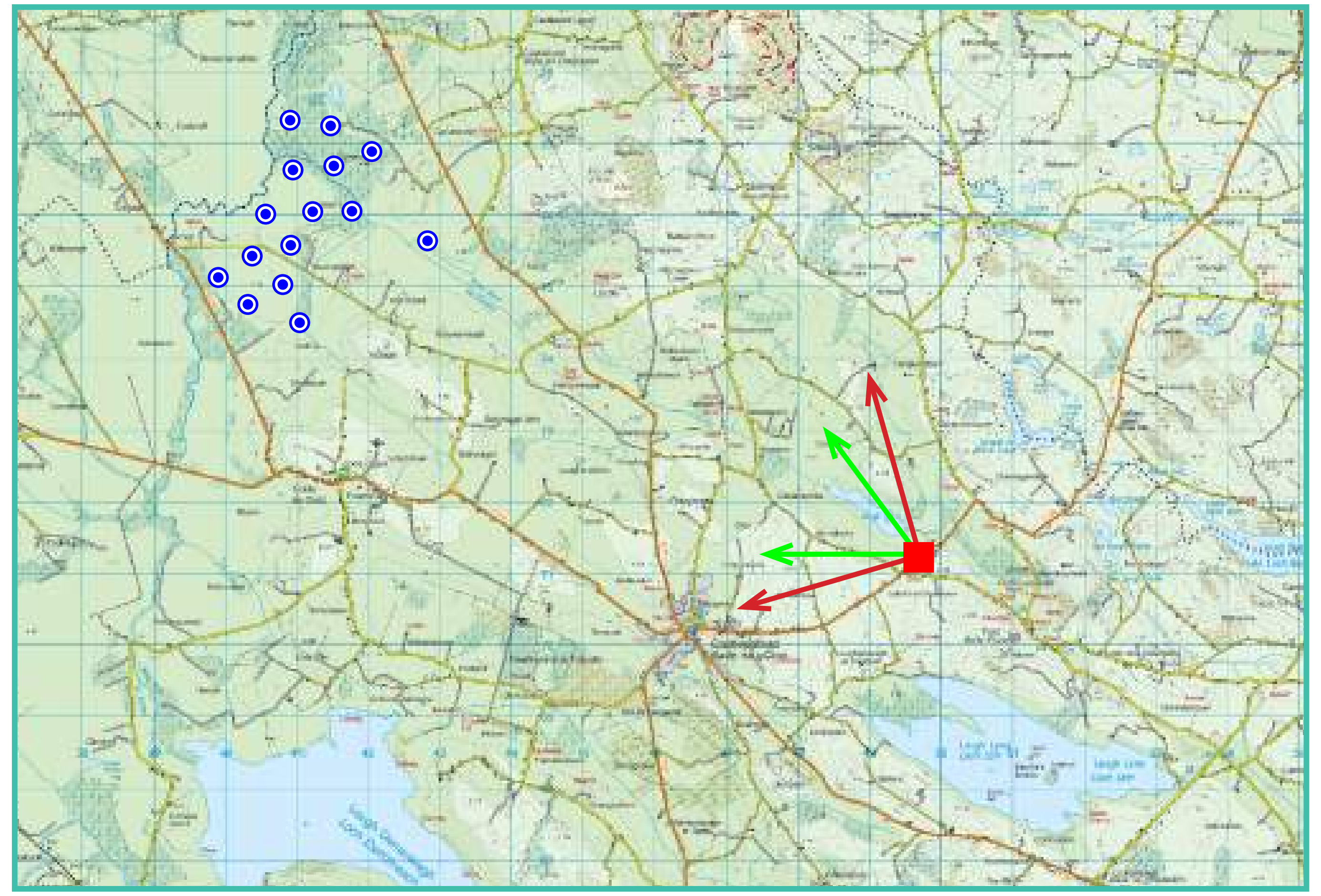
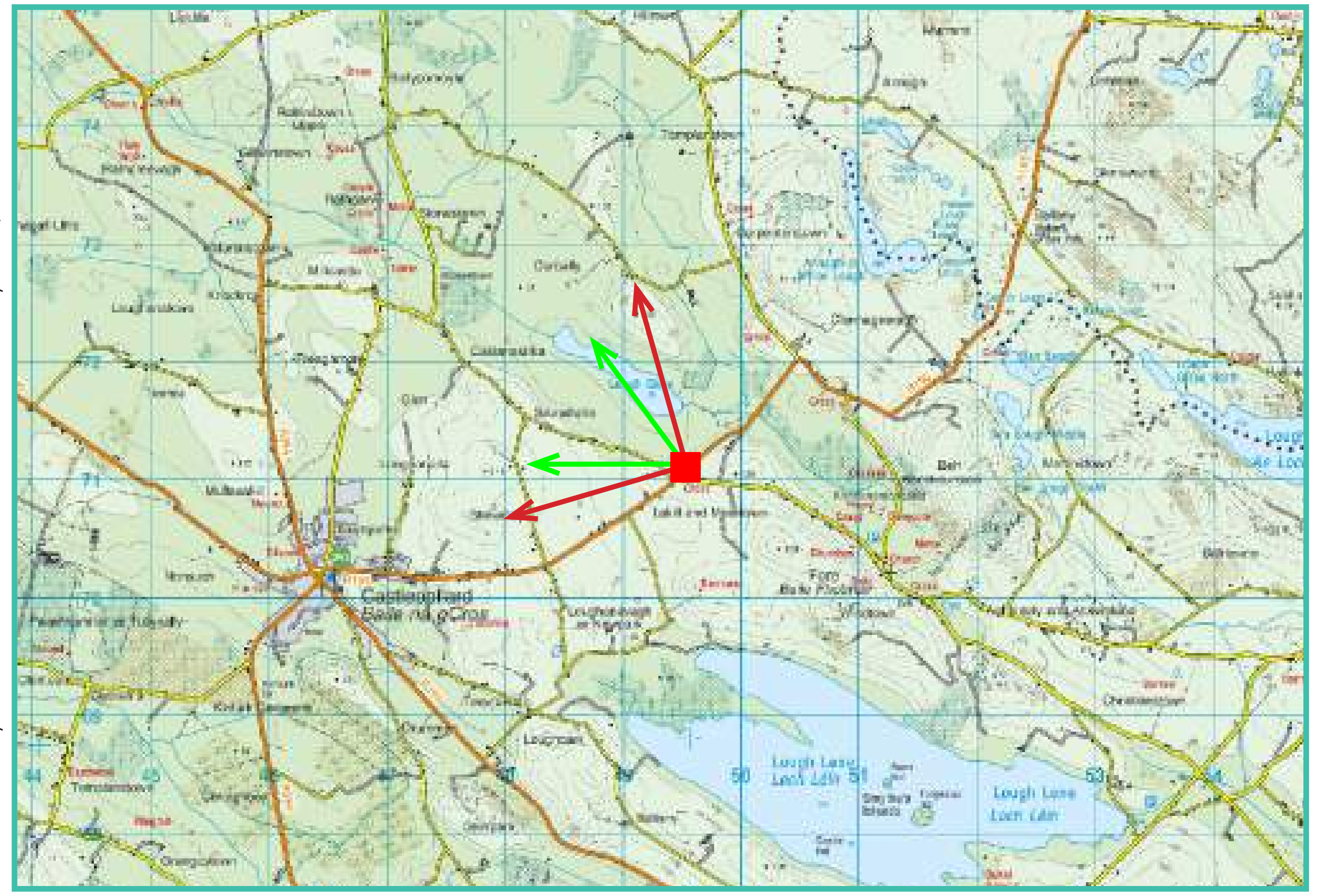


View point relative to 20km radius.



View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

254° Direction (Degrees) 299° 344°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

254° Direction (Degrees) 299° 344°

0° Included Angle (Degrees) 26.5° 53.5°

272° Direction (Degrees) 299° 326°


0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
12 14 11 13 10 9 8 6 5 7 15 3 1 2 4
272° Direction (Degrees)
299°
326°

View Point 11

Corstown

Photomontage 11

View Point: View from Sliabh na Cailliagh (Lough Crew) a National Monument & protected view, in the townland of Corstown, approximately 15.9 km east of the nearest turbine.

View point grid reference	258,614(E); 277,576(N)
Date of image taken	22.01.2021
Time of image taken	12:26pm
View point elevation	268m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	264°
Horizontal extent of proposed turbines	9°
Distance to nearest proposed turbine	15.9km (T15)
Number of proposed turbines visible	12/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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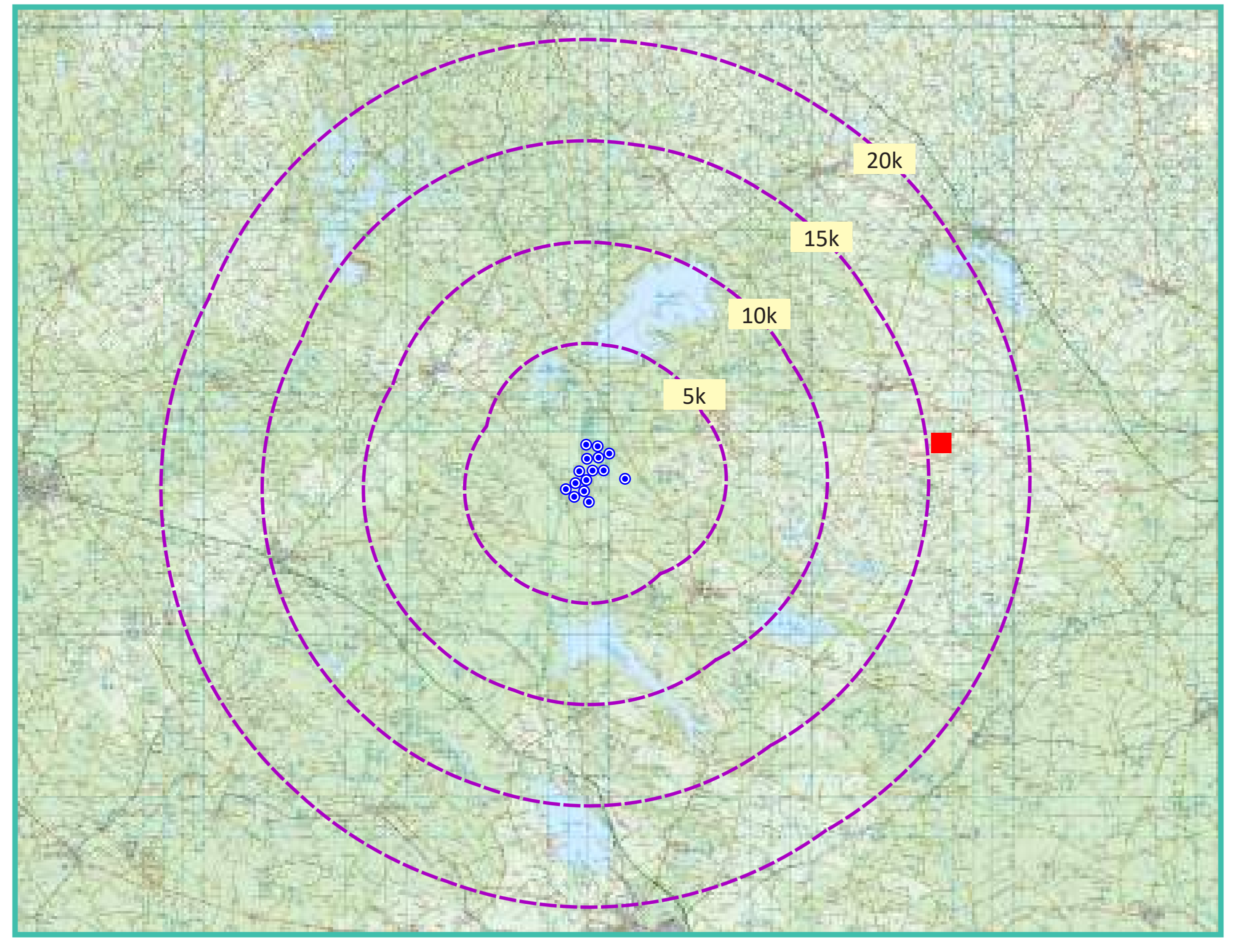
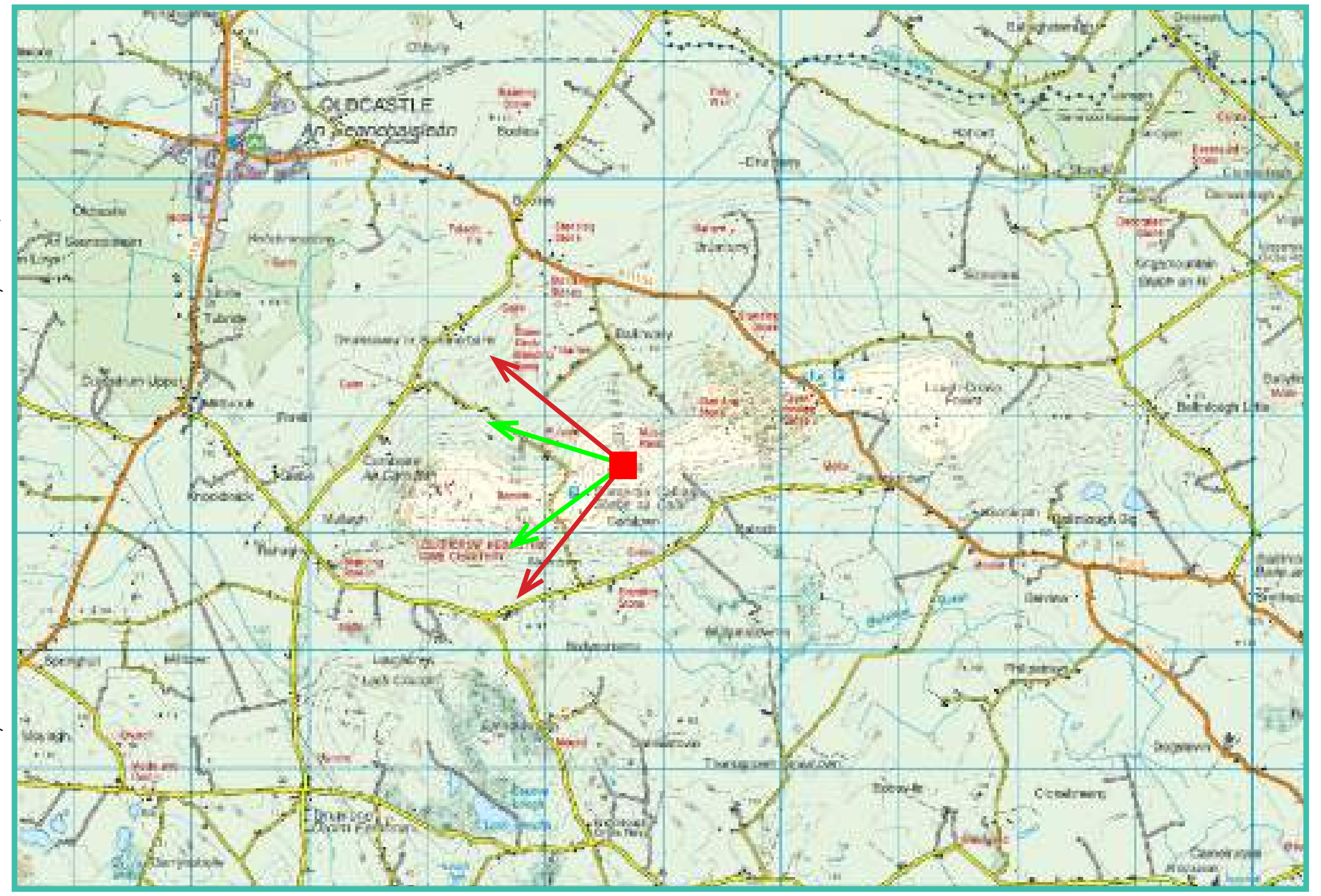


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

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E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

219° Direction (Degrees) 264° 309°

0° Included Angle (Degrees) 45° 90°

219° Direction (Degrees) 264° 309°

0° Included Angle (Degrees) 26.5° 53.5°

237° Direction (Degrees) 264° 291°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
14
12
13
11
15
10
9
5
6
8
7
3
4
2
1
237° Direction (Degrees)
264°
291°

View Point 12

Colinstown

Photomontage 12

View Point: View from the local road and protected view north of Colinstown, approximately 12.9 km southeast of the nearest turbine.

View point grid reference	253,110(E); 267,688(N)
Date of image taken	22.01.2021
Time of image taken	1:20pm
View point elevation	111m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	304°
Horizontal extent of proposed turbines	11°
Distance to nearest proposed turbine	12.9km (T15)
Number of proposed turbines visible	2/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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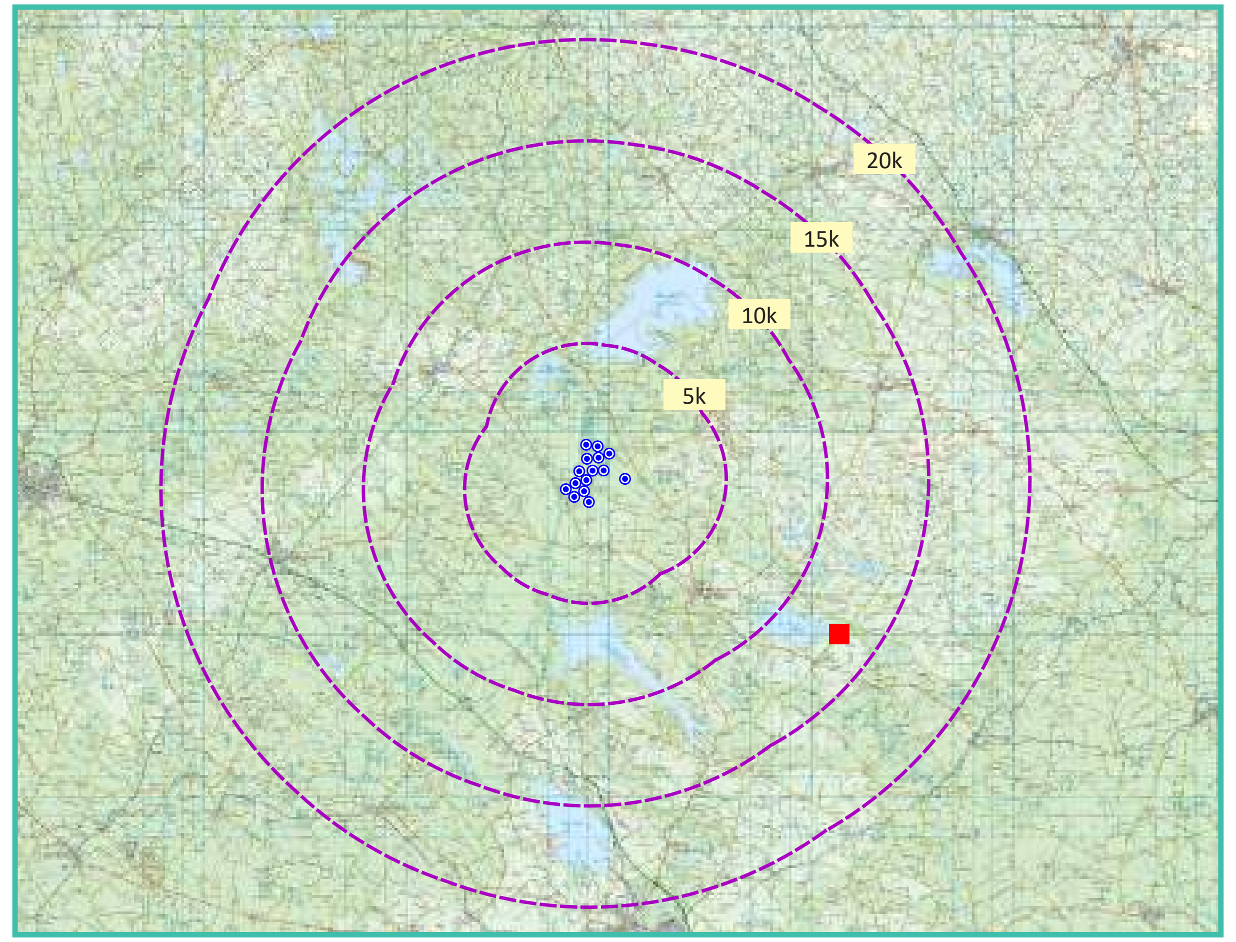
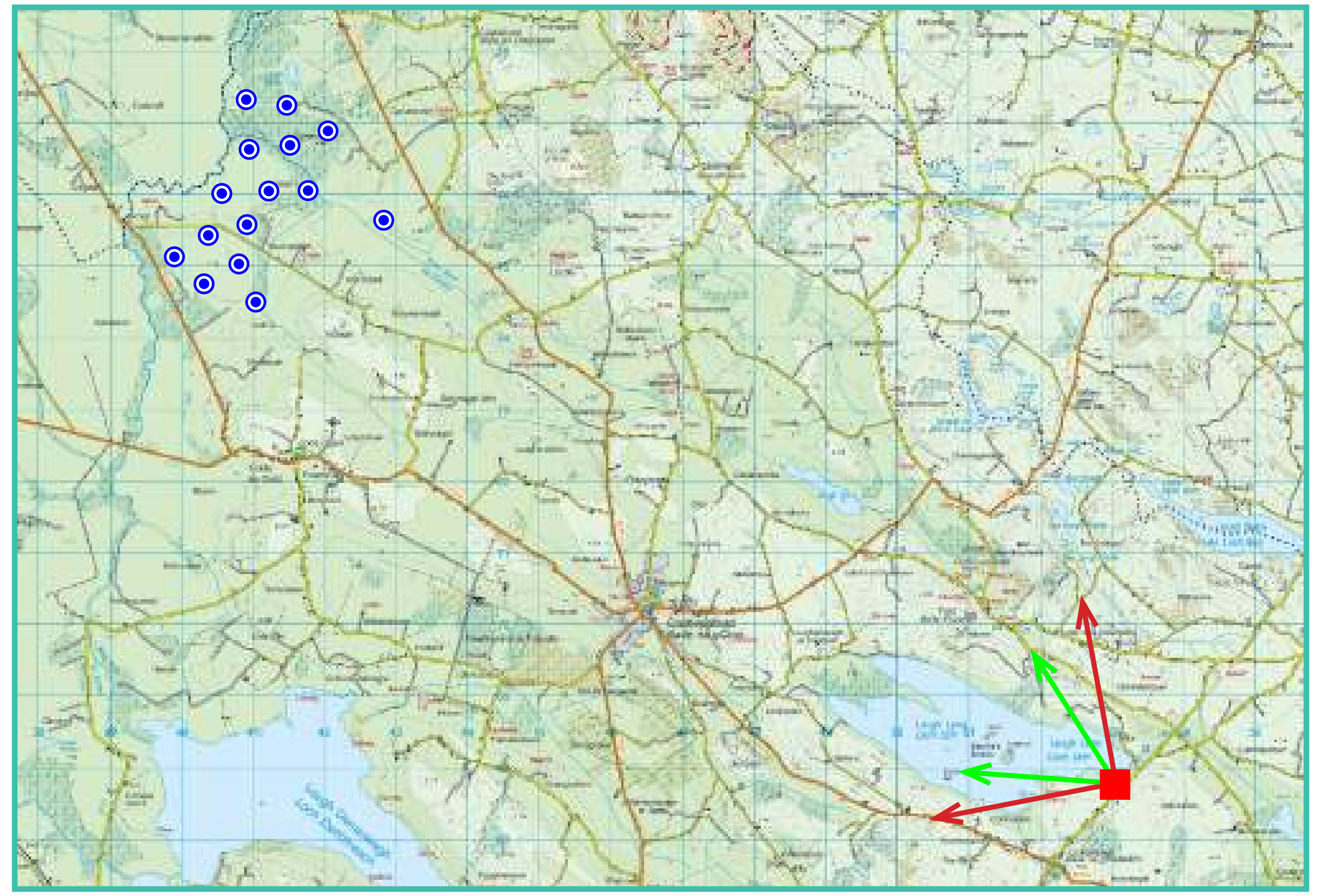


View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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Planning & Environmental Consultants
Tuam Road, Galway.

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Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

259° Direction (Degrees) 304° 349°

0° Included Angle (Degrees) 45° 90°

259° Direction (Degrees) 304° 349°

0° Included Angle (Degrees) 26.5° 53.5°

277° Direction (Degrees) 304° 331°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
12
11
14
13
10
9
8
6
2
277° Direction (Degrees)
304°
331°
200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 13

Abbeyland

Photomontage 13

View Point: View from the local road in the townland of Abbeyland, approximately 10.1 kilometres south of the nearest turbine location.

View point grid reference	239,941(E); 264,446(N)
Date of image taken	17.02.2016
Time of image taken	5.27pm
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	7°
Horizontal extent of proposed turbines	345°
Distance to nearest proposed turbine	10.1km (T14)
Number of proposed turbines visible	7/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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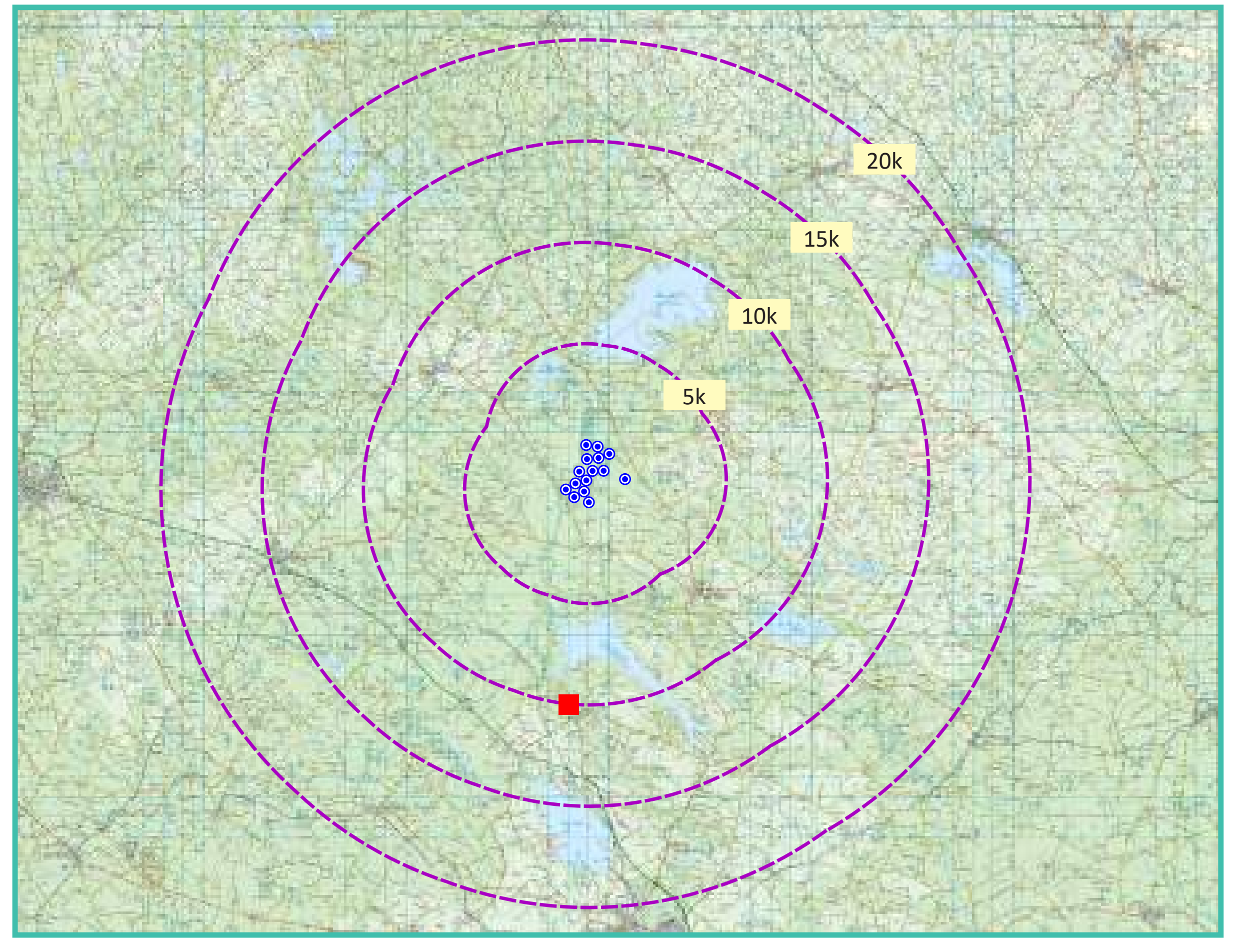
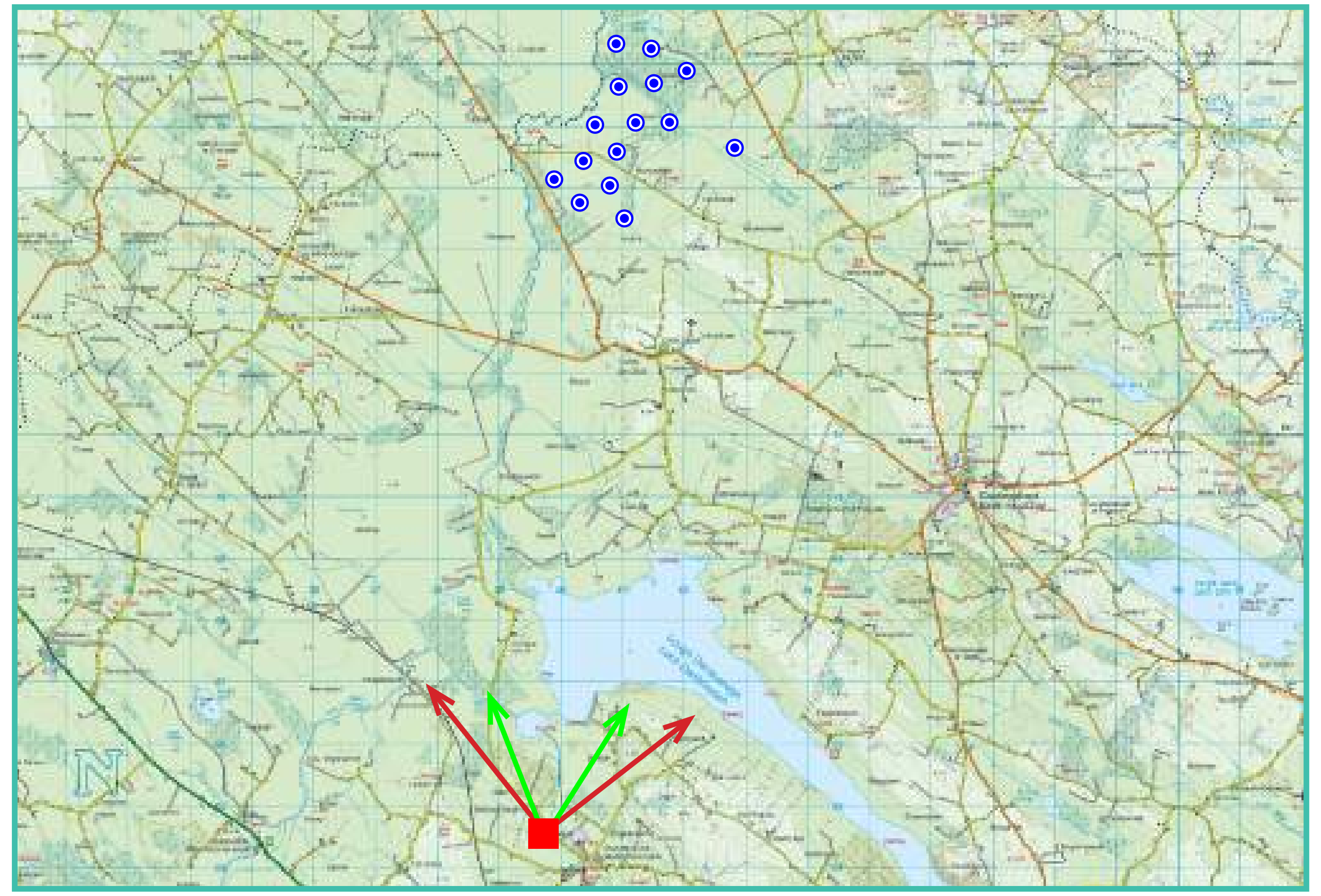


View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

322° Direction (Degrees) 7° 52°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 45° 90°

322° Direction (Degrees) 7° 52°

0° Included Angle (Degrees) 26.5° 53.5°

340° Direction (Degrees) 7° 34°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
11
12
10
8
1
13
7
9
14
6
2
3
5
4
15
340° Direction (Degrees)
7°
34°

View Point 14

Wattstown

Photomontage 14

View Point: View from the top of Frewin Hill, a National Monument, in the townland of Wattstown, approximately 16.3 kilometres south of the nearest turbine.

View point grid reference	237,734(E); 258,518(N)
Date of image taken	28.5.2015
Time of image taken	12.28pm
View point elevation	161m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	12°
Horizontal extent of proposed turbines	9°
Distance to nearest proposed turbine	16.3km (T14)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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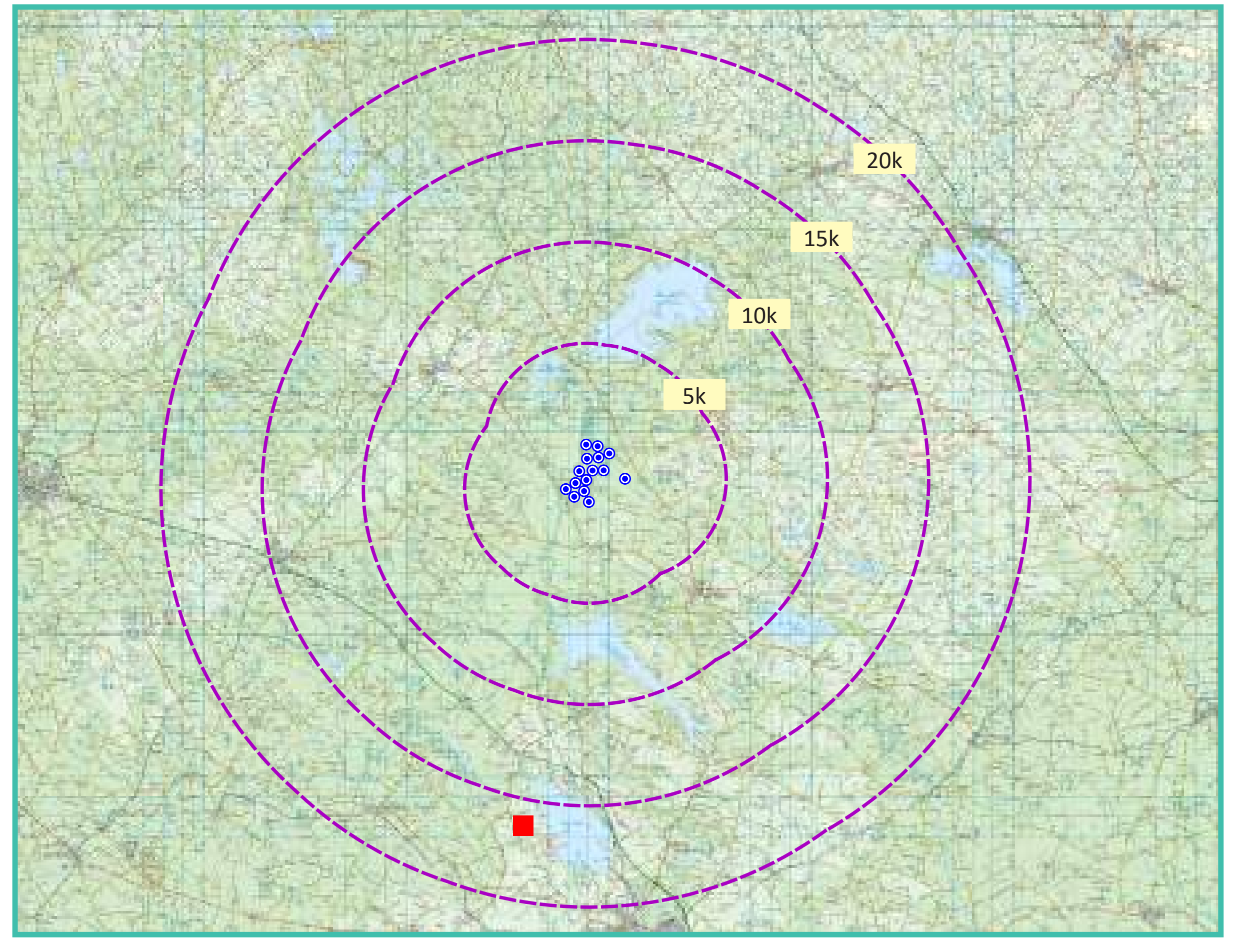
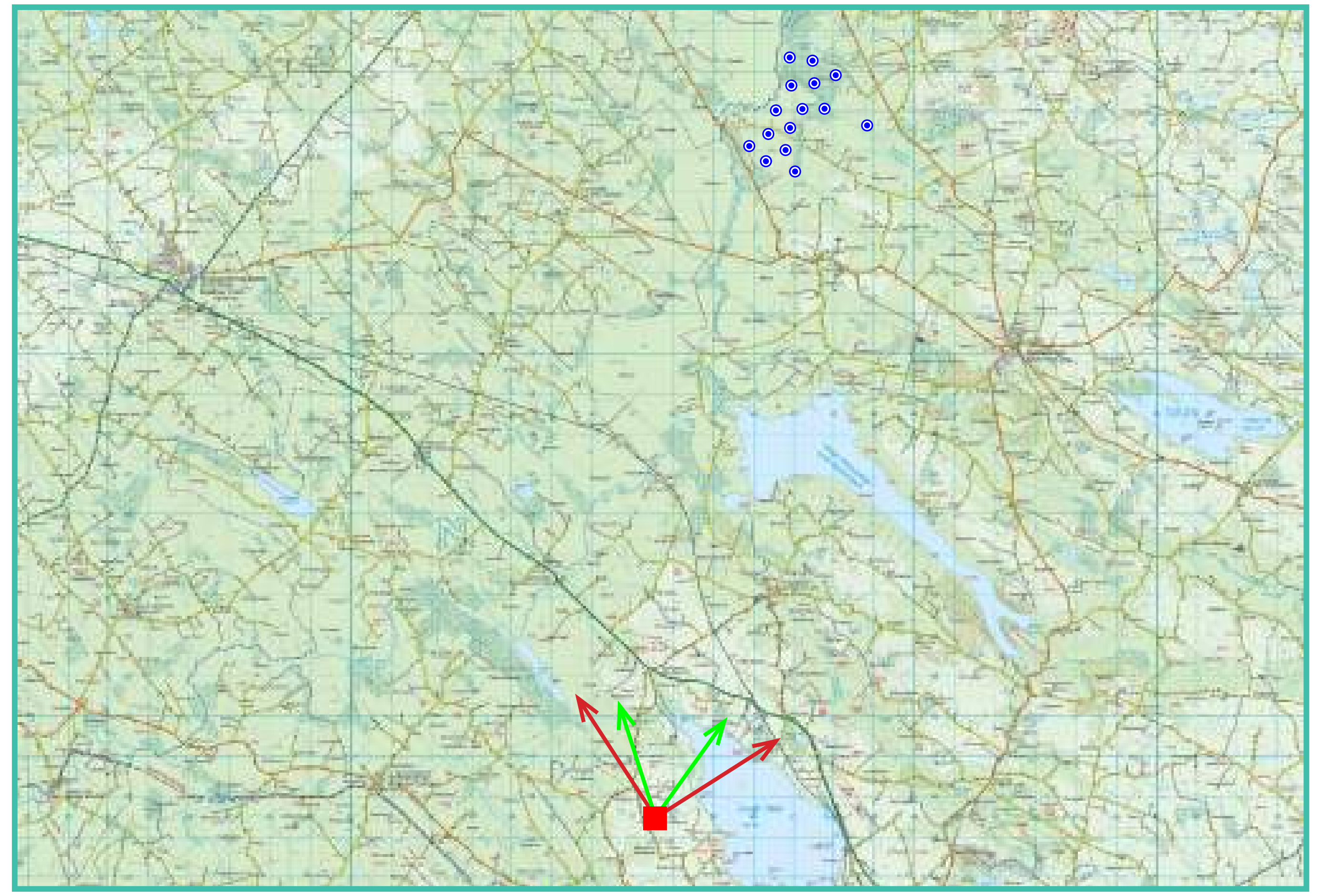


View point relative to 20km radius.



View point relative to wind farm site

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

327° Direction (Degrees) 12° 57°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

327° Direction (Degrees) 12° 57°

0° Included Angle (Degrees) 26.5° 53.5°

345° Direction (Degrees) 12° 39°


0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
11 10 12 8 1 7 13 9 6 2 14 3 5 4 15
345° Direction (Degrees)
12°
39°

TURBINE ENVELOPE RANGE

VP14 - Minimum Rotor Diameter & Maximum Hub Height

0° Included Angle (Degrees) 45° 90°

Minimum Rotor Diameter (149m)
Maximum Hub Height (100.5m)
Envelope Range Variant - 3 No. Viewpoints

Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

327° Direction (Degrees) 12° 57°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5° - Minimum Rotor Diameter & Maximum Hub Height

345° Direction (Degrees) 12° 39°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

TURBINE ENVELOPE RANGE

VP14 - Median Rotor Diameter & Median Hub Height

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90° - Median Rotor Diameter & Median Hub Height

Matching Wireframe

Median Rotor Diameter (150m)
Median Hub Height (100m)
Envelope Range Variant - 3 No. Viewpoints

Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints

327° Direction (Degrees) 12° 57°

0° Included Angle (Degrees) 26.5° 53.5°

345° Direction (Degrees) 12° 39°

0° Included Angle (Degrees)   26.5°   53.5°

345° Direction (Degrees)   12°   39°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 15

Castlepollard

Photomontage 15

View Point: View from the outskirts of Castlepollard, in the townland of Townparks, approximately 6.3 kilometres southeast of the nearest turbine.

View point grid reference	246,098(E); 270,155(N)
Date of image taken	06.10.2016
Time of image taken	12.47pm
View point elevation	91m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	320°
Horizontal extent of proposed turbines	21°
Distance to nearest proposed turbine	6.3km (T15)
Number of proposed turbines visible	5/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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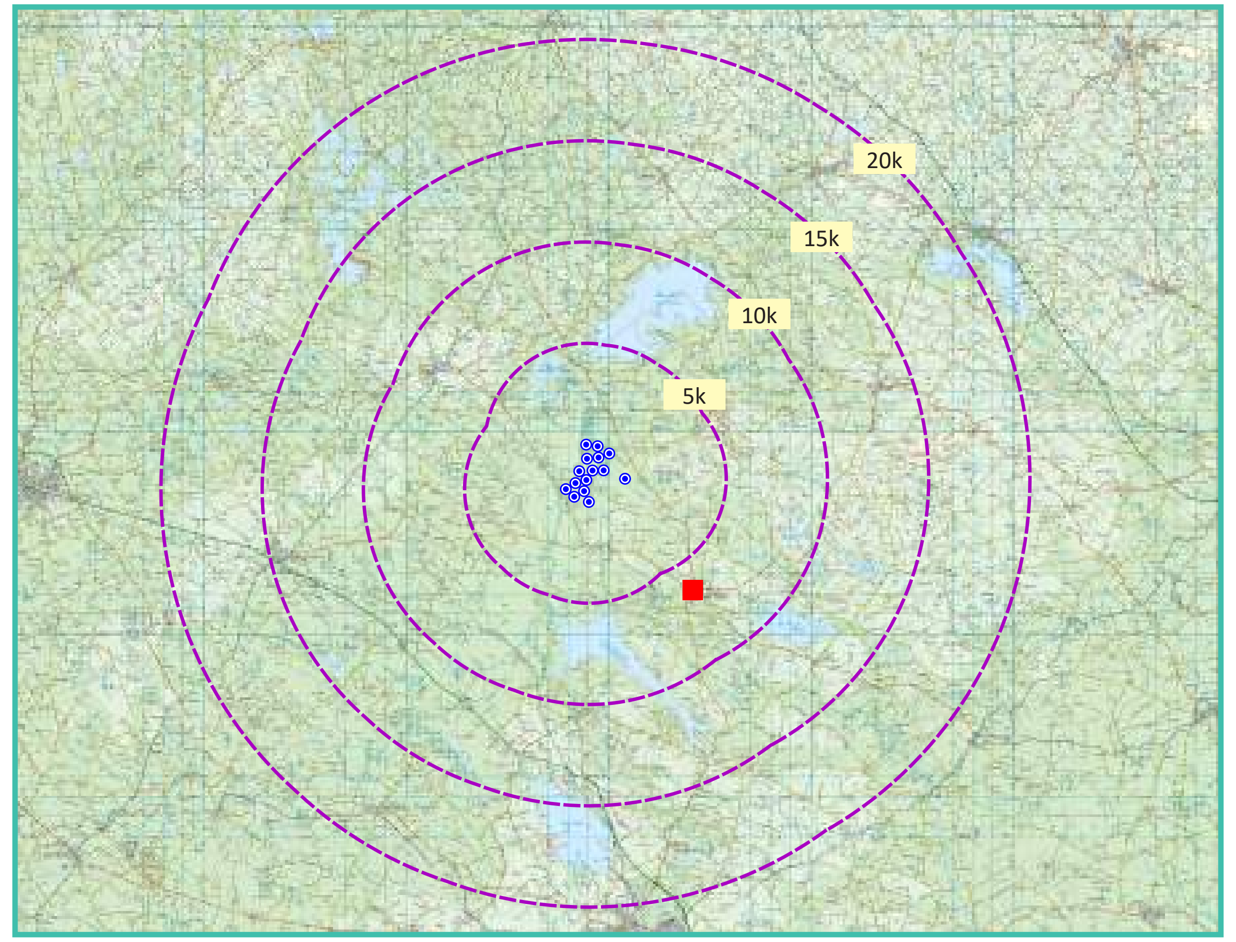
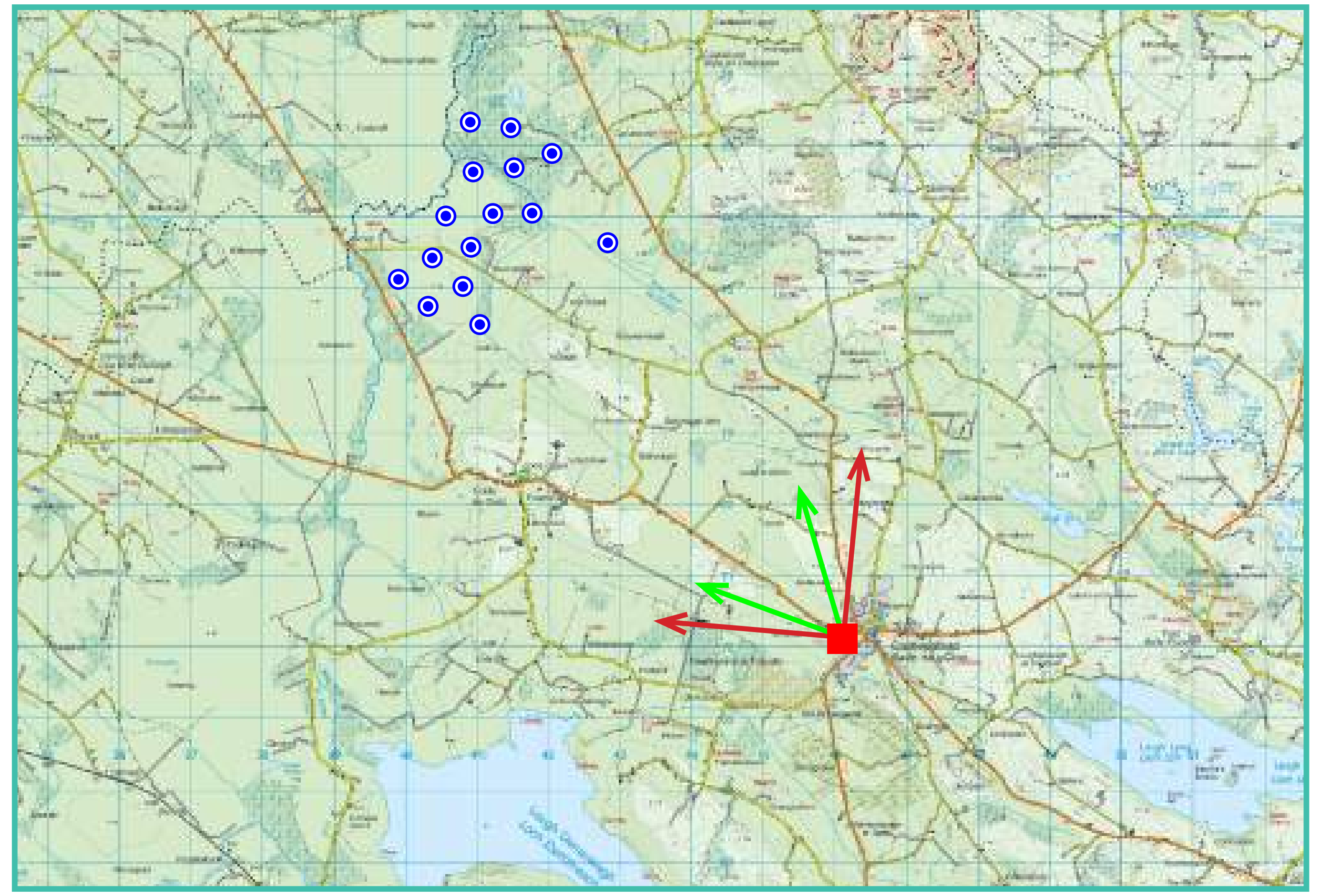


View point relative to 20km radius.



View point relative to wind farm site

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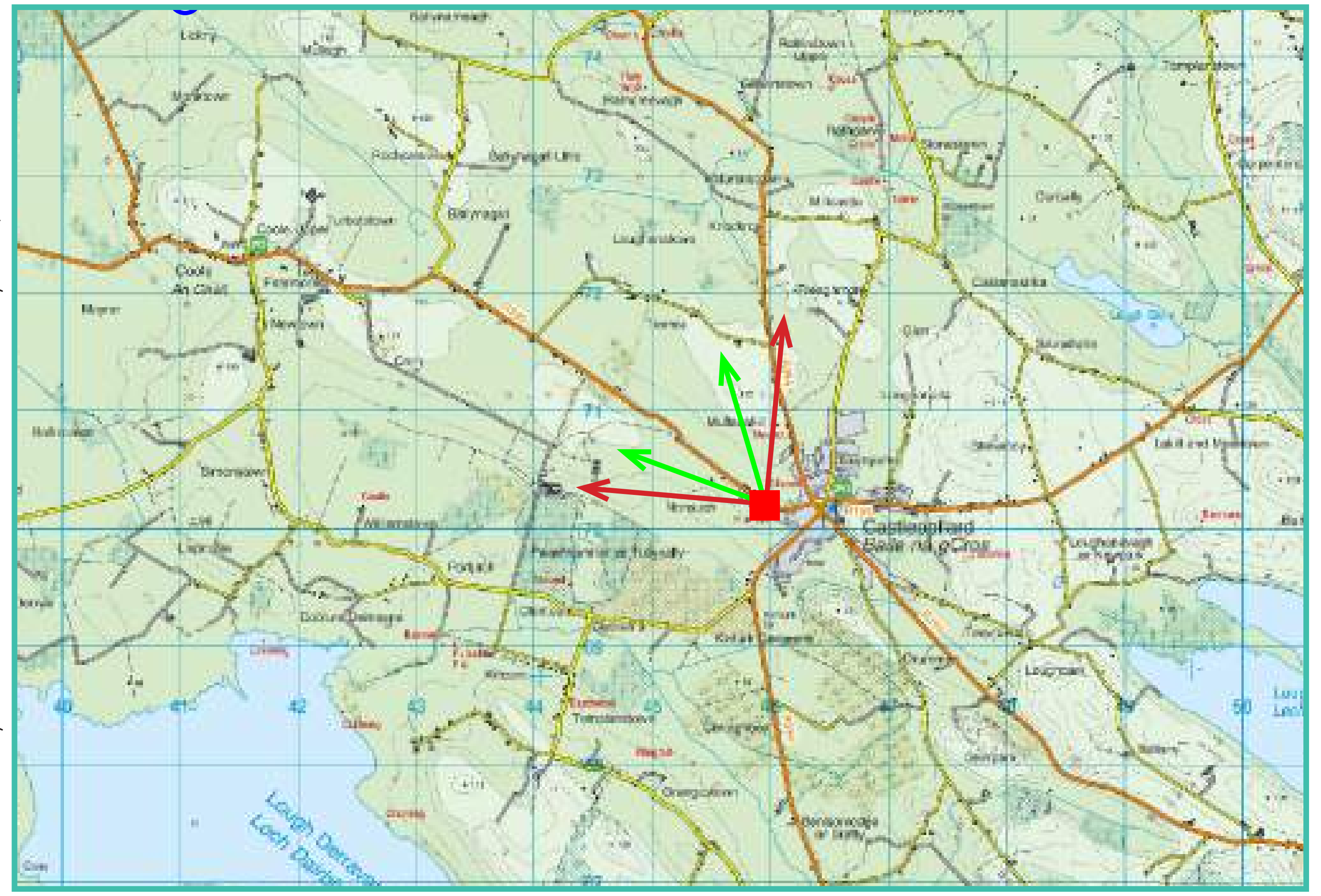

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

275° Direction (Degrees) 320° 5°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

275° Direction (Degrees) 320° 5°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

293° Direction (Degrees) 320° 347°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 16

Coole

Photomontage 16

View Point: View from the R395 Regional Road at Fearmore, Coole village, approximately 2.4 kilometres southeast of the nearest turbine.

View point grid reference	242,026(E); 272,261(N)
Date of image taken	05.02.2017
Time of image taken	1:01pm
View point elevation	99m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	347°
Horizontal extent of proposed turbines	309°
Distance to nearest proposed turbine	2.4km (T14)
Number of proposed turbines visible	9/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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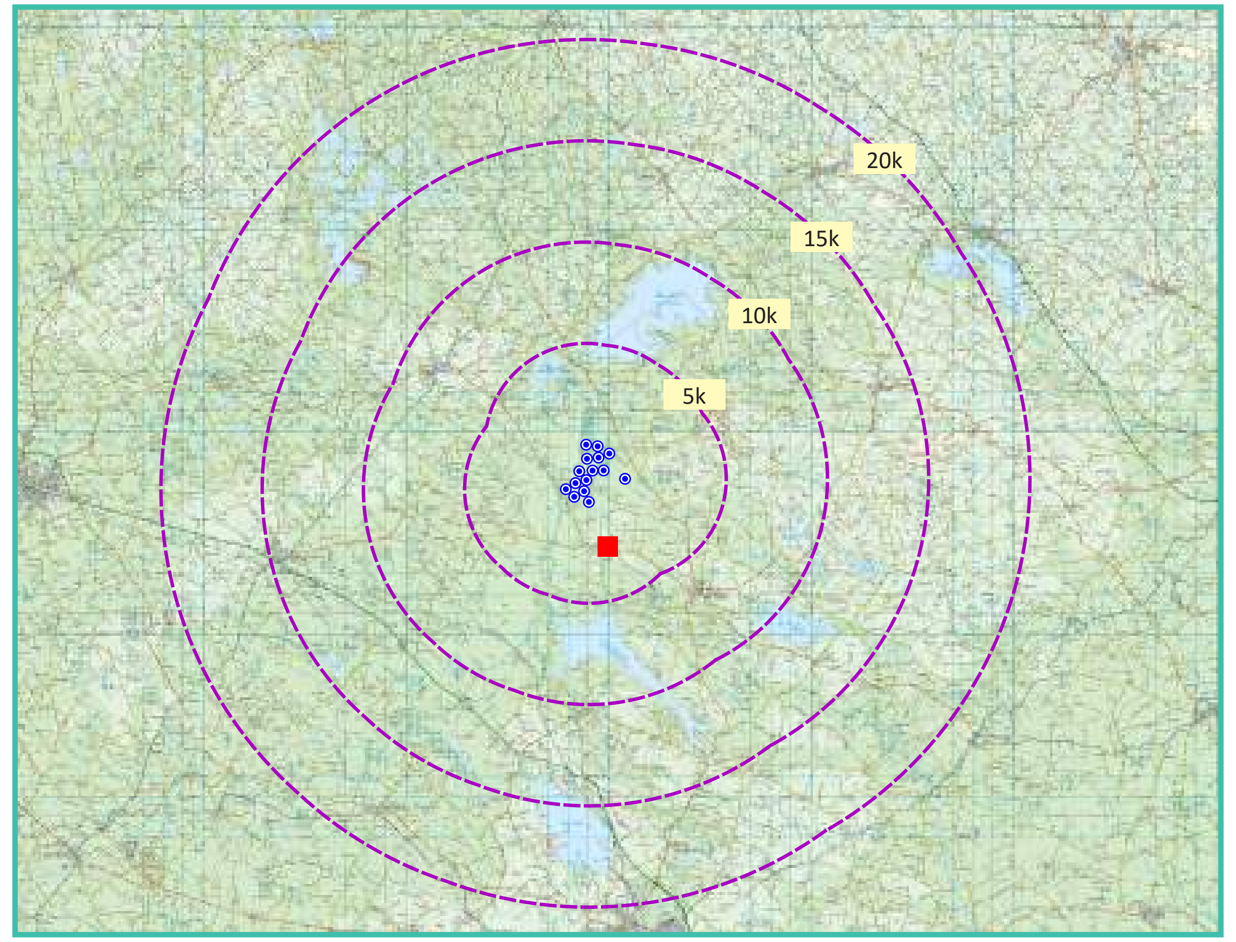
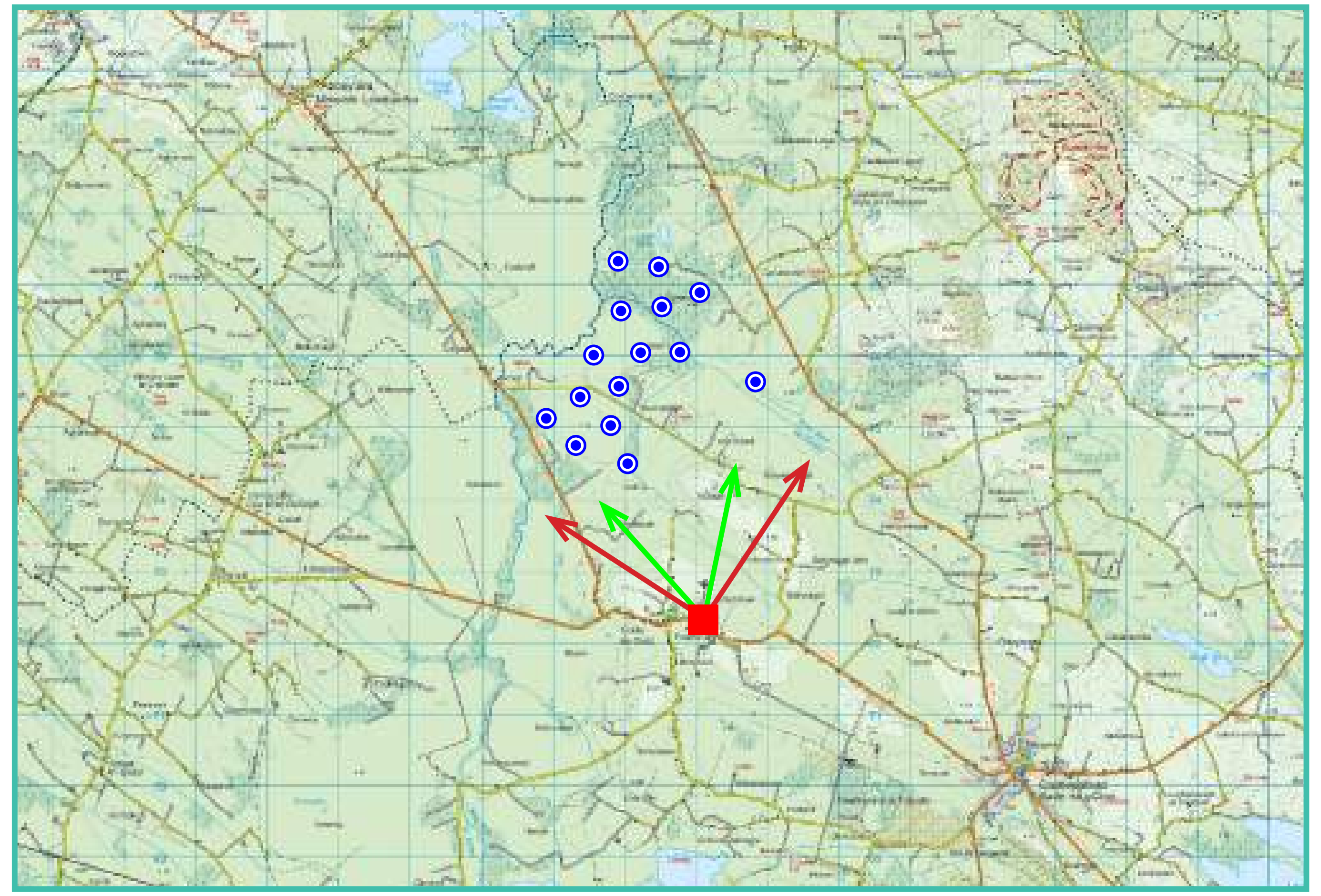
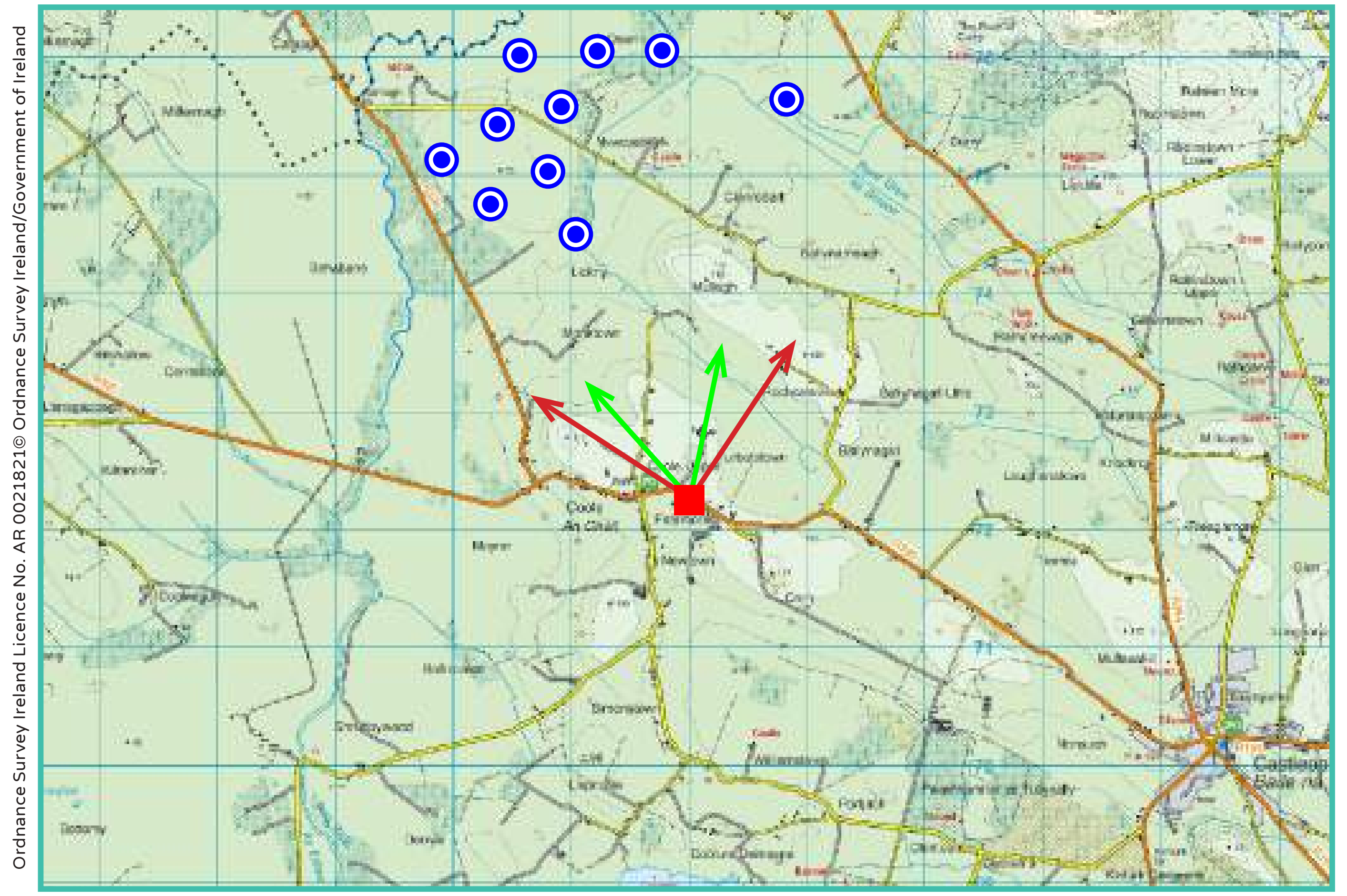


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

302° Direction (Degrees) 347° 32°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

302° Direction (Degrees) 347° 32°

0° Included Angle (Degrees) 26.5° 53.5°

320° Direction (Degrees) 347° 14°

0° Included Angle (Degrees) 26.5° 53.5°

320° Direction (Degrees) 347° 14°

View Point 17

Coole

Photomontage 17

View Point: View from the R395 Regional Road at Coole Village, in the townland of Coole, approximately 2.3 kilometres southeast of the nearest turbine.

View point grid reference	241,556(E); 272,257(N)
Date of image taken	22.01.2021
Time of image taken	1:40pm
View point elevation	95m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	355°
Horizontal extent of proposed turbines	309°
Distance to nearest proposed turbine	2.3km (T14)
Number of proposed turbines visible	0/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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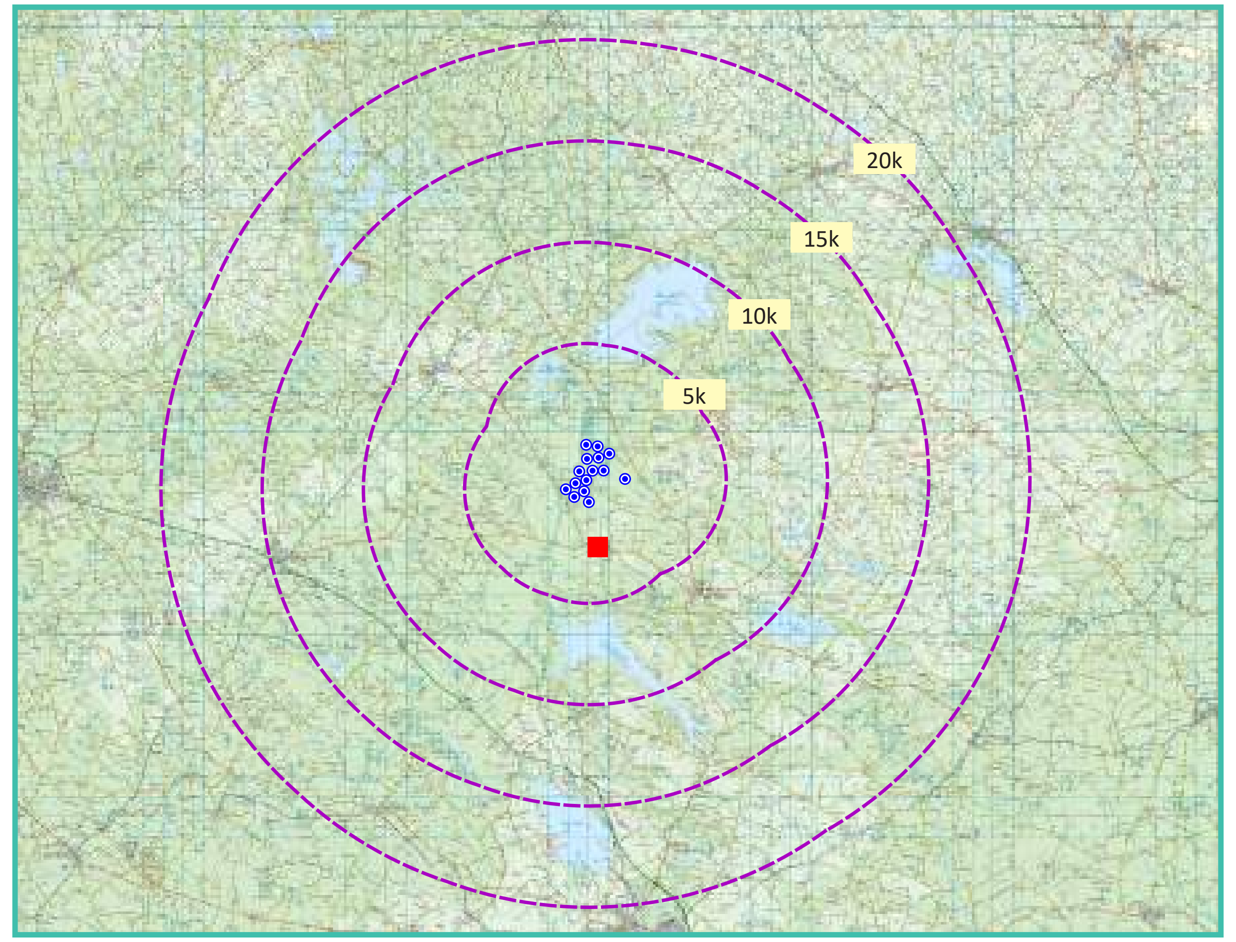
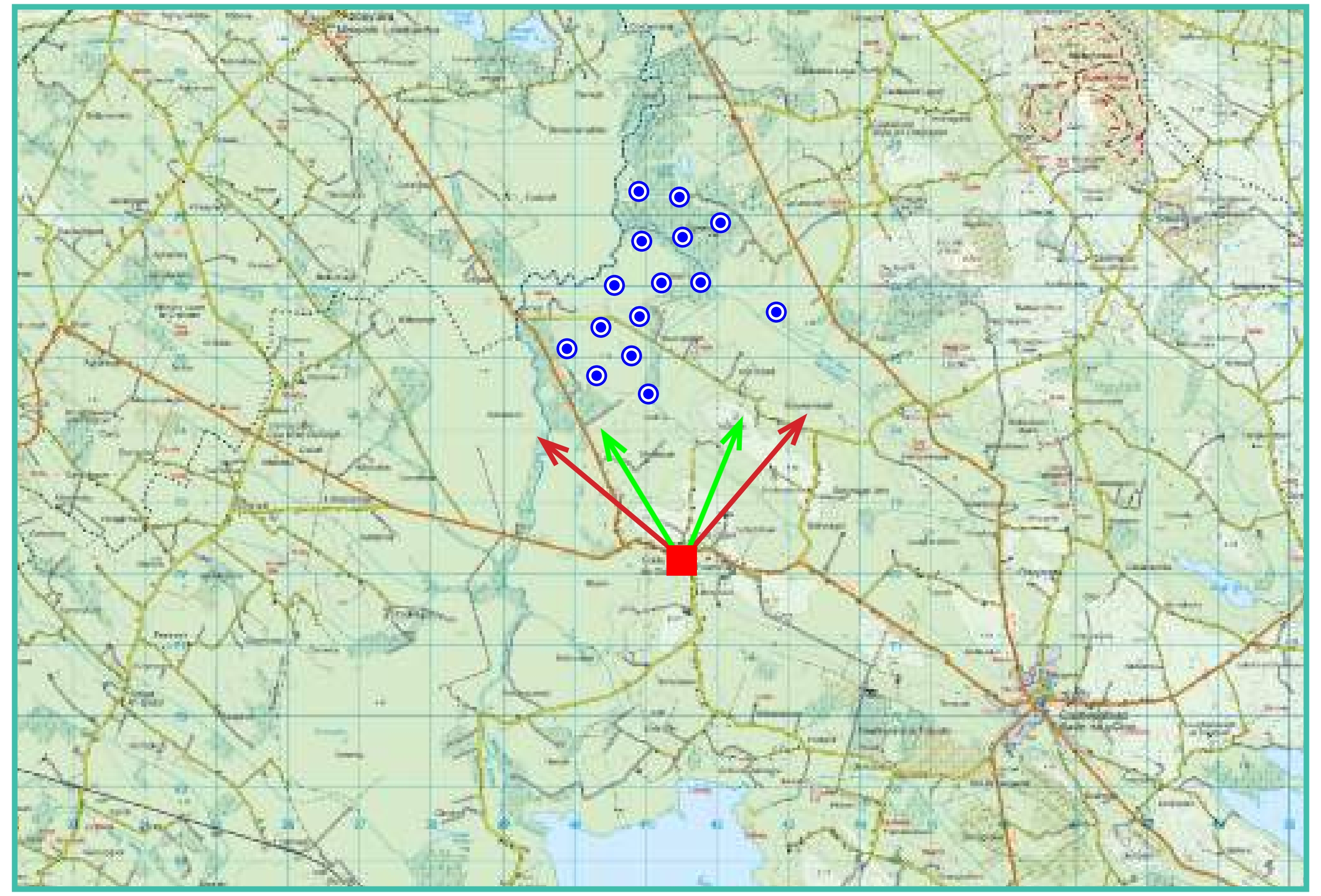
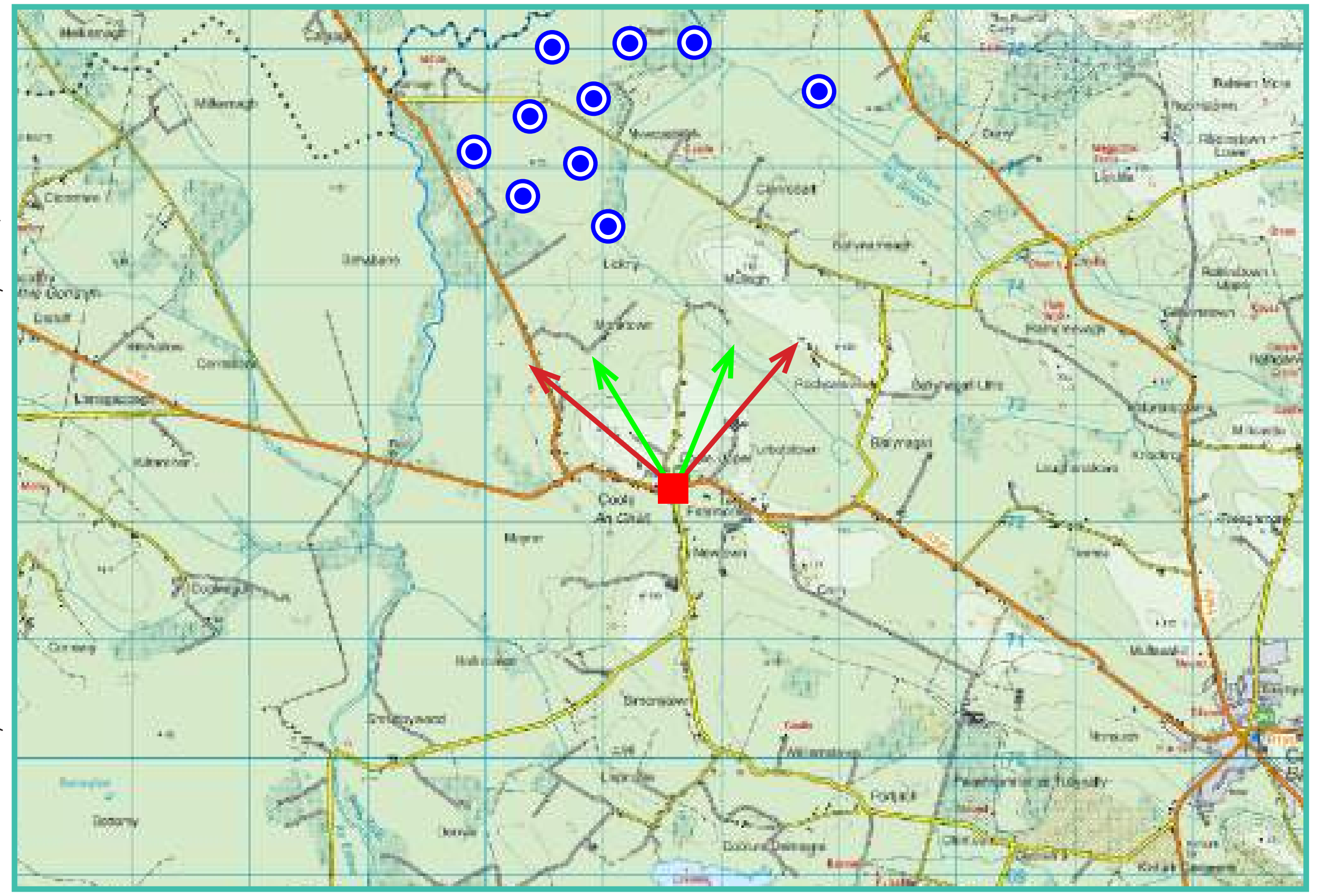


View point relative to 20km radius.



View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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Website: www.mkoireland.ie

90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

310° Direction (Degrees) 355° 40°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

310° Direction (Degrees) 355° 40°

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

328° Direction (Degrees) 355° 22°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 18

Moatfield

Photomontage 18

View Point: View from Granard Motte in the townland of Moatfield, approximately 8.6 kilometres from the nearest turbine.

View point grid reference	232,979(E); 280,749(N)
Date of image taken	22.01.2021
Time of image taken	2:17pm
View point elevation	167m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	120°
Horizontal extent of proposed turbines	17°
Distance to nearest proposed turbine	8.6km (T1)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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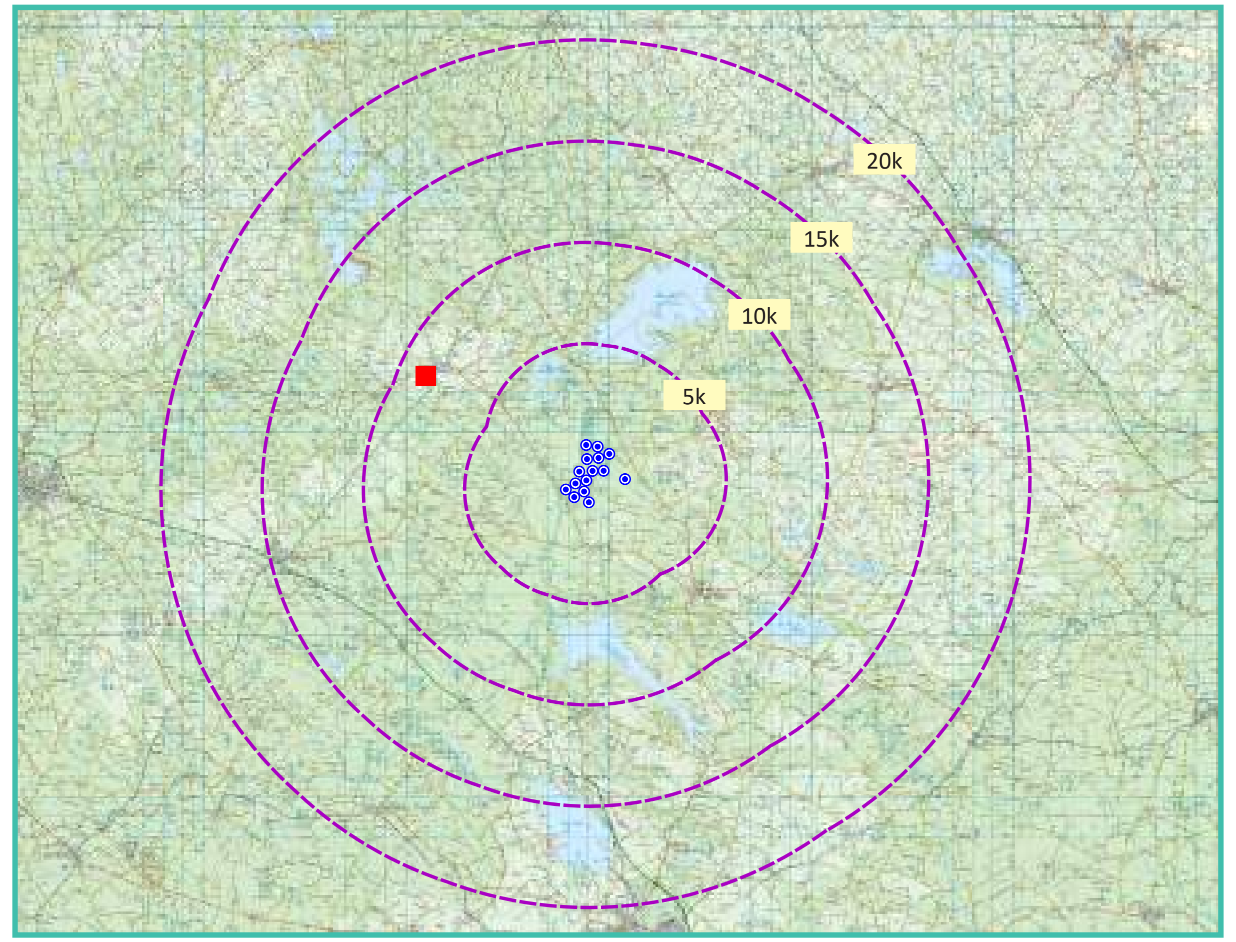
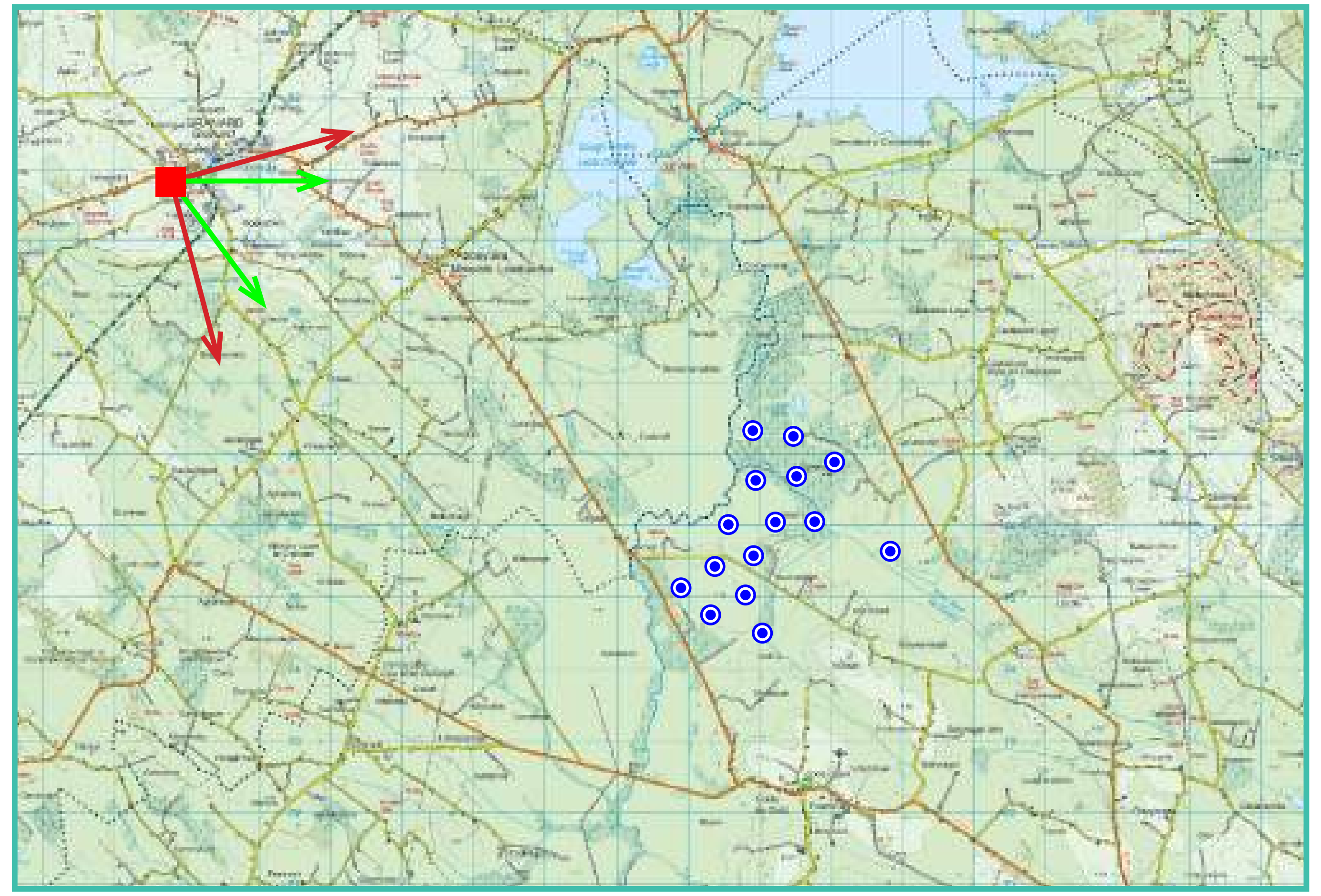
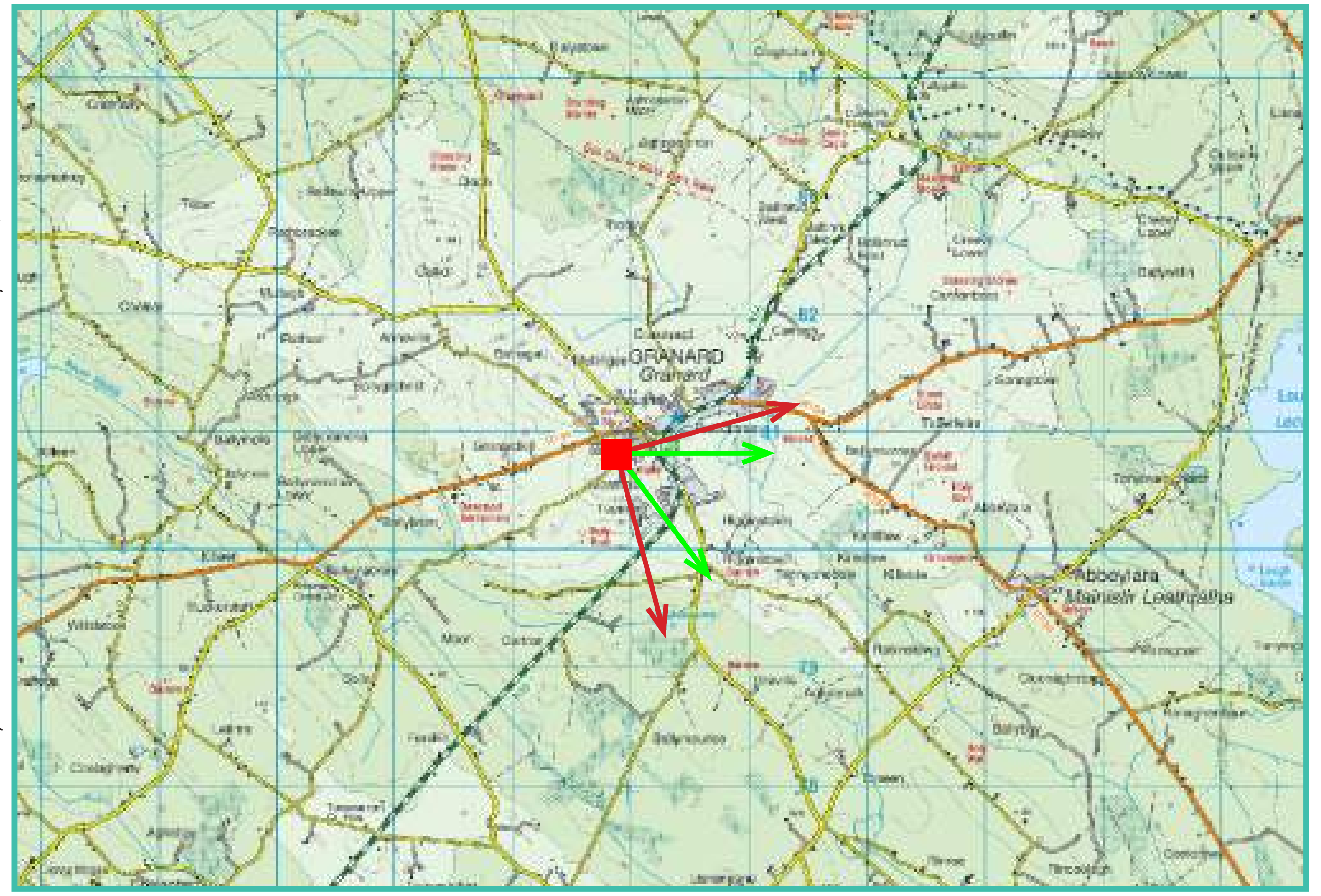


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

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90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

75° Direction (Degrees) 120° 165°

0° Included Angle (Degrees) 45° 90°

75° Direction (Degrees) 120° 165°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 26.5° 53.5°

93° Direction (Degrees) 120° 147°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 19

Camagh

Photomontage 19

View Point: View from Regional Road R396 in the townland of Camagh, Co.Longford, approximately 0.9 kilometres from the nearest turbine.

View point grid reference	239,148(E); 275,622(N)
Date of image taken	05.09.2017
Time of image taken	11:27am
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	85°
Horizontal extent of proposed turbines	83°
Distance to nearest proposed turbine	0.9km (T11)
Number of proposed turbines visible	3/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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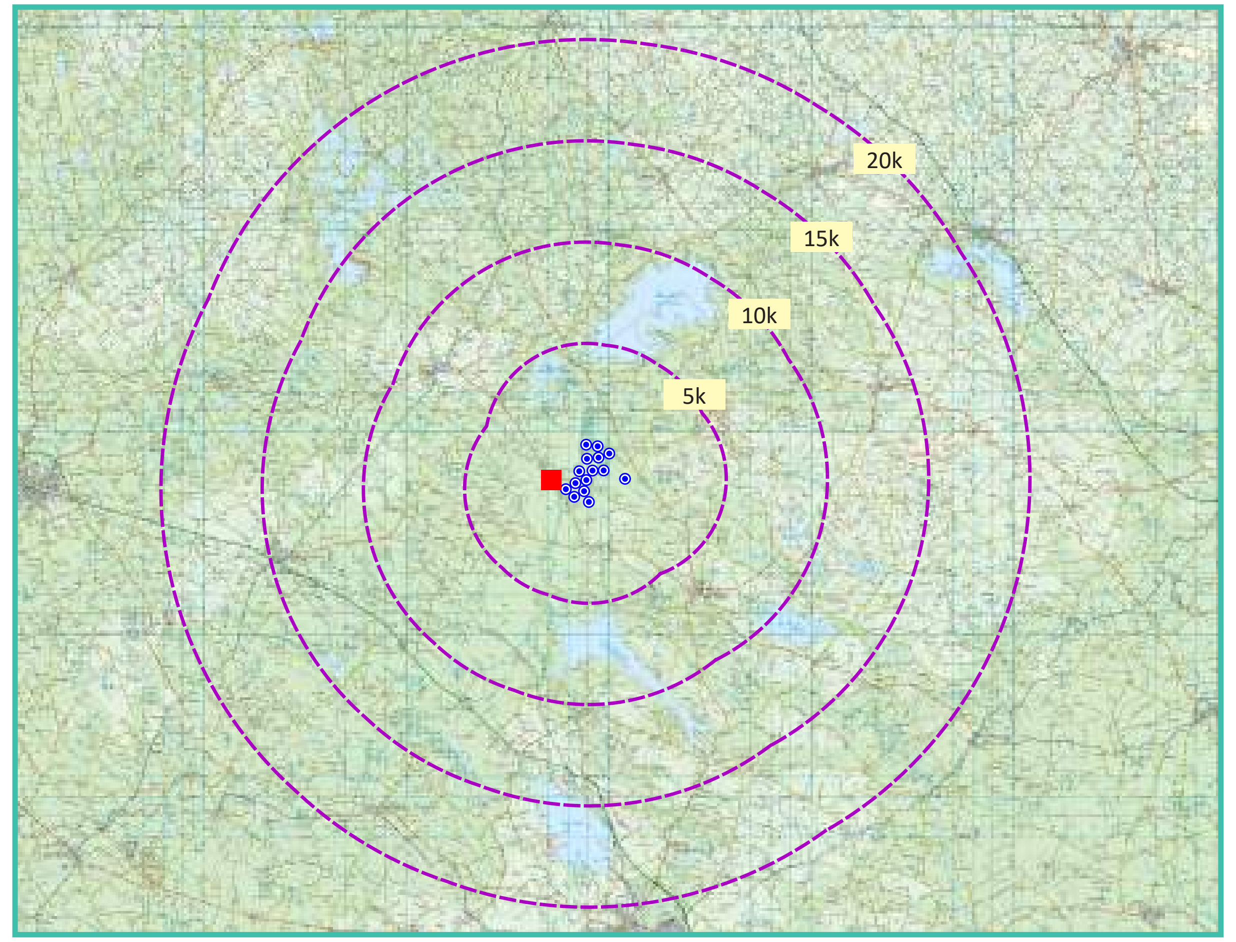
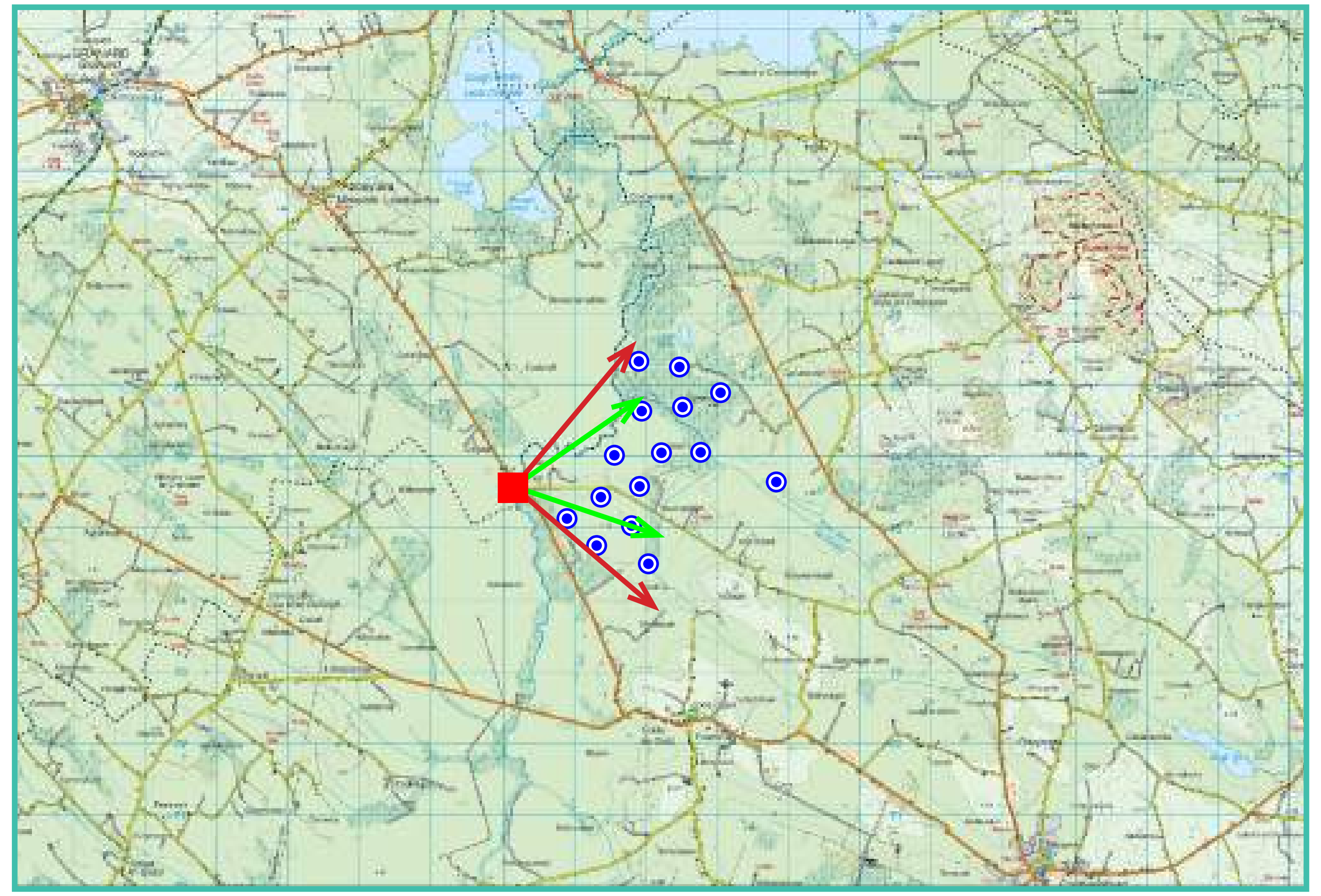
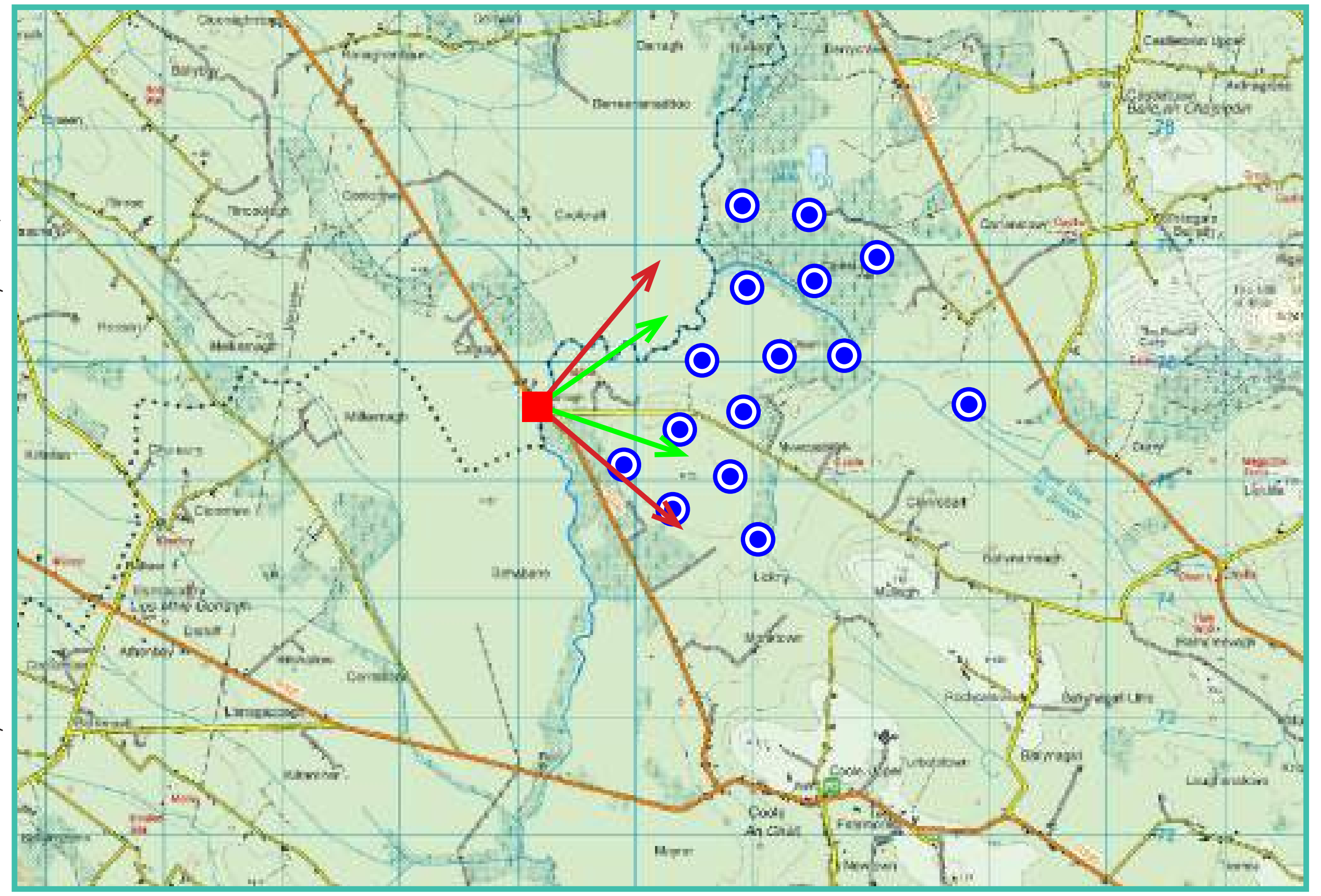


View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by
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90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

40° Direction (Degrees) 85° 130°

0° Included Angle (Degrees) 45° 90°

40° Direction (Degrees) 85° 130°

0° Included Angle (Degrees) 26.5° 53.5°

58° Direction (Degrees) 85° 112°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

View Point 20

Mayne

Photomontage 20

View Point: View from Regional Road R395 in the townland of Mayne, approximately 2.5 kilometres fror the nearest turbine.

View point grid reference	239,242(E); 272,484(N)
Date of image taken	05.09.2017
Time of image taken	11:46am
View point elevation	70m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	30°
Horizontal extent of proposed turbines	34°
Distance to nearest proposed turbine	2.5km (T12)
Number of proposed turbines visible	2/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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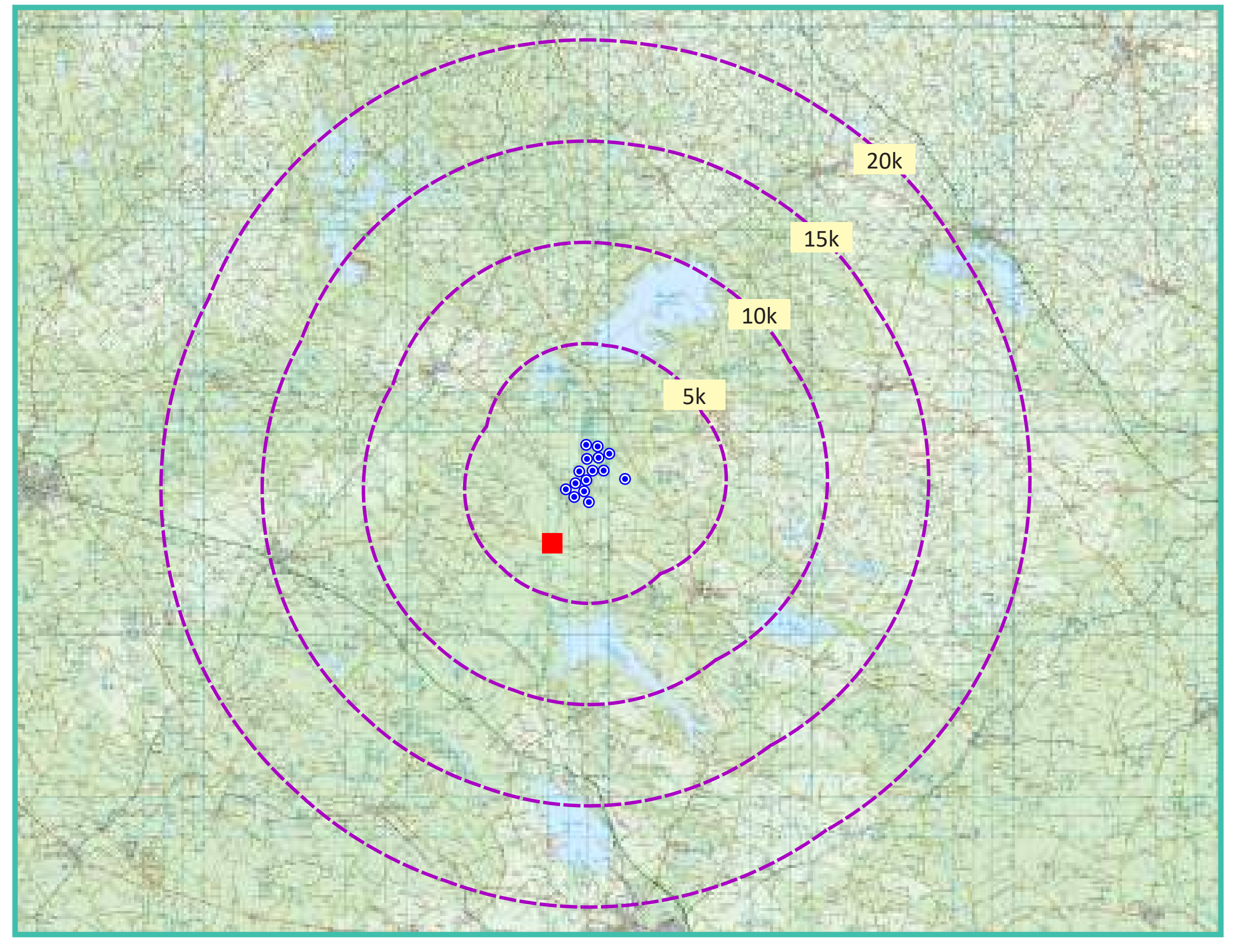
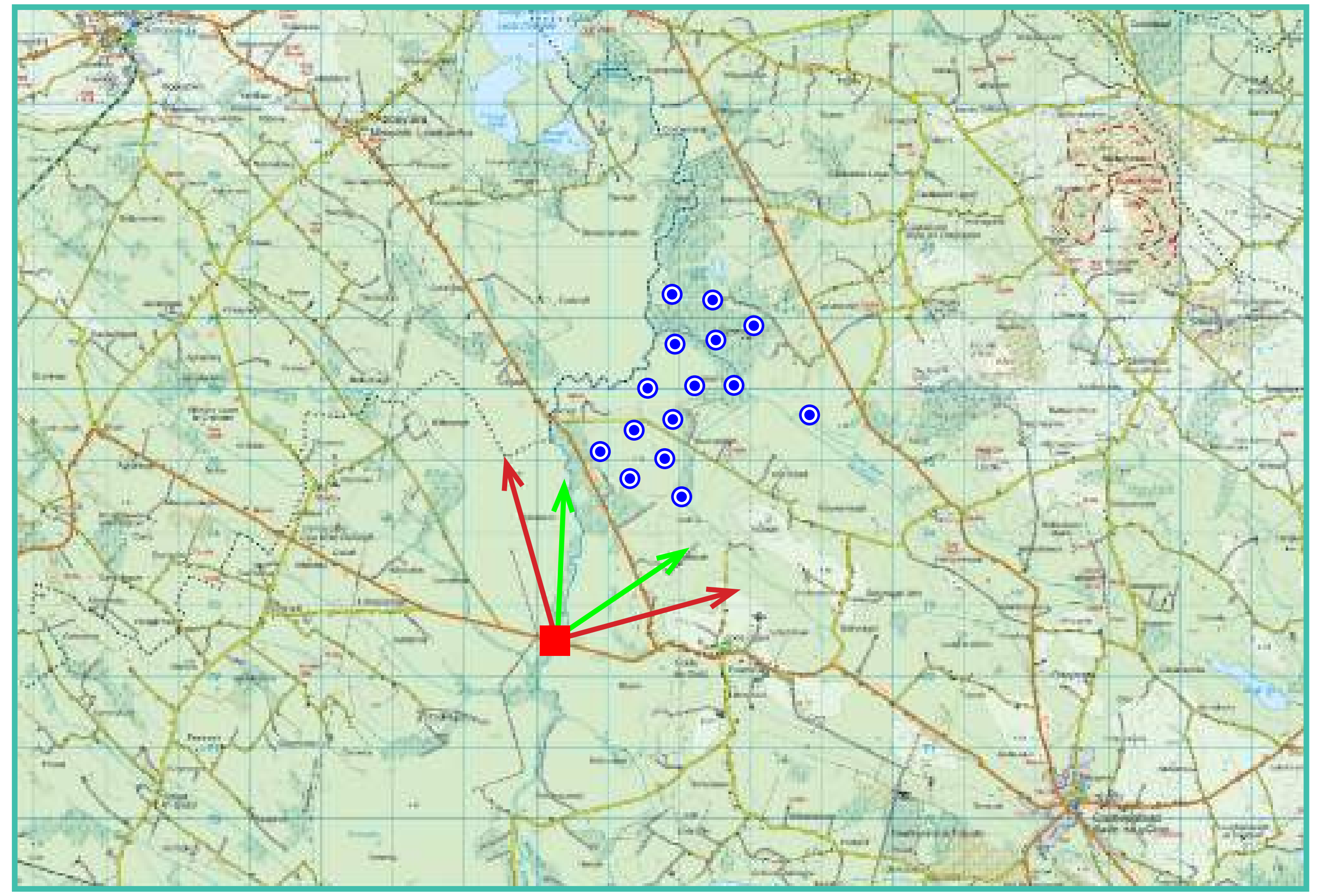
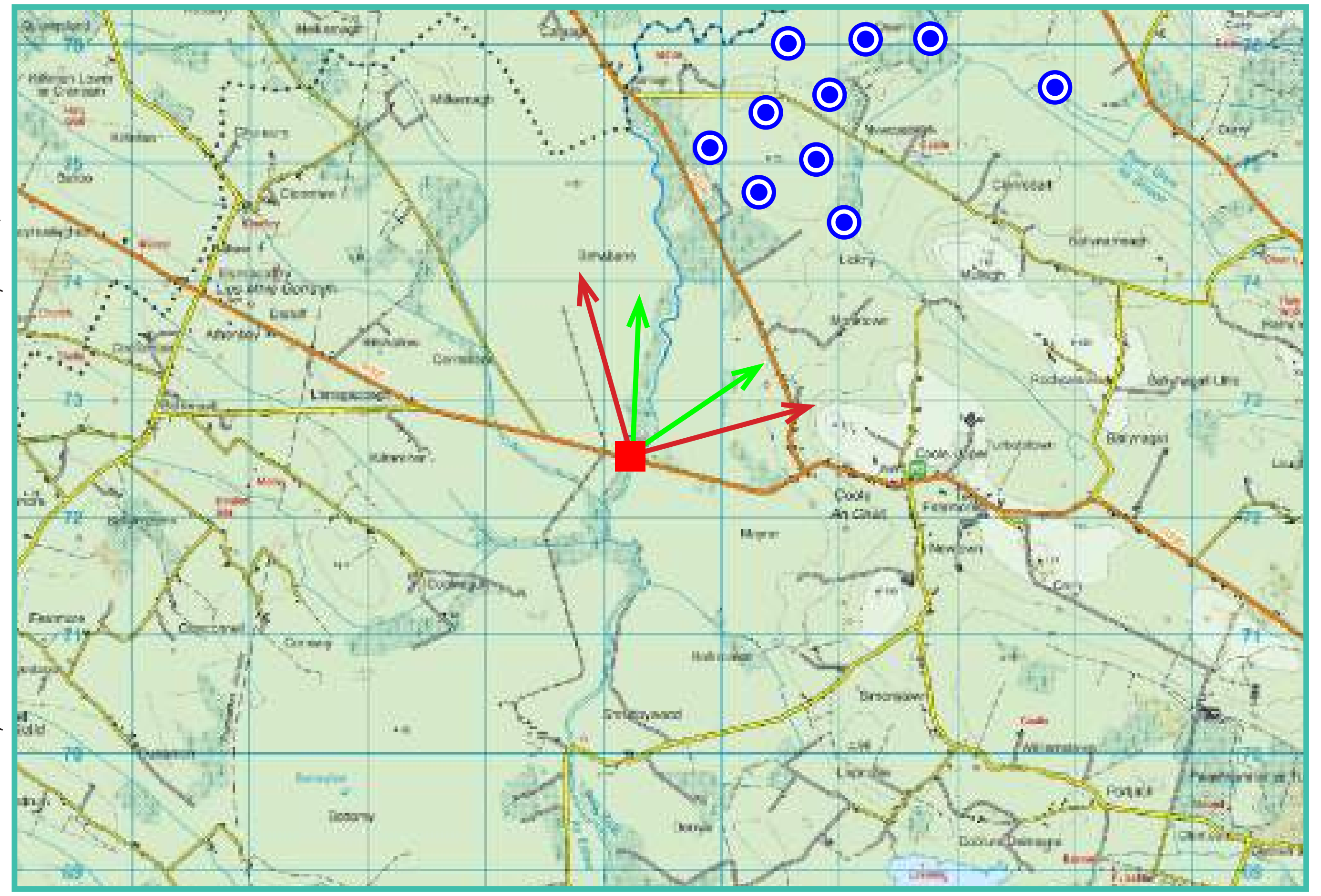


View point relative to 20km radius.



View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

345° Direction (Degrees) 30° 75°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

345° Direction (Degrees) 30° 75°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

0° Included Angle (Degrees) 26.5° 53.5°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 53.5°

3° Direction (Degrees) 30° 57°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

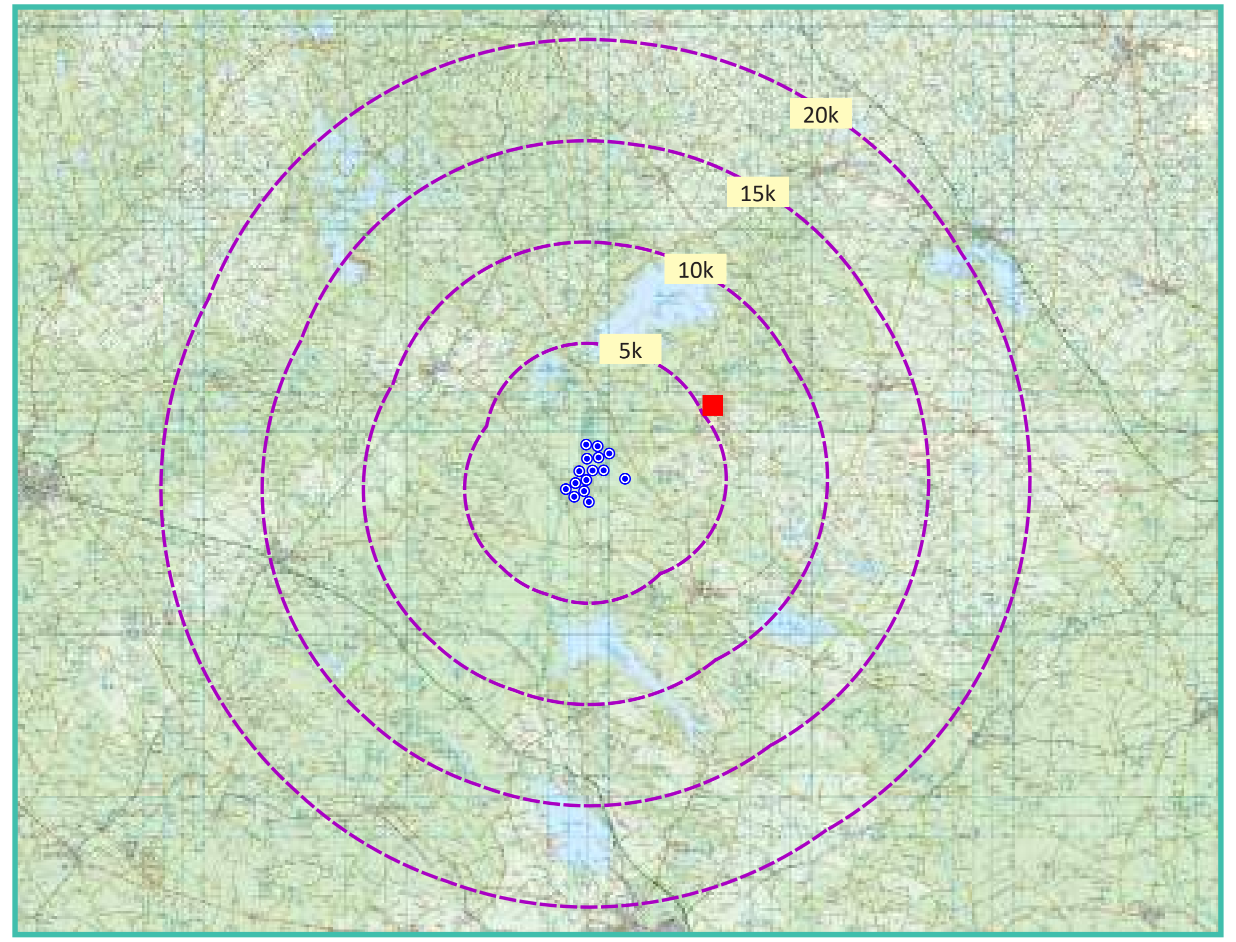
View Point 21

Mullaghmeen

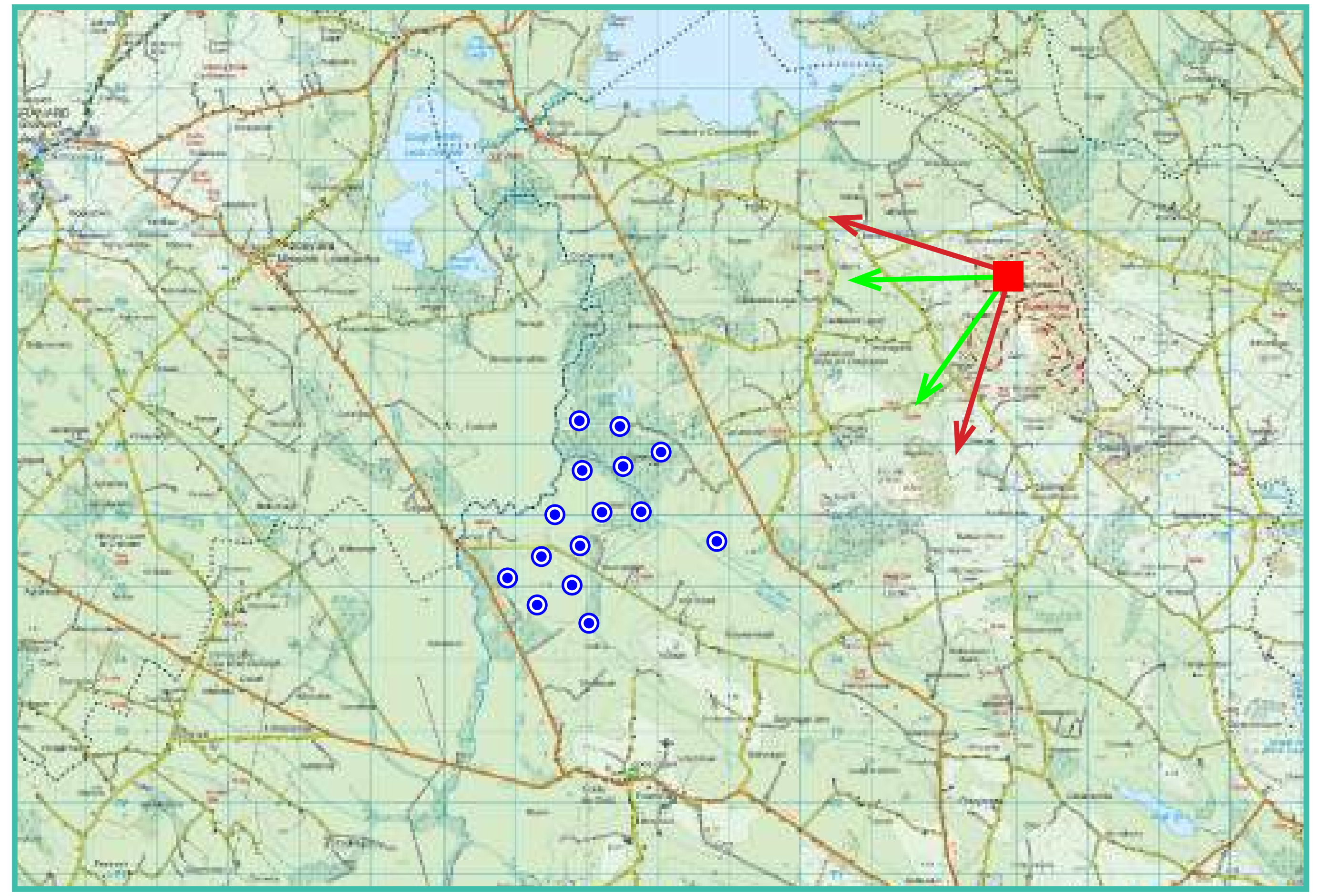
Photomontage 21

View Point: View from the cairn at Mullaghmeen, approximately 5.3 kilometres from the nearest turbine.

View point grid reference	246,779(E); 279,354(N)
Date of image taken	05.09.2017
Time of image taken	1:44pm
View point elevation	247m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	239°
Horizontal extent of proposed turbines	25°
Distance to nearest proposed turbine	5.3 km (T4)
Number of proposed turbines visible	15/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.



View point relative to wind farm site

Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

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E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

Key Image at 120°

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

194° Direction (Degrees) 239° 284°

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90°

Matching Wireframe

194° Direction (Degrees) 239° 284°

0° Included Angle (Degrees) 26.5° 53.5°

212° Direction (Degrees) 239° 266°

0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
15
14
13
12
5
9
11
10
6
8
4
3
7
2
1
212° Direction (Degrees)
239°
266°

TURBINE ENVELOPE RANGE

VP21 - Minimum Rotor Diameter & Maximum Hub Height

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90° - Minimum Rotor Diameter & Maximum Hub Height

Matching Wireframe

Minimum Rotor Diameter (149m)
Maximum Hub Height (100.5m)
Envelope Range Variant - 3 No. Viewpoints

Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints

194° Direction (Degrees) 239° 284°

0° Included Angle (Degrees) 26.5° 53.5°

212° Direction (Degrees) 239° 266°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

TURBINE ENVELOPE RANGE

VP21 - Median Rotor Diameter & Median Hub Height

0° Included Angle (Degrees) 45° 90°

Proposed Coole Wind Farm (15 Turbines) Photomontage with Cumulative at 90° - Median Rotor Diameter & Median Hub Height

Matching Wireframe

Median Rotor Diameter (150m)
Median Hub Height (100m)
Envelope Range Variant - 3 No. Viewpoints

Maximum Rotor Diameter (155m)
Minimum Hub Height (97.5m)
Presented for All Viewpoints

194° Direction (Degrees) 239° 284°

0° Included Angle (Degrees) 26.5° 53.5°

212° Direction (Degrees) 239° 266°

200445 Coole Photomontage Booklet 2021 Proposed & Permitted

Additional Photomontage for Archaeological Assessment

MKO
Planning and Environmental Consultants

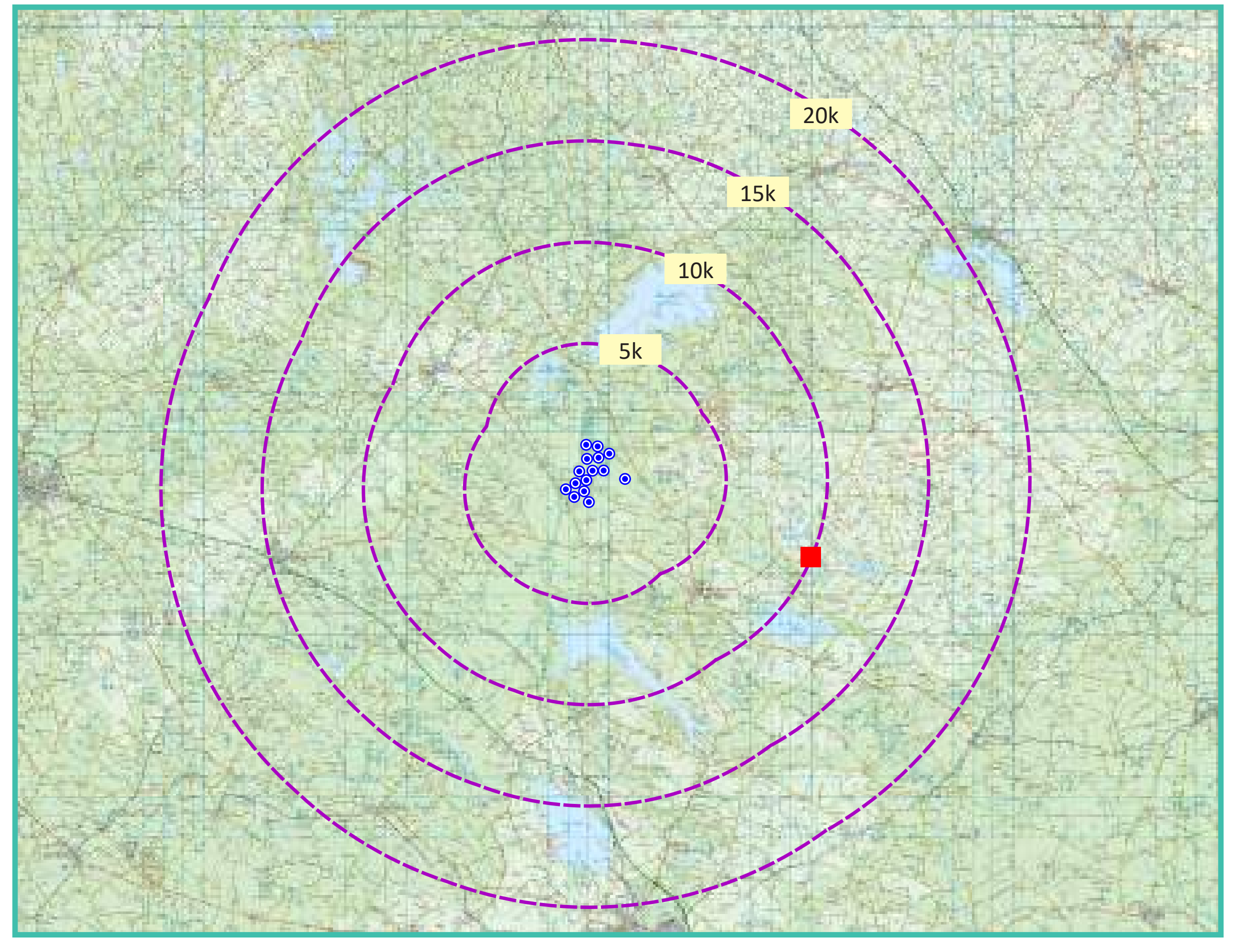
View Point 22

Fore Abbey

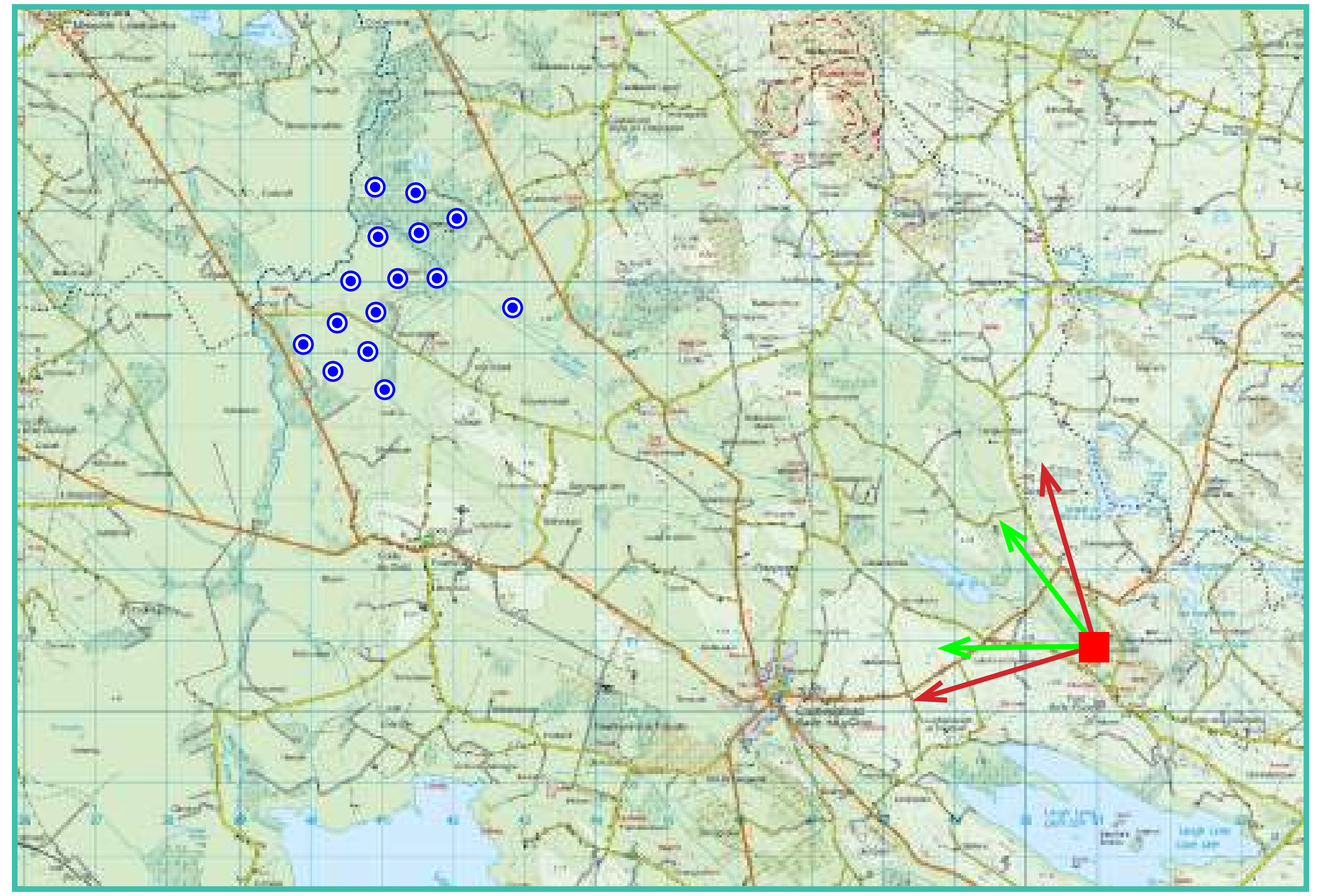
Photomontage 22

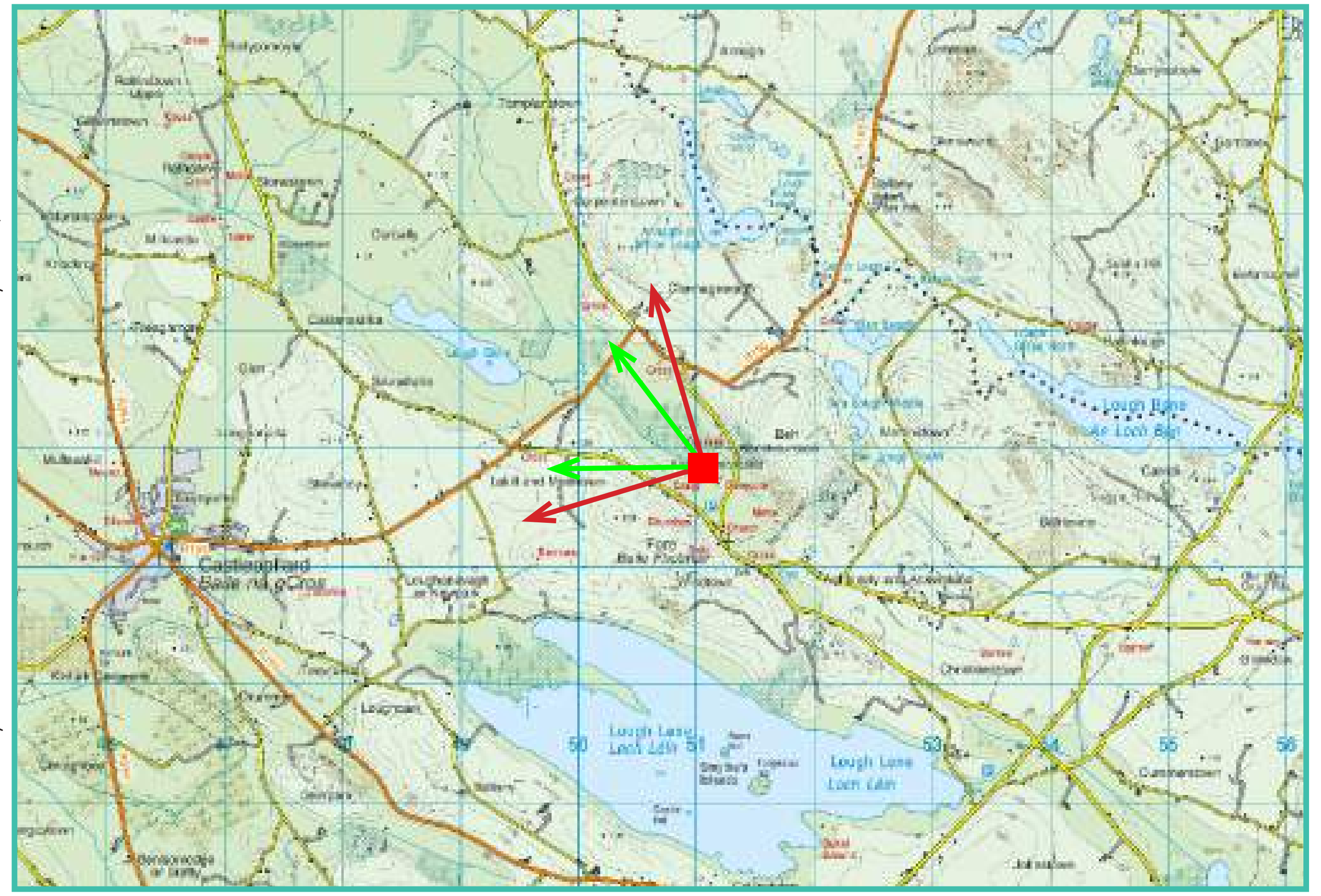
View Point: View from Fore Abbey in the townland of Fore, approximately 9.6 kilometres south east of the nearest proposed turbine location.

View point grid reference	251,090(E); 270,744(N)
Date of image taken	11.01.2017
Time of image taken	10.20am
View point elevation	85m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	297°
Horizontal extent of proposed turbines	14°
Distance to nearest proposed turbine	9.6 km (T15)
Number of proposed turbines visible	3/15
Turbine Hub Height	97.5m
Turbine Tip Height	175m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No:AR 0021821©



View point relative to 20km radius.


View point relative to wind farm site


Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Wireframe Legend

Proposed Coole Wind Farm in Blue (15T)

Permitted Coole Wind Farm in Green (13T)

Existing Ballyjamesduff Wind Farm in Grey

Prepared by
MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 56 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

53.5° View Extent

0° Included Angle (Degrees) 45° 90°

Do-Nothing Scenario - Permitted Coole Wind Farm (13 Turbines) Photomontage at 90°

Matching Wireframe

252° Direction (Degrees) 297° 342°

0° Included Angle (Degrees) 45° 90°

252° Direction (Degrees) 297° 342°

0° Included Angle (Degrees) 26.5° 53.5°

272° Direction (Degrees) 297° 324°


0° Included Angle (Degrees)
26.5°
53.5°
Matching Wireframe
Proposed Coole Wind Farm (15 Turbines)
15
3
1
2
4
272° Direction (Degrees)
297°
324°

APPENDIX 8

FI TOBAR RESPONSE

Further Information and third party responses to concerns raised regarding the Proposed Coole WF, County Westmeath

Author: Miriam Carroll

Client: MKO Ireland Ltd

C/O MKO Tuam Road,

Galway

Date: 05/09/2022

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1 INTRODUCTION

Tobar Archaeological Services Ltd prepared the archaeology and cultural heritage chapter of the EIAR which accompanied the planning application for the proposed Coole Wind Farm, County Westmeath. This document consists of a response to a request for Further Information (ABP Ref 309770-21 issued by An Bord Pleanala as well as addressing third party concerns.

Miriam Carroll and Annette Quinn are directors of Tobar Archaeological Services Ltd. Miriam and Annette both graduated from University College Cork in 1998 with a Masters degree in Methods and Techniques in Irish Archaeology. Both are licensed by the Department of Housing, Local Government and Heritage to carry out excavations and are members of the Institute of Archaeologists of Ireland. Annette Quinn and Miriam Carroll have been working in the field of archaeology since 1994 and have undertaken numerous projects for both the private and public sectors including excavations, site assessments (EIAR) and surveys. Miriam Carroll and Annette Quinn are directors of Tobar Archaeological Services which has been in operation for 19 years.

2 AN BORD PLEANÁLA REQUEST FOR FURTHER INFORMATION

The request for further information issued by An Bord Pleanála details the following:

'*6.1 Please provide a comprehensive response to the matters raised in the submissions and observations received by the Board from members of the public and prescribed bodies and to the matters raised in the report received from Westmeath County Council including the recommended planning conditions.*

6.2 In responding to submissions and observations you are requested to supplement your response with additional photomontage or drawings are required. This may include further details with respect to proposals for cultural heritage mitigation.'

3 LOCAL AUTHORITY SUBMISSIONS

3.1 Westmeath County Council

The submission by Westmeath County Council referred to Chapter 13 Archaeology and Cultural Heritage, summarised the findings of same and the recommended mitigation measures therein. WCC concluded that while the proposal would '*alter the setting and character of the area, it is not considered that this alteration to represent an inappropriate change in the context of features of archaeological and cultural interest*.' In its recommendation for conditions it cites '*Archaeological recording, reporting and any further mitigation arising from same*'. It does not request any additional information regarding archaeology or cultural heritage.

4 RESPONSES TO THIRD PARTY SUBMISSIONS

4.1 Concerns regarding effect on setting of archaeological monuments

A number of submissions raised concerns regarding the effect of the proposed wind farm development on the setting of archaeological monuments within the surrounding landscape. It is asserted in the submissions that the proposed turbines will '*damage the context, detract from the interpretation and destroy the character of the archaeological and historical sites of the area*'. Chapter 13 of the EIAR included a comprehensive assessment of the potential visual effects of the proposed wind farm development on the archaeological and cultural heritage resource. The assessment of potential impacts on setting of recorded monuments was aided by ZTV, photomontage, desk-based assessment and site inspection where appropriate. The methodology utilised in the assessment is presented in Chapter 13 section 13.2.4. There is no legislative distance or industry standard approach for the assessment of impacts on the setting of cultural heritage assets. A standardised approach was utilised for the assessment of impacts of visual setting (indirect effects) according to types of monuments and cultural heritage assets which may have varying degrees of sensitivity. The assessment of impacts on visual setting was undertaken using both the Zone of Theoretical Visibility (ZTV) map in the Landscape and Visual Impact Assessment (LVIA), as presented in Chapter 12 of the EIAR, and also viewshed analysis from specific cultural heritage assets. All SMRs, RMPs, RPS, and NIAH structures within 5km of each turbine were included in the EIAR in order to assess potential effects on setting. This is based on professional judgement and experience.

A number of submissions also refer to the photomontages taken from some National Monuments and other locations. These submissions are dealt with in the Landscape and Visual response (Appendix 6, Section 3.1). It should also be noted that the photomontages taken from the various National Monuments, including Fore Abbey, are considered to be sufficient for assisting in assessing potential visual effects on such monuments from an archaeology and cultural heritage perspective.

4.1.1 UNESCO World Heritage Sites, National Monuments and Recorded Monuments

The assessment included potential impacts to the setting of UNESCO World Heritage Sites, National Monuments (Granard Motte, Loughcrew, Fore Abbey, Fore Town Gates, Mortimer's Castle and Wattstown/Frewin Hill), recorded monuments within 5km of the nearest turbine, Protected Structures and NIAH structures.

The Hill of Uisneach (UNESCO WHS Tentative List) is situated c. 28km from the nearest proposed turbine. It was concluded that given this distance the immediate setting of the monument would not be impacted and that the potential effect to its wider setting would be Imperceptible. No change to the immediate setting of any National Monuments as a result of the proposed turbines was identified. The National Monuments in question are located at distances of between c. 8km and 16km to the nearest proposed turbine. While a change to the wider setting of the National Monuments was identified it was deemed to be Slight or Not Significant, particularly given the intervening distance of the proposed turbines from the monuments (see Chapter 13, Table 13-9). Also, it was noted that where such monuments are publicly accessible there will be a continued ability of the visitor to appreciate the monument despite the introduction of the proposed development to the wider landscape. The assessment of potential impacts on setting was aided by viewshed analysis, ZTV, photomontage, desk-based assessment and site inspection where appropriate.

A comprehensive assessment of potential effects to the setting of recorded monuments within 5km of the nearest proposed turbine was also carried out and is detailed in Chapter 13 of the EIAR. Table 13-

10 lists all recorded monuments within 5km of the proposed turbines, their sensitivity (visual dominance, above ground trace, uniqueness, proximity to site, etc.) significance of impact, and distance to the nearest turbine. Impacts to the immediate setting of any recorded monuments as a result of the proposed development was not identified. Impacts to the wider setting of such monuments is acknowledged but is deemed to be Slight in the majority of cases, with some slight-moderate and others imperceptible.

One such monument within 5km of the nearest proposed turbine is the crannog WM001-028--- at Clonsura townland. The monument is located just over 300m from the nearest proposed turbine, T2. This crannog is referred to in several submissions, with concerns regarding its proximity to Turbine 2. The assessment of potential impacts to the setting of recorded monuments included the crannóg and Chapter 13 (Section 13.4.4.1.3) noted the following regarding that monument: '*For example, the nearest monument, WM001-028, comprises a crannóg which is not readily visible in the landscape given its low-lying position and form. In addition, it is inaccessible to the public and is not apparent from the nearest public road. Despite its proximity to the nearest turbine, therefore, the potential impact to same is still regarded as slight.*'

Concerns regarding potential impacts to the setting of Mayne Bog trackway and damage to the potential for associated heritage tourism as a result of the proposed development were also raised in a number of submissions. See also the Landscape and Visual response (Appendix 6, Section 3.2). The recorded monuments comprising the togher at Mayne Bog (WM002-038---- and 039----) were included in Chapter 13 of the EIAR and are located just over 3km to the nearest proposed turbine, T14. Given the distance of the trackway from the nearest proposed turbine, no impacts to its immediate setting were identified. A change to the wider setting of the monument was acknowledged, however, and as per many of the other recorded monuments within 5km of the proposed turbines, is regarded as Slight. At the time of the assessment the trackway comprised a monument with some very fragmented surface expression (see section 13.3.1.1.6, Plates 13-6-13-11) , and the potential for some surviving sub-surface remains. Also at the time of assessment it did not comprise a publicly accessible monument with formal public access. Should the preservation of a portion of the trackway proceed, as referred to in the submissions, its appreciation and interpretation will be possible regardless of the presence of turbines at a distance of c. 3km.

Reference is also made in a submission to recorded monuments (WM007-003---- Ringfort and WM007-004---- Crannóg) on the shore of Lough Derravaragh and the effect the proposed turbines will have on the setting of such monuments. It is noted in the submission that the monuments in question are located in excess of 5km from the nearest turbine and are therefore outside the 5km study area for recorded monuments. As outlined above, the methodology utilised in the assessment is presented in Chapter 13 section 13.2.4. There is no legislative distance or industry standard approach for the assessment of impacts on the setting of cultural heritage assets. A standardised approach was utilised for the assessment of impacts of visual setting (indirect effects) according to types of monuments and cultural heritage assets which may have varying degrees of sensitivity. The assessment of impacts on visual setting was undertaken using both the Zone of Theoretical Visibility (ZTV) map in the Landscape and Visual Impact Assessment (LVIA), as presented in Chapter 12 of the EIAR. All SMRs, RMPs, RPS, and NIAH structures within 5km of each turbine were included in the EIAR in order to assess potential effects on setting. This is based on professional judgement and experience. The ringfort WM007-003- is situated c. 5.3km to the south of the nearest proposed turbine, T14, while the crannóg WM007-004- is located c. 5.5km south of the nearest proposed turbine T14. The ZTV demonstrates that 1-3 turbines would theoretically be visible from the ringfort, while 12-15 turbines would theoretically be visible from the crannóg. As per the other recorded monuments which occur within 5km of the nearest proposed turbine, the immediate setting of these monuments will not be impacted by the proposed development. A change to their wider setting is acknowledged but is regarded as Slight given the distance of the monuments to the nearest proposed turbine and their low visibility in the landscape. There is also no formal public access to these monuments.

4.2 Concern regarding Mitigation Measures

Several submissions refer to the lack of mitigation measures regarding archaeological heritage in Chapter 3 of the EIAR. Chapter 13 of the EIAR provides a comprehensive assessment of potential impacts on archaeology and cultural heritage as a result of the proposed development. It also outlines appropriate mitigation measures in relation to the recorded and unrecorded archaeological, architectural and cultural heritage resource (see section 13.4.3 for mitigation measures regarding construction phase potential (direct) impacts). In summary the mitigation proposed in Chapter 13 include the following:

- Pre-construction walkover survey / inspection of areas proposed for excavation will be undertaken to re-assess the bog for new sites
- Pre-development (pre-construction) archaeological testing of turbine bases, hardstand and access roads proposed for excavation, borrow pit, substation and compound. A report setting out the findings will be submitted to the relevant authorities.
- Archaeological monitoring (during construction) of all ground works and metal detection of spoil.
- A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
- Further mitigation such as excavation (resolution) of any newly discovered archaeological sites may be required if discovered during pre-construction archaeological testing and/or construction stage archaeological monitoring. Consultation with the National Monuments Service of the DHLGH will be required should such sites be uncovered.
- Buffer zone of 20m around the unnamed bridge on the River Glore.
- Pre-construction building survey of the stone structure adjacent to the proposed link road and monitoring of ground works during the construction phase of the project
- Archaeological monitoring of ground works for proposed junction accommodation works. A report on the monitoring should be compiled and the results submitted to the relevant authorities.

The mitigation measures detailed in Chapter 13 of the EIAR are cognisant of the potential for the discovery of unknown, sub-surface archaeological finds, sites or deposits within the proposed development site. The implementation of the mitigation measures as outlined (in particular pre-construction archaeological testing) will increase the likelihood of detecting any such sites, if present, prior to the commencement of ground works associated with the construction phase of the project. Archaeological monitoring of all ground works during the construction phase of the project will also serve to detect any previously undiscovered artefacts, features or deposits. Any archaeological testing or monitoring will be carried out under licence from the National Monuments Service (NMS) of the DHLGH and consultation with the NMS will be required should archaeological sites be uncovered during the works.

4.3 Grid Connection Route

4.3.1 Concern regarding Protected Structures

Concerns regarding the proximity of some Protected Structures to the proposed grid connection route are raised in a number of submissions. As outlined in Chapter 13, Section 13.3.2.2.1 (Table 13-7) twenty structures listed in the RPS for County Westmeath are located within 100m of the proposed grid connection route. The closest protected structure to the Grid Connection Route comprises Levington railway crossing gates which are located on the public road along which the proposed Grid Connection Route extends. The level crossing gates are 19th century in date being part of the Dublin-Sligo railway line and are still in active use. In Coole, Simonstown House (Ref. 003-042) is situated off-road in private property and will not be directly impacted by the works associated with the Grid

Connection Route which will be placed within the public road c. 38m to the north-west. Other protected structures in close proximity to the proposed Grid Connection Route comprise the gate lodge (Ref. 019-237) and gateway (019-236) to Levington Park house which is also included in the Record of Protected Structures (Ref. 019-234). The house is situated c. 130m to the north-west of the proposed underground Grid Connection Route in private property and will not be impacted by works associated with the underground cable. The roadside features associated with the house as mentioned above are situated within 2-4m of the proposed Grid Connection Route which will extend along the adjacent public road. While it is unlikely that any direct impacts to these structures will occur as a result of the proposed Grid Connection Route some mitigation at the construction stage of the Proposed Development is recommended for this area as follows (see Chapter 13 Section 13.4.3.6.3):

- Archaeological monitoring of ground works during construction where they extend past the NIAH/Protected Structures at Farranistick. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

4.3.2 Concern regarding Mitigation Measures

A concern was raised in one submission regarding the adequacy of the proposed mitigation measures relating to archaeology along the proposed grid connection route. Archaeological monitoring of ground works associated with the grid connection route where it extends past a number of recorded monuments has been recommended (See Chapter 13 Section 13.4.3.6.2). It is suggested in the submission that should archaeological remains be found during the course of the monitoring that the authorities will only be informed when the report on the completed work is submitted. As is best practice with all large-scale developments, archaeological monitoring of the works along the proposed grid connection route will be carried out under licence from the National Monuments Service (NMS) of the DHLGH. A methodology pertaining to the archaeological monitoring will be subject to the approval of the NMS and any remains uncovered during the course of the works will be reported to the NMS as per the agreed methodology in order to agree the best course of action and any further mitigation (such as excavation) required in this regard.

It is also suggested in a submission that archaeological monitoring is inadequate mitigation where the grid connection extends past Mayne church, font, graveyard and ecclesiastical enclosure (WM003-083----, WM003-083001-, 002- and 003-) and that the presence of a possible ecclesiastical enclosure around the church may suggest that a further outer enclosure is located under the public road along which the grid connection will extend. It is noted in the monument description (WM003-083003-) that 'the semi-curving form of the graveyard boundary wall possibly indicates the presence of an Early Christian ecclesiastical enclosure'. The graveyard boundary wall is situated c. 21.5m to the west of the proposed grid connection route. A review of the available cartographic and orthophotography sources does not provide any evidence for a further outer enclosure. It is considered, therefore that archaeological monitoring of ground works along the grid connection route where it extends past the church, graveyard and possible ecclesiastical enclosure is adequate mitigation. As outlined above, monitoring of the works associated with the grid connection route will be carried out under licence from the National Monuments Service (NMS) of the DHLGH. A methodology pertaining to the archaeological monitoring will be subject to the approval of the NMS and any remains uncovered during the course of the works (if present) will be reported to the NMS as per the agreed methodology in order to agree the best course of action and any further mitigation (such as excavation) required in this regard. A report detailing the results of the monitoring and any findings will be compiled on completion of the works and submitted to the relevant authorities.

5 CONCLUSION

This document comprises a response to a Request for Further Information issued by An Bord Pleanála (Ref. 309770-21) regarding the proposed Coole Wind Farm, Co. Westmeath. It also addresses a number of third party submissions, many of which raised concerns regarding the potential effects on the setting of archaeological heritage in the surrounding landscape. Concerns were also raised regarding mitigation measures relating to archaeology and protected structures, primarily along the proposed grid connection route. Concerns raised regarding photomontages are dealt with in the Landscape and Visual response and should be read in conjunction with this document. It is considered that all concerns regarding the assessment process and the results of same as reached in Chapter 13 of the EIAR are addressed here and that the mitigation measures outlined in the Chapter are appropriate for the amelioration of any potential impacts identified.

APPENDIX 9

FI IONIC RESPONSE

Ionic Consulting Ltd,
The Hyde Building,
The Park,
Carrickmines,
D18 VC44

Date: 28th October 2022

RE: Coole Wind Farm 110kV Grid Connection – RFI Responses

To whom it may concern,

Please find enclosed three reports prepared in relation to Coole Wind Farm 110kV Grid Route which were prepared to assist in providing responses to the request for further information from ABP. The reports are:

- COLE r005 RFI: TII Submission, N4 National Road, Co. Westmeath
- COLE r006 110kV Grid Route Connection RFI Response
- COLE r007 Westmeath County Council Submission – Bridge Crossings

Regards,

____

John Shanahan

On behalf of Ionic Consulting Ltd.

Note:

Following the acquisition of Ionic Consulting Limited by AFRY, on 1st July 2022, Ionic Consulting will be rebranding under the AFRY name. Future communication and project documentation you receive from us may come under the AFRY brand. In addition the Irish legal entity (Ionic Consulting Limited) will be renamed to AFRY Ireland Limited.

Coole Wind Farm

110kV Grid Route Connection

RFI: TII Submission, N4 National Road, Co. Westmeath

Ionic Consulting Ltd
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Dublin 18, Ireland

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IONIC CONSULTING

Confidentiality

Addressee

The contents of this report are for the exclusive use of the Client. If other parties choose to rely on the contents of this report they do so at their own risk.

Disclaimer

Ionic Consulting have performed the consultancy services as described in this report in accordance with a standard of best practice available within the industry. Ionic Consulting do not make any representations or warranty, expressed or otherwise as to the accuracy or completeness of the source data used in this report, and nothing contained herein is, or shall be relied upon, as a promise or representation, whether as to the past or the future in respect of that source data.

This document has been prepared by

John Shanahan
BE MSc CEng MIEI
Senior Civil Engineer
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This report has been checked by

Cormac Ó Dubhthaigh
BE MEngSc CEng MIEI
Civil Engineering Manager
Ionic Consulting

This report has been authorised by

Cormac Ó Dubhthaigh
BE MEngSc CEng MIEI
Civil Engineering Manager
Ionic Consulting

1. Introduction

The proposed Coole Wind Farm is located north of the village of Coole, County Westmeath. The wind farm 110kV grid connection is proposed between the wind farm site and the existing ESB 110kV Mullingar Substation. The overall route is approximately 26km in length, with approximately 3.4km routed along the N4 national primary road north of Mullingar and to the east of Lough Owel.

In response to the Coole wind farm and grid route planning application to An Bord Pleanála, TII submitted observations on the proposed development (reference TII 21-112941, dated 14th May 2021). This report sets out to provide technical responses to the TII observations, where required.

2. Planned Windfarm Grid Route Installation

This report is particularly focussed on a 3.4km section of the N4 road corridor located approximately mid-way between Mullingar and Multyfarnham, Co. Westmeath (refer to the map below and Appendix A). This section of grid route along the N4 would include 4 no. proposed joint bays.

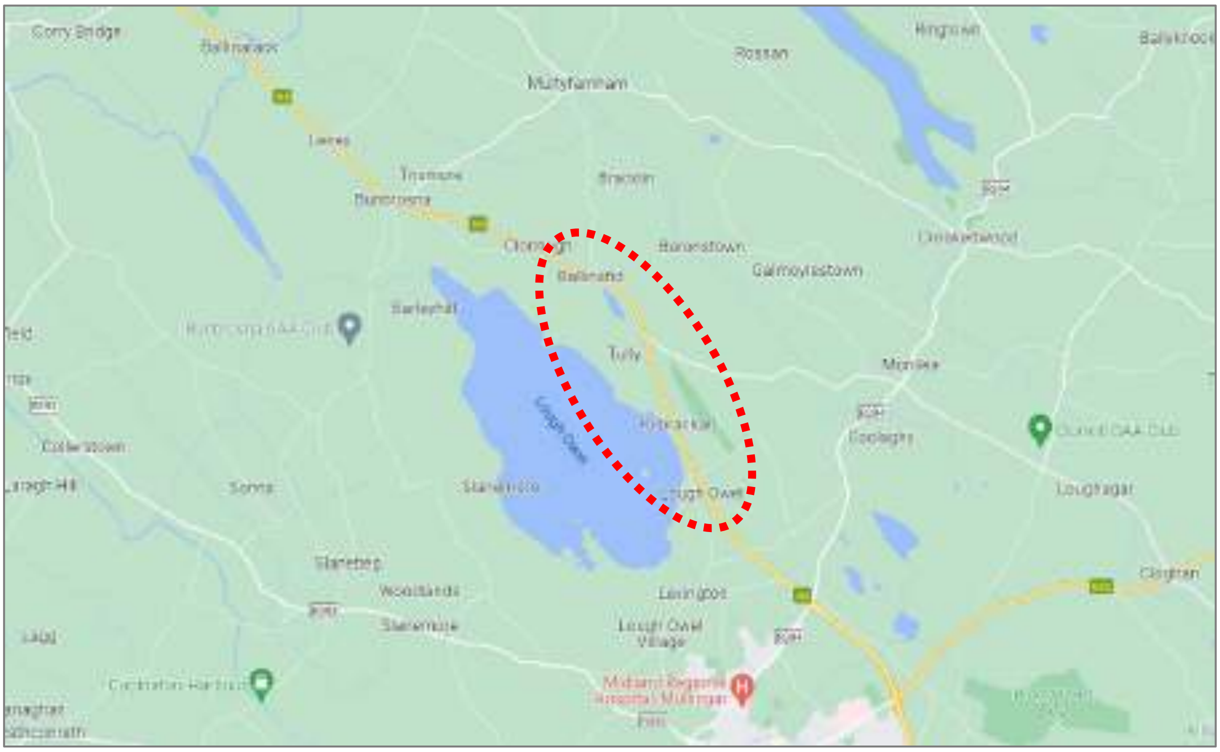


Figure 1 Location Plan

The 110kV grid connection would be installed along the N4 corridor, in the hard shoulder and verge of the N4 roadway. The planned works will be designed and built using the following standards:

- Purple Book "Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads" Rev 1 (April 2017)
- TII Publication CC-PAV-04007 "Requirements for the Reinstatement of Openings in National Roads" (May 2019)
- Any other relevant local authority or TII standard

3. Future National Road (N4) Scheme Planning

High voltage underground grid connections are a common method of constructing grid network infrastructure in Ireland, and for connecting renewable energy power generation and other infrastructure to the power network. It is common practice for underground services and utilities to be laid underground within roads and along public road corridors. It would be common for road engineering projects to have to address technical and programme challenges associated with the presence of underground utilities within a roadway, when planning or carrying out maintenance or upgrade works. Coole Wind Farm Ltd. will be available to engage with TII as required on such matters.

The purpose of this section is to outline potential online road upgrade methodologies for future road upgrades to the N4, considering the presence of the high voltage (HV) cables. Details of a potential upgrade are not currently available, so for the purposes of this exercise, two potential scenarios (A and B) have been considered below. Both scenarios presented consider road upgrade works along the existing road corridor (an online upgrade). If future N4 upgrade works involve constructing a new road within a separate corridor (an offline upgrade), the grid connection could be retained in position without impacting those works. In the case of an online upgrade, it may be necessary to relocate the underground cables to an intermediate temporary location to facilitate the construction sequencing. Without knowing the details of any proposed upgrade it is not possible to predict if this would be required, however the methodology involved would be similar to that presented in scenario B.

For the purposes of this exercise, as outlined in Figure 2, the HV cable is shown located in the hard shoulder of the existing roadway.

3.1 SCENARIO A: Major Road Resurfacing, no road realignment required

In this scenario, if a full or partial resurfacing is required, no movement of the HV cable would be required. For many road upgrade works involving underground HV cables, the works do not involve movement or removal of the cable/ducting. This is partly due to the depth of burial (approximately 1.2m) and partly due to the material used to construct the cable trench (cement bound granular material [CBGM] around the ducting with graded stone [Cl. 804] within the upper section of the trench).

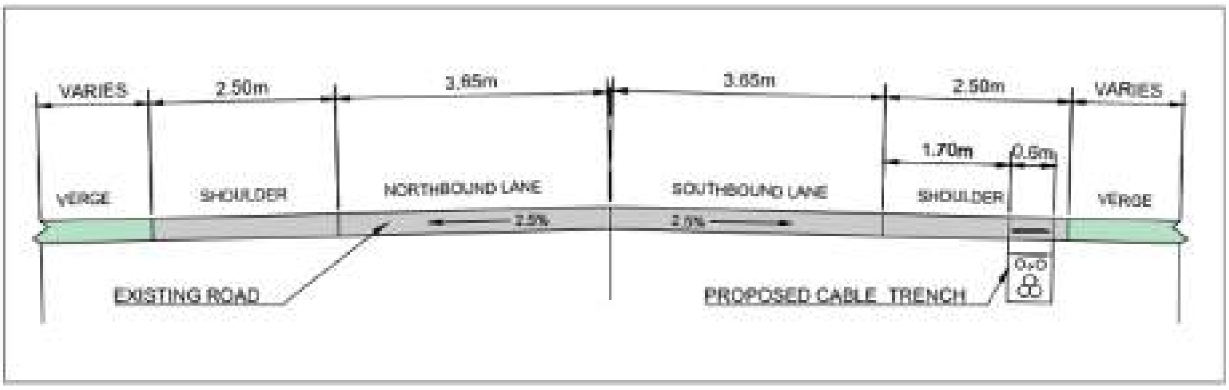


Figure 2 Illustrative road cross-section with proposed grid route within the hard shoulder

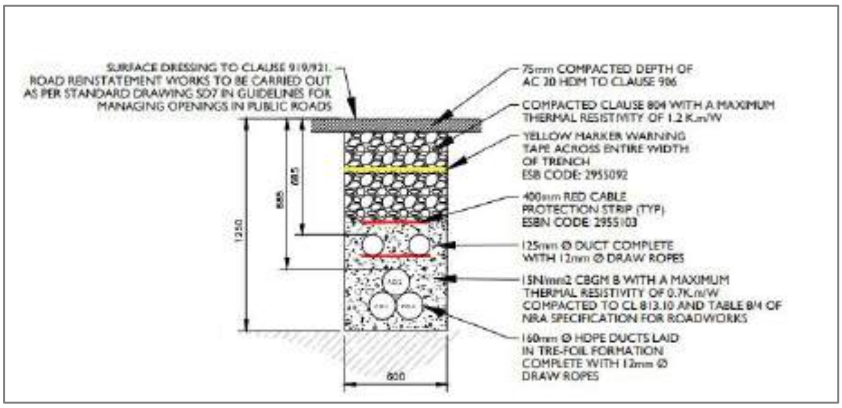


Figure 3 110kV trench detail

3.2 SCENARIO B: Major road upgrade involving both vertical and horizontal re-alignment

In this scenario the HV cable is located in the same position as per Scenario A, however the major road upgrade would require a vertical and horizontal re-alignment of the existing road (an online upgrade), refer to illustrative cross-section in Figure 4.

This scenario imagines that the cable must move location from the southbound lane to the northbound extended lane.

It should also be noted that the road widening depicted in Figure 4 is not the only configuration of a road upgrade. However, Scenario B generally holds true for upgrades as the principal will be the same. The methodology of the upgrade is discussed below.

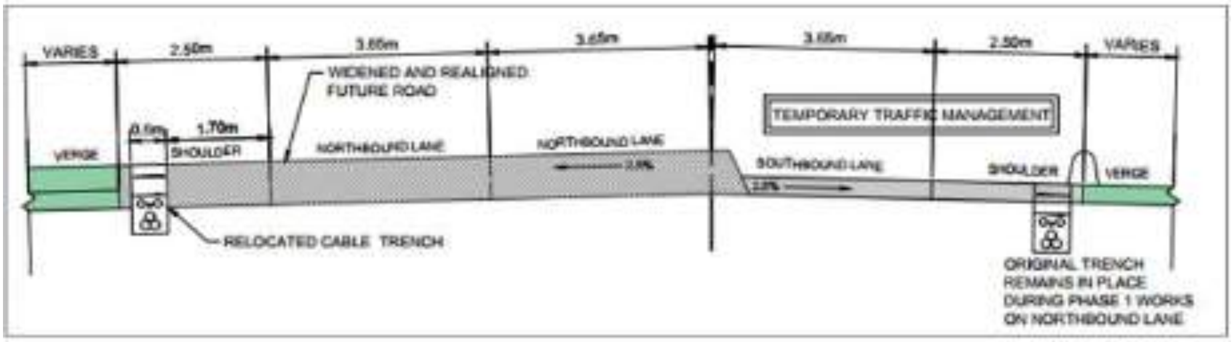


Figure 4 Illustrative Road cross-section for an online upgrade involving both vertical and horizontal alignment

3.2.1 Scenario B Methodology

Phasing of Works:

The works required for moving the HV cable requires 2 phases. Phase 1, as illustrated in Figure 4, is to install the new ducting on the northbound carriage while keeping the southbound carriage open. The southbound carriage will, at that time, contain a live HV cable and this sequence would be chosen to minimise outages on the circuit.

Phase 2 will then require the north bound carriage to be open while the south bound is closed. The original Coole cable will be de-energised, and the removal will take place. The remainder of the road construction will then take place.

It is assumed that the N4 must stay at least partially open to traffic during any major upgrade works by means of appropriate traffic management. Therefore, the phasing of works required for the cable move should not significantly impact staging of the overall road upgrade.

Construction Methodology:

In Phase 1 of the proposed methodology, there are several steps that have been depicted in Figure 5, Figure 6, Figure 7 and Figure 8 below.

- **Step** 1: the road sub-base layers would be constructed to the approved design by the TII contractor. An integrated road/trench design and specification would be provided by the designers and would undergo an approval process with TII, EirGrid and other relevant stakeholders.
- **Step 2**: the cable trench would be excavated as per an integrated design.
- **Step 3:** the cable trench would be installed with the requisite ducts, tape and backfill as per the agreed design and specifications.
- **Step 4:** the road construction would continue, adding the upper layers across the road and compaction of same. As above, this would be completed to the agreed specifications and approved design. The final layers and surfacing would be across the entire road width.

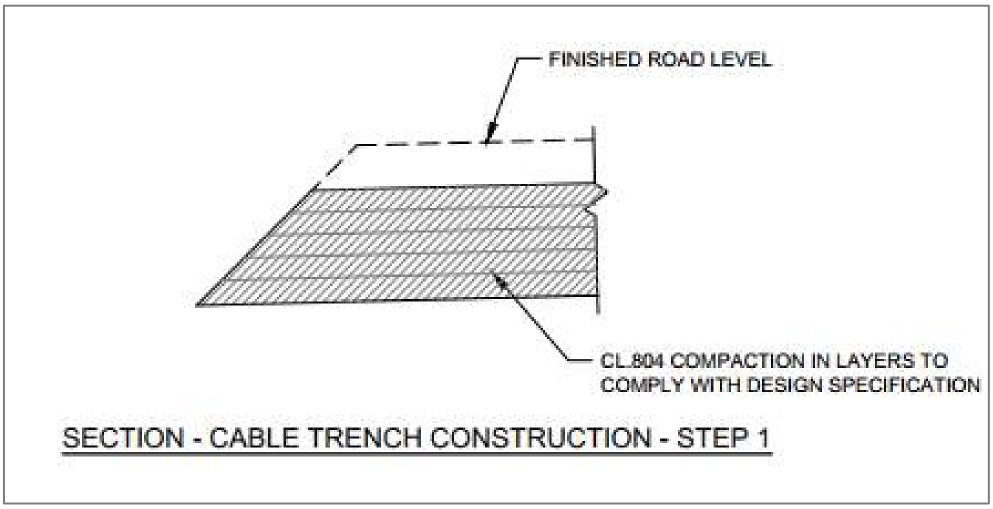


Figure 5 Step 1 of Construction

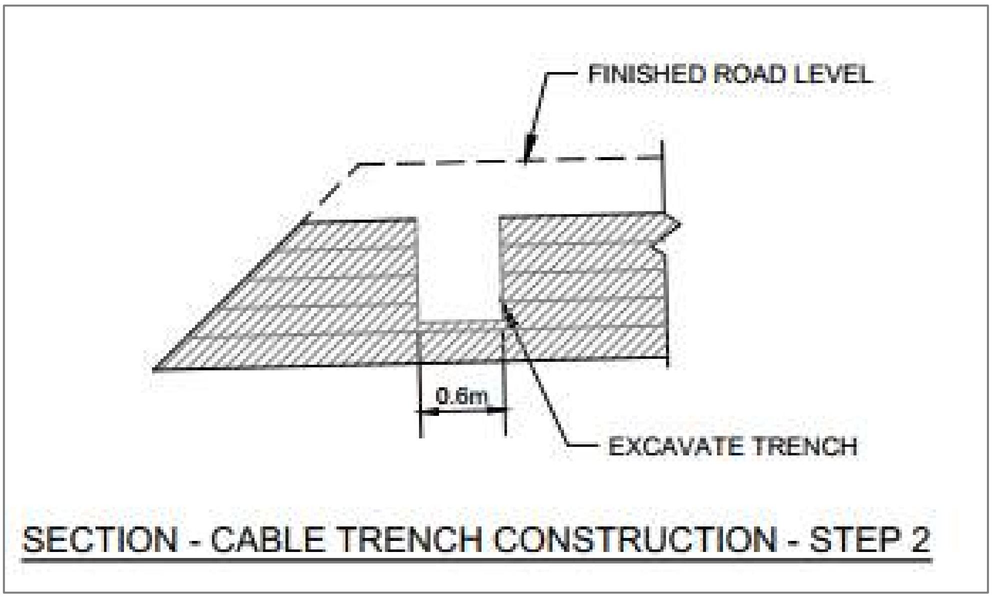


Figure 6 Step 2 of Construction

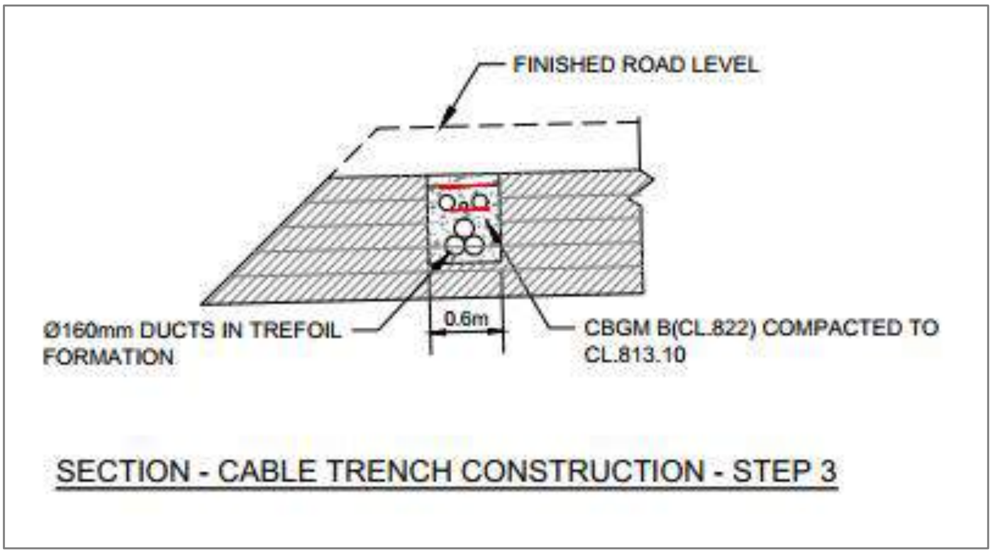


Figure 7 Step 3 of Construction

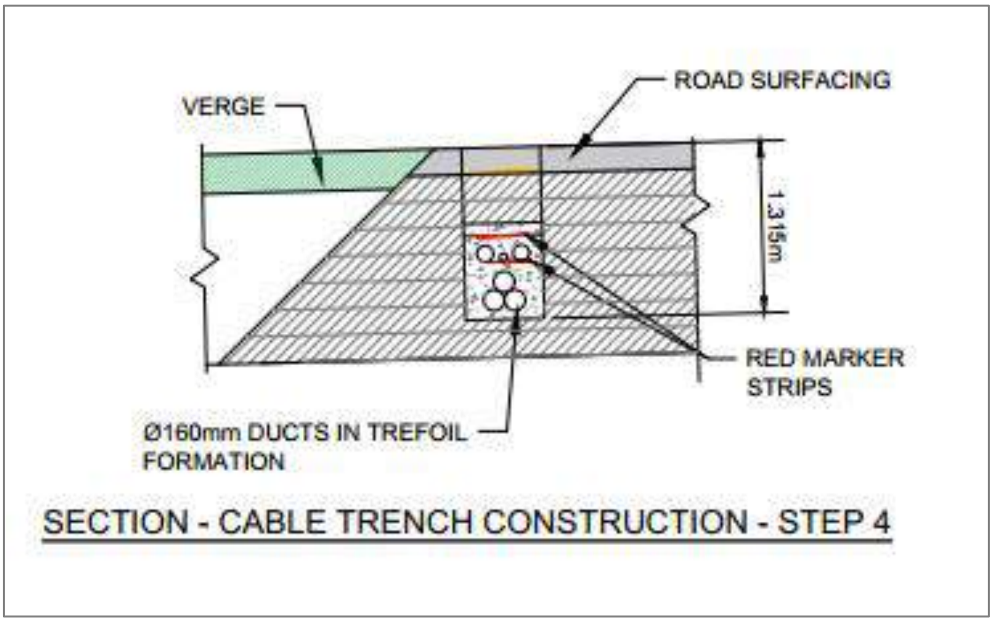


Figure 8 Step 4 of Construction

Once the cable has been moved to the other side of the N4, the new cables will then be jointed to the existing cables at an appropriate location. The sequence of works in this scenario is outlined in the following pages.

Health and Safety

The Health and Safety Authority (HSA) Code of Practice for Avoiding Danger from Underground Services should be referenced when designing or working near to high voltage power cables.

In the case of a major road upgrade as outlined in the previous sections, the following would apply:

1) All designs works will require the identification of underground services through dial before you dig, record retrieval, ground penetrating radar and CAT scanner as required.
2) The first stage of works would be the installation of new ducts away from the existing circuit and therefore outside of zone of any live underground cables.
3) The next stage of works would require the de-energisation of the existing cable to allow any works take place within the zone of the live underground cable.
4) No works would take place near or adjacent to live underground cables.
5) Finally, all energising and de-energising works will be with the supervision of ESB Networks.

In the case that the road is to be resurfaced, a power cable outage would not be required. However, if the road were to be opened at a location containing high voltage cable, as per scenario B outlined above, contact must be made with ESBN, and an outage would be required for such works.

Sequence of Works
The following is the sequence of works required to install the new ducting and cable, de-energise the existing cable and re-energise new cable **in the event of a major road upgrade.**

It should be noted any new designs would be completed in coordination with, or completed by the TII appointed designer.

- N4 major upgrade works require moving Coole 110kV grid connection
- A new design would be prepared for the new cable location
- TII designers would integrate the new cable trench design into road upgrade design
- Construction commences
- Ducting (civil works) would be installed in the new location
- Cable would be pulled into new duct and jointed within the works
- Existing circuit would be de-energised
- Existing circuit is cut as it exits the N4 works
- New cable is connected and jointed to the exisitng cable, and then re-energised
- Old cable is removed from ducts and road upgrade works continue

4. 110kV joint Bay & Trench Details

4.1 Joint Bay Details

Joint bay details are indicated on drawing COLE d005.4.1 (refer to Appendix B). Joints bays are precast concrete units and comprise a ground slab and surrounding retaining walls. Joint bay locations, details, backfilling, and surface reinstatement design will be agreed with EirGrid, ESBN, Westmeath Co. Co. and TII prior to any works and a detailed design will be developed by the Coole 110kV grid route designer.

From an EirGrid/ESBN perspective, joint bays are located where the terrain and access are suitable for facilitating cable pulling equipment, cable jointing, maintenance, fault finding and future operation of the installation.

An extract from the joint bay drawing is included below, showing a plan and sections of the structure.

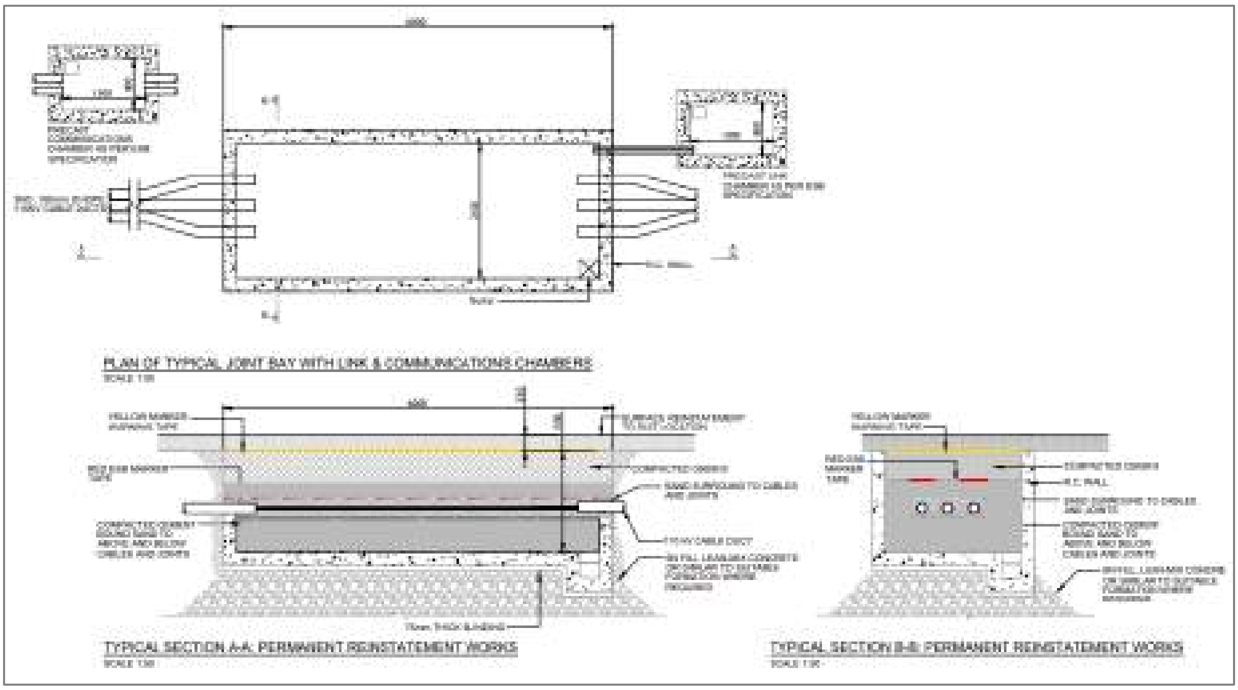


Figure 9 Standard 110kV Joint Bay

4.2 Cable Laying Details

The proposed cable trench details are indicated on drawing COLE d005.4.2 (refer to Appendix B). A standard trench will be 0.6m wide and 1.25m in depth, containing 3 no. power ducts/cables in trefoil formation at the base of the trench, with 1 no. communications ducts/cable and 1 no. earthing duct/cable situated above them.

The trench location within the road cross-section will be agreed with EirGrid, ESBN, TII and Westmeath County Council during a design review process at detailed design stage. Usually, it is proposed to lay the ducting within the road hard shoulder or within the grass verge (where either are available). Details, backfilling, and surface reinstatement design will be agreed with EirGrid, ESBN, Westmeath Co. Co. and TII prior to any works and a detailed design will be developed by the Coole 110kV grid route designer.

An extract from the trench drawing is included below.

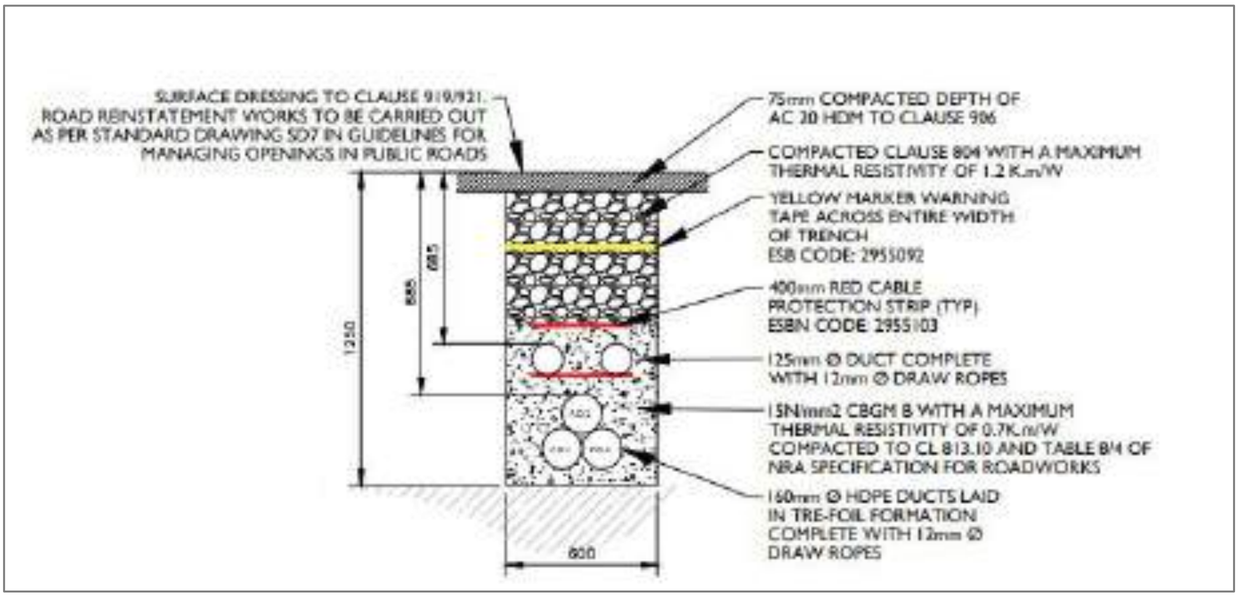


Figure 10 Grid connection trench detail

The reinstatement will be designed to be in accordance with the relevant TII or local authority standards, including TII publication "Requirements for the Reinstatements of Openings in National Roads".

Where the trench passes through the road pavement, the extent of reinstatement will be confirmed with TII and Westmeath County Council at detailed design stage and confirmed during the road opening licence application.

It is acknowledged that the quality of installation, supervision of installation and materials used during installation of these civil works is a determining factor of any issues that may be encountered along the road surface once works are complete.

The 110kV grid route is proposed to be installed to the EirGrid specification, which requires CBGM material to be installed for the entirety of the circuit. This limits the potential for any settlement issues within the backfill around the ducts themselves. The grid route designers and contractors will be subject to a prequalification process, which can be utilised to ensure that the chosen companies are familiar and experienced with the relevant EirGrid and TII standards and specifications.

5. Road Management & Maintenance

In their response submission, TII outlined what they consider to be a number of significant implications for road authorities in the management and maintenance of the strategic national road network resulting from the laying of high voltage electricity cabling in the national road reservation including:

I. Impacts on embankments, bridges, drainage, road furniture infrastructure leading to future maintenance liabilities

II. Impediments to future routine network improvements such as pavement overlay and strengthening, installation of new verge-side signs and other road furniture

III. Impacts on network traffic flows during installation

IV. Impediment to future on-line upgrades of national roads because of the implications to road authority/TII in having to incur the additional costs of moving underground cables in order to accommodate road improvements

These items are addressed in the table below from a technical perspective.

I. Impacts on embankments, bridges, drainage, road furniture infrastructure leading to future maintenance liabilities	The proposed trench will be positioned so that it will not negatively impact the stability of embankments along the road corridor. It is acknowledged that any negative impacts on a road embankment, which would contain or be adjacent to the proposed grid route, could potentially be detrimental to both the road and grid route itself. The grid route does not cross bridges along the section along the N4. Where the trench would be positioned within the hard shoulder, this should not inhibit the maintenance or replacement of any roadside drains. Where the proposed trench is in proximity to drainage pipes or other infrastructure, a minimum clearance will be maintained in accordance with the EirGrid/ESBN specification. Where the trench would be in the grass verge, then the position of the trench could be agreed with TII/Westmeath CO. Co. to ensure a designated space is retained to allow for drainage maintenance or improvement works. The trench position will be subject to agreement with EirGrid/ESBN as well the road authorities (TII & Westmeath Co. Co.).
II. Impediments to future routine network improvements such as pavement overlay and strengthening, installation of new verge-side signs and other road furniture	With regard to pavement overlay, it is not envisaged that the grid route would inhibit pavement replacement along this section of the N4, refer to Section 3 Scenario A. With regard to strengthening the pavement, given the concrete surround to the ducting, the trench section should provide suitable strength within the lower section of the trench. Where the trench would be positioned within the hard shoulder, this should not inhibit the installation of verge-side road signs and other furniture. Where the trench would be in the grass verge, then the position of the trench could be agreed with TII/Westmeath Co. Co. to ensure a designated space is retained for any anticipated signs or furniture.

III. Impacts on network traffic flows during installation	A traffic management plan and programme of works will be developed with the road authorities in order to ensure any disruption to traffic flows are minimised during installation of the ducting. Given the width of the road corridor it is not envisaged that a road closure would be required to construct the ducting along this section of the N4.
IV. Impediment to future on-line upgrades of national roads because of the implications to road authority/TII in having to incur the additional costs of moving underground cables in order to accommodate road improvements	Refer to Section 3 Scenario B.

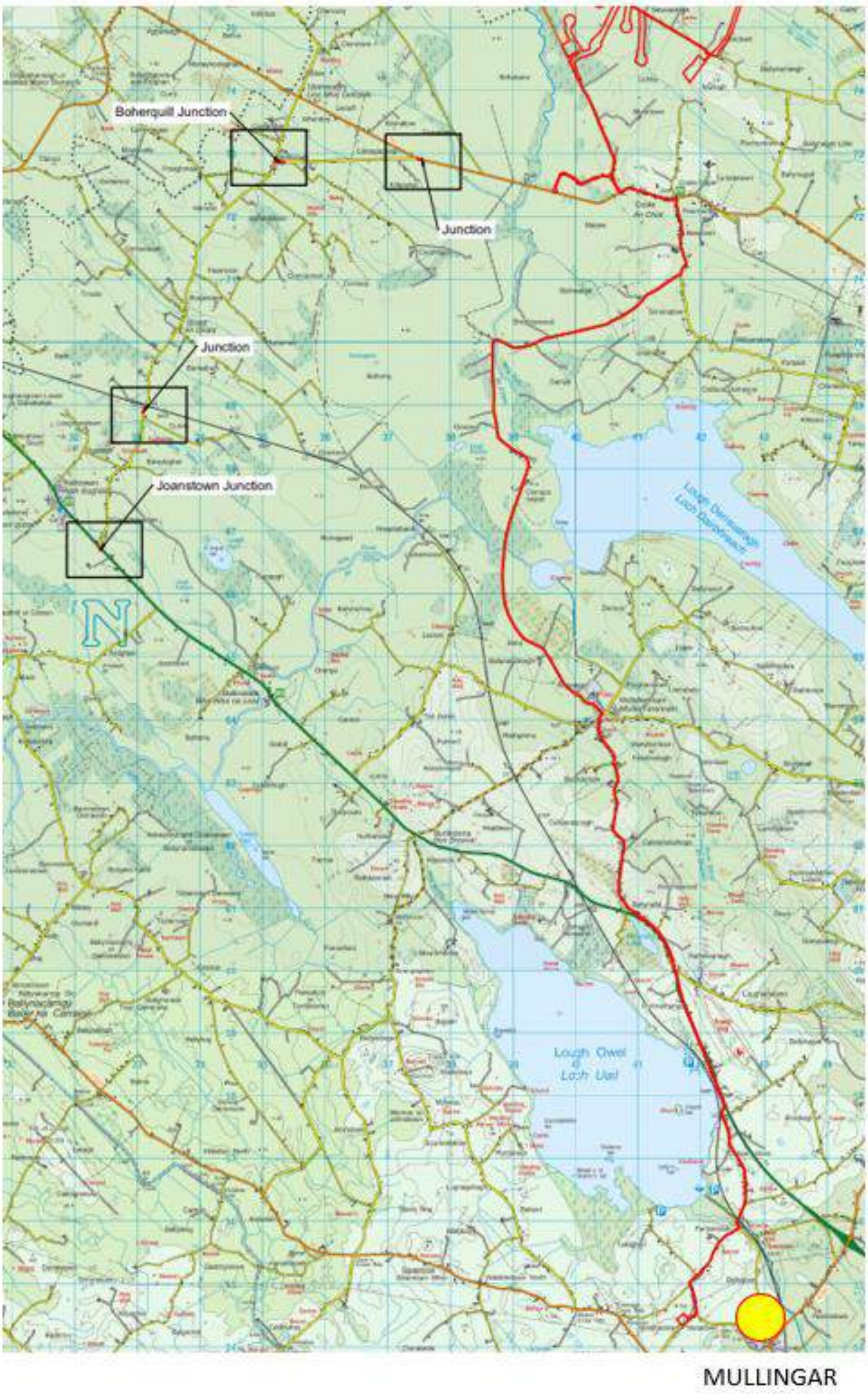
6. National Road Network Maintenance & Safety: Haul Route

In their submission, TII stipulated a number of requirements of the developer with regards to the haul route:

Any works to the N4/L1927 junction shall comply with TII publications and shall be subject to a Road Safety Audit as appropriate. Subject to the RSA, works should ensure ongoing safety of all road users.	Noted. The road widening works will be designed to comply with the relevant TII publications and subject to a RSA as appropriate. Works and designs will be progressed to ensure ongoing safety of all road users.
All proposals are requested to be referred to TII.	Noted. Proposals will be referred to TII.
Any damage caused to the road pavement "due to the turning movement of abnormal length loads" shall be rectified in accordance with TII Standards and details shall be agreed with the Road Authority prior to the commencement of any development on site.	Noted. However, we suggest that prior to commencement of deliveries a road condition survey be completed to record the condition of the road in advance of deliveries. If damage is noted a further road condition survey can be completed after deliveries and compared against the before condition in order to determine the extent and type of repairs required.
The developer shall consult with all PPP Companies, MMaRC Contractors and road authorities over which the haul route traverses to ascertain any operational requirements such as delivery timetabling, etc. and to ensure that the strategic function of the national road network is safeguarded.	Noted.

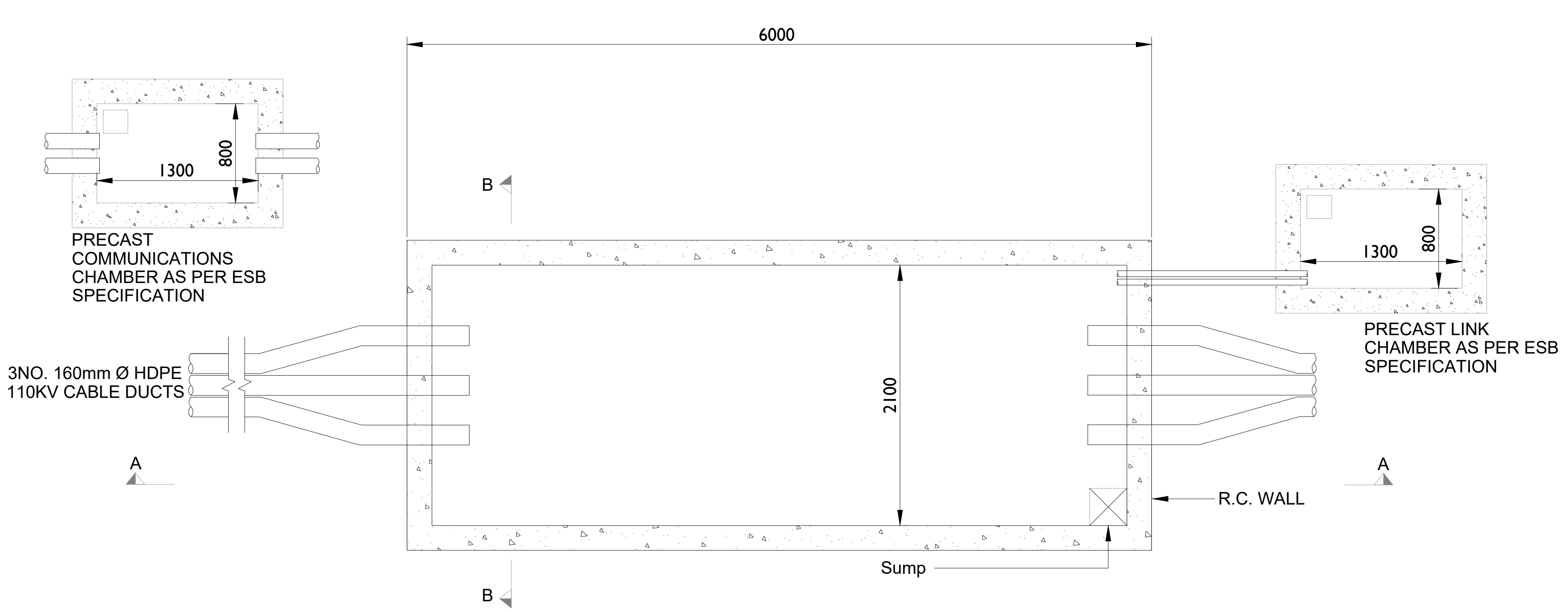
APPENDIX A

Site Overview – N4 Grid Connection Route



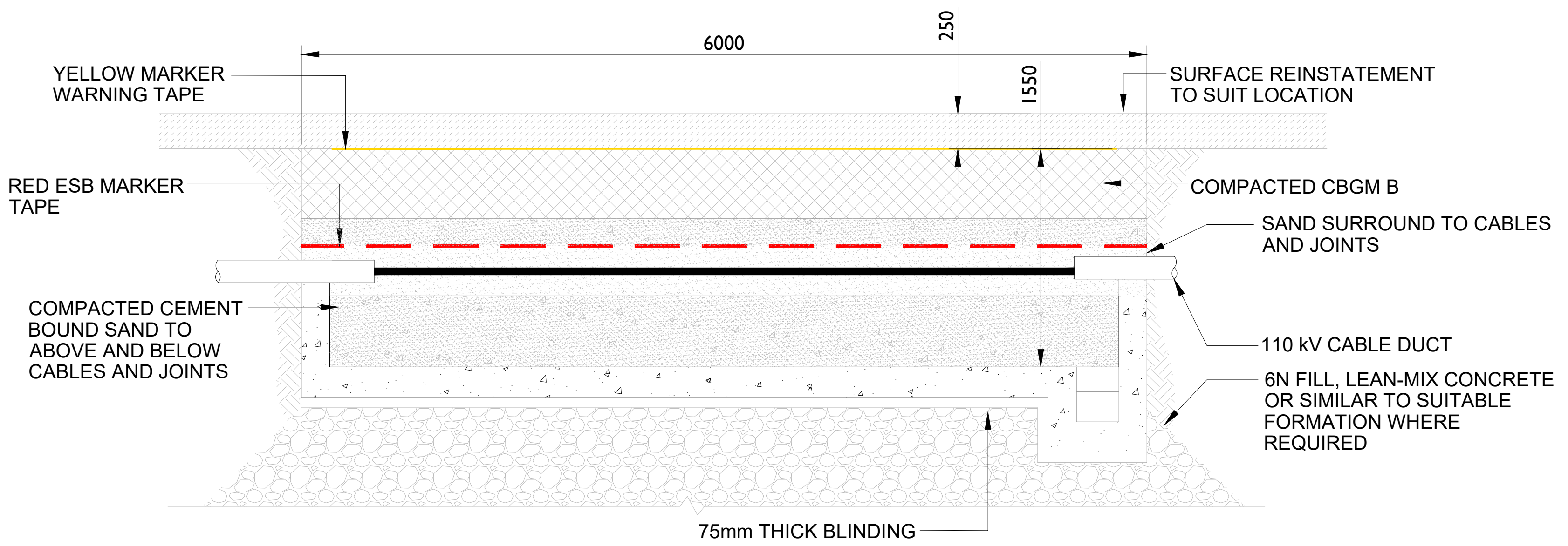
APPENDIX B

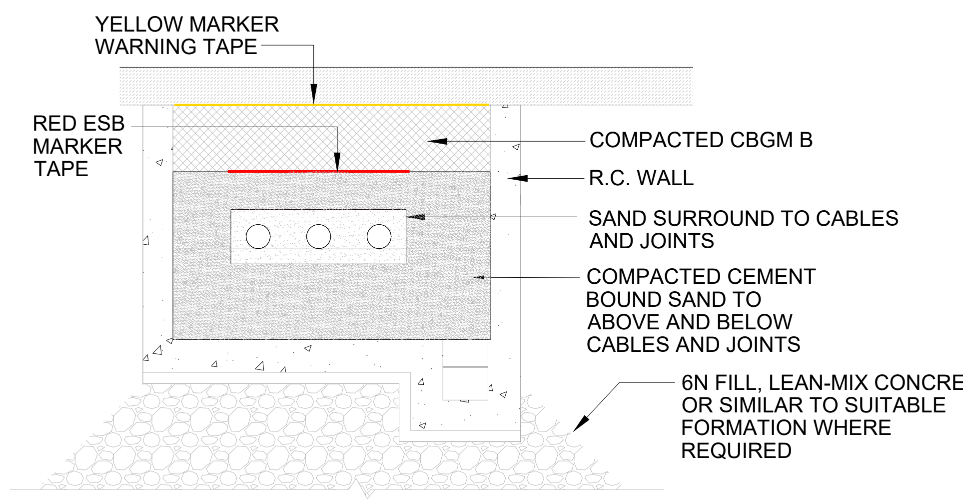
Coole – Cable Trench Cross-Section & Joint Bay



PLAN OF TYPICAL JOINT BAY WITH LINK & COMMUNICATIONS CHAMBERS

SCALE 1:50





TYPICAL SECTION A-A: PERMANENT REINSTATEMENT WORKS

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TYPICAL SECTION B-B: PERMANENT REINSTATEMENT WORKS

SCALE 1:50

NOTES

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A	24.01.2020	M.B.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: JOINT BAY TYPICAL DETAILS

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	19/01/2020	DRAFT

DRAWING NUMBER: COLE d005.4.1

Plotted - 24/01/2020 14:06:57
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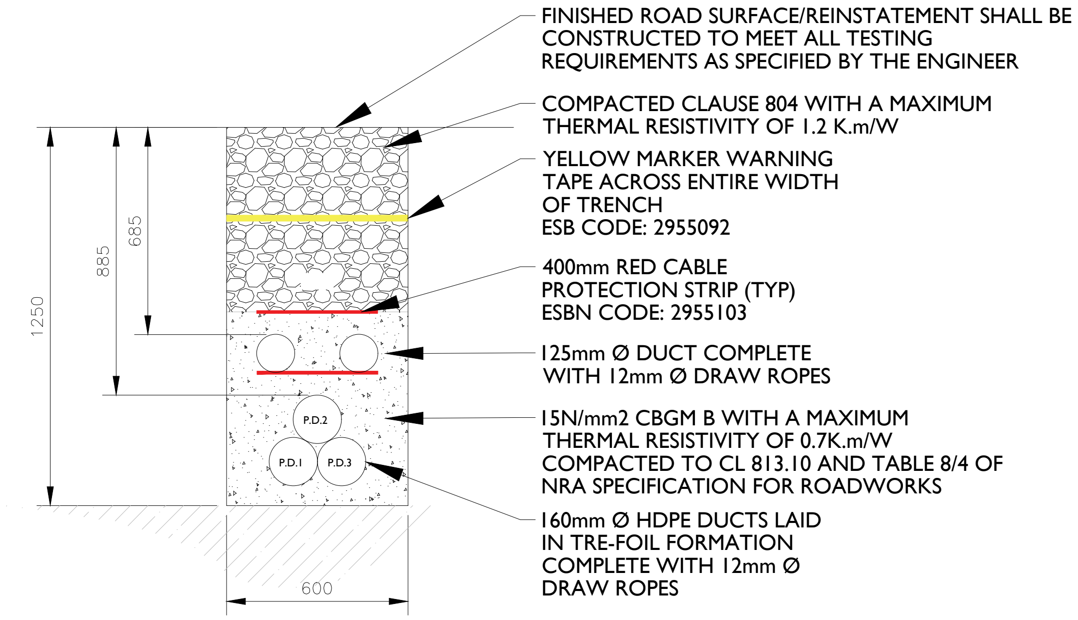
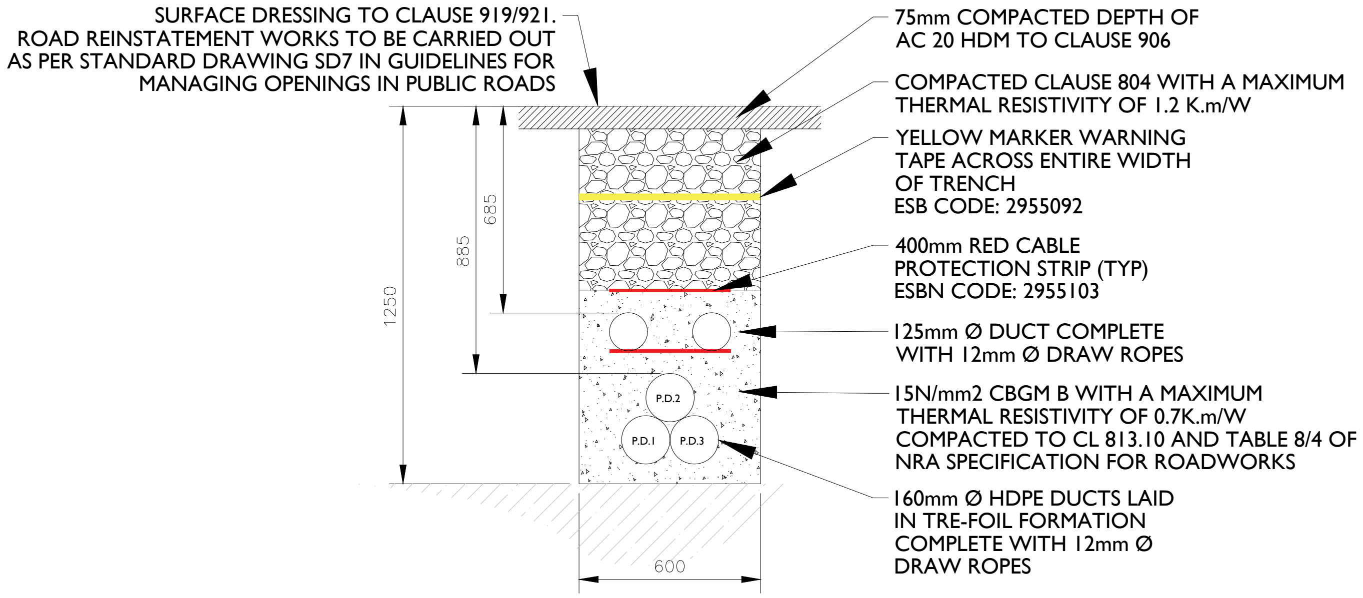


TYPICAL TRENCH DETAIL - PRIVATE ROAD



TYPICAL TRENCH DETAIL - PUBLIC ROAD

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
GRID ROUTE TRENCH
TYPICAL DETAILS

REVISION
A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	19/01/2020	DRAFT

DRAWING NUMBER
COLE d005.4.2

Coole Wind Farm

110kV Grid Route Connection

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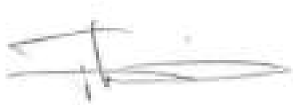

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1. Introduction

The proposed Coole Wind Farm is located north of the village of Coole, County Westmeath. The wind farm 110kV grid connection is proposed between the wind farm site and the existing ESB 110kV Mullingar Substation. The overall route is approximately 26km in length.

This report aims to provide clarification to the questions raised in third party submissions in relation to electric and magnetic fields and duct crossings.

2. Electric & Magnetic Fields

One of the submissions raised questions in relation to electric and magnetic fields (EMF) and underground grid connections. The questions raised related to:

- Maximum levels of magnetic field associated with the underground cables at distances from the cables
- Forecasted range of magnetic fields throughout the day and how forecasted values are calculated
- Confirmation if forecasted magnetic fields are within acceptable limits

EirGrid are the state owned company that manages and operates the transmission grid across the island of Ireland, and the proposed Coole Wind Farm 110kV grid connection will be designed and constructed to their specifications. Following construction the grid route will be handed over to transmission system asset owner (TAO) ESBN and will be operated by transmission system operator (TSO) EirGrid.

The following resources relating to EMF are included here to provide further information and provide answers, where available:

- https://www.eirgridgroup.com/about/health-and-safety/
- EMF & You, Information about Electric & Magnetic Fields and the electricity transmission system in Ireland, July 2014 – EirGrid (refer to Appendix A)
- The Electricity Grid and Your Health, Answering Your Questions – EirGrid (refer to Appendix A)
- Literature Review of Electromagnetic Fields (EMF) and Human Health, and an Evidence Base of EMF Measurements from the Irish Transmission System, RPS for EirGrid 2014 https://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Evidence-Based-Environmental-Study-1-EMF.pdf

Some extracts are presented below, to assist in answering the questions raised in the consultation.

- Maximum levels of magnetic field associated with the underground cables at distances from the cables

Figure 1 indicates anticipated magnetic field levels at an alternating current underground grid connection. The figure indicates levels of 2.32 microteslas directly above the underground cables and 0.15 microteslas at a distance 10m away. Figure 2 illustrates the range of magnetic field from overhead and underground alternating current grid connections operating in Ireland. The forecasted range for a 110kV underground cable route is 0 to <4 microteslas (µT), with the field level reducing with distance from the cables.

Measurements, commissioned by EirGrid, were taken on the Irish transmission system in 2014. The results are included in the RPS reference above and are in line with anticipated magnetic field levels.

These fields are far below the 1998 ICNIRP Guidelines for exposure to AC magnetic fields (100µT). It should be noted that in 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200µT reference level for exposure for the general public, but these have not yet been adopted by the European Union (page 13 EMF & You, EirGrid).

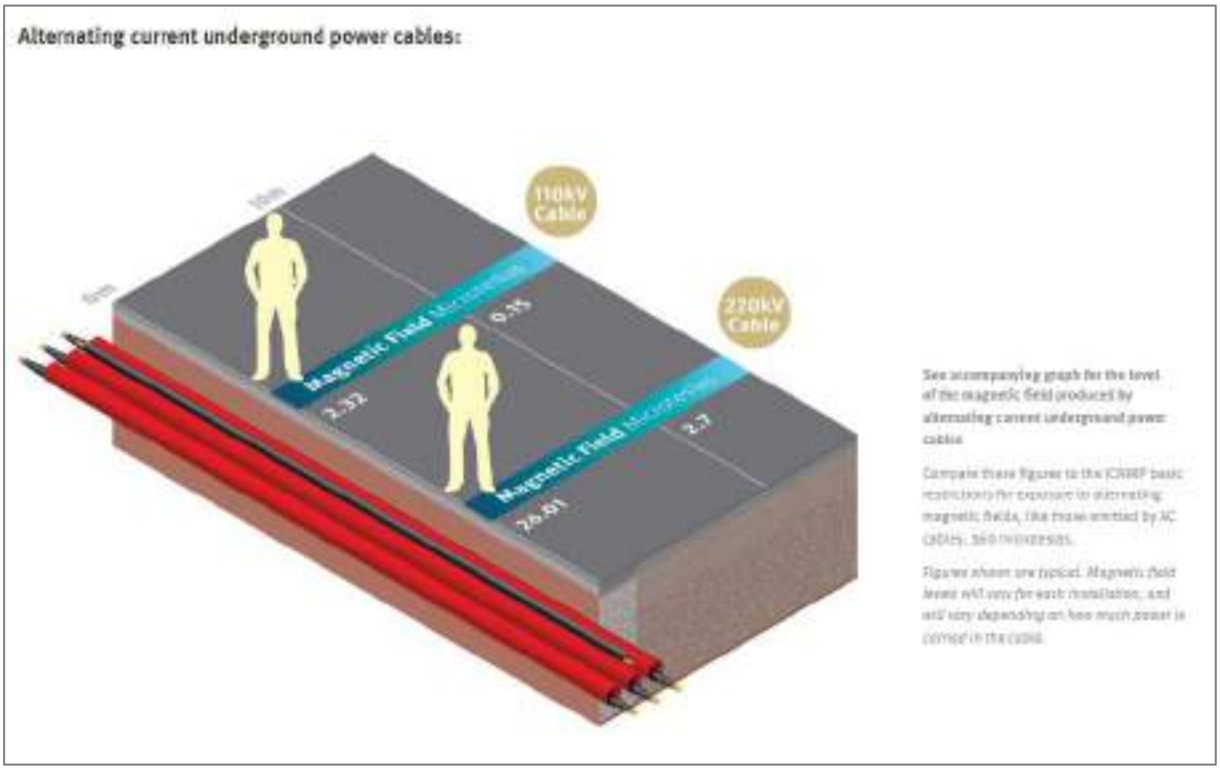


Figure 1 Extract from EirGrid's information website https://www.eirgridgroup.com/about/health-and-safety/

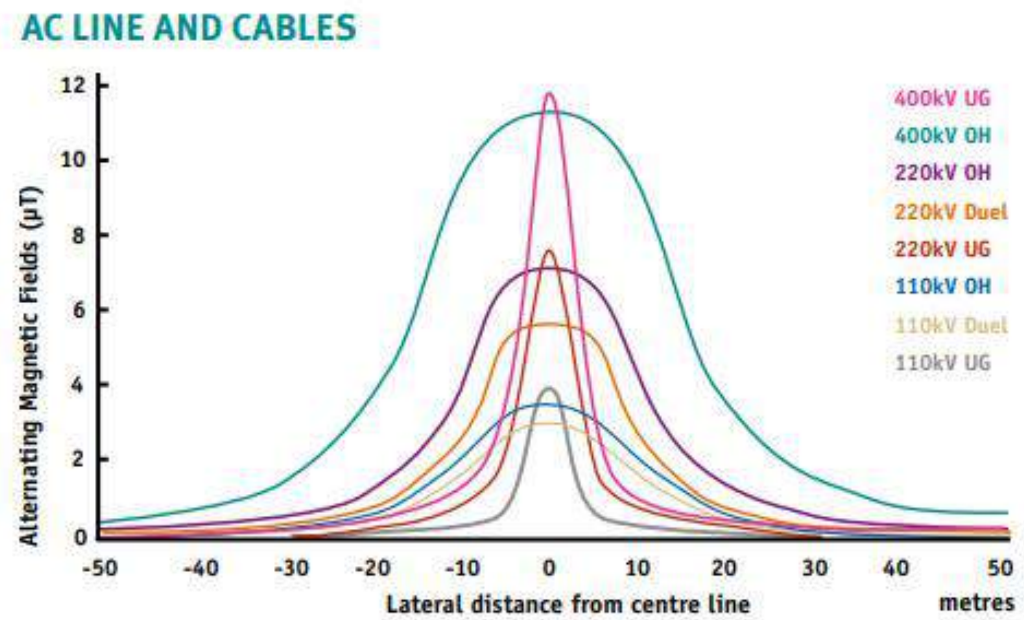


Figure C illustrates the magnetic field from overhead AC lines operating in Ireland. The fields strength decreases with distance. The fields from these AC lines are far below the 1998 ICNIRP Guidelines for exposure to AC magnetic fields (100µT).
In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200µT reference level for exposure for the general public, but these have not yet been adopted by the European Union.

Figure 2 Extract from EirGrid document EMF & You (refer Appendix A) showing 110kV underground cables with an alternating magnetic field <4 µT directly over the cable trench

- Forecasted range of magnetic fields throughout the day and how forecasted values are calculated

Magnetic field levels will vary for each installation and will vary depending on how much current is carried in the cable (EirGrid, refer to Figure 1 above), which is dependant on the output from the wind farm, which in turn is dependant on wind speeds throughout a given day. The forecasted range for a 110kV underground cable route is 0 to <4 µT, but given the variable nature of the generation it is not feasible to provide a forecast throughout a given day. Refer to the ICNIRP https://www.icnirp.org/ for further information regarding EMF forecasted values, the RPS reference above for measured values, and the further reading provided by EirGrid, in Figure 5 below.

THE MAGNETIC FIELD

The magnetic field is produced by moving electric charges and so the strength of the magnetic field varies directly with the current flows in lines or cables. As a result, the magnetic field can vary at different times during the day. You can imagine this as being like the flow rate of water in a water pipe. Magnetic fields are measured in units of microtesla (µT).

Figure 3 Extract from EMF & You (pg. 7), EirGrid

Want to know more?

This leaflet is EirGrid's summary on this topic. If you want to investigate further, here are some useful links to information on EMFs from national and international agencies.

International Commission on Non-Ionizing Radiation Protection: EMFs
http://bit.ly/ICNIRP_LF

International Commission on Non-Ionizing Radiation Protection: Power Lines
http://bit.ly/ICNIRP_Lines

World Health Organization
http://bit.ly/WHO_EMF

European Commission
http://bit.ly/EC_EMF

Irish Government
http://bit.ly/Ireland_EMF

UK Public Health England
http://bit.ly/UK_EMF

US National Institute of Environmental Health Services
http://bit.ly/NIEHS_EMF

Figure 4 Extract from The Electricity Grid and Your Health, EirGrid

- Confirm if forecasted magnetic fields are within acceptable limits

EirGrid have confirmed that forecasted magnetic fields are within acceptable limits. Please refer to Figure 6 below.

What are the recommendations on exposure to EMFs?

EirGrid operates the transmission grid to stringent safety recommendations. National and international agencies make these recommendations. They do this independently of any grid operator.

Several of these recommendations come from the International Commission for Non-Ionizing Radiation Protection (ICNIRP).

This is an independent body, funded by public health authorities around the world.

ICNIRP has investigated the safety of EMFs for decades, and provides guidance on safe levels of exposure. The HSE recommends that ICNIRP guidelines are followed to protect the health of the public.

As you can see from the diagrams above, we design the electricity network to make sure that public exposure to EMFs complies with these guidelines.

Figure 5 Extract from EirGrid's information website https://www.eirgridgroup.com/about/health-and-safety/

3. Crossing Existing Ducts

One of the submissions raised questions in relation to crossing existing ducts along the grid connection route. Questions raised related to:

- Steps that can be taken to avoid damage to existing ducts or services during installation of the 110kV grid connection.
- Steps that can be taken to ensure safety of the existing cable and ensure no damage to health or infrastructure.
- Demonstration of a methodology to avoid damage to existing utilises and services and preventing the occurrence of electric accidents during construction and thereafter.

Trenching workings for the 110kV underground grid connection will be completed following the guidelines and recommendations of the following documents:

- Code of Practice For Avoiding Danger From Underground Services, Health & Safety Authority
- How You Can Avoid Hitting Electrical Cables When Digging and Drilling, ESB Networks

Both documents are included in Appendix B for reference. Generally safe excavation practices will involve the following steps which will help to avoid any damage to existing services:

a) Use records/plans to correctly locate underground services. Local knowledge of existing buried ducts and services can also be particularly useful.
b) Utilise ground investigation techniques to identify the location of underground services along the route. This can involve intrusive ground investigations like slit trenches, or unintrusive methods such as ground penetrating radar.
c) Use cable locating devices on site.
d) Use safe excavation practices, e.g. hand digging in the vicinity of existing ducting and utilities.

The crossing of the existing low voltage/communications cable will be designed and constructed in accordance with the EirGrid Specification and associated standard details. A detailed design will be completed for the entire route and all crossings, and will be subject to a detailed review and approval process with EirGrid and other stakeholders, including utility owners. This will help to ensure the safety and integrity of existing infrastructure and the proposed grid route.

At a duct crossing, the minimum clearance between the ducts (proposed 110kV ducts and existing utility duct) will be in accordance with the EirGrid specification (Section 4.2), which requires a minimum clearance of 300mm between ducts in any direction. The 110kV cables route will cross existing utilities either above or below, and the standard EirGrid drawings are included in Appendix C. The 110kV ducts will be surrounded in concrete at crossing locations, and ESBN warning tape and steel plates will be included within the trench, refer to Figure 6 below. These measures provide warmings during any future excavations and provide protection to the power cables.

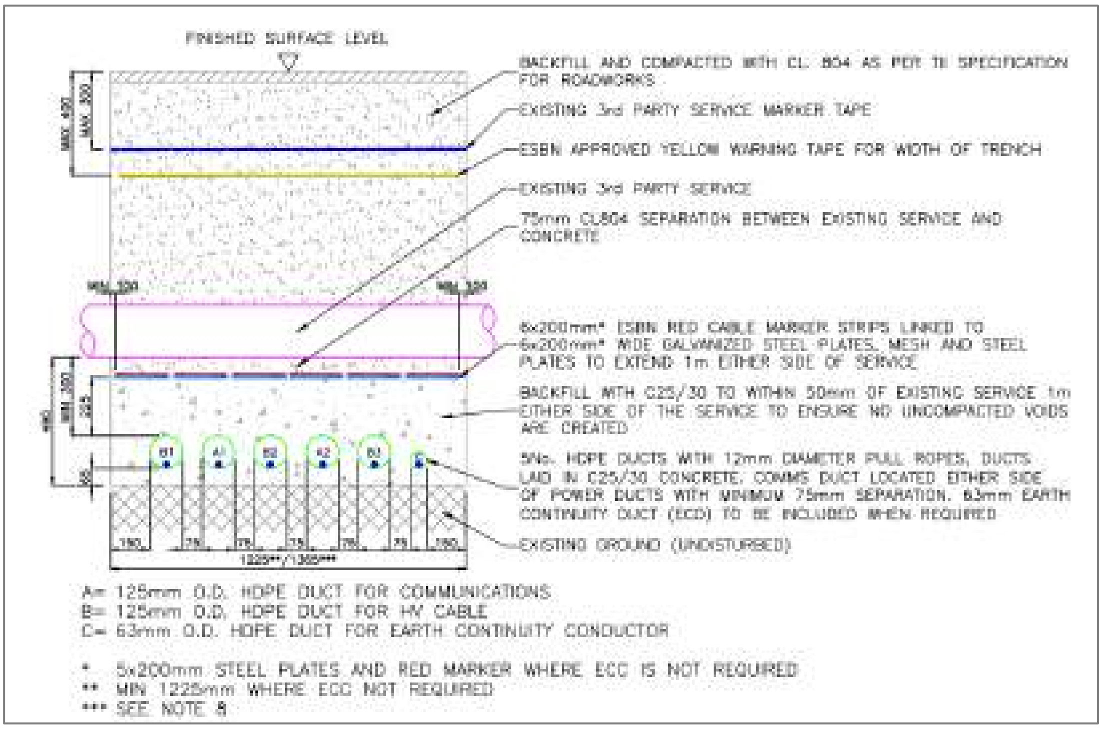


Figure 6 Extract from EirGrid standard details for crossing a 3rd party duct (Drawing XDC-CBL-STND-H-003, refer Appendix C)

APPENDIX A

- EMF & You, Information about Electric & Magnetic Fields and the electricity transmission system in Ireland, July 2014 – EirGrid
- The Electricity Grid and Your Health, Answering Your Questions – EirGrid

EIRGRID

EMF & YOU

Information about Electric & Magnetic Fields and the electricity transmission system in Ireland

Revised July 2014

GRID25

www.eirgridprojects.com

PUBLIC INFORMATION GUIDE

ABOUT EIRGRID

EirGrid, a state-owned company, is the operator of the national electricity grid in Ireland.

The national grid is an interconnected network of high-voltage power lines and cables, comparable to the motorways, dual-carriageways and main roads of the national road network.

EirGrid operates power lines at three voltage levels (400 kilo Volts (kV), 220kV and 110kV) and is approximately 6,400km in overall length.

WELCOME

The national grid is vital to ensuring that all customers, – industrial, commercial and residential – have a safe, secure, reliable, economic and efficient electricity supply.

In developing the grid we look to international and national best-practice guidelines regarding public health and safety, ensuring that the system complies with them at all times.

We know that some people have questions and concerns when there is a grid development proposed in their area.

This publication was developed to give an overview of the electricity transmission system in Ireland and the Electric and Magnetic Fields (EMF) associated with it.

We aim to provide you with factual information on EMF, in relation to both underground and overhead technologies.

For more information, including evidence-based studies that include detailed EMF readings from Irish transmission lines, we recommend you review reports published on our website at www.eirgridprojects.com along with links to other sources of information.

EirGrid remains committed to designing and operating the transmission system to the highest standards.

We will not compromise on the health and safety of the public and our staff in designing or operating the national grid.

We welcome your feedback and recommendations for the inclusion of further information on our website.

Fintan Slye

Fintan Slye
CHIEF EXECUTIVE

WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

The existence of electric and magnetic (EMF) fields has been recognised since electricity was discovered and these have been the subject of thousands of scientific studies around the world. Research conducted over the past 30 years has significantly enhanced our knowledge of EMF.

EirGrid understands that some people may have concerns about the potential effects of EMF from power lines on health. There has been considerable public debate surrounding EMF and this has generated many questions. For example:

- What are EMF?
- What studies have been carried out?
- Are there risks to human health?
- What is the national and international guidance on EMF exposure?
- Do power lines affect animals?
- Should people take any special precautions against EMF?
- What is EirGrid's position on EMF exposure?

This publication provides information about the current scientific, regulatory, and company perspectives and sources of additional information on EMF to answer these questions.

Electric and Magnetic Fields occur both naturally and from man-made sources.

All electricity, both natural and man-made, produces two types of fields: electric fields and magnetic fields. EMF are produced by natural phenomena which have been a constant part of the environment throughout human evolution. For instance, the Earth has a natural electric field and a magnetic field.

The most common source of man-made EMF that we encounter is electricity.

The man-made sources include all electrical systems including house wiring, electrical appliances and overhead and underground power lines. In Ireland the voltage in homes is 230V. Electricity in Ireland is transmitted at voltages of up to 400,000V (400kV).

THE ELECTRIC FIELD

The electric field depends on voltage. The higher the voltage, the stronger the electric field. You can imagine it as being like pressure in a water pipe. A 400kV power line produces a higher electric field than a 110kV power line. The magnitude of an electric field is expressed in volts or kilovolts (thousands of volts) per metre. This is written as V/m or kV/m.

Electric fields are strongest closest to a power line and their level reduces quickly with distance. Electric fields are blocked by buildings, trees etc.

Therefore, inside a typical house the dominant sources of electric fields are typical household appliances such as microwave ovens, hair-dryers and electric blankets.

There are no external electric fields associated with underground cables. This is because the electric field produced is contained within the cable.

THE MAGNETIC FIELD

The magnetic field is produced by moving electric charges and so the strength of the magnetic field varies directly with the current flows in lines or cables. As a result, the magnetic field can vary at different times during the day. You can imagine this as being like the flow rate of water in a water pipe. Magnetic fields are measured in units of microtesla (μT).

Unlike electric fields, magnetic fields are not blocked by buildings, trees etc. Like electric fields, magnetic fields are highest closest to an electricity line or cable and their level reduces quickly with distance from the line or cable.

Appliances that use a lot of power, such as electric heaters or cookers, generate higher levels of magnetic fields than lower powered appliances.

Q WHY DOES A FLUORESCENT LIGHT GLOW UNDER A HIGH VOLTAGE POWER LINE?

There is a well-known phenomenon whereby a fluorescent light will glow dimly if placed below a high-voltage power line. This effect is caused by the electric field. The electric field causes a tiny current (measured in millionths of an ampere) to flow through the mercury vapour inside the tube which casts a weak glow.

The moment you move the fluorescent light away from the line, the electric field weakens and the light goes out. This phenomenon has no impact on people or other organisms.

WHAT IS THE ELECTROMAGNETIC SPECTRUM?

Electromagnetic energy travels in waves. These waves span a broad range of frequencies from static frequency (fields that do not change direction with time) at one end of the spectrum, to very high frequency (fields that change billions of times per second) at the other end of the spectrum.

The electromagnetic spectrum shown in *Figure A* identifies the various types of electromagnetic energy based on their frequency. The earth’s magnetic field is largely constant and therefore is described as a static field. Its frequency is very low or zero. The earth's static magnetic field (which acts like a giant bar magnet) causes a compass to align north-south.

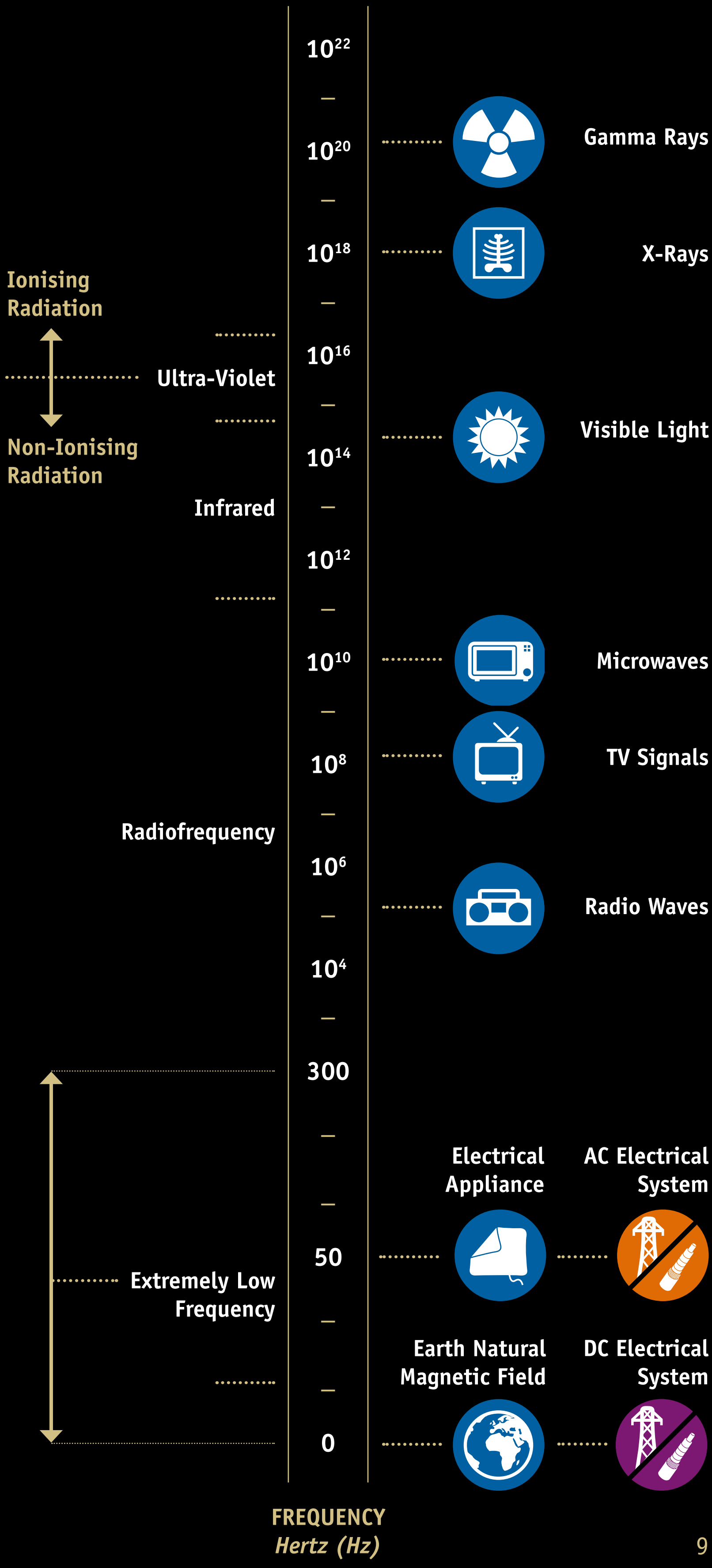
Most man-made sources of electric and magnetic fields fluctuate in direction and intensity. They are called time-varying or alternating current fields (AC). Time-varying or AC fields come from anything that runs on electricity, from electrical installations to household appliances.

Their frequency is expressed in hertz (Hz). Hertz is the rate at which the field alternates back and forth per second. The electric power system operates at 50Hz in Ireland and Europe and 60Hz in some other places such as North America and thus is a source of EMF at these frequencies. Such frequencies are in the extremely low frequency (ELF) range, 0-300Hz. The ELF-EMF from all electrical equipment are time-varying fields with a dominant frequency of 50Hz in Ireland/Europe.

The strength of the EMF or field depends on how close you are to the equipment. Hence the EMF a person can experience from a household appliance can be similar or higher than that from transmission lines because you can be much closer to the household appliance than an overhead transmission line, which is usually several metres or more away from you.

THE ELECTROMAGNETIC SPECTRUM

FIGURE A



ARE EMF ASSOCIATED WITH ELECTRICITY THE SAME AS RADIATION?

No. The fields resulting from electricity are fundamentally different from x-ray and gamma ray radiation.

Whilst these are all forms of electromagnetic energy there are important fundamental differences.

The term radiation is usually used to refer to ionising energy. Ionising means that, if the radiation is sufficiently strong, it can break bonds in molecules and therefore damage biological molecules including the DNA of cells. Only the high-frequency portion of the electromagnetic spectrum is ionising. This includes, x-rays, gamma rays and ultraviolet light.

The energy in visible light, radio frequency and fields in the static and 50Hz ranges, including electricity, are all classified as non-ionising.

It is very important to realise that 50Hz fields, i.e. electricity, are non-ionising. They have insufficient energy to ionise molecules.

Examples of non-ionising energy include EMF from the earth and electric power sources, radio waves and TV waves, microwaves, and most frequencies of visible light. See *Figure A*, page 9.

WHAT SCIENTIFIC STUDIES ON THE HEALTH IMPACT OF EMF HAVE BEEN CARRIED OUT?

Since 1979 many scientific studies have been carried out on the possible effects of EMF on people.

To determine if something is harmful to health, scientists evaluate the results from three different types of studies.

1. EPIDEMIOLOGICAL STUDIES

Epidemiology is the study of patterns of disease in populations. It searches for statistical links or associations between exposures, such as EMF, and disease in human populations. Epidemiological studies are usually observational, meaning that researchers investigate, but do not try to change, what happens as people go about their daily lives. As a result, epidemiological studies are susceptible to certain kinds of errors that lead an exposure and a disease to be associated even when one does not cause the other. For example, the positive association between number of doctors per capita and mortality rates arises not because doctors increase mortality, but rather because of social and economic factors such as industrialisation and job opportunities. Likewise, just because persons with a certain health condition live near electric power sources does not mean that the fields from these power sources caused the condition. Other environmental and behavioural causes would have to be ruled out, as would the possibility that some people moved to the area after already developing the health condition.

2. EXPERIMENTAL STUDIES – PEOPLE AND ANIMALS

These studies involve exposing people or animals to EMF in controlled laboratory conditions and looking for biological changes. For practical reasons, human experimental studies of EMF are usually short-term. Experimental studies generally study effects of short-term exposures.

3. EXPERIMENTAL STUDIES – CELLS AND TISSUES

These studies involve exposing isolated tissues and cells to EMF in controlled laboratory conditions to investigate potential mechanisms of interaction.

TWO TYPES OF TECHNOLOGY

Transmission systems worldwide are typically constructed as overhead lines and in some cases underground cables are used.

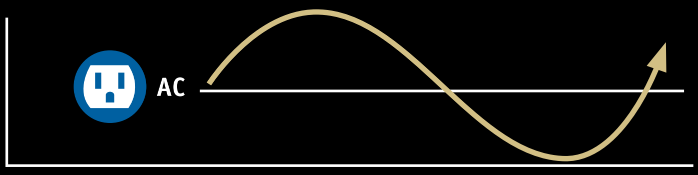
Two types of technology can be used to transmit electricity. Both AC and DC power lines produce electric and magnetic fields. AC lines produce AC electric and magnetic fields and DC lines produce static electric and magnetic fields.

When electricity transmission cables are placed underground, the metallic shielding of the cables block the electric field from the cables above the ground, but this shielding does not block the magnetic field from the cables.

EirGrid operates approximately 6,400 km of high-voltage transmission lines that carry AC electricity at voltages of 110kV, 220kV and 400kV. EirGrid also owns and operates the East-West Interconnector which is a 260km high voltage direct current (HVDC) Interconnector. This carries DC electricity from a converter station in County Meath, on underground and subsea cables to a converter station in North Wales (or in the reverse direction). More information about this project can be found at www.eirgridprojects.com

The transmission grid is constructed and operated to rigorous safety standards. Among the standards to which it adheres are those as set out by the International Commission on Non-Ionising Radiation Protection (ICNIRP) – the independent standard-setting body for EMF which is recognised by the World Health Organisation and the European Union. Established in 1992, it provides science-based guidance and recommendations, including recommended limits of exposure.

ALTERNATING MAGNETIC FIELDS



STATIC MAGNETIC FIELDS

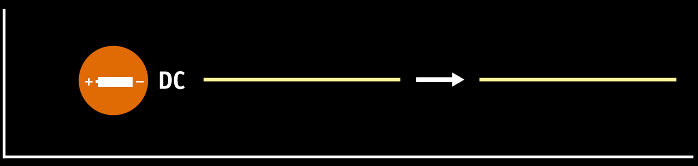


Figure B. Schematic comparison of AC and DC current flow and the resulting magnetic fields.

THE EFFECT OF DISTANCE ON MAGNETIC FIELDS

Both AC and DC technologies produce magnetic fields and both decrease with distance as you move away from the line or cable. See graphs below:

AC LINE AND CABLES

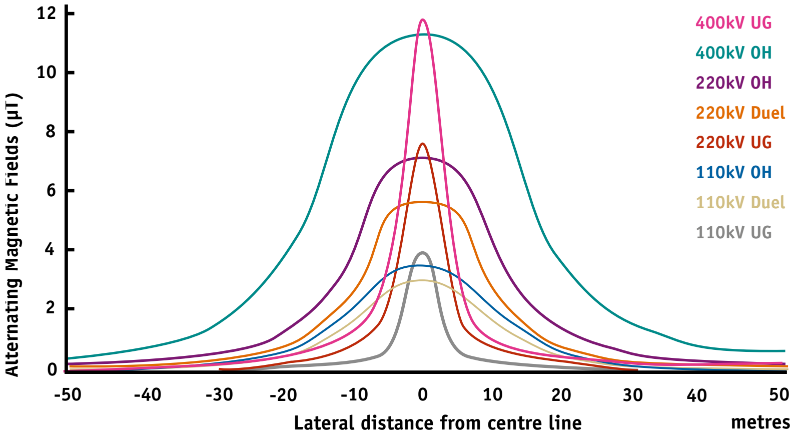


Figure C illustrates the magnetic field from overhead AC lines operating in Ireland. The fields strength decreases with distance. The fields from these AC lines are far below the 1998 ICNIRP Guidelines for exposure to AC magnetic fields (100µT).
In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200µT reference level for exposure for the general public, but these have not yet been adopted by the European Union.

UNDERGROUND DC CABLE

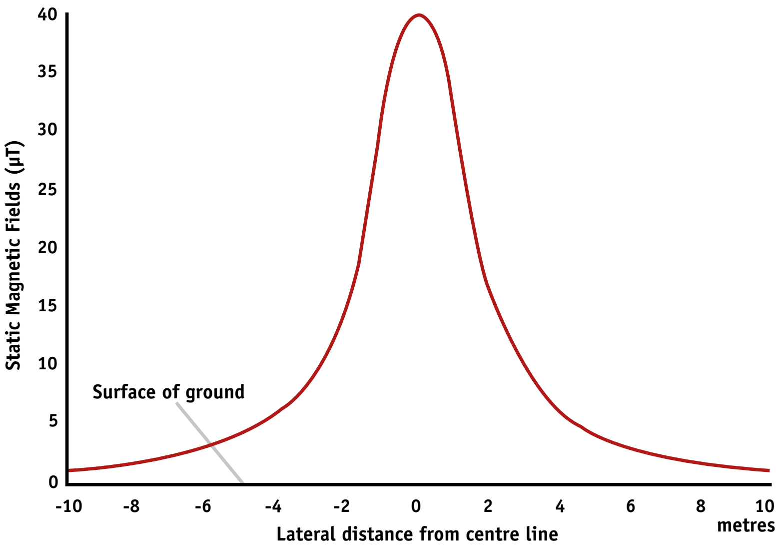


Figure D illustrates that the DC magnetic field decreases rapidly as you move away from the cable centre line. At a distance of 10 metres, the static magnetic field from the cable diminishes to 0.6µT. The DC magnetic field from this cable is far below the ICNIRP guideline (400,000µT).

DIRECT CURRENT CABLES

The fields associated with DC cables like those of the East-West Interconnector are predominately static fields and have no frequency i.e. the direction of the field does not change or oscillate (0Hz). This is different than AC lines or cables which have alternating fields which change or oscillate at 50 times a second (50Hz).

The magnetic fields associated with the East-West Interconnector have similar characteristics to the magnetic field that occurs naturally in the earth, e.g., earth's own magnetic field. Naturally occurring magnetic fields, such as that of the earth, are relatively weak. The earth's magnetic field varies between 30μT at the equator and 60μT at the north and south poles. In Ireland, the intensity of the earth's magnetic field is approximately 49μT.

Underground DC cables are normally buried to a depth of approximately 1 metre and the strongest static magnetic field produced along the route of the East-West Interconnector in Ireland is on the ground directly above the buried cable. For the East-West Interconnector this is approximately 43μT. This value is similar to or lower than the Earth's natural magnetic field.

Figure D, page 13 illustrates that the magnetic field from the East-West Interconnector decreases rapidly as you move away from the cable centre line. At a distance of 10 metres, the static magnetic field from the cable diminishes to 0.6μT.

Sources of static magnetic fields, besides the earth and the East-West Interconnector, include those generated by suburban transportation systems, permanent magnets, MRI scanners and some industrial processes.

Graph 3 on page 30 illustrates the range of static magnetic field levels measured near electric trains and magnets in common devices compared to calculated static magnetic field levels from the East-West Interconnector cables when the cables are carrying maximum current.

WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT RESEARCH ON DC MAGNETIC FIELDS AND HEALTH?

Research has been conducted over many decades on the potential biological or health effects of exposure to DC magnetic fields.

Independent review panels of scientific experts assembled by authoritative national and international scientific agencies have reviewed this research. None has concluded that static magnetic fields found in normal living and working environments cause adverse health effects.

These agencies include the World Health Organisation (2006), the National Radiological Protection Board of Great Britain (2004), and the International Agency for Research on Cancer (IARC) (2002). In 2009 the International Commission on Non-Ionising Radiation Protection (ICNIRP) issued guidelines for exposure for members of the public to DC magnetic fields. Other more recent reviews have been performed for the UK's Health Protection Agency (2008) and the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (2007, 2009).

These agencies concluded that exposure to only very strong DC magnetic fields can cause biological effects. The exposures required to produce such effects, however, are extraordinarily high relative to levels of DC magnetic fields produced by common sources.

The International Commission on Non-Ionising Radiation Protection (ICNIRP) developed its guidelines for exposure limits to the public and workers after reviewing evidence from cell and tissue studies, experimental studies of humans and laboratory animals, and epidemiologic studies.

The ICNIRP limits for occupational exposure to static magnetic fields is *2T for the head and trunk, and 8T for limbs.

The ICNIRP limits for general public exposure to static magnetic fields is ** 0.4T.

The ICNIRP published additional guidance on exposures to DC magnetic fields in 2014, but stated: "The guidelines are not expected to be relevant for the general public because all exposures to intense magnetic fields below 1Hz are currently found at workplaces."

The ICNIRP noted that cardiac pacemakers may be affected by very strong magnetic fields, but the levels where this might occur are more than ten times higher than the highest magnetic field produced by DC cables such as those of the East-West Interconnector.

* 2T = 2,000,000μT
** 0.4T = 400,000μT

Installation of East-West interconnector in a public road in Ireland

WHAT IS THE VIEW OF THE IRISH GOVERNMENT ON DC FIELDS?

In Ireland, the Government published a report of the Expert Group on the Health Effects of Electromagnetic Fields on 22 March, 2007 (DCMNR, 2007).

A panel of eight scientists examined a wide range of issues in relation to the potential health effects of EMF, including those produced by the electricity system.

The panel's conclusions regarding static magnetic fields were similar to those of the World Health Organisation and other scientific agencies.

During the planning and construction of the East-West Interconnector, concerns were raised about the magnetic fields produced by currents flowing through its DC cables.

The Irish Government appointed an Independent Expert Panel to measure and assess the fields from the cables. The panel was satisfied from the measurements provided that the magnetic field at all frequencies was well below levels recommended by the ICNIRP guidelines.

The measurements and reports from this independent study can be found at www.dcenr.gov.ie/energy.

In response to public concerns about magnetic fields from the East-West Interconnector, in 2011, the Irish Government commissioned a Dutch health scientist to investigate the situation.

In 2012, the Government commissioned a report* from the Chief Medical Officer which concluded that the East-West Interconnector does not pose a risk to public health.

*www.dcenr.gov.ie/energy/

Where can I find more information on DC magnetic fields?

The following are sources EirGrid recommends you visit should you require more detailed information on DC magnetic fields.

- Expert Group on Health Effects of Electromagnetic Fields. Department of Communications, Energy and Natural Resources (DCENR) 2007. www.dcenr.gov.ie/energy/
- Department of Communications, Energy and Natural Resources (DCENR). Data and Report of the Expert Monitoring Panel on Electro Magnetic Fields (EMF) Emissions in relation to the East-West Interconnector (EWIC) www.dcenr.gov.ie/energy/
- International Commission on Non-ionising Radiation Protection (ICNIRP). Fact Sheet – On the guidelines on limits of exposure to static magnetic fields published in Health Phys 96(4);504-514; 2009. www.icnirp.de/PubEMF.htm
- World Health Organisation (WHO). Static electric and magnetic fields – Fact Sheet N°299 (March 2006). www.who.int/peh-emf/publications/facts/fs299/en/

ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

The assessments by the national and international health and scientific agencies of health and biological research on DC magnetic fields do not support the idea that fields generated by the underground cable system would have any health impacts on humans or animals.

All exposures are far, far below limits on public exposure recommended in health guidelines.

WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT RESEARCH ON AC MAGNETIC FIELDS AND HEALTH?

National and international health and scientific agencies have reviewed more than 30 years of research including thousands of studies.

None of these agencies has concluded that exposure to ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. Agencies have recognised a statistical association between estimated higher long-term exposures to magnetic fields and childhood leukaemia in some epidemiological studies. However they have not been able to rule out the contribution of chance, selection bias and other factors to explain this association with reasonable confidence. Neither long-term studies of animals, nor studies of cellular mechanisms, have confirmed a biological basis for such an association. This explains why no health agency has concluded that there is a causal relationship between magnetic fields and health effects.

SCENIHR is the European Union's Scientific Committee on Emerging and Newly Identified Health Risks. The committee provides opinions

on emerging or newly-identified health and environmental risks. On 4 February 2014, SCENIHR published its "Preliminary opinion on Potential health effects of exposure to electromagnetic fields (EMF)". This is an update to its 2009 opinion.

The committee reported that new epidemiology studies do not shed light on a previously reported association with childhood leukaemia. Shortcomings in these studies, and a lack of experimental support from animal studies or cellular evidence prevent a causal interpretation of this statistical association.

Several recent epidemiology studies examined residential proximity to power lines and childhood leukaemia risk, but overall provided no new evidence for an association. In the largest study to date, Bunch et al. (2014) provided an extension and update to the 2005 study in the United Kingdom by Draper et al. The authors extended the study period by 13 years (1962-2008), included lower voltage lines (132kV) in addition to 275/400kV lines, and included Scotland in addition to England and Wales in their analyses. Bunch et al. (2014) included over 53,000 childhood cancer cases and over 66,000 healthy control children and reported no overall association with residential proximity to 132kV, 275kV, and 400kV power lines for leukaemia or any other cancer among children. The statistical association with distance that was reported in the earlier Draper et al. (2005) study was not apparent in this extended analysis.

No health agency has concluded that exposure to EMF from power lines and other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health.

In 2007, the World Health Organisation updated the International Agency for Research on Cancer (IARC) report with the publication of its comprehensive review of ELF-EMF health research.[1]

THE CONCLUSIONS OF THE WORLD HEALTH ORGANISATION REPORT CAN BE SUMMARISED AS FOLLOWS:

- The research does not establish that exposure to EMF of the nature associated with power lines causes or contributes to any disease or illness.
- There are no substantive health issues related to electric fields at levels generally encountered by members of the public.
- While epidemiology studies have reported a weak statistical association between childhood leukaemia and long-term exposures to magnetic fields greater than 0.3-0.4μT, this association is not supported by the laboratory studies and has not been considered a causal relationship.
- The animal studies as a whole do not show adverse effects, including cancer, among animals exposed to high levels of magnetic fields.
- The laboratory studies on cells and tissues have not confirmed any explanation as to how weak magnetic fields could cause disease.
- Because the epidemiology studies have limitations and the experimental studies provide little or no support for an association with cancer or mechanisms to cause cancer, the World Health Organisation did not conclude that magnetic fields cause childhood leukaemia. Thus, considering all of the research together, the reviewers for the World Health Organisation did not conclude that magnetic fields cause any long-term, adverse health effects.
- The view of the World Health Organisation on ELF-EMF and health issues provided on its website is "based on a recent in-depth review of scientific literature, [we conclude] that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields".[2]

[1] http://www.who.int/peh-emf/publications/elf_ehc/en/index.html
[2] http://www.who.int/peh-emf/about/whatisemf/en/index.html

To date, the whole body of scientific research has not confirmed any adverse effect to human health from EMF.

The independent international health and scientific agencies are continuing to review and monitor the possibility of health effects from exposure to EMF. They are doing this not because they have identified a problem but to ensure that even the smallest possibility of a health risk has not been overlooked, given that everyone in the developed world is exposed to EMF. The findings of these agencies carry considerable weight, as they reflect the judgements of groups of multiple scientists rather than the views of individuals.

The World Health Organisation stated that the scope of any actions we may take to reduce EMF exposure, either personally or as a society, should be proportional to the strength of the science. The actions to reduce exposure should be very low in cost and should not compromise the health, social and economic benefits of electricity to our society.

WHAT IS THE VIEW OF THE IRISH GOVERNMENT?

In March 2007, Ireland's Department of Communications, Marine and Natural Resources (DCMNR) assembled a panel of independent scientists to review EMF and radio frequency research. The conclusions are summarised in the document entitled "Health Effects of Electromagnetic Fields". The conclusions of this report were consistent with those of The International Agency for Research on Cancer (IARC), the World Health Organisation and other national and international agencies. In relation to EMF, the report states:

'No adverse health effects have been established below the limits suggested by international guidelines.'

In January 2014, the Department of the Environment announced it was conducting a review of the latest research on EMF and EirGrid is committed to addressing any recommendations in this report.

WHAT IS THE VIEW OF THE EUROPEAN UNION?

In 1999, the Council of the European Union adopted a recommendation in relation to public and occupational exposure to EMF. This recommendation applies the exposure guidelines advocated in 1998 by the ICNIRP, to locations where people spend significant time.

The 1998 ICNIRP guidelines specify limits on exposure to EMF, which are called ‘basic restrictions’. To make sure that these basic restriction limits are not exceeded, ‘reference levels’ for both electric and magnetic field exposure are provided. For the general public these reference levels at 50Hz are 500kV/M and 100μT.[3] If the EMF exposure level is less than the reference level, compliance with the basic restriction is assured. If exposure exceeds the reference level, the circumstances of the exposure need to be examined more closely to confirm compliance.

[3] In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200μT reference level for exposure for the general public, but these have not yet been adopted by the European Union.

ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

A 2007 Government report stated that, while there is limited scientific evidence of an association between ELF-EMF and childhood leukemia, considerable research carried out in laboratories does not support this possibility.

Nevertheless, the report recommended that the evidence should not be discounted and suggested no-cost, or low-cost, precautionary measures to lower people's exposure to ELF fields.

As a precautionary measure, it recommended that future power lines and power installations should be sited away from heavily populated areas. The report also noted that lowering international guideline limits as a precautionary measure is not recommended by the World Health Organisation.

These precautionary goals are achieved by EirGrid by routing lines as far from existing residences as is reasonably possible, optimising the phasing of adjacent lines, and incorporating stakeholder input during the consultation process carried out in the development of new electricity infrastructure.

Source: Report from Expert Group on the Health Effects of Electromagnetic Fields for Department of Communications, Marine and Natural Resources, 2007.

DO POWER LINES AFFECT ANIMALS?

As with human health, some have expressed concern about the potential effects of EMF from high-voltage transmission lines on animal health, welfare, behaviour and productivity.

The potential effects from EMF on both economically important domesticated animal species and wildlife have been investigated since the 1970s. This has led to a good understanding of the potential means by which EMF could affect organisms in the vicinity of power lines.

Overall, the research does not show that EMF have adverse effects on the health, behaviour or productivity of animals, including livestock.

The substantial body of research on wild and domestic animals is informative for all large mammals and does not indicate any risk.

Thus, there is no scientific basis in the research literature to conclude that the presence of a transmission line would create conditions that would impair the health of animals or would precipitate abnormal behaviour.

Studies on dairy cows, for example, failed to find any consistent variation in fertility, hormone levels, milk fat content or dry matter intake beyond what would be expected due to normal variation even when exposed to ELF-EMF far stronger than would occur from the Irish transmission system.

Other research on sheep has examined the effect of ELF-EMF on weight gain, wool production, behaviour, onset of puberty and immune function. None of the studies showed consistent or replicated evidence of adverse effects.

CROPS, PLANTS AND TREES
As scientific literature has accumulated, both from laboratory and field studies, on the potential effect of EMF from transmission lines on plants, including agricultural crops and trees, and forest and woodland vegetation, no adverse effects on plants have been reported from electric and magnetic field exposures at levels comparable to those near high-voltage transmission lines.

Where can I find more information on ELF fields?

The following are sources EirGrid recommends you visit should you require more detailed information on AC fields.

- **THE WORLD HEALTH ORGANISATION – INTERNATIONAL EMF PROJECT (2007)**
  www.who.int/mediacentre/factsheets/fs322/en/index.html
- **THE EUROPEAN HEALTH RISK ASSESSMENT NETWORK ON ELECTROMAGNETIC FIELDS EXPOSURE (2010)**
  http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf
- **HEALTH PROTECTION AGENCY**
  www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/ElectricAndMagneticFields/HealthEffectsOfElectricAndMagneticFields/
- **DEPARTMENT OF COMMUNICATIONS ENERGY AND NATURAL RESOURCES**
  www.dcenr.gov.ie
- **EUROPEAN COMMISSION**
  http://ec.europa.eu/enterprise/sectors/electrical/documents/lvd/electromagnetic-fields/
- **INTERNATIONAL AGENCY FOR RESEARCH ON CANCER**
  www.iarc.fr/en
- **INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION**
  www.icnirp.de
- **SCIENTIFIC COMMITTEE OF THE EUROPEAN COMMISSIONS**
  http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenihr_consultation_19_en.htm
- **EIRGRID PROJECTS**
  www.eirgridprojects.com

WHAT IS EIRGRID'S POSITION AND COMMITMENT?

EirGrid's position on EMF and health is based on the authoritative conclusions and recommendations of established national and international health and scientific agencies which have reviewed the body of scientific research.

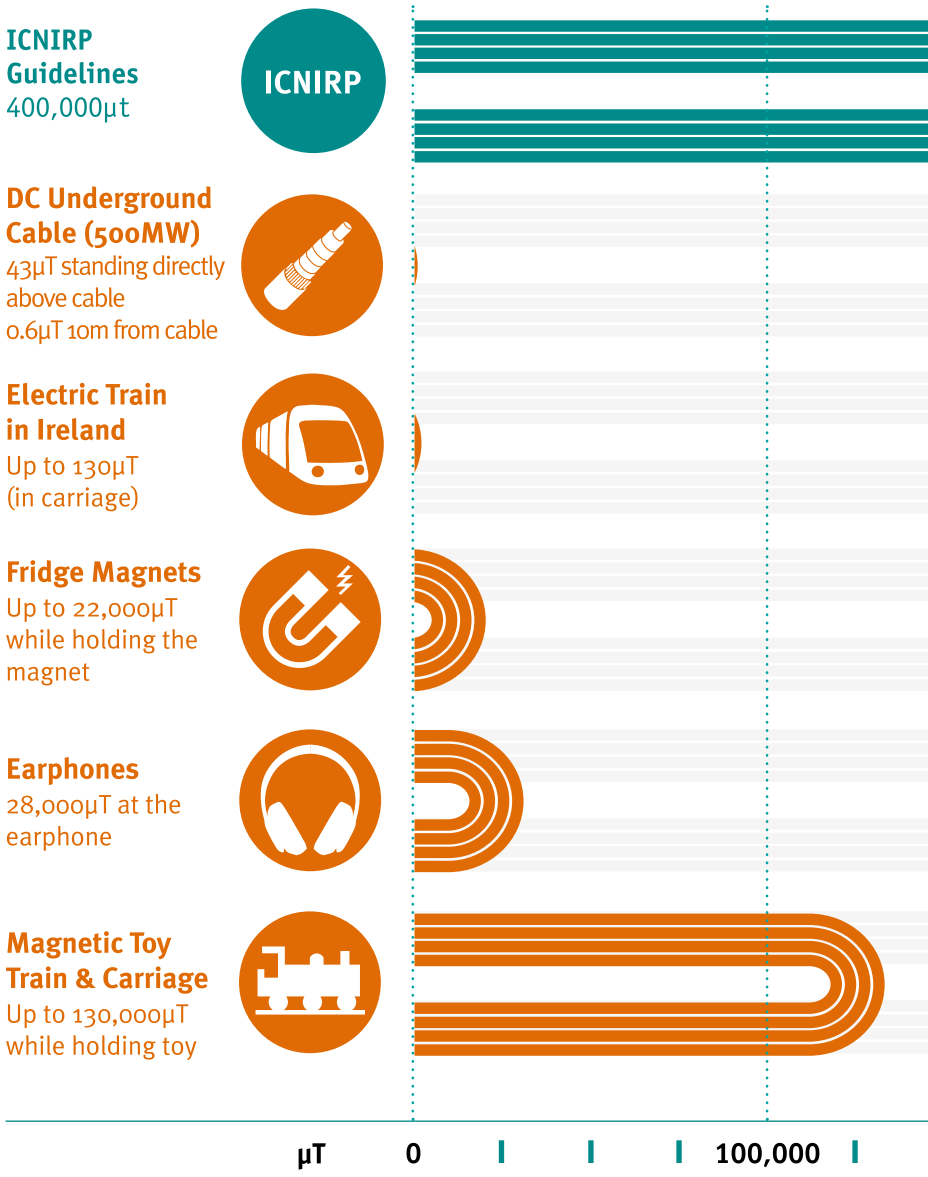
These agencies have consistently concluded that the research does not indicate that EMF cause any adverse health effects at the levels encountered in our everyday environment and that compliance with the existing ICNIRP standards provides sufficient public health protection.

EirGrid recognises that some individuals are concerned about issues regarding EMF and health. EirGrid is committed to addressing these concerns by continuing to:

- Design and operate the transmission system in accordance with current international guidelines on EMF (ICNIRP), as reviewed by the World Health Organisation and endorsed by the EU and the Irish Government.
- Closely monitor engineering and scientific research in this area.
- Provide information to the general public and to staff on this issue.

COMPARISON OF DC MAGNETIC FIELDS FROM COMMON SOURCES

Graph 1. DC magnetic fields from common sources compared to calculated magnetic fields from a 500MW DC cable.



THE INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION (ICNIRP) WAS ESTABLISHED IN 1992.

This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

This graphic provides an indication of approximate fields from lines and appliances. For actual measurements from DC cables already built in Ireland see www.dcenr.gov.ie/energy/

Source of data: Compliance Engineering Ireland (CEI).

AC ELECTRIC FIELDS

Graph 2. The graphic opposite shows some examples of different sources of electric fields and how they compare to typical electric fields associated with overhead electricity lines that make up part of the electricity grid in Ireland.

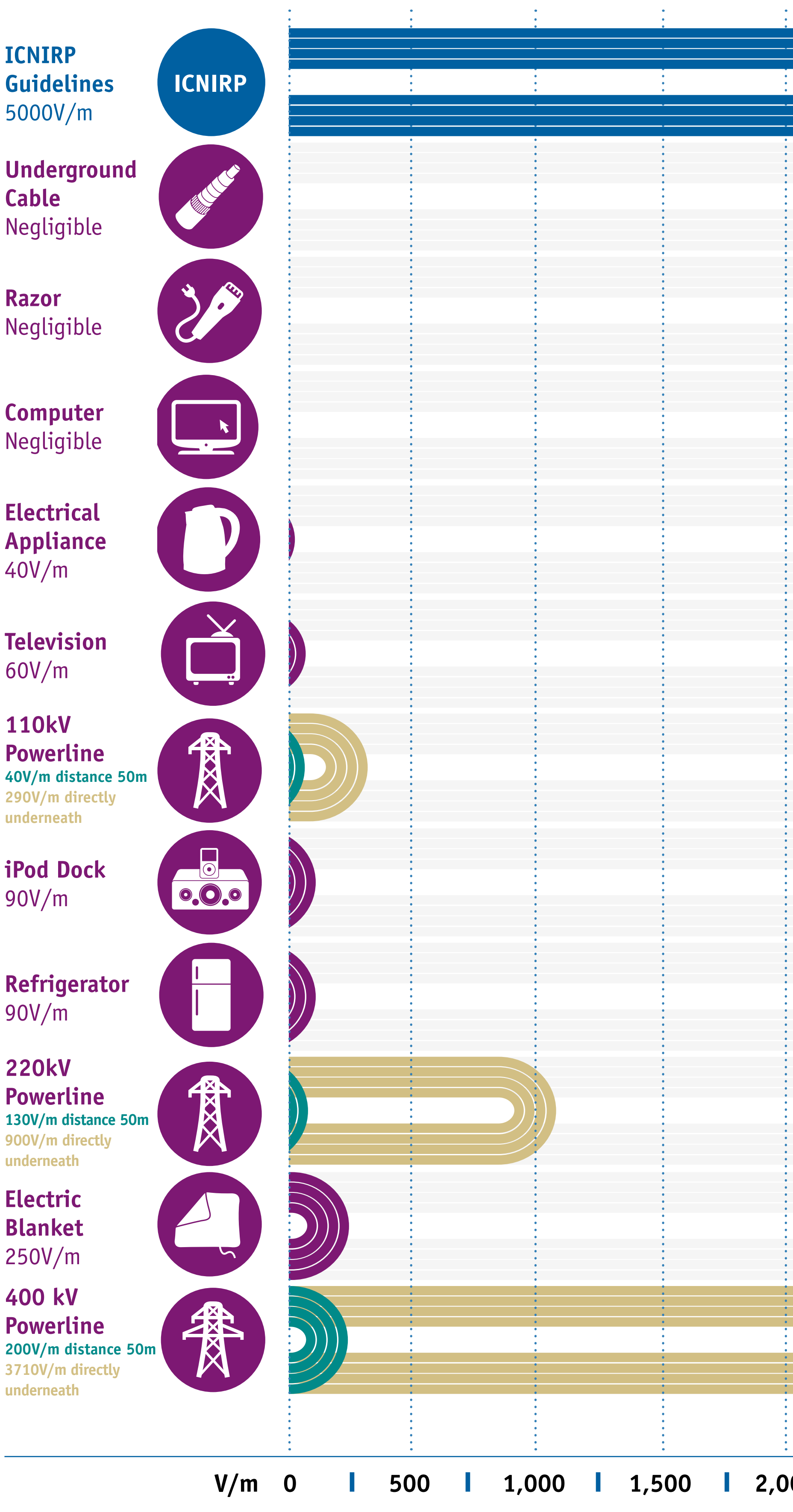
The graph also references the ICNIRP guidelines for exposure to electric fields set to ensure public health and safety.

THE INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION (ICNIRP) WAS ESTABLISHED IN 1992.

This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

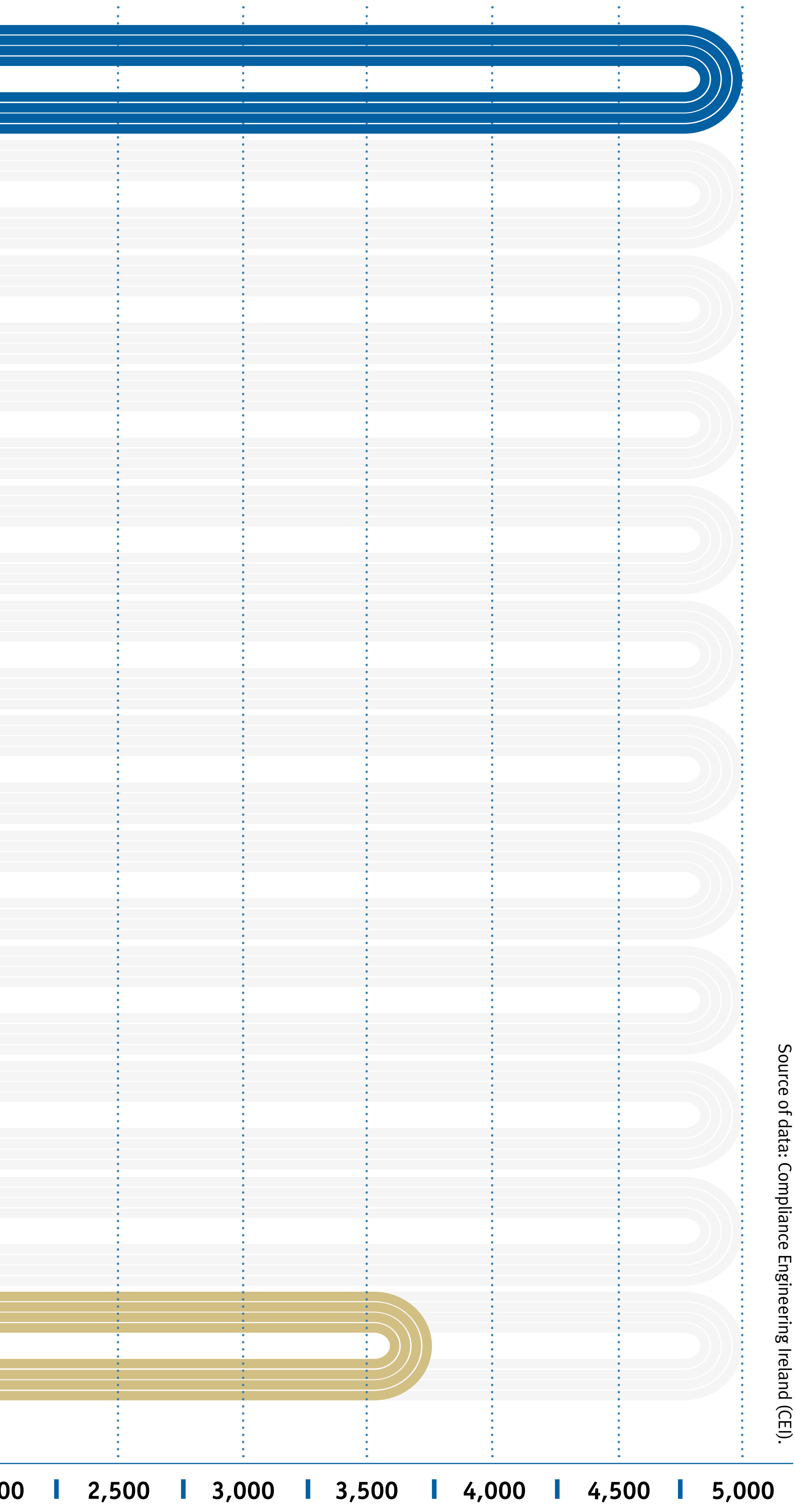
This provides an indication of approximate fields from lines and appliances. For actual measurements from transmission lines already built in Ireland see eirgridprojects.com

COMPARISON OF AC ELECTRIC FIELDS



5kV/m is a reference value, 9.2KV/m is maximum allowable electric field as per the ICNIRP recommendati

S FROM COMMON SOURCES



Source of data: Compliance Engineering Ireland (CEI).

ons (using the Dimbylow calculations).

AC MAGNETIC FIELDS

Graph 3. The graphic opposite shows some examples of different sources of magnetic fields and how magnetic field levels from these sources compare to typical magnetic field levels from electricity lines or cables that make up part of the electricity grid in Ireland.

The graph also references the ICNIRP guidelines for exposure to magnetic fields set to ensure public health and safety.

THE INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION (ICNIRP) WAS ESTABLISHED IN 1992.

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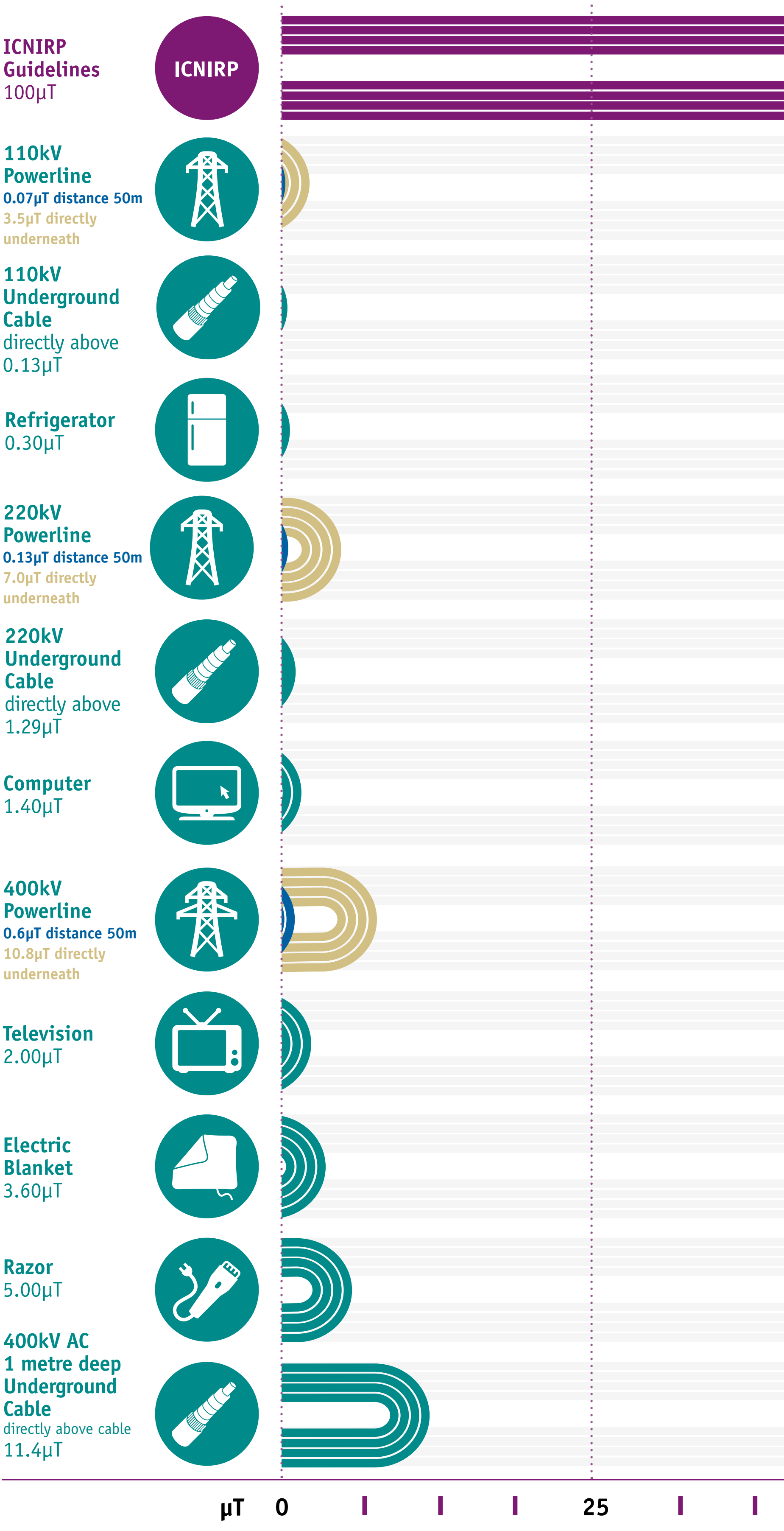
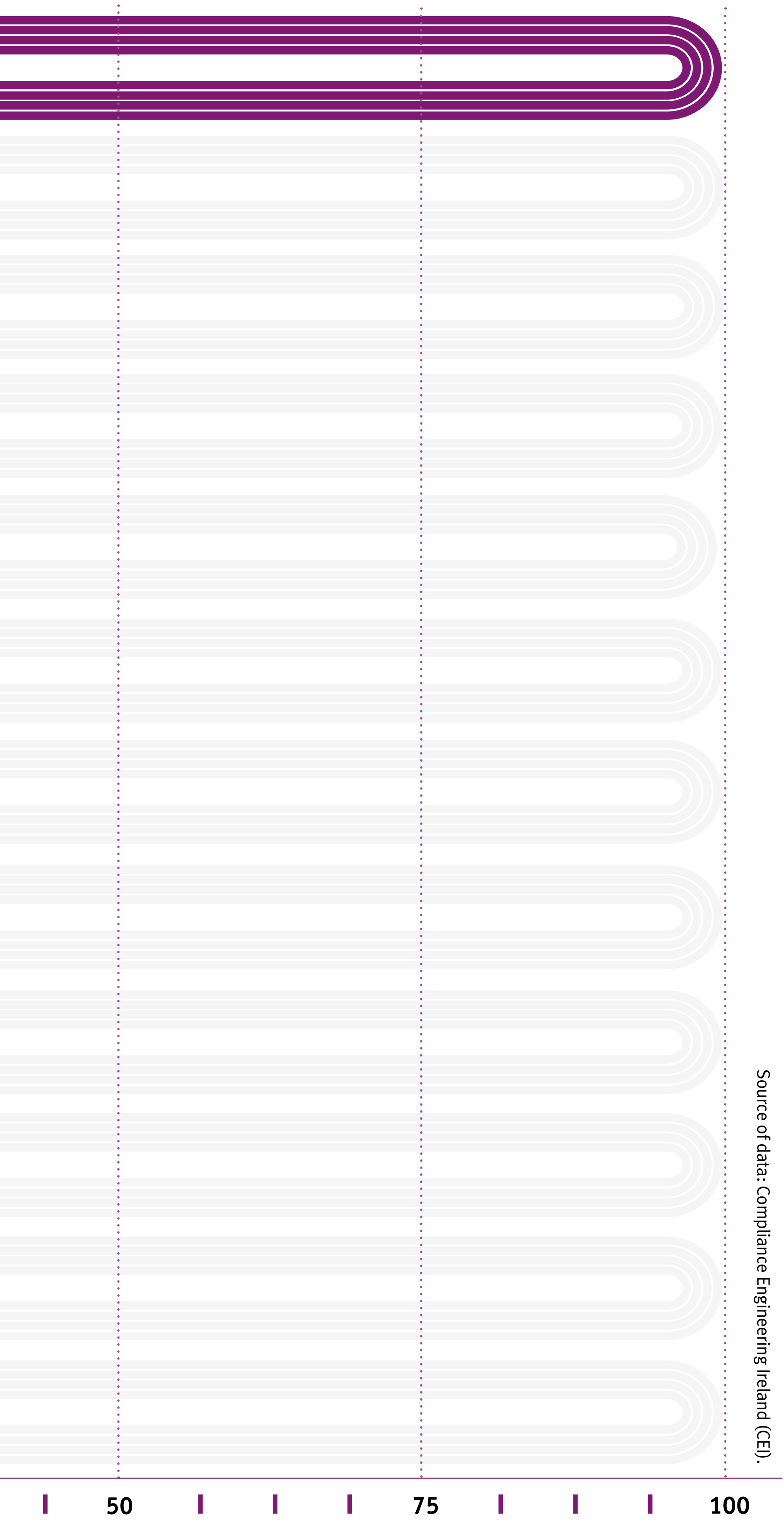
This graphic provides an indication of approximate fields from lines and appliances. For actual measurements from transmission lines already built in Ireland see eirgidprojects.com

COMPARISON OF DIFFERENT SOURCE



S OF AC MAGNETIC FIELDS (μT)



GLOSSARY

AC (ALTERNATING CURRENT)
Electricity that changes direction at regular intervals is described as AC electricity. AC is the form in which electricity is delivered to our homes and businesses. This is the type of electricity used mainly on the Irish transmission system and in every other system in the world.

CARCINOGENIC
Any substance or agent, including ionising radiation, that causes cancer.

CONDUCTOR
An object or material that can carry electricity, like the power cables used in an overhead line.

CURRENT
The movement of an electrical charge similar to the rate of fluid flow in a pipeline.

DC (DIRECT CURRENT)
Electricity that flows in one direction only, like the battery in your car.

ELECTRIC FIELD
An electric field is created by the difference in electric potential (voltage) between the conductors in power cables. The strength of an electric field is expressed in units of volts per meter (V/m). Higher voltage sources produce higher electric fields.

ELECTROMAGNETIC FIELD
The term electromagnetic field is frequently used to refer to electromagnetic energy across a wide frequency spectrum ranging from the earth's natural fields to cosmic radiation. Sometimes it refers to frequencies above about 100 kHz where electric and magnetic fields are coupled and radiate away from sources.

ELF (EXTREMELY LOW FREQUENCY)
Frequencies found at the end of the electromagnetic spectrum that contain very little energy and cannot directly break molecules apart, ie., non-ionising. 50Hz electric power operates at ELF levels.

FREQUENCY
AC Electricity is transmitted in waves. The number of times the wave repeats itself in a second is the frequency and is measured in Hertz. On the Irish transmission system, AC electricity is transmitted at 50Hz.

INDUCED CURRENT
A flow of electric current in an object created by the proximity to an AC power source.

IONISING RADIATION
Radiation, such as X-rays, which has sufficient energy to break molecular chemical and electrical bonds.

MAGNETIC FIELD
Created by the movement of electric charges.

Magnetic fields surround magnetic materials and electric currents. In magnetic materials and permanent magnets, the field is created by the coordinated spins of electrons and nuclei within iron atoms. The magnitude of the magnetic field is expressed as magnetic flux density, also referred to as magnetic field strength. Measured in Tesla (for large fields) or μT (for small fields).

MOLECULE
The smallest particle of a substance that retains the properties of that substance.

NON-IONISING RADIATION
Electromagnetic fields at frequencies that do not have enough energy to disrupt atoms or molecules.

RADIATION
Any of a variety of forms of energy propagated through space.

VOLTAGE
Voltage is the difference in electric potential between any two conductors of a circuit. It is the electric 'pressure' that exists between two points and is capable of producing the flow of current through an electrical conductor. Voltage in a power line is comparable to pressure on a pipeline. Voltage is measured in units of kilovolts/m.

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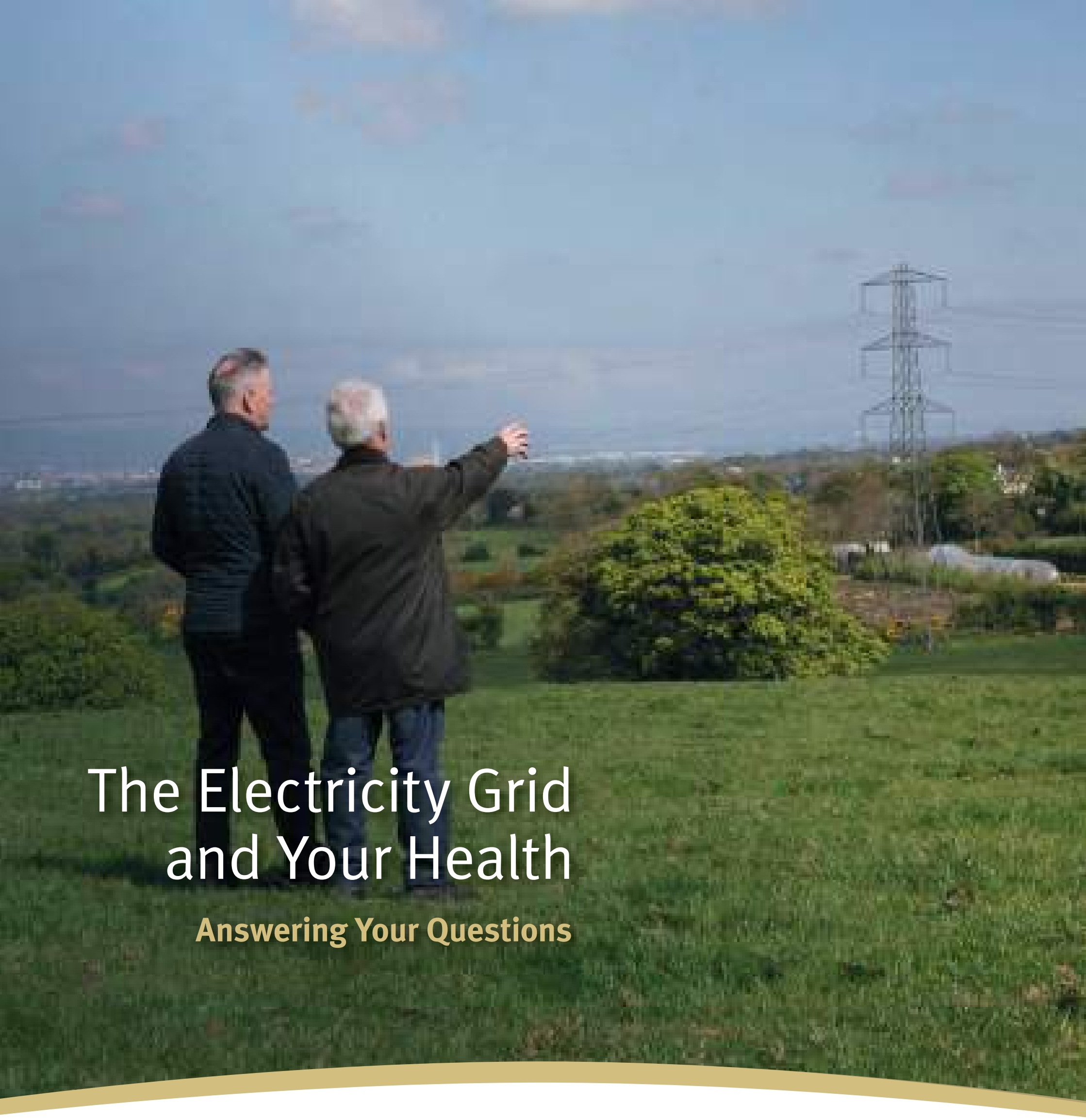
07/14
EG/CW/EMF/V2



The Electricity Grid and Your Health

Answering Your Questions

EIRGRID

The current. The future.

EirGrid is responsible for a safe, secure and reliable supply of electricity – now and in the future.

We develop, manage and operate the electricity transmission grid. This brings power from where it is generated to where it is needed – throughout Ireland.

We use our grid to supply power to industry and businesses that use large amounts of electricity. Our grid also powers the distribution network. This supplies the electricity you use every day in your homes, businesses, schools, hospitals, and farms.

We develop new electricity infrastructure only when it is needed. EirGrid answers to Government and to regulators.

Our safety promise

We obey all laws, and meet all applicable health and safety standards. We work for the benefit and safety of every citizen in Ireland.

Electricity is a very safe way to provide energy to homes and businesses, and we use a lot of it in our daily lives. This requires EirGrid to transmit large amounts of electricity.

The main safety risk this creates is accidental electrocution – and this is a very low risk.

To protect against this risk, we send this energy on wires carried by poles and pylons, or buried underground in cables.

However, some people worry about the electric and magnetic fields (EMFs) that are found near electricity lines and cables.

What are EMFs?

When electric current flows, both electric and magnetic fields are produced. The EMFs from electricity are in the extremely low frequency end of the electro-magnetic spectrum. (See flap.) They occur in the home, in the workplace, or anywhere we use electricity.

However, people everywhere are exposed to EMFs wherever they live, not just from electricity lines. Natural sources of EMFs include the earth's geomagnetic field, and electric fields from storm clouds.

EMFs occur anywhere that electricity is generated, transmitted or used. Apart from power lines, this includes electrical appliances and wiring in our homes and businesses.

Like other issues related to man-made technologies, extremely low-frequency EMFs have been measured, researched and closely monitored.

The consensus from health and regulatory authorities is that extremely low frequency EMFs do not present a health risk.

We know that some people have genuine concerns about EMFs and health. This leaflet aims to simply explain the facts about EMFs, based on current information from health and scientific agencies.

Are EMFs the same as radiation?

No. The fields resulting from electricity are fundamentally different from x-ray and gamma ray radiation. Although they are all forms of electromagnetic energy, there are important and fundamental differences.

The term radiation usually refers to electromagnetic energy that falls at the ionising end of the spectrum. This kind of energy is capable of breaking bonds in molecules. This damages our basic biological building blocks – the DNA of our cells.

Only the high-frequency portion of the electromagnetic spectrum is ionising. This includes x-rays and gamma rays.

EMFs from the electricity grid are non-ionising. This term means that they do not have enough energy to cause damage to human or animal cells in the same way ionising radiation does.

Another source of non-ionising energy are EMFs from the earth itself. The non-ionising end of the spectrum also includes radio waves, TV signals, and visible light.

Some people fear that EMFs could cause cancer in the same way that ionising radiation does. However, the scientific consensus is that there is no credible way to explain how this could happen.

Why are there recommendations on exposure to EMFs?

We can't easily avoid EMFs, as western society has become dependent on technologies that produce them.

But too much of anything can affect human health. This applies to every aspect of our lives; from the food we eat, to how sedentary we are. It also applies to EMFs: at high levels of exposure there are harmful effects.

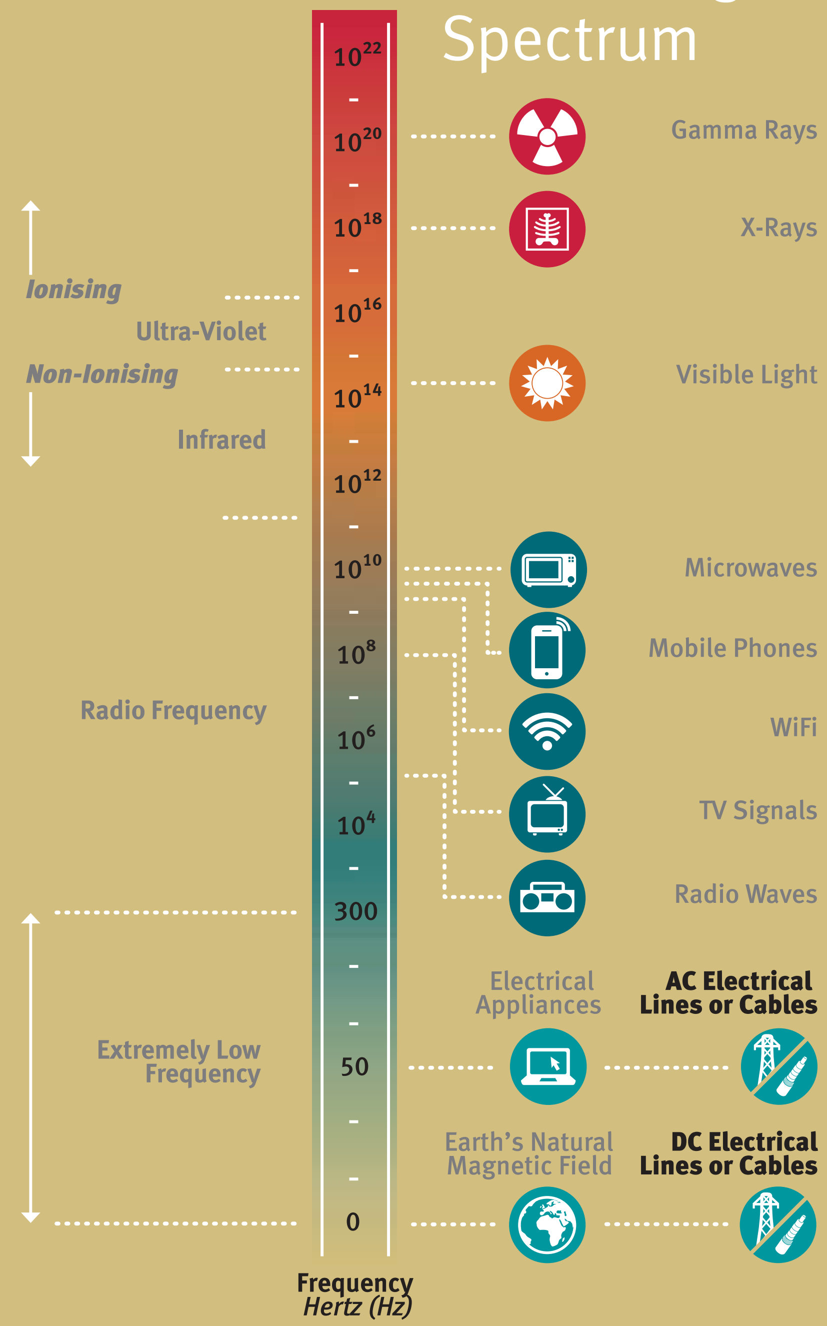
Because of this, health and regulatory authorities recommend exposure limits for extremely low-frequency EMFs.

However, forty years of research has found no hazardous effects from long-term exposure to low levels of EMFs.

This includes the small amounts of extremely low frequency EMFs produced by electricity.

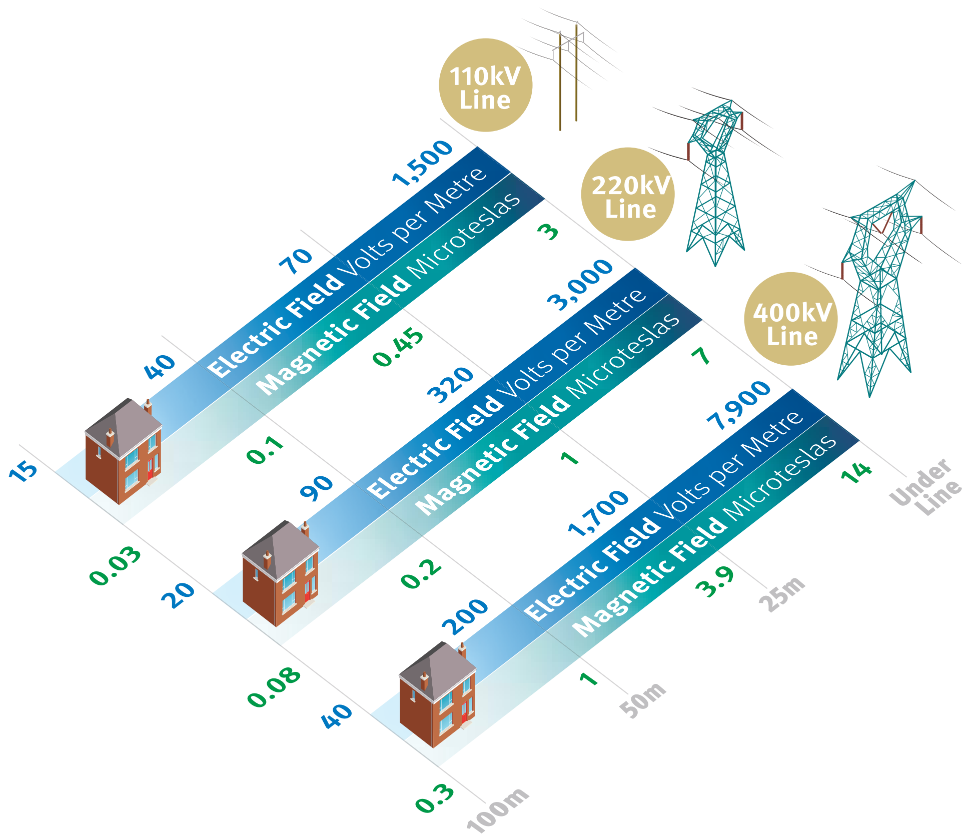
This occurs in home appliances and domestic wiring as well as overhead lines, underground cables, and substations.

Electromagnetic Spectrum



What EMFs do overhead AC power lines produce?

Compare the EMF levels below to ICNIRP basic restrictions for exposure to 50 Hz fields.
Electric field: 9,000 volts per metre. Magnetic field: 360 microteslas.



What are the recommendations on exposure to EMFs?

EirGrid operates the transmission grid to stringent safety recommendations. National and international agencies make these recommendations. They do this independently of any grid operator.

Several of these recommendations come from the International Commission for Non-Ionizing Radiation Protection (ICNIRP).

This is an independent body, funded by public health authorities around the world.

ICNIRP has investigated the safety of EMFs for decades, and provides guidance on safe levels of exposure.

The HSE recommends that ICNIRP guidelines are followed to protect the health of the public.

We design the electricity network to make sure that public exposure to EMFs complies with these guidelines.

The diagram on this page shows the levels of EMFs measured near power lines at various distances.

As you can see, levels of EMFs near electricity infrastructure drop considerably as you move away from the lines.

The levels of the electric field depend upon the line voltage, while the magnetic field depends on how much power is being transmitted.

The figures shown are based on the overhead line structures we use operating at typical line loads.

Figures shown are typical. Electric fields will vary with the voltage of each installation, and magnetic fields will vary depending on how much power is carried on each type of line.

Alternating current and direct current

Alternating current (AC) is used to generate and transmit electricity across the grid.

It allows us to quickly respond to the changing needs for electricity.

This is important because large amounts of energy cannot be stored. Electricity must be produced as soon as it is needed, and instantly sent to where it is needed.

Alternating current allows for this. This is why the vast majority of the grid is made up of overhead lines carrying high voltage alternating current.

AC electricity is then sent from the grid to the local electricity distribution network. This network uses the familiar wooden poles and lines that supply power to your home. This network carries lower amounts of power, to meet the typical needs of electricity used in homes, farms and small businesses.

Direct current (DC) is an alternative way to transmit electricity. It is generally used to transfer large amounts of power from one point to another. DC electricity levels cannot be increased or decreased in the same way as AC electricity.

DC Electricity is generally used for the following purposes;

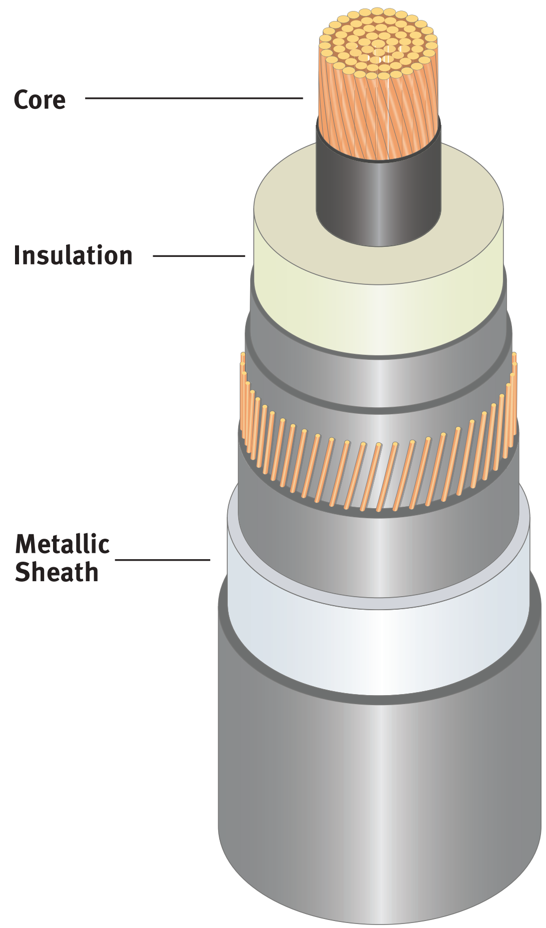
- Transmitting large amounts of power over very long distances – like the East West Interconnector or the proposed Celtic Interconnector.
- Connecting two separate transmission grids of different strength, or that operate at different system frequencies.

In these circumstances, a converter station is needed to change the AC electricity – as used on the grid – to DC electricity.

At the destination, another converter station then changes the DC electricity back to AC, so it can be put back on the grid.

How do underground or undersea power cables work?

To safeguard the power they carry, high voltage cables are insulated and covered in protective sheaths. The cable's metallic sheath also blocks the electric field.



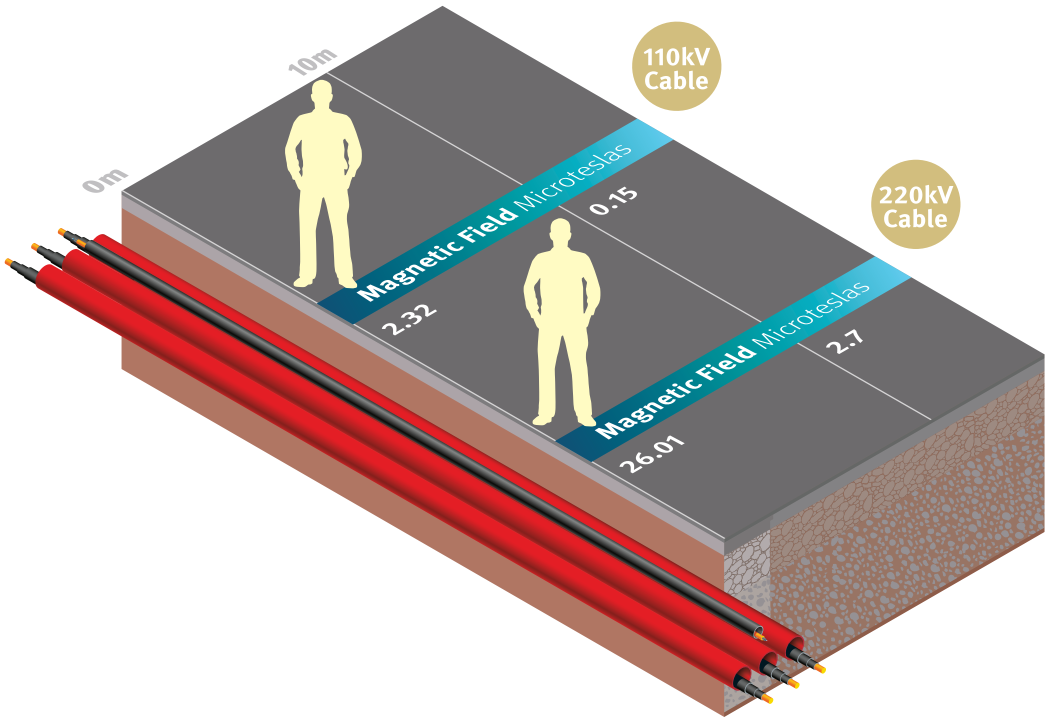
Typical example of a DC underground cable

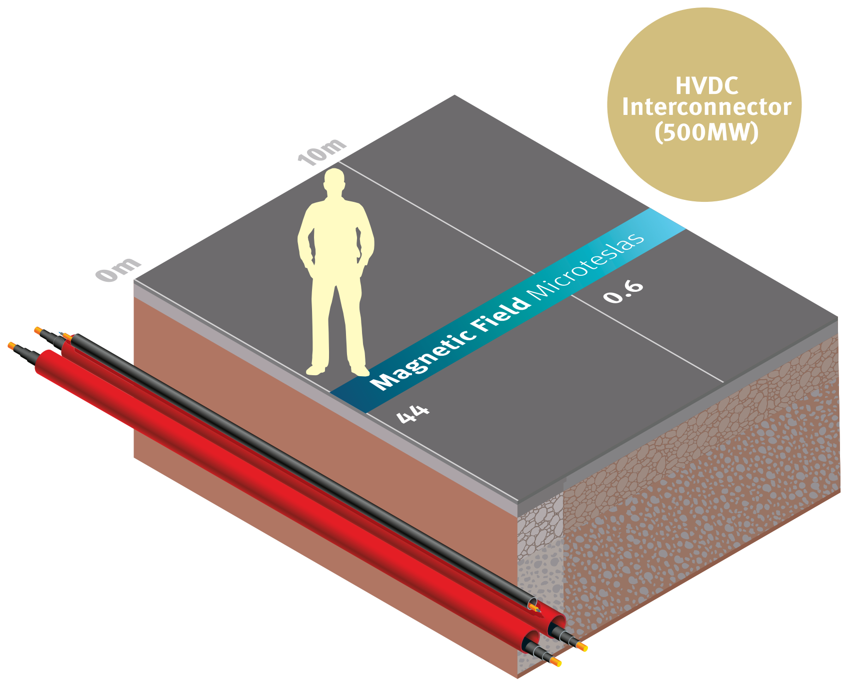
What magnetic field levels do alternating current underground power cables produce?

Compare these figures to the ICNIRP basic restrictions for exposure to alternating magnetic fields, like those emitted by AC cables: **360 microteslas.**

What magnetic field levels do direct current underground power cables produce?

Compare these figures to the ICNIRP basic restrictions for exposure to static magnetic fields, like those emitted by DC cables: **400,000 microteslas.**





Figures shown are typical. Magnetic field levels will vary for each installation, and will vary depending on how much power is carried in the cable.

Why do some people say EMFs are harmful?

The most common concern about EMFs from power lines is a fear that magnetic fields could be associated with childhood leukaemia.

This was first suggested in a 1979 epidemiological study. These kinds of studies look at patterns of disease in populations. While they cannot prove a cause of disease, they can suggest statistical associations that need further investigation.

Because of the 1979 study, power lines and childhood cancers have been comprehensively investigated. These investigations included more epidemiological research, as well as laboratory studies.

There have been mixed results from subsequent epidemiological studies. Some have reported associations with magnetic fields; others have not. Recent studies conducted in the UK, France, Denmark and the US have not established associations between a home near transmission lines and childhood leukaemia.

Crucially, laboratory studies have found no connection and no explanation of how power lines could have this effect.

Based on this history and its own review of research, the World Health Organization states there is no evidence to conclude that exposure to low-level EMFs is harmful to human health.

This issue has become emotive and controversial for some, as none of us can see EMFs or easily control our exposure to them.

There are campaigners who believe any possibility of risk – even unproven – needs action.

There are also some people with health problems that they believe are caused by power lines.

However, anybody who lives in the modern world has widespread exposure to extremely low-frequency EMFs. This is the case whether or not they live near power lines.

Will EMFs be declared hazardous in future?

Those who have fears about EMFs worry that, in future, science will eventually discover they are hazardous.

They look at known carcinogens like tobacco and point out that it was once viewed as safe.

It is helpful to explore this comparison to provide further reassurance.

When there are concerns about a potential health hazard, scientists look for evidence across a variety of studies.

The link between cigarettes and lung cancer was first proposed in 1930s. This was when population studies first showed the clear parallel rise in cigarette consumption and lung cancer.

It took just 20 years to prove this cause and effect, using animal testing, cellular pathology and chemical analysis.

By the 1950s, the scientific case was proven. Over the following decade, health and government authorities started to act on this proof.

In comparison, electricity has been transmitted over lines since the start of the 1900s. Particularly in the UK and the USA, the high-voltage grid expanded hugely in the second half of that century.

There have been more than 100 years of power line use. There has also been over forty years of scientific research into low-level exposure to low frequency EMFs from all electrical sources, including power lines.

The WHO states: “Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals.”

There has been a very significant amount of historic exposure, and a very lengthy period of on-going and rigorous investigation.

Yet, there is no conclusive proof that EMFs from power lines are hazardous, nor to explain how they could cause harm.

Want to know more?

This leaflet is EirGrid’s summary on this topic. If you want to investigate further, here are some useful links to information on EMFs from national and international agencies.

International Commission on Non-Ionizing Radiation Protection: EMFs
http://bit.ly/ICNIRP_LF

International Commission on Non-Ionizing Radiation Protection: Power Lines
http://bit.ly/ICNIRP_Lines

World Health Organization
http://bit.ly/WHO_EMF

European Commission
http://bit.ly/EC_EMF

Irish Government
http://bit.ly/Ireland_EMF

UK Public Health England
http://bit.ly/UK_EMF

US National Institute of Environmental Health Services
http://bit.ly/NIEHS_EMF

EIRGRID

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Version 1.1 published in May 2019 Printed on recycled paper - please recycle

APPENDIX B

- Code of Practice For Avoiding Danger From Underground Services, Health & Safety Authority
- How You Can Avoid Hitting Electrical Cables When Digging and Drilling, ESB Networks

ESB NETWORKS

HOW YOU CAN AVOID HITTING ELECTRICAL CABLES WHEN DIGGING AND DRILLING

Plain English Approved by NALA

9800101

How you can avoid hitting electrical cables when digging and drilling

ESB Networks 2017

Revised 2021

Document Reference: DOC-190505-AJV

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ESB NETWORKS

Serving all electricity customers

DO YOU KNOW WHAT LIES BELOW?

Always dial before you dig

Avoid the dangers of underground electricity cables.
Contact us to get maps which show the locations of ESB Networks' underground cables.

PHONE: **1800 928 960**

EMAIL: **dig@esb.ie**

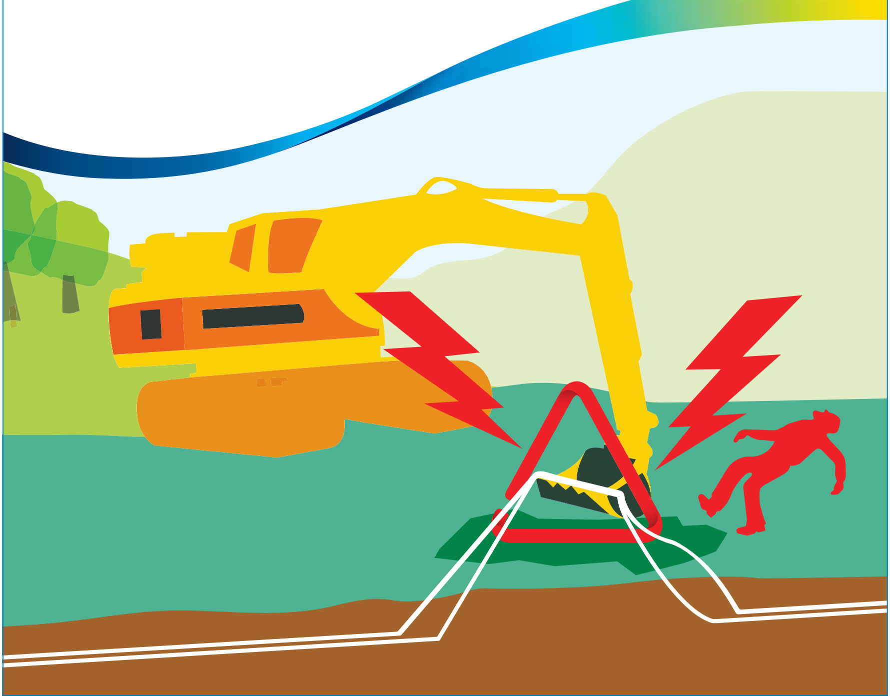
FAX: **01 6388169**

In case of emergency phone
1800 372 999 (24 HOUR/7 DAY SERVICE)

www.esbnetworks.ie

HEALTH AND SAFETY AUTHORITY

IMPORTANT: Please refer to the HSA "Code of Practice For Avoiding Danger From Underground Services" on how to safely carry out excavation work in the vicinity of underground cables. Available at www.hsa.ie



1. What type of work does this booklet apply to?

This booklet provides guidelines that apply to all work that involves penetrating the ground at or below surface level where there may be:

- buried ESB Networks cables; or
- privately owned cables like street lighting cables.

This includes:

- digging trenches to lay pipes or cables; and
- excavation (removing earth to change ground levels or dig a foundation for a house or other structure to be built).

It also includes trenchless techniques like:

- moling (where a machine (mole) forces its way through the soil along the desired path of the pipe),
- pipe ramming (where pipe soil can enter the open pipe when it is being installed),
- horizontal directional drilling (drilling that is precisely directed over a long path using different methods), and
- sheet piling (a wall of connected steel sheets that are driven into the ground to provide support to structures, prevent flooding and so on).

2. Examples of work

Digging trenches and excavation		
Using hand tools	Using a jackhammer	Mechanical excavator
		
Moling	Horizontal directional drilling; moling or pipe ramming	
		
Using a concrete saw	Driving earth-rods	Cutting into service ducts
		

3. What are the hazards of doing work near cables?

Underground cables

When digging or drilling, one of the main dangers is damaging underground electricity cables. You can get an electric shock or be electrocuted if you come in contact with live cables of any voltage including low voltage.

Low voltage cables can be fatal

Contact with cables of any voltage, even low voltage, can cause fatal injuries such as damage to the heart.

Explosion, fire or flames

If a cable is pierced or crushed causing the outer cable sheath and the inner conductors of the cable to connect, this can cause explosion, fire or flames. You could end up with severe and potentially fatal burns to your hands, face and body.

Catastrophic electrical fires

High voltage power cables can be oil filled and oil can ignite. Electrical fires can be catastrophic if damage spreads to other nearby services such as gas pipes. If a gas pipe ignites it can further fuel the fire.

4. Where can I find the legal requirements?

The legal requirements to ensure a safe place of work are set out in the:

- Safety Health and Welfare at Work Act;
- Safety Health and Welfare at Work Construction Regulations;
- Safety, Health and Welfare at Work (General Application) Regulations; and
- Health and Safety Authority (HSA) Code of Practice for Avoiding Danger from Underground Services

5. How can I ensure a safe system of work?

When working near underground cables there are steps to follow which can help you reduce the risk of having an accident. These steps are covered in detail in the 'Code of Practice for Avoiding Danger from Underground Services' produced by the Health and Safety Authority and available from www.hsa.ie.

In this section we describe the three main ways you can make sure that you will have a safe system of work. You must:

a. use plans correctly to help you locate power cables (see 5.1);

b. use cable locating devices (see 5.2); and

c. use safe digging and drilling practices (see 5.3).

These three practices complement each other. You should use all three to ensure that you do not contact or cause damage to a cable buried in the ground.

5.1 How do I use plans to locate power cables?

Before you start work, you must have all of the cable plans for the location. Make sure that they are always kept on site while work is under way.

You should make sure cable plans:

- are up-to-date;
- cover all cable voltages at the location; and
- can be understood by you.

You should also make sure that you use cable plans:

- before starting to dig; and
- throughout all of the work.

Understanding plans and maps

You should understand the scale of the plans and be able to read and understand the map legends, symbols and guideline notes. However, you should understand that plans may only give an indication of the location, configuration (how they are organised) and number of cables present. You cannot rely on plans for accurate distance measurement.

Assume there are more cables than you know about

Always assume that there are more buried cables present than you have located. You should understand that service cables (small cables which bring electricity to a building or lighting point) are not usually shown on cable plans. This includes things like low voltage cables serving individual premises or other electrical supplies like:

- lamp posts,
- parking ticket machines,
- bus shelters,
- advertising hoardings, and
- traffic lights.

You should always check the area for signs that might suggest the presence of service cables and use a cable locator and safe digging practice (see 5.3).

Depth of cables

Most cable plans will not show you cable depths so you must never assume you know how deep cables are. This means you must always be cautious.

Some cables may be found at very shallow depths.

5.2 Use cable locating devices to help find cables

You should use suitable cable-locating devices along with the cable plans to find out as accurately as possible the position of underground cables in or near the work area. You should be trained and able to use the cable-locating device to locate underground cables.

Hum detectors

Hum detectors are used to locate a cable buried in the ground. An example of a hum detector is a cable-locating device set on power mode. Hum detectors are the easiest cable-locating devices to use, but they do not respond to unloaded (where no current is flowing) or direct current (where the current flows only in one direction) cables.

Hum detectors may also fail to detect:

- lightly loaded low voltage cables (such as those used for street lighting); and
- high voltage power cables.

Radio frequency detection mode

A locator with a radio frequency detection mode may detect unloaded, lightly loaded, direct current and high voltage power cables. This means that you should use this for additional back-up checks. Even where a locating device does not give a positive reading there may still be cables present and these may still be live.

Mark cable position on the ground

You should make the position of all cables located on the ground using waterproof paint or crayon.

5.3 Safe digging and drilling practices

1.	**Proceed with caution**
	Treat all cables found anywhere as 'live'.
2.	**Hand dig when possible**
	• Wherever possible, hand dig near buried cables. • Use insulated hand tools with wooden or fibreglass handles.
3.	**Watch those picks and crowbars**
	Take special care using picks or insulated crowbars.
4.	**Protect yourself**
	Wear gloves and eye protection.
5.	**Keep handheld power tools away from cables**
	Do not use hand held power tools within 0.5m of marked position of electricity cables
6.	**Follow advice for handheld power tools over marked cable lines**
	Do not use handheld power tools directly over a marked line of a cable unless:

you have already found the cable at that position by careful hand digging beneath the surface;

and

it is a safe depth (at least 300mm) below the bottom of the surface to be broken; or

you have used a physical barrier to prevent the tool striking the cable.

7. Keep using the cable locator right throughout the project

- When the surface has been broken out, use a cable locator again to reconfirm the position of services.
- You should use the cable locator frequently and repeatedly during the work.

8. Mechanical excavators

- Before using a mechanical excavator near electricity cables, you should excavate trial holes by careful hand-digging.
- Confirm the depth of the cable(s) at the point of work.
- You should not operate the excavator within a radial distance of 300mm (300mm in any direction) from the cable or cables.
- When using a mechanical excavator near electricity cables keep everyone clear of the bucket and the excavator while it is digging.

9.	**Watch out for concrete**

Where an electric cable is embedded in concrete, arrange for the cable to be disconnected before breaking off concrete.

10.	**Protect exposed cables**

Where cables become exposed for any reason, you should take suitable precautions to prevent damage while other works are going ahead. For example, you could use physical ways to do this like using timber boarding or sand bags.

11.	**Leave exposed cables alone**

Do not use exposed electricity cables as a convenient step or hand-hold.

12.	**Don't move cables**

- Do not handle or try to alter the position of exposed ESB electricity cables unless under the instruction of an authorised ESB person.
- Take extreme care where joints in the cables have been exposed.

13.	**Damaged cables, gas pipes or high pressure water mains**

Watch out for even slight damage, like a scrape to the outer surface, to:

- electricity cables,
- gas pipes, or

• high pressure water mains.

If they are even slightly damaged, you should tell the owner of the property immediately. People should be kept well clear of the area until it has been made safe by the owner.

14. Keep contact numbers handy

You should have the 24-hour emergency contact number for ESB and other relevant utilities readily available for immediate contact if damage occurs to an:

- electricity cable,
- gas pipe, or
- high pressure water mains.

The ESB emergency telephone number for cable damages is 1800 372 999.

6. Diversion of underground cables

Contact ESB Networks as early as possible in the planning stage if you need to divert the underground network to make your construction work possible.

Cable diversions can take several months

Cable diversions can take several months due to things like:

- wayleave serving (sorting out the legal rights to access private land to install cables);

- road opening licence requirements; and
- ESB Networks workloads.

Sometimes, we cannot design a suitable cable diversion because there is no alternative route. Generally, it is significantly more costly and difficult to divert cables at the higher voltages.

7. What happens if you damage an underground cable?

Oil-filled cables

Some cables are filled with oil and if damaged, the oil may ignite leading to an explosion.

High voltage cables

Repairs to high voltage cables are extremely costly and time consuming. Costs can be more than €50,000.

Low voltage cables

Low voltage cables are unsafe to handle and can cause injury and electrocution. They are not safer than other voltages.

Loss of electricity supply

Damage to cables can cause loss of supply to customers. This may result in serious consequences for emergency services like hospitals.

National Grid at risk

For higher voltages the effects can extend to the entire national electricity grid.

Person responsible for damage must pay all costs

All costs associated with damage to cables must be borne by the party who did the damage.

8. What to do if someone is injured

Serious accident

If there is a serious accident, seek medical help immediately.

Contact the emergency services on:

- 112; or
- 999.

You should also phone the ESB Networks Emergency number:

- 1800 372 999.

Do not approach person until clear

Do not approach the injured person unless:

- they are well clear of the electrical hazard; or
- the electricity supply is confirmed to be **Off** by an ESB Networks authorised person.

Do not move the injured person unless they are in further danger

You should not move an injured person unless they are in further immediate danger.

Be cautious when attending a casualty

Anyone attending a casualty should be sure not to touch exposed cables, tools or machinery in case they are still live.

Guard the site

Guard the site so that other people do not enter the danger area.

Treat burns urgently

Any burns should be treated by trained medical staff and severe burns should receive urgent attention as they may prove fatal.

Have a first aid kit

A first aid kit should always be available.

9. Further safety information

ESB Networks provide a range of safety information on our website:

- www.esbnetworks.ie.

You can download free PDF versions of safety booklets and posters at: www.esbnetworks.ie

Our booklets

- Avoidance of electrical hazards when working near overhead electric lines
- How you can avoid hitting electrical cables when digging or drilling
- Construction Safety.
- Be Winter Ready.
- Farm Safely with Electricity.
- ESB Networks Electrical and Magnetic Fields.
- Consequences of Flooding for Electrical Safety.
- How you can avoid hitting electrical cables when digging or drilling

You can see our safety videos on our website

www.esbnetworks.ie

10. Useful contacts

How to contact ESB Networks

ESB Network's emergency number	1800 372 999
ESB Network's general queries number	1800 372 757

Use this general number to find about:

- new electricity connections;
- increased capacity;
- voltage enquiries; and
- safety and technical queries.

ESB Network's website	www.esbnetworks.ie

For cable maps and records

To get power cable maps or records:

Email us at:	dig@esb.ie;
Phone us at:	1800 928 960 +353 1 858 2060 This service operates Monday to Friday only.
Fax us at	01-638 8169
Write to us at:	ESB Networks Central Site, St Margaret's Road, Finglas, Dublin 11.

When applying to us for power cable maps or records, you should include:

- a map of the area where work is to take place;
- a contact name and phone number; and
- the email address where the information is to be sent.

Note: We will send maps to you by email within 10 days in PDF format.

How to contact the Health and Safety Authority (HSA)

Phone or website

- Phone: 01-614 7000
- Website: www.hsa.ie

Address

You can write to the HSA at:

HSA

The Metropolitan Building

James Joyce Street

Dublin 1

D01 K0Y8.

ESB Networks Emergency Number:

Phone 1800 372 999

(24 hour / 7 day service)

www.esbnetworks.ie

NETWORKS

HEALTH AND SAFETY AUTHORITY

Code of Practice For Avoiding Danger From Underground Services

Our vision:
Healthy, safe and
productive lives.

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Originally published in January 2010 by the Health and Safety Authority, updated in May 2016, The Metropolitan Building, James Joyce Street, Dublin 1.

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Foreword

The Health and Safety Authority, with the consent of Mr Gerald Nash TD, Minister of State for Business and Employment, publishes this amended Code of Practice, titled "*Code of Practice for Avoiding Danger from Underground Services*", in accordance with Section 60 of the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005).

The aim of the code of practice is to improve the level of safety with which excavation work, and other work involving underground services, is carried out. In particular, it aims to reduce the incidence of damage to underground services and in doing so to minimise risk to personnel who are involved in this work.

The code of practice provides practical guidance as to the observance of Part 5 of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (SI No. 291 of 2013) which, inter alia, requires that adequate precautions are taken in any excavation, shaft, earthwork, underground works or tunnel to avoid risk to persons at work arising from possible underground dangers. Such dangers include underground cables or other distribution systems, the circulation of fluids and the presence of pockets of gas, and appropriate investigations to locate them must be undertaken before excavation begins. The Code of Practice also provides practical guidance as to the observance of Sections 19 and 20 of the Safety, Health and Welfare at Work Act 2005 in respect of relevant excavation work.

This amended code of practice comes into effect on Monday 30th May, 2016, and replaces the "Code of Practice for Avoiding Danger from Underground Services" issued by the Authority on 11 January, 2010. Notice of the issue of this amended code of practice, and revocation of the 2010 code of practice, was published in the Iris Oifigiúil on Friday 27th May, 2016.

As regards the use of codes of practice in criminal proceedings, section 61 of the Safety, Health and Welfare at Work Act 2005 provides as follows:

61.– (1) Where in proceedings for an offence under this Act relating to an alleged contravention of any requirement or prohibition imposed by or under a relevant statutory provision being a provision for which a code of practice had been published or approved by the Authority under section 60 at the time of the alleged contravention, [subsection (2) shall have effect with respect to that code of practice in relation to those proceedings.

(2) (a) Where a code of practice referred to in subsection (1) appears to the court to give practical guidance as to the observance of the requirement or prohibition alleged to have been contravened, the code of practice shall be admissible in evidence.

(2) (b) Where it is proved that any act or omission of the defendant alleged to constitute the contravention—

(i) is a failure to observe a code of practice referred to in subsection (1), or

(ii) is a compliance with that code of practice, then such failure or compliance is admissible in evidence.

(3) A document bearing the seal of the Authority and purporting to be a code of practice or part of a code of practice published or approved of by the Authority under this section shall be admissible as evidence in any proceedings under this Act.

Dr. Marie Dalton
Secretary to the Board
Health and Safety Authority

1.0 Introduction

1.1 Background

This Code of Practice (COP) replaces the Code of Practice for Avoiding Danger from Underground Services issued by the Authority in 2010 and is the result of a joint initiative between the Health and Safety Authority, Construction Industry Federation, Irish Congress of Trade Unions, key utility companies/service providers and local authorities that are involved in the provision and maintenance of vital underground services. This COP takes into account legislative changes in the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013.

The aim of this COP is to improve the level of safety with which excavation work is carried out. In particular, it aims to reduce the incidence of damage to underground services and in doing so to minimise risk to personnel who carry out this work.

1.2 Status of the Code of Practice

This COP is published by the Health and Safety Authority under Section 60 of the Safety, Health and Welfare at Work Act 2005 and with the consent of the Minister of State at the Department of Jobs, Enterprise and Innovation.

This COP is intended to provide practical guidance to utility/service providers, clients, designers, planners, project supervisors (both design process and construction stage), contractors, safety representatives and any personnel who are involved in work where there is a risk from underground services.

A failure to observe any part of this COP will not in itself render a person liable to civil or criminal proceedings. However, where the COP gives practical guidance on the observance of any of the relevant statutory provisions, compliance or non-compliance with those provisions may be admissible as evidence in criminal proceedings. The requirements of this COP are without prejudice to the general obligations placed on employers and others by the current Safety, Health and Welfare at Work Act, Construction Regulations and other associated occupational safety, health and welfare legislation.

1.3 Scope of the Code of Practice

This COP gives recommendations and practical guidance on how to carry out excavation work safely in the vicinity of underground services. In this context 'excavation' means any work that involves penetrating the ground at or below surface level.

Excavation carried out in the vicinity of underground services includes work associated with a new or existing building that may involve the risk of damaging underground services. It encompasses all excavation work carried out on roadways, streets, footpaths and other open areas where there is a likelihood of buried underground services.

This COP also contains guidance on how to prevent future damage to services that are currently being installed.

2.0 General

2.1 Introduction

Electricity cables, gas pipes, water pipes and sewers, if damaged, may pose a direct danger to personnel who are working on the site. Damaged telecommunications cables may also be hazardous, although direct risk of personal injury is rare.

If an electricity cable, telecommunications cable, gas pipeline or water main suffers any impact or any damage, however slight, the incident must be reported to the network operator without any undue delay. Refer to Appendix 5, item 12.

2.2 Electricity cables

Injuries that result from damage to live electricity cables are usually caused by the explosive effects of arcing current and by any associated fire or flames that may follow when the sheath of a cable and the conductor insulation are penetrated by a sharp object such as the point of a tool, or when a cable is crushed severely enough to cause internal contact between the sheathing and one or more of the conductors. Typically, this causes severe and potentially fatal burns to the hands, face and body.

Some high-voltage electricity cables (e.g. 38kV and higher voltage) are filled with oil and, if damaged, the oil may auto-ignite and create an explosion or fire. Injuries may also be caused by the explosive effects of cable materials being vaporised by large currents. There is also a risk of electric shock when underground services are damaged.

Incidents may also arise from cables that have been damaged, but have not been reported to the relevant utility/service provider and, therefore, have not been repaired. In such circumstances nearby services such as plastic gas pipes may be at risk from damaged live electricity cables, which could create explosions or increase the risk of fire.

2.3 Gas pipes

Damage to gas pipes can cause leaks and may lead to high-pressure gas being released, with associated flying debris, noise, fires or explosions. There are two types of damage:

- Damage that causes an immediate leak following a pipe rupture. Those most likely to be at risk are the personnel carrying out the work and others in the immediate vicinity.

- Damage that causes a leak some time after the event. For example, damage to a pipe wrapping or surface may occur while work is being carried out and this damage may lead to a leak at a later date. Damage may also occur after the work has been carried out. For example, poor reinstatement may leave a pipe inadequately supported or subjected to unequal forces. Those most likely to be at risk are members of the public.

Refer to Section 10 and Appendix 2 for requirements.

2.4 Water pipes and sewers

While damaged water pipes are less likely to cause an injury, a jet of water emanating from a high-pressure main could injure people or damage adjacent underground services. In addition, a water leak from an underground pipe could wash away subsoil, thereby reducing support for adjacent services, roads and structures. There is also a risk of flooding trenches or low-lying areas such as nearby basements.

Sewers are generally gravity fed, but some sewage is pumped at pressure. While the main risk to people associated with damage to sewers is the possibility of contamination, these pipes may also emit gases such as methane or hydrogen sulphide. At certain concentrations, methane may be flammable.

Water mains and sewers require ongoing maintenance to ensure that they function effectively; clear access should always be maintained to pipes, especially near flanges, valves, manholes etc. The laying of gas pipes or electricity cables in parallel above or in immediate proximity to a water main or sewer substantially increases the risk of injury to the crews who may have to carry out subsequent maintenance tasks.

2.5 Telecommunications cables

Although damage to telecommunications cables may be very expensive, generally there is no direct risk of personal injury. However, damage to cables can pose a risk to the general population served by these cables. A breakdown in service can result in isolation from essential services such as fire brigade, ambulance and gardaí. Therefore, it is imperative that all precautions necessary are taken to avoid damaging telecommunications cables. If damage does occur, it must be communicated to the utility/service provider without delay. In case of damage to a fibre optic cable, it is advised that an individual should never look into either end of a severed fibre optic cable as laser light might damage eyesight.

2.6 Accumulation of gases

Flammable and toxic gases from sewers and other services may enter and accumulate in service ducts, particularly if ducts have been damaged. Such gases may also accumulate in chambers and manholes and may pose a risk to personnel who are carrying out work in these areas. The gas may also be transported in these ducts to nearby structures where the risk of explosion may be even greater.

> Where entry into a confined space is necessary, the requirements identified in the Confined Space Code of Practice must be complied with.

3.0 Role of the client

3.1 Introduction

Clients play a very important role when it comes to safety and health on construction projects. The Safety, Health and Welfare at Work (Construction) Regulations 2013 define a 'client' as a person for whom a project is carried out.

The Construction Regulations place duties on the client. Clients must make assessments and only appoint competent designers or contractors for the works. If the construction project involves more than one contractor, has a particular risk or will last longer than 30days/500 person days they must appoint a competent project supervisor design process (PSDP) and a competent project supervisor construction stage (PSCS). Project supervisors co-ordinate the management of health and safety with regard to the design and construction of the project.

Clients have a legal duty to be reasonably satisfied that the appointed project supervisors to carry out the work are competent to do so and will dedicate sufficient resources to the project to comply with their legal safety obligations.

3.2 Information from clients

Clients or their agents have a duty to pass on any relevant information relating to underground services that may be in their possession to the PSDP or the PSCS. This information should be as up to date as possible. The client should also make available a copy of any Safety File that is relevant to the construction work that is about to be undertaken.

3.3 Other duties that may apply

In accordance with Section 15 of the Safety, Health and Welfare at Work Act 2005, it is the duty of each person (or company) who has control to any extent of any place of work, or any part of a place of work, to take such measures as are reasonable for them to take to ensure, so far as is reasonably practicable, that the place of work is safe and without risk to health. In certain cases, this provision may be applicable to clients who commission projects that will involve carrying out excavation work near underground services.

Section 17 of the 2005 Act specifies duties to be complied with by persons who commission or procure construction work. Such persons must appoint in writing a competent person or persons to ensure, so far as is reasonably practicable, that the project is designed and is capable of being constructed to be safe and without risk to health.

4.0 Design process roles

4.1 Definition of designer

'Design' covers the preparation of drawings, design details, specifications and bills of quantities. A 'designer' is defined as any person who is involved in such work.

4.2 Project supervisor design process

All designers' work should be co-ordinated by a project supervisor for the design process (PSDP). The PSDP has a duty to prepare and provide to the project supervisor for the construction stage (PSCS) a preliminary safety and health plan if the project is expected to last more than 30 days or 500 person days, or if it contains a 'particular risk', as defined in the Safety, Health and Welfare at Work (Construction) Regulations 2013. One such 'particular risk' is working near high-voltage power lines (i.e. voltages greater than 1.0 kV), including overhead lines and underground cables.

The preliminary safety and health plan must contain an overall description of the project, its proposed timescale and appropriate information relating to other work on the site. It must also specify any work related to the project that will involve 'particular risks'.

Unforeseen circumstances may arise during the execution of the project and may result in a design change. This may in turn have safety, health and welfare implications. The PSDP has a duty to co-ordinate the designers in relation to the safety, health and welfare implications of any change in the original design.

The PSDP must prepare a Safety File for the project and present it to the client when the project is complete.

Where new services are being laid it is important that they do not prevent access to existing services. Any risk to crews carrying out maintenance on the existing services caused by the laying of new services must be identified at an early stage and minimised as far as is reasonably practicable.

The Principles of Prevention must be applied at all stages of the design process.

4.3 Use of plans during design

Where possible, the designers should obtain up-to-date maps and records of all potentially hazardous underground services in order to allow them to consider, at the design stage, the risks posed by those services. Plans and maps should be made available to prospective contractors at tender stage or contract negotiation stage. Before beginning any work on a site, the contractor should be satisfied that the drawings supplied contain the most up-to-date information available for the area in which the works are to be carried out.

4.4 Underground services and building work

4.4.1 Relocating underground services some distance away from the proposed construction site may provide a reasonably practicable means of avoiding the risk of causing damage to these services. Any request for the relocation of services should allow for sufficient time for the relevant utility/service providers to evaluate such proposals and carry out their work.

Buildings and other permanent structures should not be erected over underground services because this may create additional risks for construction workers and could prevent future access to those services. If it is not possible to avoid erecting a structure over an underground service, arrangements should be made with the relevant utility/service provider to relocate the service if this is practicable.

4.4.2 Other options to relocating the services may include:

- Repositioning structures or parts of structures to ensure that contact with underground services is avoided while the work is being carried out.
- Arranging for the supply contained within the underground services to be disconnected during the work.
- If neither of these options is practicable, then choosing methods to avoid contact, such as using ground beams to protect the service(s), may present a reasonably practicable option.

4.4.3 Designers should take into account any ancillary work that may be required, including the erection of perimeter fencing and walls or the construction of roadways. Early identification and planning are essential if risks are to be controlled.

4.4.4 Where new services such as electrical or gas supplies are being installed, it may be possible to reduce risks by not installing or commissioning these services until other ground works and installation works have been completed.

4.5 Underground services in paths and roadways

4.5. The options facing designers who are planning a new service in a roadway may be more limited. In order to select a route that avoids contact with existing services, it is important to have access to the most up-to-date information about those services. One option is to choose a route that has a low density of underground services. For example, a cable television duct might be routed at the side of a road, if that site has a reduced cable density. Designers of gas pipelines should also be aware of the requirements contained in IS 328:2003 Code of Practice for Gas Transmission Pipelines; IS 265:2000 Installation of Gas Service Pipes and I.S. 329:2003+A1:2009 Code of Practice for Gas Distribution Mains.

4.5.2 Having reduced the risks to a level as low as is reasonably practicable by design, information should be provided by the designer(s) about the risks that remain. In most cases the best way of informing those physically excavating in the vicinity of underground services is by providing the information on drawings, ensuring that the information given is the best available.

5.0 Construction stage roles

5.1 Project supervisor construction stage

The role of a project supervisor construction stage (PSCS) is to co-ordinate the project from a health and safety perspective. The PSCS must also develop the safety and health plan, which should outline how the management of the safety, health and welfare of on-site personnel is to be achieved. In addition, the PSCS must facilitate safe access to the site and co-ordinate the overall implementation of safe working procedures.

5.2 The contractor

All contractors on site must co-operate with the PSCS to allow the PSCS to comply with his or her statutory obligations and all contractors have a duty to co-operate with each other on issues concerning health and safety. The contractor must also supply accurate information in a timely fashion to the PSCS to allow for the preparation of the Safety File.

Contractors must carry out a site-specific risk assessment. They should also ensure that their employees have adequate training and that any plant or machinery is, so far as is reasonably practicable, safe and does not pose a risk to health. Contractors should also put in place measures to ensure that the health and safety of personnel employed by them will not be adversely affected by the work being carried out.

Sections 6 to 13 of this COP set out practical measures for protecting the safety, health and welfare of employees and non-employees while excavation work is being carried out in the vicinity of underground services.

5.3 Utility/service providers

All undertakings that have underground services should ensure that their records and maps are maintained as accurately as possible. They should make these records readily available to designers and contractors, as appropriate (see Section 7.3).

In circumstances where a utility/service provider is asked to provide permanent services for a building development, that company will be acting in the role of contractor. Therefore, while it is on site, it will be required to comply with any directions given by the PSCS. However, in circumstances where the provision of services is physically separated and demarcated from the site, then the utility company may assume the role of client for the purposes of the Safety, Health and Welfare at Work (Construction) Regulations 2013.

The utility/service providers should make all reasonable efforts to facilitate clients, designers and contractors to manage the safety risks arising from work activities close to underground services.

5.4 Employees

Safe systems of work must always be adhered to. All workers on site must take reasonable care to protect their own safety and the safety of others who might be affected by their actions. They must not engage in any behaviour likely to endanger health and safety on site. They should report without delay any defects in the safety and health regime that might endanger anyone in the workplace.

Employees must also attend training and assessments as might reasonably be prescribed by their employers with regard to health and safety and they must not misrepresent the level of training which they have attended.

6.0 Safe system of work

6.1 Introduction

Underground utility networks are a common feature in both rural and urban areas and their presence should be assumed until proved otherwise. The guidance given in this COP aims to minimise the risk involved in work that may expose persons to inadvertent contact with underground networks. It sets out a safe system of work that is based on obtaining as much information as possible about buried services before excavation or other ground penetration work begins and using that information to ensure that the work is carried out safely.

6.2 Basic elements

In the context of this COP, a safe system of work is defined as having three basic elements:

- **Plans:** Plans or other suitable information about all buried services in the area should be obtained before excavation work begins (see Section 4 and Section 7.4). This material should be passed on as early as is reasonably practicable by the designer through the project supervisors to the contractor who is tendering for, or is negotiating the carrying out of, the works.

  Plans that were used at the design stage and at the tendering stage may be out of date by the time excavation work begins. Therefore, before beginning any such work, the contractor should check that the plans supplied are the most up to date available.

  Account should also be taken of possible indications of the existence of underground services such as the presence of houses or other buildings, lamp posts, illuminated traffic signs, pit covers or evidence of reinstated trenches. However, the absence of such indicators does not necessarily mean that underground services do not exist.

- **Locators:** Suitable cable- and pipe-locating devices should be used in conjunction with any available plans to determine as accurately as possible the position of metallic underground services in or near the proposed work area. It should be noted, however, that these devices do not detect plastic pipes (see Section 8).

- **Safe digging practices:** Excavation work should be carried out carefully and should follow recognised safe digging practices (see Section 9).

These key elements – plans, locators and safe digging practices – complement each other and all three should be used when working near buried services. Using one element alone is not enough.

6.3 Employees

Employees should receive adequate instruction and training in the above procedures (see Section 14). A suggested job aid for workers' information is set out in Appendix 5. It is particularly important that anyone who is using a locator should have received thorough training in the use and limitations of that particular type or model of device. Most manufacturers will provide such training, and employers should ensure that this is adequate for their employees' needs.

Under the Safety, Health and Welfare at Work (Construction) Regulations 2013 persons carrying out certain named tasks – including locating underground services, signing, lighting and guarding on roads and assisting in the implementation of health and safety at roadworks – are required to be in possession of a relevant and valid Construction Skills Certification Scheme (CSCS) card. Training and instruction requirements are dealt with in Section 14.

6.4 Procedures

The organisation and arrangements necessary for avoiding danger from underground services should form part of employers' statutory Safety Statements. Written, site-specific risk assessments of the work being undertaken should be carried out and may include the appropriate use of the relevant Safe System of Work Plans (SSWP).

7.0 Use of plans in the preparation of projects

7.1 Introduction

Up-to-date plans of all potentially hazardous underground services in the area should be obtained before excavation work begins. Where possible, providers of all relevant underground services should be consulted. It should be noted that there may be more than one service provider in a particular catchment area for certain types of utility. For example, while most electricity cables under roads and other public areas are owned by ESB Networks, many electricity cables are the property of local authorities and are used for providing services such as public lighting, traffic lights and so on.

7.2 Emergency works

In the case of emergency* works it may not be possible to obtain all requisite up-to-date plans prior to beginning excavation work. In such situations, all other aspects of safe digging practice should be complied with (see Section 9) and the work should be carried out in the same manner as if there were underground services on the site.

7.3 Availability of plans from utility/service providers

7.3.1 Utility/service providers should make available either up-to-date, readable plans that show the recorded line and depth (where known) of all underground services in the proposed work area, or they should provide other suitable information that achieves the same objective. The inclusion of a symbol key will generally be necessary to help the recipient understand the plans.

7.3.2 Utility/service providers should do everything that is reasonably practicable to ensure that such information is made available to enquirers. They are likely to receive many routine applications for information and they should consider how best to make this information available at short notice. In cases where utility/service providers have reservations about releasing copies of plans for commercial or security reasons, they should offer an alternative method of co-operation. For example, they might send a representative to the site to communicate the requisite information to designated contractor personnel only.

7.4 Use and limitation of plans

Plans vary in scale, content and style and adequate instruction and training in how to read and interpret them should be given to anyone who needs to use them.

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* If the question arises in criminal or civil proceedings as to whether works were emergency works, it is for the person alleging that they were to prove that this was the case. Clients and contractors should not use ‘emergency’ work as an excuse to justify a failure to plan properly when starting work without plans or other suitable information about underground services in the area.

Plans may give an indication of the location, configuration and number of underground services on a particular site. However, they are rarely drawn accurately to scale and, even if they claim to be accurate, they should not be relied upon in order to obtain accurate distance measurements. Errors may have been made during drafting or the scale may have been altered during reproduction, particularly if the original data was obtained from a microfiche slide or a digital map. Accuracy may be further limited because:

- Use of low-scale maps may not give a reasonable indication of location or configuration of underground services. Where possible use 1:500 in preference to 1:1000.
- The position of reference points (e.g. the kerb line) may have changed since the plans were prepared.
- The re-grading of a particular surface area may mean that the depths shown on the plan are no longer correct.
- Fixtures such as cables may have been moved without the knowledge of the utility/service provider.
- In many cases service connections are not marked.
- Services that appear as straight lines on a map may, in fact, be laid out in a snake-like formation; excessively long cables may have been laid in horizontal loops outside substations and switch rooms.
- Plans may show spare ducts.
- The routes of older services in particular may not have been recorded and so the absence of records should never be taken as proof that the area in question is free of underground services.

To determine the actual position of services and the depth of these services on site, safe digging practices must be used at all times. Such practices include the use of detection equipment and the hand digging of trial holes as required. See Section 9.

8.0 Cable- and pipe-locating devices

8.1 Position of services

The position of any services in or near the proposed work area should be pinpointed as accurately as possible by means of a locating device. This device should be used in conjunction with plans and other relevant information (see Section 8.2) as a guide to the possible location of services and to help interpret the signal.

8.2 Types of locating devices

The main types of locator available are:

- **Hum detectors:** (e.g. a cable-locating device set on power mode) are receiving instruments that detect the electromagnetic field radiated by live electricity cables, which have a current flowing through them. However, these instruments will not detect service connection cables to unoccupied premises or street lighting cables during the daytime, as little or no current will be flowing through those cables at that time. They may also fail to detect some well-balanced high-voltage cables that generate little magnetic field. It should be noted that the absence of current in a live cable does not in any way alter the risk of injury to a person if the cable is damaged.

- **Radio frequency detectors:** (e.g. a cable-locating device set on radio mode) are receiving instruments that respond to low-frequency radio signals, which may be picked up and re-emitted by cables and long metallic pipes. If radio frequency detection is used, other metallic objects may re-radiate the signal and results may vary appreciably according to locality, length of the buried cable or pipe, distance from the termination and geographical orientation.

- **Transmitter-receiver instruments:** With these instruments a small portable transmitter or signal generator is connected to a cable or pipe, or placed very close to it, so that the signal is induced into it. The receiver then detects that signal. Usually, some part of the cable or pipe will need to have been located in advance of the operation in order to ensure that the transmitter is positioned correctly. Transmitter-receiver instruments generally require more skill to operate than other types of locators. They may, however, provide useful information in difficult situations where using other locator equipment has not proved successful. In addition, they can provide a depth-measuring facility.

- **Metal detectors:** Conventional metal detectors will usually locate flat metal covers, joint boxes and so on, but may well miss round cables or pipes. They can be a useful tool for finding inspection points, which may provide connection points for a transmitter for use of transmitter-receiver instruments.

- **Ground-penetrating radar:** Such devices are capable of detecting anomalies in the ground, which may indicate the presence of an underground service. However, the sole use of this method would not determine the precise nature of the service and it should be used in conjunction with maps and other information about the services and ground conditions present. It is also preferable that this technique is used together with more conventional forms of locating device.

Most commercially available instruments use more than one of these techniques and may also include a depth-measuring facility.

8.3 Locating the service

The degree of confidence with which buried services may be detected depends on a number of factors such as the characteristics of the devices being used; the type and depth of the service; the magnitude of any electric current carried by the service cable; the effects of other cables and metal pipes close by; and the training, skill, hearing and experience of the operator.

A locator may not be able to distinguish between cables or pipes running close together and may represent them as a single signal. If two cables or pipes are sited one above the other, it may not detect the lower one. For that reason, frequent and repeated use of the locator should be made during the course of the work.

A locator may not detect plastic pipes or other non-metallic ducts and services unless:

- A metallic tracer wire has been laid with the pipe, which enables a signal transmitter-receiver to be used. Plastic gas, water, sewage pipes and fibre optic cables are the most likely type of non-metallic services to be encountered and some of these may have been laid with metallic tracer wires.

- A small signal transmitter is inserted into and then pushed along the pipe. This is a sophisticated technique and is not likely to be appropriate for many sites.

A locating device should always be used in accordance with the manufacturer's instructions, including being calibrated at regular intervals and not being used outside the specified date. A locating device should be checked regularly and maintained in good working order.

The line of any identified services should be noted and marked with waterproof crayon, chalk or paint on paved surfaces. Any residual markings should be erased after excavation, as far as possible.

On grassed or unsurfaced areas, wooden pegs should be used. Steel pins, spikes or long pegs, which could damage services laid at shallow depth, should not be used.

Under the Safety, Health and Welfare at Work (Construction) Regulations 2013, persons carrying out the task of locating underground services are required to be in possession of a Construction Skills Certification Scheme (CSCS) card. This is dealt with in more detail in Section 14.6.

9.0 Safe digging practices

9.1 Excavating

Once plans and a locator device have been used to determine the position of underground services, excavation may proceed. This work should be carried out carefully, following recognised safe digging practices.

Trial holes should be dug using hand tools to confirm the position of any buried services. Special care should be taken when digging above or close to the assumed lines of any such services. Hand-held power tools are the main source of danger to personnel and they should not be used too close to underground services. (See Appendices 1 and 2 for advice on appropriate safety margins for electricity cables and gas pipelines respectively.)

Hand tools, incorrectly used, are a common cause of accidents. However, if they are used carefully and if the approximate position of services has been determined through the use of plans and locators, these tools may provide a satisfactory method for exposing underground services. Every effort should be made to excavate alongside the service rather than directly above it. Final exposure of the service by horizontal digging is recommended as the force applied to hand tools may be controlled more effectively.

In particular:

- Spades and shovels should be used rather than other tools. They should not be thrown, or spiked into the ground. Rather, they should be eased in with gentle foot pressure.

- Picks, pins or forks may be used with care to free lumps of stone and other materials and to break up hard layers.

- Picks should not be used in soft clay or other soft soils in areas close to buried services.

Particular care should be taken in cases where gas leak search techniques, such as barholing, are used. Refer to Bord Gáis guidance material for advice. Similar precautions should apply when piles or earth rods are being driven into the ground.

Alternative excavation methods such as hydro or air digging tools and vacuum excavation may be used in certain circumstances. However, a detailed, site-specific risk assessment will need to be carried out first to estimate the specific risks associated with the use of these techniques, such as the presence of gas, spark ignition and injuries from ejected soil.

9.2 Damaged services

If an underground service suffers damage, no matter how slight, the utility/service provider should be informed immediately.

In the case of electricity cables, gas pipes, fibre optic telecommunications cables or high-pressure water mains, arrangements should be made to keep personnel well clear of the area until the damage has been repaired or otherwise made safe by the utility/service provider.

9.3 Identification of services

Failure to identify underground services correctly can cause accidents. Correct identification may prove difficult as the utility/service providers may have used a wide variety of materials and colours over a number of years. It is important to remember that colours may appear differently under poor or artificial lighting. In addition, ducts may well contain any one of a number of services, irrespective of the type or colour of the duct.

Some services are very similar in appearance and the following approaches should be adopted until such time as their identity has been positively confirmed:

- The housing for some water pipes and a significant proportion of electricity cables and telecommunications cables are made from black plastic. If a black plastic-covered service is encountered, it should be assumed to be a live electricity cable until proved otherwise. A small percentage of directly buried electricity cables are red in colour, these should not be mistaken for red-coloured electricity cable ducting.

- Iron and steel water pipes may look very similar to gas pipes. Therefore, if any iron or steel pipe is uncovered, it should be handled as if it is a gas pipe.

- Some services run in ducts, which may make these services difficult to identify. Where red ducts are uncovered, the services inside those ducts are likely to be electricity cables of modern installation and they should be treated as such. Where yellow ducts are uncovered, they are likely to be gas pipes and should be treated as such. Black and orange ducts have been used as standard colours for electricity cables in the past and they should be handled as if they contain electricity cables.

- Electricity cables may also be installed in concrete pipes, steel pipes and in plastic ducts in a range of colours. Where there is any doubt about the identity of an exposed service, it should be treated as if it is an electricity cable or gas pipe until proved otherwise.

- Telecommunications cables may be installed in concrete pipes, smooth black ducting or grey corrugated ducting. All cables should be assumed to be live until disconnected and proved to be safe. Contractors should obtain written confirmation of disconnection from the utility/service provider before removing a redundant service or arrange for the utility/service provider to remove the service.

All new buried plastic piping should meet the requirements of Irish Standard (IS) 370:2007 for new installations (see Appendix 6). For example, new ducts installed since 2005 for electricity cables (where the voltage exceeds 125V) should be coloured red. See also Appendix 1 for other relevant specification details.

While colour coding is intended to give an indication of which service is contained within the buried plastic piping, caution must be exercised until the precise nature of the service has being confirmed.

9.4 Support to exposed services

Services uncovered in an excavation may need to be supported and should never be used as handholds or footholds by personnel when climbing out of an excavation.

9.5 Back-filling

Back-filling of any excavation should be carried out carefully. Warning tiles, bricks, tapes and any other protective materials that are lying above the services should be replaced in their original position unless an expert adviser confirms that the original position was incorrect. If the original position turns out to have been incorrect, then the warning tiles and other materials should be placed above the services to which they refer.

Warning tape should not be used for any other purpose (such as guarding an excavation trench) and waste tape should not be left in the excavation area when it is back-filled.

Fill material that contains items such as large pieces of rock and hardcore should not be used as this could cause damage to the services.

For specific advice on back-filling in the vicinity of gas pipes (i.e. where long-term damage is a particular hazard) see Appendix 2. Alternatively, utility/service providers may provide direction and advice on how to back-fill trenches in which their services have been exposed.

9.6 Burial of existing services

If underground services have been found to be too shallow, or if the plans or other information have proved to be inaccurate, the relevant utility/service provider should be informed – preferably before the excavation is back-filled. The utility/service provider should then amend its records accordingly.

9.7 Protection against burns

Burns are the main injuries that result from damage to live electricity cables, or from fire or explosion following a gas leak. Burns are likely to be most severe where skin is not covered and therefore, based on a site-specific risk assessment, appropriate skin cover for hands, arms, legs and upper body should be used.

The wearing of protective clothing should never be used as a substitute for a safe system of work.

9.8 Insulated digging tools

Where excavation work is being carried out near live cables, the use of insulated tools is strongly recommended. Generally, tools such as shovels, spades or picks should have insulated fibreglass or wooden handles. Fibreglass crowbars are also available and these should be used where feasible. If this is not feasible, then the crowbars should be fitted with insulated handles.

10.0 Safe systems of work for trenchless methods

Increasingly, trenchless methods are being used for the laying or renovation of underground pipes and cables, particularly in cases where it is necessary to avoid disturbing surface areas. The most widely used techniques are impact-moling, pipe-bursting and auger-boring. Care should be taken when using trenchless methods to avoid colliding with, and thereby damaging, other services. With moling and pipe-bursting it is also important not to work too close to other services as displaced soil may escape into nearby pipes or ducts.

As moling takes place underground, the actual path taken is unseen and not guaranteed, the pertinent risks associated with moling must be taken into account at both the design and construction stages. Possible damage using trenchless methods includes damage to structures and damage to other services.

Consideration must be given to the location of all services present and may involve appropriate consultation with the relevant utility/service providers. Competent planning, organisation and implementation will be required before and during trenchless works. The recommendations for safe digging practices outlined in Section 9 must be referred to.

Plans, locators and trial holes should be used to determine the position of existing services. The path of the equipment to be used should then be calculated accordingly. In order to avoid danger and allow sufficient clearance for the maintenance of existing services, the general guideline is that the minimum clearance between adjacent services should be either 300mm or one and a half times the diameter of the pipe being laid, whichever is the greater. For electricity cables, gas mains, telecommunications cables and water mains, clearances for maintenance work should be a minimum 300mm in all directions. Trenchless methods (moling/directional drilling) must not take place within ten metres of a gas pipeline unless the gas network operator has been consulted.

In certain circumstances, clearances may need to be varied. Therefore, contractors should take into account factors such as the construction of adjacent plant; ground conditions; bore diameter; the accuracy and reliability of the technique/equipment being used; and whether the other plant is parallel or crossing the proposed line. In addition, the requirements of nearby utility/service providers may need to be taken into account.

Moles are prone to deflection from their planned course and, if there are existing services in the vicinity, a mole-tracking device should be used. Where trenchless methods are being used, all equipment which is electrically bonded to the mole should be earthed at all times in case the equipment strikes a power cable and this causes it to become live. As an additional precaution, an equipotential mat can be used for the operator to stand on.

The use of no-dig technology carries its own risks. Several recorded examples exist where, unknown to the installing contractor, a new service such as a gas main had been pushed through a sewer pipe, resulting in a blockage in the sewer pipe. The subsequent use of clearing techniques such as jetting machines by the sewer maintenance teams put these crews at risk when they unknowingly cut through the gas pipe.

11.0 New housing developments

Underground services that are located within the confines of partly completed new housing developments are especially prone to damage from the numerous site operations that may need to be carried out.

The construction of a single trench may help to control the position and separation of underground services. Where services are laid on a partly developed site, special arrangements may be required for their temporary protection at vehicle/plant crossing points.

Close liaison should be maintained between the developers, their contractors and the utility/service providers. A marked-up plan of the estate, showing the up-to-date position of underground services (including any variations from planned routes) should be kept on site and referred to in advance of carrying out excavations or other ground penetration works.

12.0 Installation of new services near existing services

New underground services often have to be laid in ground that already contains other services. Where it is reasonably practicable to do so, the utility/service provider that is planning the new installation should aim to position it in such a way that it is separated from all existing underground services by an adequate distance. Guidance on the requisite distances to be maintained may be found in the UK publication *National Joint Utilities Group (NJUG) Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus 2013*. The Irish Standard for colour code for buried plastics piping (IS 370:2007) should be referred to (see Appendix 6). Every effort should be made to comply with these standards (unless otherwise noted in this COP) or other equivalent standards of good practice for new installations in order to minimise risk to personnel now or at some future date.

Where the installation of a new service is likely to obstruct access to an existing service for more than a few metres, then all reasonably practicable measures should be used to avoid this situation. In particular, the practice of laying multiple ducts directly above other services should be avoided.

In circumstances where it is not possible to comply with the recommended services separation standard, because of underground services congestion or some other factor, the relevant utility/service provider must be contacted and as great a separation as is reasonably practicable should be maintained.

Designers and contractors must be aware that if placing services in parallel to existing utilities that are closer than the specified distances, unacceptable risks may be introduced, particularly to persons who at a later stage may require access for utility maintenance.

Unless formal agreement has being obtained from the utility/service provider or the relevant person representing the utility/service provider there should be no circumstance where access is restricted to existing services. Access to services is essential for maintenance work and possible emergency response.

13.0 Demolition sites

Special difficulties may arise in the case of service terminations in a derelict property or on a demolition site.

Contractors who plan to engage in demolition work have a duty to give adequate notice to the relevant gas, electricity and water authorities of their intention to carry out this work. Demolition should not begin until the relevant authorities have confirmed in writing that the supply has been disconnected or some other appropriate safeguarding action has been taken.

As noted in Section 4, there is an onus on the PSDP who is co-ordinating the design team to identify hazards associated with the existing environment, including known hazardous underground services.

Underground services on industrial or commercial sites may be the property of the site occupier. A contractor who is planning to demolish buildings or plant on such a site should contact the site occupier or the site owner to ensure that all relevant services are isolated before demolition work begins.

Even where supplies have been disconnected, contractors should be aware that:

- Services that run through a site may not be providing a service to that site.
- Bottle-ended or pot-ended cables must be treated as live unless confirmed otherwise.
- Some services may not have been recorded on the original plans and, consequently, may not have been identified or disconnected.

14.0 Training and instruction

14.1 Introduction

Digging close to underground services is potentially dangerous. Both the workers and the supervisors who are involved in this activity need an appropriate level of knowledge, skills and experience in order to ensure that the work is carried out safely. Anyone who does not possess these attributes should work under the close supervision of someone who does have the requisite experience and competencies.

14.2 Provision of information and instruction

Prior to work commencing on site all employees/operatives must be given appropriate information and instruction, through induction, toolbox talks or other equivalent means of communication. The information and instruction provided may include all or some of the following, as appropriate:

- Completion and communication of a relevant Safe System of Work Plan.
- Site-specific risk assessments.
- Operating procedures.
- Permits to work procedures.
- Relevant drawings, maps and other related information.

14.3 Training for supervisors and operatives

In accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013, operatives must satisfactorily complete the one-day Safe Pass safety awareness programme. However, this is an introductory course in construction safety and does not in itself provide sufficient training in relation to the hazards and risks involved in digging close to underground services.

Personnel* who are involved in either the supervision or carrying out of excavations in the vicinity of hazardous underground services should be appropriately trained in one or more of the following areas, as required:

- Planning of the work.
- Legislation.

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* These include workers who manually work on excavations in streets, utility/service provider employees who manually work on excavations and those directly supervising these workers. Excavator drivers may be excluded if they received sufficient relevant training on an excavator driving course. However, if they are involved in excavation outside the excavator, they should receive the stipulated training.

- Risk assessment.
- Liaison with utility/service providers.
- Use of plans and drawings from the various utility/service providers.
- Appropriate use of cable- and pipe-locating devices.
- Location of underground services (CSCS, see Section 14.6.1).
- Identification of services.
- Safe digging practices.
- Personal protective devices.

Refresher training will be required periodically depending on the work being carried out by personnel. Employees should not refuse reasonable offers of training; they should co-operate with their employers regarding training and they should make relevant documentation demonstrating receipt of training available for inspection as appropriate.

14.4 Site-based direct managers/supervisors

Those involved in direct management and supervision of site-based work require relevant competencies to deliver safety standards on site. They will need health and safety training in order to:

- Assess and prioritise the risks on a particular project.
- Design safe systems of work that are appropriate to specific site conditions.
- Prepare clear, simple safety method statements that can be used and understood by site workers.
- Check that suitable personal protective clothing and appropriate equipment has been provided and is being used correctly.

14.5 Role of the project supervisor construction stage in training

As part of their duty to co-ordinate site safety, the PSCSs must have a system in place for checking that on-site operatives have been appropriately trained, even if those operatives are not their employees. The PSCS should have a system in place for ensuring that all craft and general construction workers on site have an up-to-date Safe Pass card and appropriate Construction Skills Certification Scheme (CSCS) cards where required.

14.6 Construction Skills Certification Scheme

The Construction Skills Certification Scheme (CSCS) is managed by the Further Education and Training Authority, SOLAS. This scheme is backed up by legislation, in particular Schedule 5 of the Safety, Health and Welfare at Work (Construction) Regulations 2013. The regulations list tasks which are common to the construction industry. If a task is listed in the schedule then you must hold a CSCS card to carry out that task on a construction project. Some of the common CSCS tasks in relation to avoiding dangers from underground services are set out in the sections below.

A large number of underground services are located under roads (including footways, cycle tracks, roadways etc.). Carrying out construction work on or near a roadway brings additional hazards, the most obvious being live traffic. The Safety, Health and Welfare at Work (Construction) Regulations 2013 (SI No. 291 of 2013) sets out the CSCS training requirements in regards to protecting workers and the public when working on roads.

For further information on the CSCS, contact SOLAS Tel: + 353 (0) 1 53302500 or Email: info@solas.ie.

14.6.1 Locating of underground services (CSCS): The 2013 regulations require persons carrying out the task of locating underground services to be in possession of a CSCS card. Contractors must ensure that underground services are located before excavation begins. This task and the methods involved are dealt with in detail in Section 8.

14.6.2 Signing, lighting and guarding (CSCS): Where any construction work which obstructs the roadway (part of the road where vehicles travel) or where pedestrians, people with disabilities or cyclists are diverted on to the roadway due to construction work, there must be on that site at all times when road signing, lighting and guarding is being installed, modified or removed, at least one person who has been issued with a valid construction skills registration card relating to signing, lighting and guarding on roads. In general this relates to works which interfere with the roadway traffic. Furthermore, the works both on and off the roadway must also be supervised by a competent person who has been issued with a valid construction skills registration card relating to signing, lighting and guarding on roads.

14.6.3 Assisting in the implementation of health and safety at roadworks (CSCS): When construction works on roads are in progress you must have a person on site who has been issued with a valid construction skills registration card relating to ‘assisting health and safety at roadworks’, where the person possessing a valid signing, lighting and guarding CSCS is not present. In general this relates to work which does not interfere with the roadway traffic.

Appendices

Appendix 1:	Electricity Cables
Appendix 2:	Gas Pipelines
Appendix 3:	Water Pipes and sewers
Appendix 4:	Telecommunications cables
Appendix 5:	Suggested job aid for workers on a safe system of work for digging
Appendix 6:	Summary of ISO 370:2007
Appendix 7:	Useful contacts

Appendices 1 to 4 give advice on matters relating to each of the five main types of underground services (gas, electricity, water and telecommunications). This is additional information and should be read and used in conjunction with the advice contained in the main text.

Appendix 1: Electricity cables

Plans

A1.1 The electricity service providers should be consulted wherever possible and all relevant plans obtained. (Note: While most electricity cables are owned by ESB Networks, many underground cables are the property of local authorities and are used for the provision of services such as public lighting, traffic lights and so on. Other underground cables may be the property of public bodies or private companies.)

A1.2 The representation of underground cables on plans may vary depending on the density of the underground networks (i.e. the number of cables running in close proximity), the scale of the plans and local historical recording conventions. Advice for interpretation should be sought from the issuing office. It should be noted that low/medium-voltage cables and high-voltage cables may be shown on separate plans.

Cable-locating devices

A1.3 While hum detectors (e.g. cable-locating devices set on power mode) are the easiest devices to use, they do not respond to unloaded or direct current cables. Furthermore, they may fail to detect lightly loaded low-voltage cables (such as those used for street lighting) and well-balanced high-voltage cables. A locator with a radio frequency detection mode may detect these cables and, therefore, should be used for additional back-up checks.

In some situations it may be possible to use a generator (genny) to induce a traceable signal on to a cable and this signal can then be used to trace the position/depth of the cable at locations remote from the genny using a cable detector.

A1.4 Even where a locating device does not give a positive reading, there may still be cables present and these may still be live.

A1.5 If a cable that is recorded on a plan cannot be located, appropriate assistance or advice should be sought. If digging has to start before such assistance or advice has been obtained, extreme care should be taken.

Safe digging practices

A1.6 In the vast majority of cases there will be no permanent surface markers or other visible signs to indicate the presence of a buried cable. Even if no cables are shown on plans or detected by a locator, a close watch should be kept for any signs that might indicate their presence.

A1.7 Underground cables are normally laid in trenches between 400mm and one metre deep. However, depths should never be assumed. Cables are often found just below the surface. As a result, therefore, even shallow excavations may present a source of danger. This factor should always be borne in mind, particularly if the ground has been disturbed or if there are cellars or other structures such as bridges in the area, which may have prevented cables being laid at standard depths.

A1.8 Cables may have been laid in any of a number of different ways – directly in the ground with a bed or surround of fine soil or sand; in earthenware or concrete pipes; in pitch-filled cast iron formers; or in plastic pipes or ducts. Occasionally they may be encased in steel pipes, or a covering of tiles, bricks, slabs, timber boards or coloured plastic marker tape may be laid above them. However, such coverings may have been disturbed and moved subsequently and should not be relied upon to give an accurate indication of cable position. These factors further emphasise the importance of using safe digging practices.

A1.9 During digging work, a careful watch should be kept for evidence of cables and repeat checks should be made with a locator to determine more precisely the position of any cable. Note: a cable should be considered positively located only after it has been safely exposed. Even then, digging should proceed with care, as there may be other cables, particularly high-voltage cables, nearby or lower down.

A1.10 Occasionally, cables are terminated in the ground by means of a seal or some other form of external mechanical protection. These pot-ended or bottle-ended cables should always be treated as live and should not be assumed to be abandoned or disused. They may be difficult to detect with locators even when live.

A1.11 When joints on electricity cables are encountered, they should be treated with extreme care. The joints may be enclosed in cast iron, earthenware or plastic casings. They need proper support and should never be disturbed, except following consultation and agreement with the utility/service provider.

A1.12 The use of hand-held power tools to break up paved surfaces often leads to accidents. Where practicable, such power tools should not be used within 500mm of the indicated line of a cable buried in or below a hard surface. Where power tools have been used to break away the surface from the indicated line of the cable, it should then be positively located by careful hand digging under the hard surface. The material under the hard surface should be removed gradually until the cable is exposed. If the cable is not exposed, then it must be assumed to be embedded in the hard surface. Where possible, a cable locator should be used as a depth guide down the side of the excavation.

The 500mm safety margin may be reduced:

- Where congestion of buried cables renders it impracticable.

- Where surface obstructions limit the space available; but only if the line of the cable has been positively identified by plans and confirmed by a locator.

Because it may be difficult to confirm depth, hand-held power tools should never be used over the cable unless either:

- The cable has already been exposed by digging under the surface to be broken out and is at a safe depth (at least 300mm) below the bottom of the hard surface material.

or

- Physical precautions have been taken to prevent the tool striking the cable. Advice on the safe use of hand tools is given in Section 9.

A1.13 Excavating close to electricity cables buried in concrete is dangerous. For this reason alone electricity cables should not be buried in concrete and the utility/service providers should ensure that their employees and contractors are aware that this practice is unacceptable.

A1.14 Using mechanical means to break up concrete can cause damage to cables. If the cable is live, anyone present is likely to be injured.

A1.15 Alternative routes should be carefully considered as a means of avoiding cables that are buried in concrete.

A1.16 Where it is necessary to break away or disturb the concrete in which a cable is embedded, the utility/service provider should be asked to disconnect it from the supply, or an alternative safe method of excavation should be agreed with the utility/service provider before excavation work begins. It is important to note that the use of powered hand tools close to cables is likely to represent the greatest risk of injury.

A1.17 Where a buried cable has been disconnected from the supply to allow for safe excavation, it is essential that liaison should be maintained between the parties involved to ensure that the work has been completed and that workers have cleared the site before the cable is reconnected.

A1.18 Where mechanical excavators are being used in an area likely to be in the vicinity of underground cables, the work should be arranged in such a way as to ensure that damage to cables is avoided. In addition, all personnel should be kept well clear of the excavator bucket while digging work is going on.

Drivers should be instructed to remain in the cab if a cable is struck. If the driver has to leave the cab, he or she should jump clear of the machine, rather than climb down, to avoid the risk of electrocution. A designated person should be assigned to guard the excavator and ensure that no person enters the area or touches either the excavator or the cable until the utility/service provider has made the damaged cable safe.

A1.19 The most common injuries resulting from cable accidents are flash burns, splatter burns from molten metal or ignited oil and electrical burns. Burns are likely to be most severe where skin is not covered and therefore, based on a site-specific risk assessment, appropriate skin cover for hands, arms, legs and upper body should be used.

A1.20 Accidents sometimes occur after underground cables have been exposed. Cables should not be used as handholds or footholds by anyone climbing in and out of the trench. Where a cable that is exposed for more than one metre crosses a trench, support should be provided. If the exposed length is less than one metre, support should still be considered if joints have been exposed or if the cable appears otherwise vulnerable to damage. If advice or help is needed, the cable service provider should be contacted.

Suitable precautions should be taken to prevent damage from ongoing work in the excavation area (e.g. by use of physical means such as timber boards or sand bags). Cables that are lying at the bottom of an excavation area should be protected by nail-free wooden planks, troughing or some other suitable means. Care should be taken not to use materials or equipment that could damage or penetrate the outer sheath of the cables. Cables should not be moved aside unless the operation is supervised by the utility/service provider. Precautions should be taken to prevent access to exposed cables by children or other unauthorised personnel.

A1.21 Hard or sharp materials, such as pieces of rock, large stones, hard-core or surplus concrete, should not be tipped into open cable trenches. Advice on back-filling cable trenches should be obtained from the cable service provider. As a general rule, all exposed cables should be back-filled with a 75mm minimum surround of compacted sand. Disturbed tiles and bricks should be replaced and new yellow-coloured warning tape should be placed above the excavated area.

A1.22 Any damage to an electricity cable should be reported immediately to the cable service provider and work should not be undertaken in the vicinity of a damaged cable until the service provider has investigated its condition. (Some cables may automatically 'trip out' when damaged, but these may be re-energised at any time unless the cable service provider is notified of the damage.)

Recommended standards for new underground electricity cable installations on new developments and in existing roads and streets

A1.23 Buried electricity cables may be laid either directly in the ground or they may be installed in impact-resistant ducts or pipes. As a general guideline, new cables should be installed at depths of approximately 450mm in footpaths and driveways and at greater depths of approximately 600mm when installed in road carriageways or grassed areas. However, local conditions may dictate that these depths vary, particularly where pipes and cables cross, or where underground structures or other obstructions are crossed. Depths may also vary at entrances to buildings, beside street furniture and at underground link disconnection boxes. Deviation from the recommended standards outlined above should only occur if local conditions make compliance impracticable. If cables are buried at shallower depths than those recommended, then this should be noted on the record drawings.

The clearance in all directions between underground electricity cables and other services should be approximately 300mm. With the exception of crossing points, services should not be laid above electricity cables. This is because, following installation, continuous access will be required for the repair of faults or the installation of new service connections. These connections are usually jointed live in the case of low-voltage mains cables.

While there is no agreed industry standard in Ireland governing the relative lateral positioning of services in footpaths, general guidance may be found in the UK publication *National Joint Utilities Group (NJUG) Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus 2013.* Efforts should be made to comply with this standard, or other equivalent standards of good practice in relation to the positioning of new installations.

Colour marking and strength specification of ducts for underground electricity cables

A1.24 All new underground ducts laid for the installation of electricity cables of 125V or greater must be **RED** in compliance with IS 370:2007 (see Appendix 6) and must carry the warning: **DANGER ELECTRICITY CABLES**. They must also conform to the deformation and impact resistance requirements and all other requirements as set out in the 'Material Specification' (see Section A1.25).

A1.25 Material specification for red uPVC and MDPE ducting for the installation of underground electricity cables

	MAINS CABLE DUCT	HOUSE SERVICE CABLE DUCT
Duct outside diameter (mean)	125.0mm – 125.4mm	50mm
Duct type	uPVC, 6m lengths; Spigot and socket type	MDPE, 6m straight lengths or 50m coils
Duct rating	Normal duty per EN 50086 – 2 specification	750N – EN50086 – 2
uPVC quality	100% virgin material	100% virgin material
Duct colour – outside	Red – BS Type 5252 04E53 – 04E56	Red as for 125mm Minimum 1mm thickness of colour
Duct deformation requirement	Must pass EN50086 – 2 <5% deformation requirement for 450N loading on 200mm sample	Must pass EN50086 – 2 - :1996 <5% deformation for 750N loading on 200mm sample
Impact resistance	Per 50086 – 2 12 samples; 5kg striker: 570mm fall height:>28 Joules – no crack in at least 9 samples	As for 125mm
Duct minimum wall thickness	The larger of the two criteria: (1) Wall thickness to pass 5% deformation /impact requirement above and (2) Minimum wall thickness of 3.8mm (required for cable pulling)	Duct wall thickness based on 750N loading test
Duct end; spigot end	Spigot: plain end bevelled to allow easy jointing of duct on site, minimum thickness of plain end to be 1.3mm, bevel length 5mm	Duct ends bevelled to allow jointing of duct on site
Circumferential mark on plain pipe end for correct push-in distance	Circumferential mark required to indicate correct push-in distance for duct jointing for spigot and socket joints. Location: 105mm – 110mm to suit socket length below	Clear circumferential mark required to indicate correct push-in distance for duct jointing using standard 50mm couplers
Duct ovality including socket	2.00mm max.	1.4mm max.
Eccentricity of socket relative to duct	None allowed and no angle allowed between socket centre line and the duct longitudinal axis to avoid ripping cable sheath during cable pulling	None
Duct inner surface	Smooth, low-friction surface completely free of ripples, sharp edges and protrusions. Friction coefficient <0.28	As for 125mm ducting Friction coefficient <0.28

	MAINS CABLE DUCT	HOUSE SERVICE CABLE DUCT
Legend content:	'DANGER ELECTRICITY CABLES'	'DANGER ELECTRICITY CABLES'
Repetition rate/gap between legend	150mm max gap between adjoining legends	150mm max gap between adjoining legends
Colour of legend, size of lettering	Black NOTE: 3 lines of 20mm @ 120°	Black 2 X 8mm – 10mm height @ 180° apart
Batch No./name of manufacturer and date of manufacture	6mm minimum lettering size	6mm minimum lettering size
Red colour fastness	One year minimum required so as to provide 12-month storage period at builders' providers premises One year outdoor weathering test required or suitable accelerated colourfastness test	One year minimum required so as to provide 12-month storage period at builders' providers premises
All bends for 125MM duct	All angles: radius = 1.2m minimum for 22, 45 and 90° material as per pipe specification above. (3.8mm minimum thickness)	
Bend ovality	2mm max (same as for pipe)	
Couplers for 50mm OD duct		Slip or rubber gasket type with no internal obstructions/sharp edges. A centering ridge is required that does not protrude

Appendix 2: Gas pipelines

A.2.1 General requirements

Natural gas, which is highly flammable, is transported in a network of polyethylene and steel pipes at pressures up to 85 bar. Damage to a gas main may result in large volumes of gas escaping into the atmosphere in an uncontrolled manner. Even if there is no smell of gas, any damage to a gas pipe should be reported, regardless of how minor the damage might appear. An immediate repair may prevent an accident at a later stage due to a stress failure at the location of the original minor damage.

Most underground gas pipes are the property of gas transmission or distribution companies. One notable exception to this is private 'metered' estates, which may have gas piped to users from a bulk liquefied petroleum gas (LPG) tank. In such cases, the service provider should be able to supply the requisite information. Estates that comprise privately owned dwellings do not normally have a site owner or manager. In such circumstances information may be obtained from the LPG supplier, whose name and telephone number (manned twenty-four hours each day) should be displayed in the bulk storage vessel compound. The risks associated with leaking LPG are even greater than those associated with leaking natural gas as it is heavier than air and does not disperse as readily. In addition, it can travel great distances below ground level before accumulating at low levels.

All personnel who are involved in carrying out work near underground gas plant should observe the specific requirements set out by the gas network operator. Network operator staff or representatives must have access to underground and above-ground plant at all times. Unauthorised repairs to gas pipes must not be made. If there is any doubt about the need to carry out repairs, the advice of the relevant gas network operator company should be sought.

Natural gas pipeline infrastructure in Ireland may be categorised as transmission pipeline or distribution pipeline.

A.2.2 Transmission pipelines

See Section A.2.4 for requirements common to both transmission and distribution pipelines:

Transmission pipelines operate at internal pressures between 7 bar and 85 bar. They are the primary spine pipelines that transfer gas throughout the country. They are constructed from steel with a black or concrete coating and may have marker posts at intervals along their length, particularly at field boundaries and road crossings.

- Transmission gas pipelines are generally between 150mm and 1000mm in diameter and coated in yellow and/or encased in black wrapping.

If a transmission main is identified within ten metres of any intended excavations (including vertical boring), then work must not proceed until the gas network operator has been consulted. See greater distance requirements in relation to special operations in Section A.2.2.7.

The network operator should be consulted before commencement of excavation works within ten metres of any large pressure reduction plant, i.e. above-ground gas installation (AGI) or district regulator installation (DRI), as shown on the map records.

Gas Networks Ireland: 'Dial Before You Dig' enquiries: 1850 427 747.

A.2.2.1 Locating the transmission pipeline: The gas network operator should arrange for locating and marking out of the pipeline as well as for the supervision of the digging of any trial holes necessary to confirm the position of the pipeline.

A.2.2.2 Orientation and location: Where a new service is to cross either above or below an existing transmission gas pipeline, the normal minimum distance between the outside of the pipeline and the service to be installed should be 600mm.

In special circumstances this distance may be reduced at the discretion of the network operator's engineer. At such crossings both the pipeline and the new service should be suitably supported to prevent any future settlement and the back-fill should be packed and consolidated to the satisfaction of the network operator's engineer (see Section A2.2.6).

As a general rule, no new service should be laid parallel to an existing transmission gas pipeline. However, in special circumstances (e.g. motorways) a new service may be laid parallel to an existing pipeline provided that there is adequate clearance (normally 600mm) between them and provided that the service is not laid in parallel either directly above or below the existing pipeline.

A.2.2.3 Cathodic protection: Transmission gas pipelines are cathodically protected. Where a new service is to be laid and similarly protected, the network operator (once notified) is obliged to carry out interaction tests to determine whether its system is adversely affected.

A.2.2.4 Pressure testing: Hydraulic testing of other installations (e.g. high-pressure water mains) should not take place within eight metres of an existing transmission gas pipeline unless precautions have been taken to mitigate the effects of a possible burst. These precautions may include the use of pre-installation tested pipe, sleeving, barriers etc. as agreed with the gas network operator's engineer.

A.2.2.5 Excavation: Where it is necessary to excavate below a transmission gas pipeline, the pipeline must during all stages of the operation be supported to the satisfaction of the gas network operator's engineer. On completion, permanent supports should, if necessary, be constructed to avoid future settlement.

Mechanical excavation by powered tools is not permitted within a distance of three metres and the use of hand-held power-assisted tools should not be permitted within 1.5 metres of a transmission gas pipeline or associated equipment. Consideration may be given to a relaxation of these limits provided that prior notice of the excavating methods to be used is given to the network operator and the safeguards to be employed are agreed between all parties.

To avoid damage during construction work, exposed gas pipelines must be protected as directed by the network operator's engineer.

A.2.2.6 Back-filling: Parties responsible for the new works should give the gas network operator at least forty-eight hours notice of their intention to back-fill under, over or near an existing transmission pipeline. The gas network operator's representative must be in attendance during all back-filling operations and advise on the suitability and degree of consolidation of back-fill material around the pipeline. Any damage to the coating of the transmission gas pipeline, even if minor in extent, must be brought to the notice of the gas network operator so that any necessary repairs may be carried out before back-filling is completed. The gas network operator must make repairs as efficiently and as quickly as practicable.

A.2.2.7 Special operations: *Explosives* must not be used within 400 metres of gas transmission pipelines (30 metres for distribution pipelines), without prior consultation with the gas network operator.

Piling and/or demolition works; the gas network operator must be consulted before any piling is carried out within 15 metres of an existing gas pipeline.

A.2.3 Distribution pipelines

Distribution pipelines operate at internal pressures less than 7 bar. They transmit gas at medium pressure (more than 100 mbar and less than 7 bar) or low pressure (less than or equal to 100 mbar) and are mainly constructed from polyethylene (PE).

The pipeline is predominantly yellow in colour, but may have brown or black stripes. Mains gas pipelines usually run parallel to property in the footpath, grass verge or road and range in size from 63mm to 315mm diameter. Service gas pipelines are connected to mains and run to a meter position at the property and range in size from 20mm to 63mm diameter.

Note: There is a limited use of steel pipes in areas like bridges or where only shallow depths can be achieved Gas Network Ireland: 'Dial Before You Dig' enquiries: 1850 427 747.

A.2.4 Requirements common to both transmission and distribution pipelines
Requirements under A.2.2 take precedence in the vicinity of transmission pipelines.

A safe system of work must always be followed – refer to Section 6.

Work involving piling, demolition, directional drilling, use of explosives or hot works may require special precautions to be taken.

A.2.4.1 Planning and obtaining utility maps: It is imperative that early contact is made with the gas network operator to obtain a gas network map and that this is made available to operatives on site for the duration of any works. The responsible person should ensure that operatives on site understand the map and are continually informed of any updates.

A.2.4.2 Identifying distribution mains and services: Where the presence of gas mains which operate at pressures greater than 7 bar is indicated (i.e. a transmission pipeline), the gas network operator must be consulted before work begins.

The depth of cover from gas distribution mains laid in a roadway is normally 750mm. For those laid in a footway it is normally 600mm. The depth of cover for gas service connections is normally 450mm in both roadways and footpaths. However, at entry points to buildings, the depth of cover for a service connection may be 375mm. It is important to note that these depths are merely a guide and pipes may be found at shallower levels. For example, pipes such as those passing over cellars or in the vicinity of bridge structures may have been laid at shallower levels, or the depth of cover may have been reduced after the pipe was installed due to other works such as road alterations being carried out in the area.

Polyethylene mains may have been inserted into redundant cast iron or ductile iron gas mains. Marker tiles may have been used above gas pipes, for example where they have been laid at a shallow depth in bridge structures or above cellars.

Polyethylene mains may have a coloured plastic marker tape above them. The presence of gas plant may also be indicated by valve boxes and marker posts. Marker posts/plates are sometimes used to indicate the position and size of valves or siphons on gas mains. However, such markers may have been disturbed and should not be relied upon as an accurate indicator of pipe position.

Plans do not normally show the position of service connections. Their existence should be assumed and it may be possible to estimate the probable line of the service connection pipe from the gas meter boxes/cabinets, house entry points, service risers and gas valve covers, or from the point of entry to the premises. Older buildings may have no visible signs of a service, as the service may run directly into the building underground, with the meter fitted internally. In these cases a check should be made inside the building to identify the service route to the meter position.

A.2.4.3 Safe digging practices and avoidance of pipeline impact:

(i) Excavations near gas pipelines: Where gas pipes cross, or are parallel and close to excavations, changes in back-fill may cause differential ground settlement and increased stress in the pipe. Where pipes are parallel and close to excavations, the degree of risk depends on the depth of the excavation, the distance of the pipe from the excavation and the type of soil. If an excavation is likely to affect support for a gas pipe, the gas network operator should be consulted. If gas pipeline or gas plant relocation is necessary, the gas network operator should be contacted to arrange diversion before work begins.

The network operator should be consulted before commencement of excavation works within ten metres of any large pressure reduction plant, i.e. above-ground gas installation (AGI) or district regulator installation (DRI), as shown on the map records.

(ii) Pipe locators: Before excavation, locator devices that use radio frequency detection or transmitter-receiver technology should be used to help locate metallic gas pipes. However, it should be noted that the majority of distribution gas pipelines are made of polyethylene and cannot be traced by such devices. This factor further reinforces the importance of using plans and safe digging practices.

(iii) Road construction work: If road construction work is being carried out close to the top of a gas pipe, the gas network operator should be consulted to give guidance on specific precautions to be taken.

(iv) Mechanical excavators: Mechanical excavators pose the highest risk and **should not** be used within three metres of a gas transmission pipeline or within 0.5 metres of a gas distribution pipeline.

Gas pipes may have projections such as valve housings, siphons and stand pipes and these will not be shown on the plans. In order to allow for these projections, mechanical excavators should not be used within the distances identified above.

(v) Hand-held power tools: Hand-held power tools may damage buried gas pipes and they should be used with care until the exact position of an underground pipe has been determined. They should not be permitted within 1.5 metres of a transmission gas pipeline or associated equipment.

(vi) Hand digging: Plastic gas pipes should be located by hand digging before mechanical excavation begins. It may also be necessary to use this method to locate metallic pipes if their position has not already been determined by a pipe-locating device. The use of hand digging is particularly important for service connection pipes, which will not be marked on plans. The recommended method is to dig a trial trench along the road near the kerb, or on the footpath, where the depth of the service connection pipes is likely to be at its shallowest. Once the position and depth of the pipes have been determined, work may proceed.

(vii) Special operations: *Explosives* must not be used within 400 metres of a gas transmission pipeline (30 metres for a distribution pipeline), without prior consultation with the gas network operator.

Piling and/or demolition works; the gas network operator must be consulted before any piling is carried out within 15 metres of an existing gas pipeline.

(viii) Crossing points: In cases where heavy plant and other machinery may have to cross the line of a gas pipe during construction work, the number of crossing points should be kept to a minimum. These points should be clearly indicated and crossings at other positions along the line of the pipe should be prevented. Where the pipe is not adequately protected by an existing road, crossing points should be suitably reinforced with sleepers, steel plates or a specially constructed reinforced concrete raft. The gas network operator will advise on the type of reinforcement necessary.

(ix) Hot work: If hot work, such as welding or laying hot bitumen, is to be carried out adjacent to gas pipes or installations and there is any risk of that work affecting the integrity of a pipe or pipe surface, the gas network operator should be consulted. Gas pipelines, their protective coating and above-ground plant must be protected against damage by heat transfer, sparks or naked flames.

(x) Uncovering a gas pipe during excavation: If a gas pipe with a damaged wrapping is uncovered during excavation work, the gas network operator should be informed so that repairs may be carried out to prevent future corrosion and leakage.

Pipe restraints or thrust blocks close to gas mains should never be removed.

(xi) Positioning of structures in the vicinity of gas pipelines: Manholes, chambers or other structures should not be built over, around or under a gas pipeline or gas plant. Work should not be carried out that results in a reduction of cover or other protective measures without prior consultation with the gas network operator.

(xii) Use of concrete or other hard material: Concrete or other hard material should never be placed or left under or near any gas pipe as this could cause pipe fracture at a later date. Concrete back-fill or slabbing should not be used within 300mm of a gas pipe or associated connections.

(xiii) Back-filling distribution pipelines after excavation work: If a gas pipe is uncovered during excavation work, the back-fill should be adequately compacted, particularly beneath the pipe itself. This measure is designed to prevent any settlement that could subsequently damage the pipe. The back-fill should comprise fine material or sand and should not contain stones, bricks, lumps of concrete etc. It should be suitably compacted to give comparable support and protection to that provided before excavation. Power compaction should not take place until a 200mm cover of selected fine-fill is in place.

Any protective measures, such as marker tape or marker tiles, should be reinstated.

A.2.5 In the event of damage to a gas pipeline

In the event of damage to a gas pipeline, work should cease immediately and the following precautionary measures should be taken:

- Do not turn any electrical switches on or off (e.g. ignition switches).
- Do not operate any plant or equipment.
- Move people away from and upwind of the affected area.
- Restrict employee and public access to the affected area.
- Prevent smoking, the use of naked flames, the use of mobile phones and other ignition sources in the vicinity of the leak.
- Report the leak/damage immediately to the gas network operator emergency number.
- Provide accurate information on your location and the nature of the incident.
- Do not attempt to repair the damage.
- Do not cover up a damaged main or service pipeline, this may lead to the gas travelling through ducts, sewers, chambers or voids and potentially building up inside a premises or confined space.
- Do not turn off any gas valves in the road or footpath (you may be causing further problems by doing so).
- Assist the gas network operator emergency personnel as required to safeguard life and property.

It is critical that any damage to gas pipelines, even if the pipe does not appear to be leaking, is reported to the gas network operator.

Gas Networks Ireland Emergency Number: 1850 20 50 50.

Appendix 3: Water pipes and sewers

The appropriate records office should be contacted and the location of all sewers, water mains, kiosks, meters and wiring/cable ducting should be determined before any excavation work begins. The location of mains on drawings should be taken as approximate. In general, if there is a sewer or water main (diameter greater than or equal to 300mm) in the vicinity, then the appropriate service provider engineer should be contacted in order to co-ordinate the excavation work.

Mains runs must be marked out before excavation begins.

During excavation, in addition to the safe digging practices previously outlined in this COP, the following precautions should be taken:

- If a water main spans a road cutting or similar excavation, then the main must be adequately braced so that no movement takes place.
- If a pipe anchor is exposed, then excavation must cease and the appropriate engineer must be contacted.
- Fittings (ferrules, air valves and so on) should not be interfered with.
- Excavation in the vicinity of mains must be carried out by hand in order to avoid damage to the pipe.

If the pipe in question is a high-pressure trunk main, then the following additional precautions must be adhered to:

- No personnel should be positioned inside the trench while the mechanical excavator is operating, in case a high-pressure break occurs.
- Continuous inspections are essential in order to determine whether the next excavation level is clear.
- If any leak is discovered, then the service provider must be contacted immediately and the area sealed off to keep it safe and to prevent members of the public from gaining access.

In relation to the installation of new services, in particular gas or electricity services near existing water or sewer mains, the following additional precautions are recommended:

- No new service should be laid above or along the length of an existing water main or sewer.
- Where the new services have to cross a water main or sewer this should be done at right angles as far as is reasonably practical.
- New installations should always avoid blocking access to valves, flanges etc., where subsequent maintenance may be required.
- Where a new service is likely to limit access for future maintenance to the service, contact with the relevant local authority should be made in advance of the works.

Appendix 4: Telecommunications cables

Pre-planned work

A4.1 The cable providers should be consulted wherever possible and all relevant plans obtained. (Note: While most telecommunications cables are owned by Eir, many underground cables are the property of local authorities or private companies.)

A4.2 The representation of underground cables on plans may vary depending on the density of the underground networks (i.e. the number of cables running in close proximity), the scale of the plans and local historical recording conventions. Advice for interpretation should be sought from the issuing office.

Cable-locating devices

A4.3 While using cable-locating devices to locate underground telecommunications cables you must understand the limitations of each operating mode and the need to use both power and radio modes to locate the underground service.

A4.4 Even where a cable-locating device does not give a positive reading, there may still be cables present. Cable-locating devices will not detect fibre optic cables.

A4.5 If a cable that is recorded on a plan cannot be located, appropriate assistance or advice should be sought. If digging has to start before such assistance or advice has been obtained, extra care should be taken to avoid damaging the cable.

Safe digging practices

A4.6 In the vast majority of cases there will be no permanent surface markers to indicate the presence of a buried cable. Frequently, however, the presence of marked communications manhole covers or other street furniture will indicate the presence and general run of telecommunications cables. Even if no cables are shown on plans or detected by a cable-locating device, a close watch should be kept during excavation for any signs that might indicate their presence.

A4.7 Underground telecommunications cables are normally laid at adequate and sufficient depth in trenches but depths should never be assumed. Cables must not be laid just below the surface.

If in doubt the network provider should be contacted.

A4.8 Cables may have been laid in any of a number of different ways. In urban areas steel wire armoured telecommunications cable can be found buried directly in the ground or in ducting of various colours ranging in size from 25 to 100mm, Telecommunications cable may also be found in earthenware or concrete pipes. Occasionally they may be encased in steel pipes. Coloured plastic marker tape may be laid above the ducting.

A4.9 During digging work, a careful watch should be kept for evidence of cables and repeat checks should be made with a cable-locating device to determine more precisely the position of any cable.

A4.10 Any damage to a telecommunications cable should be reported immediately to the cable service provider. No work which involves back-filling around the damaged cable should be undertaken until the service provider has investigated its condition and carried out any required repairs.

A4.11 Recommended standards for new underground telecommunications cable installations on new developments and in existing roads and streets are to be adhered to. However, local conditions may dictate that these depths vary, particularly where pipes and cables cross or where underground structures or other obstructions are crossed. The clearance in all directions between underground telecommunications duct and other services should be approximately 300mm. With the exception of crossing points, services should not be laid above telecommunications duct. This is because, following installation, continuous access will be required for the repair of faults.

A4.12 While there is no agreed industry standard in Ireland governing the relative lateral positioning of services in footpaths, general guidance may be found in the UK publication *National Joint Utilities Group (NJUG) Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus 2013*. Efforts should be made to comply with this standard, or other equivalent standards of good practice in relation to the positioning of new installations.

Appendix 5: Suggested job aid for workers on a safe system of work for digging

WORKER JOB AID

Safe System of Work for Digging

These Guidelines apply to all work which involves penetrating the ground at or below surface level.

When working near buried services USE

Maps
CAT
Safe Digging System
Company Policies & Procedures

All 4 complement each other

Always be aware that the depth of cover may be very shallow and that there may be no bricks, warning tape or other protection in place. Always assume that there will be more services than you can find.

BEFORE You Start Digging

- ✓ **Ensure you have appropriate Utility Plans** *Remember*: service connection cables & pipes from *the main to buildings or public lights may not be shown*

Look Out For

Manhole Covers
Valve Covers
Lamp Posts
Houses/Buildings
Meters, Coms. Network
Signs of Previous Digging

→ *Services*

- ✓ **Always use Cable Locator (CAT) to trace all services**
- ✓ **Mark the positions of the cables & pipes** *using waterproof crayon, chalk or paint*
- ✓ **Highlight & Assess the Hazards and ensure all relevant staff are aware of the hazards, especially** when electric cables and/or gas mains are in vicinity of work area.

IMPACT

- Inspect Site Location. Look for indicators to services
- Mark the location of services on the surface before digging
- Plans and Maps should be available & used on site before digging
- Always assume that there will be more services than you can find
- CABLE LOCATOR should always be used (in Power & Radio modes) before starting work and throughout the course of the work
- Take Care. Where ever possible hand dig close to buried services. Observe 'SAFE DIGGING PRACTICE'

Page 2

WORK USING 'SAFE DIGGING PRACTICE'

1. Where ever possible **Hand Dig** near buried services

2. Take special **CARE** using picks, pins or crowbars

3. Wear **Gloves** & other appropriate **PPE** *(Personal Protective Equipment)*

4. Do not use hand held power tools within 0.5 metres of marked position of electricity cables unless the number of services makes it impossible or surface obstructions reduce the space available.

5. Do not use hand held power tools directly over marked line of cable **UNLESS** -
   a) You have already found the cable at that position by careful hand digging beneath the surface AND it is at a safe depth (at least 300mm) below the bottom of the surface to be broken **OR**
   b) Physical means have been used to prevent the tool striking it.

6. When the surface has been broken out use CAT again to re-confirm position of services. Frequent and repeated use should be made of CAT during the course of the work.

7. Before using a mechanical excavator in the vicinity of electricity cables, trial holes should first be excavated by careful hand digging. Confirm the depth of the cable(s) at the point of work. The excavator should not be operated within a radial distance of 300mm from the cable(s).

8. When using Mechanical Excavator in the vicinity of electricity cables keep everyone clear of bucket while it is digging

9. Where an electric cable is embedded in concrete, arrange for the cable to be SWITCHED OUT before breaking off concrete.

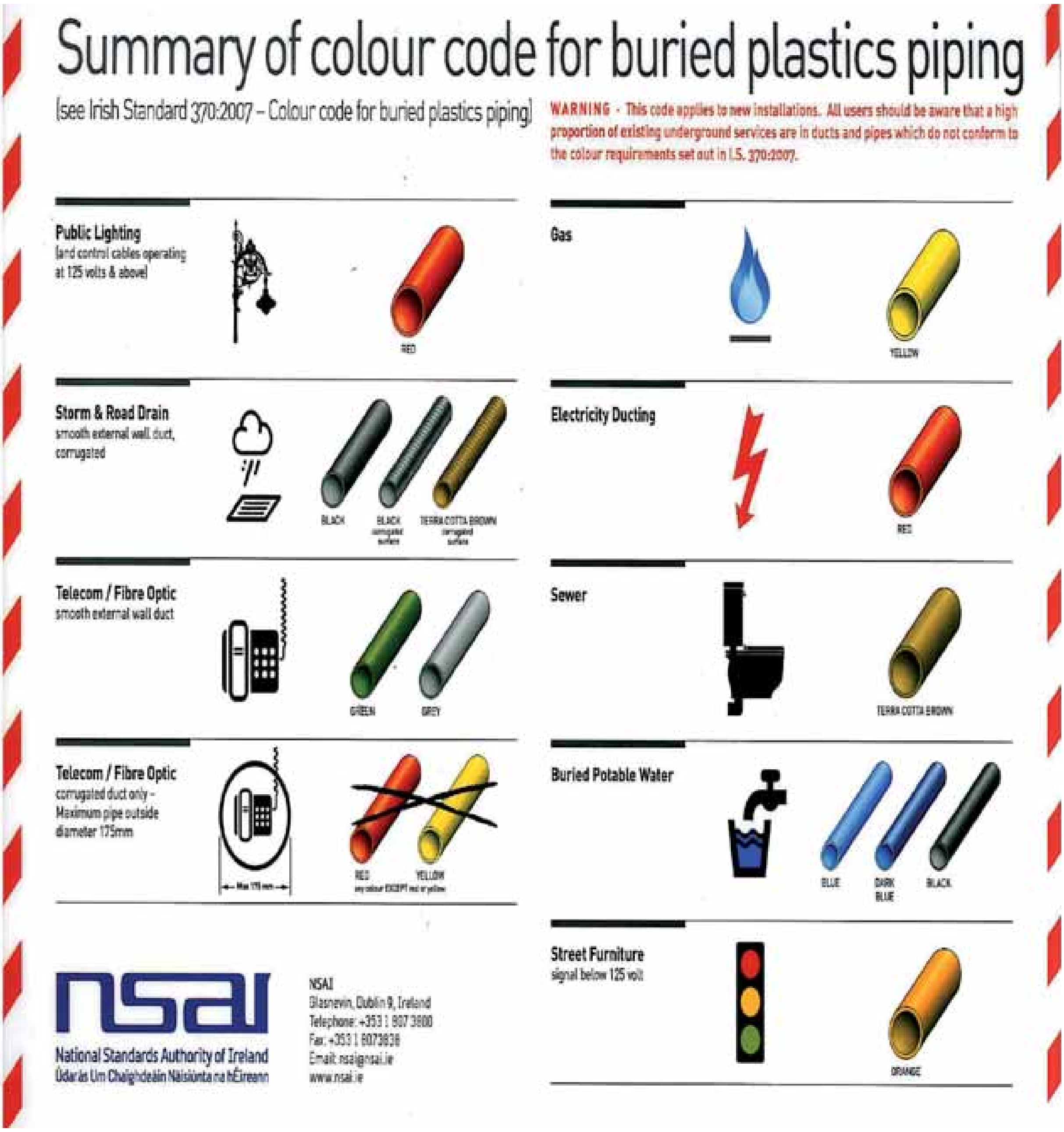
10. Do not use exposed electricity cables as a convenient step or hand hold.

11. Do not handle or attempt to alter the position of an exposed electricity cables (unless under the direction of approved ESB personnel). Extreme care should be taken where joints have been exposed.

12. If an electricity cable, gas pipe or high pressure water mains suffer any damage, however slight, the owner should be informed immediately and people should be kept well clear of the area until it has been made safe by the owner.

13. Backfill around services with sand and use appropriate utility warning marker tape. Do not build into manhole or other structure or encase in concrete.

Appendix 6: Summary of IS 370:2007



Appendix 7: Useful contacts

ESB Networks

For all emergencies, including any damage to underground electricity cables or plant, call **1850 372 999 (**or if you are phoning from outside Republic of Ireland 00 353 21 2382410).

For other ESB Networks queries, including general queries in relation to underground electricity cables, overhead lines, new connections etc., call 1850 372 757, email: dig@esb.ie or see area office addresses at: www.esb.ie/esbnetworks.

For all ESB Networks map records (underground cables, overhead lines and other plant):

(a) Write to Central Site, ESB Networks, St Margarets Road, Finglas, Dublin 11.
(b) Send a fax to 01 638 8169.
(c) Email: dig@esb.ie
(d) Register for access to electronic map records (make arrangements via (a) or (c) above).

All map requests should include the following information: (i) a site map/area map with geographic reference, (ii) a return postal address and (iii) a telephone contact number.

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APPENDIX C

- EirGrid standard crossing drawings

1 2 3 4 5 6 7 8

A B C D E F

STANDARD 110kV CABLE DRAWINGS
STANDARD CROSSING BELOW
3rd PARTY SERVICE FOR 125mm DUCTS

DRAWING No.	SHEET No.	DESCRIPTION	REVISION No.
XDC-CBL-STND-H-003	001	STANDARD 3rd PARTY CROSSING 125mm INDEX SHEET	00
XDC-CBL-STND-H-003	002	STANDARD 3rd PARTY CROSSING 125mm BELOW IN FULL FLAT FORMATION	00
XDC-CBL-STND-H-003	003	STANDARD 3rd PARTY CROSSING 125mm BELOW IN TREFOIL FORMATION	00

REV	DESC	DRAWN	CHECKED	APPROVED	DATE
00	FIRST ISSUE	DA	DG	CF	09/03/2020

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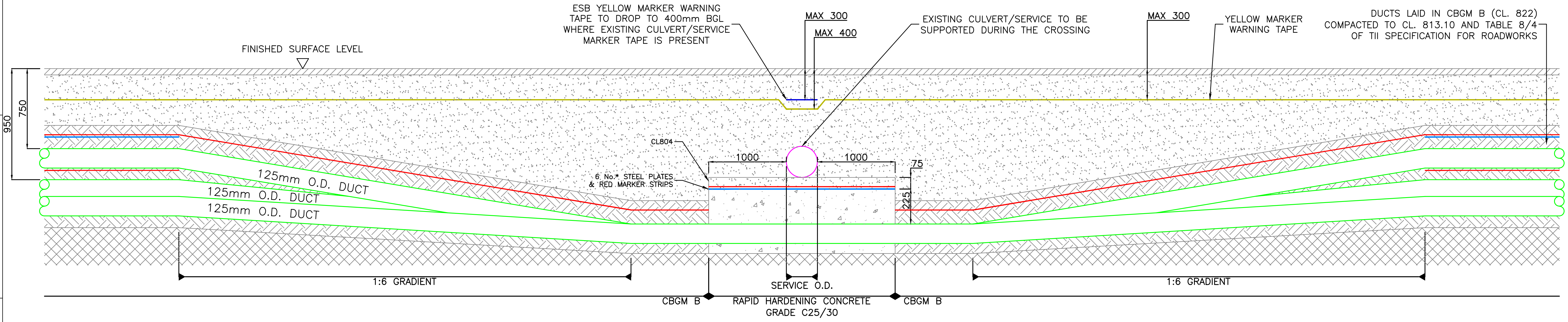
Web: www.eirgrid.com

STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE
STANDARD 3rd PARTY CROSSING
125mm
INDEX SHEET

No of Shts 3 | SIZE A3 | SCALE N/A

DRAWING NUMBER XDC-CBL-STND-H-003 | SHEET 001 | REV 00



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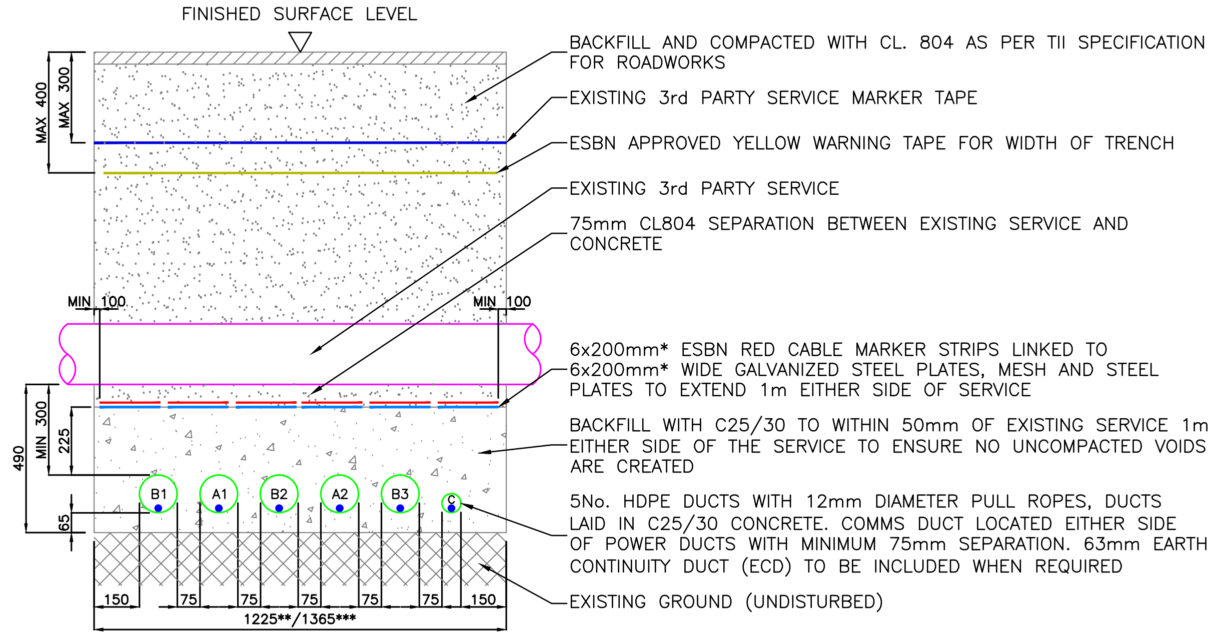
7. HAND DIG WITHIN 500mm OF EXISTING SERVICE.
8. WHERE AN EARTH CONTINUITY CONDUCTOR (ECC) IS REQUIRED, A MIN 63mm DUCT TO BE INSTALLED OUTSIDE OF PHASE DUCT.
9. IF EXISTING SERVICE MARKER TAPE IS NOT PRESENT, THE ESBN YELLOW MARKER TAPE SHOULD BE INSTALLED AT MAXIMUM 300mm BELOW FINISHED SURFACE LEVEL.

- RED MARKER STRIP
- YELLOW MARKER WARNING TAPE
- EXISTING SERVICE MARKER STRIP
- 6mm GALVANISED STEEL PLATE
- RAPID HARDENING WET CONCRETE C25/30
- CBGM B (CL. 822), COMPACTED TO CL. 813.10
- BACKFILL, COMPACTED (CL. 804)
- EXISTING GROUND

FULL FLAT FORMATION FOR CROSSING BELOW 3RD PARTY SERVICE



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C= 63mm O.D. HDPE DUCT FOR EARTH CONTINUITY CONDUCTOR

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** MIN 1225mm WHERE ECC NOT REQUIRED
*** SEE NOTE 8

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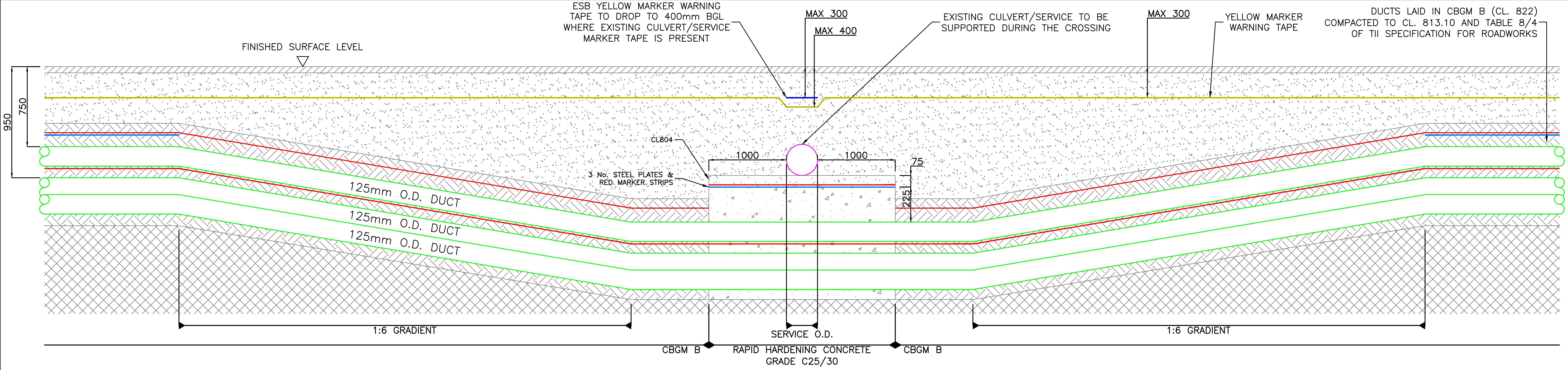
STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE
STANDARD 3rd PARTY CROSSING 125mm BELOW IN FULL FLAT FORMATION

No of Shts	SIZE	SCALE
3	A3	N/A

DRAWING NUMBER	SHEET	REV
XDC-CBL-STND-H-003	002	00



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YELLOW MARKER WARNING TAPE

EXISTING SERVICE MARKER STRIP

6mm GALVANISED STEEL PLATE

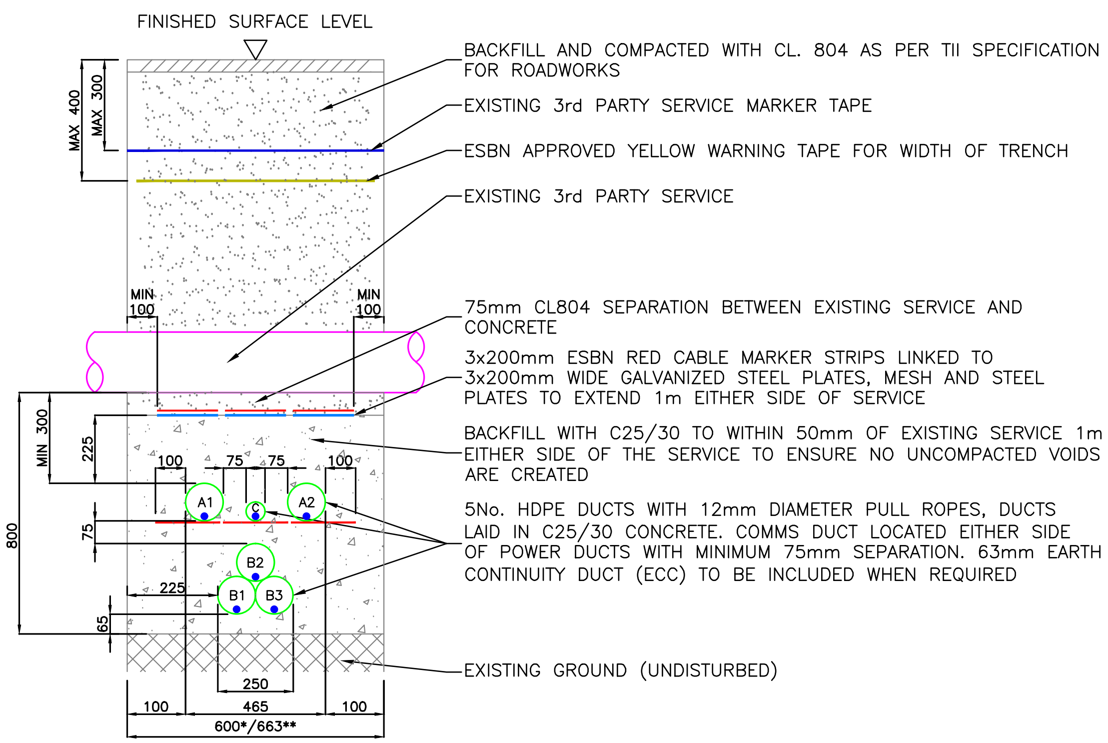
RAPID HARDENING WET CONCRETE C25/30

CBGM B (CL. 822), COMPACTED TO CL. 813.10

BACKFILL, COMPACTED (CL. 804)

EXISTING GROUND

TREFOIL FORMATION FOR CROSSING BELOW 3RD PARTY SERVICE



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STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE
STANDARD 3rd PARTY CROSSING 125mm BELOW IN TREFOIL FORMATION

No of Shts	SIZE	SCALE
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DRAWING NUMBER	SHEET	REV
XDC-CBL-STND-H-003	003	00

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A B C D E F

STANDARD 110kV CABLE DRAWINGS
STANDARD CROSSING ABOVE
3rd PARTY SERVICE FOR 125mm DUCTS

DRAWING No.	SHEET No.	DESCRIPTION	REVISION No.
XDC-CBL-STND-H-001	001	STANDARD 3rd PARTY CROSSING 125mm INDEX SHEET	00
XDC-CBL-STND-H-001	002	STANDARD 3rd PARTY CROSSING ABOVE IN FULL FLAT FORMATION 125mm HV DUCTS	00
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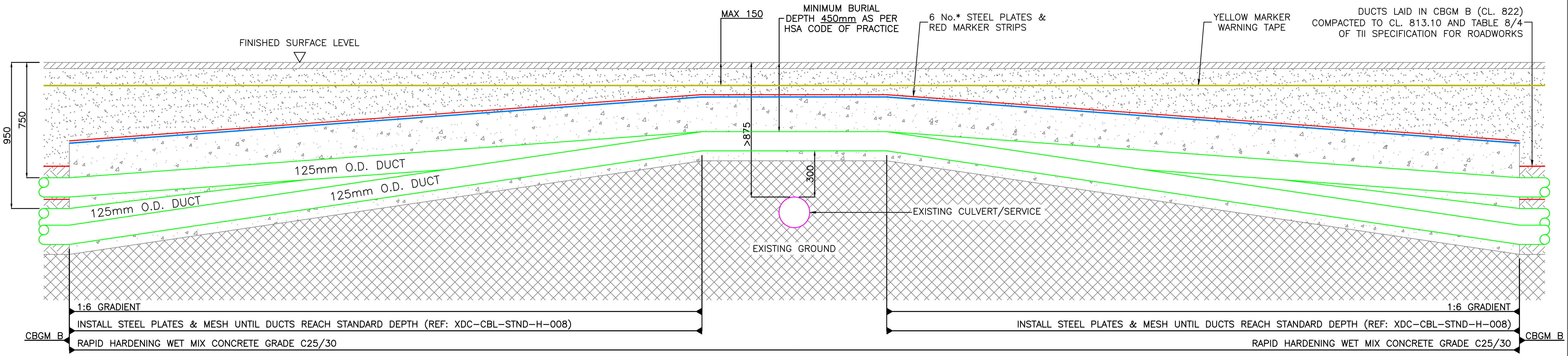
STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE
STANDARD 3rd PARTY CROSSING
125mm
INDEX SHEET

No of Shts 3 | SIZE A3 | SCALE N/A

DRAWING NUMBER XDC-CBL-STND-H-001 | SHEET 001 | REV 00



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YELLOW MARKER WARNING TAPE
EXISTING SERVICE MARKER STRIP
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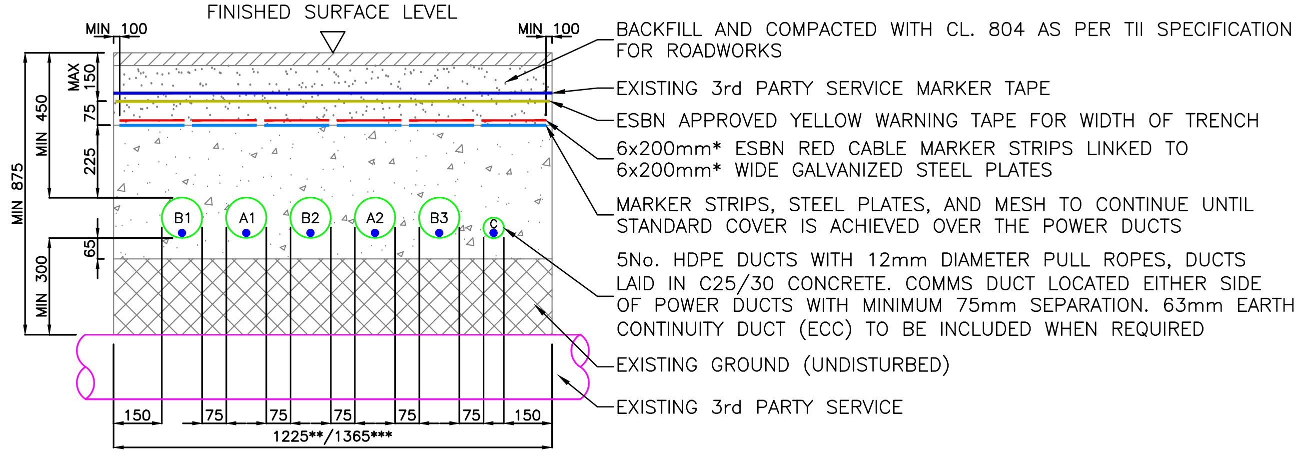
RAPID HARDENING WET CONCRETE C25/30
CBGM B (CL. 822), COMPACTED TO CL. 813.10
BACKFILL, COMPACTED (CL. 804)
EXISTING GROUND

FULL FLAT FORMATION – REDUCED DEPTH FOR CROSSING OVER 3RD PARTY SERVICE



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STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE
STANDARD 3rd PARTY CROSSING ABOVE IN FULL FLAT FORMATION 125mm HV DUCTS

No of Shts	SIZE	SCALE
3	A3	N/A

DRAWING NUMBER	SHEET	REV
XDC-CBL-STND-H-001	002	00

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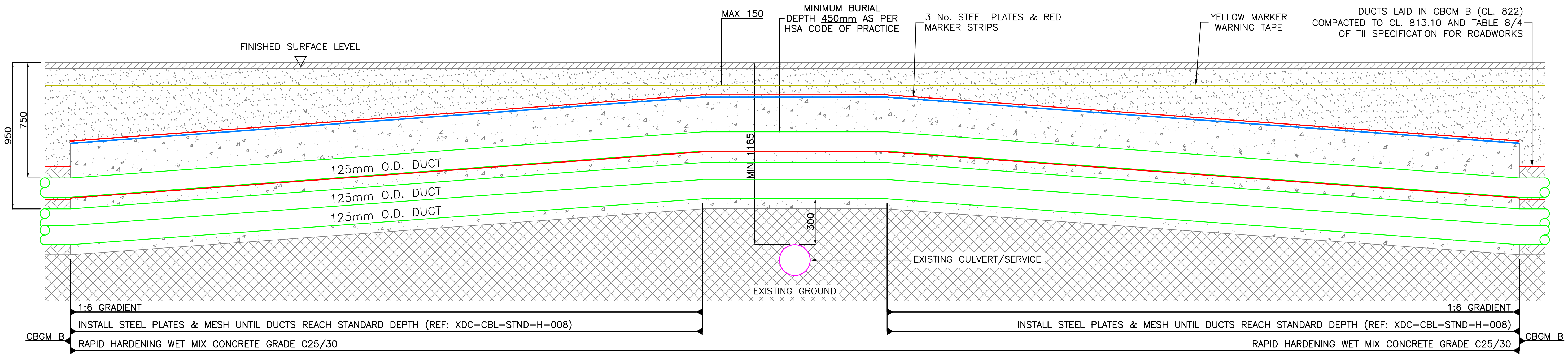

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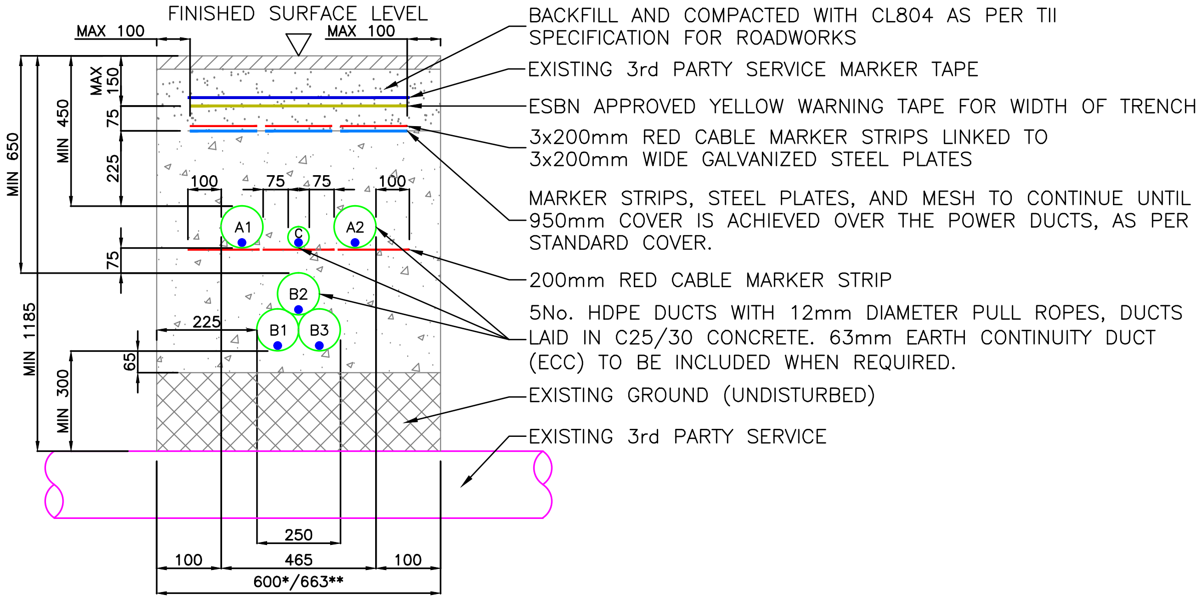
TREFOIL FORMATION – REDUCED DEPTH FOR CROSSING OVER 3RD PARTY SERVICE



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STANDARD 110kV CABLE DRAWINGS

DRAWING TITLE: STANDARD 3rd PARTY CROSSING ABOVE IN TREFOIL FORMATION 125mm HV DUCTS

No of Shts	SIZE	SCALE
3	A3	N/A

DRAWING NUMBER	SHEET	REV
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Coole Wind Farm

Grid Route Connection RFI

Westmeath County Council Submission – Bridge Crossings

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Confidentiality

Addressee

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Disclaimer

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This document has been prepared by

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Cormac Ó Dubhthaigh
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Civil Engineering Manager
Ionic Consulting

This report has been authorised by

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Civil Engineering Manager
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1. Introduction

The proposed Coole Wind Farm is located north of the village of Coole, County Westmeath. The wind farm 110kV grid connection is proposed between the wind farm site and the existing ESB 110kV Mullingar Substation. The overall route is approximately 26km in length.

In response to the Coole wind farm and grid route planning application to An Bord Pleanála, Westmeath County Council (WCC) submitted observations on the proposed development in a submission dated 1st June 2021. The submission raised observations from Westmeath County Council Transportation Section in relation to Bridge Crossings 3 (Shrubbywood Bridge) and 10 (Clonava Bridge) and this report aims to provide a response to the queries raised. Figure 1 shows the location of the two bridge crossings.

Consultation with Westmeath County Council

During the FI response period, Coole Wind Farm Ltd. engaged with Westmeath County Council Transportation Section on the observations raised in relation to Bridge Crossings 3 and 10. A meeting was held on 10th October 2022 between representatives of Coole Wind Farm Ltd, Westmeath County Council (Transport Department), MKO (Lead Planning & Environmental Consultant) and Ionic (Electrical/Civil Engineering Consultant). All feasible crossing options at the time were presented and discussed at the meeting including the options as submitted in the EIAR (Clonava Bridge: Options A and B; Shrubbywood Bridge: Option A) and alternative options (Clonava Bridge: Options C, D & E; Shrubbywood Bridge: Options B, C and D) as detailed in this report below. Shortly before the meeting with Westmeath County Council, EirGrid had provided an informal indication that they would give consideration to a solution involving splitting the grid connection ducts into both verges of a bridge crossing in some specific circumstances and therefore the further alternative options, Clonava Bridge Option E and Shrubbywood Bridge Option D, were presented.

The Council's main concerns related to the potential of proposals to compromise future maintenance or rehabilitation work on the bridges and requested further alternative options be considered.

Through a number of subsequent phone calls between representatives of Coole Wind Farm Ltd. and Westmeath County Council, the additional alternative options were discussed. It was agreed that prior to commencement of development security in a form to be agreed with the Planning Authority could be put in place to safeguard future maintenance or rehabilitation work at these bridge crossings.

Westmeath County Council were agreeable to this proposal, and it is noted that WCC raised no objection to the proposed development in principle.

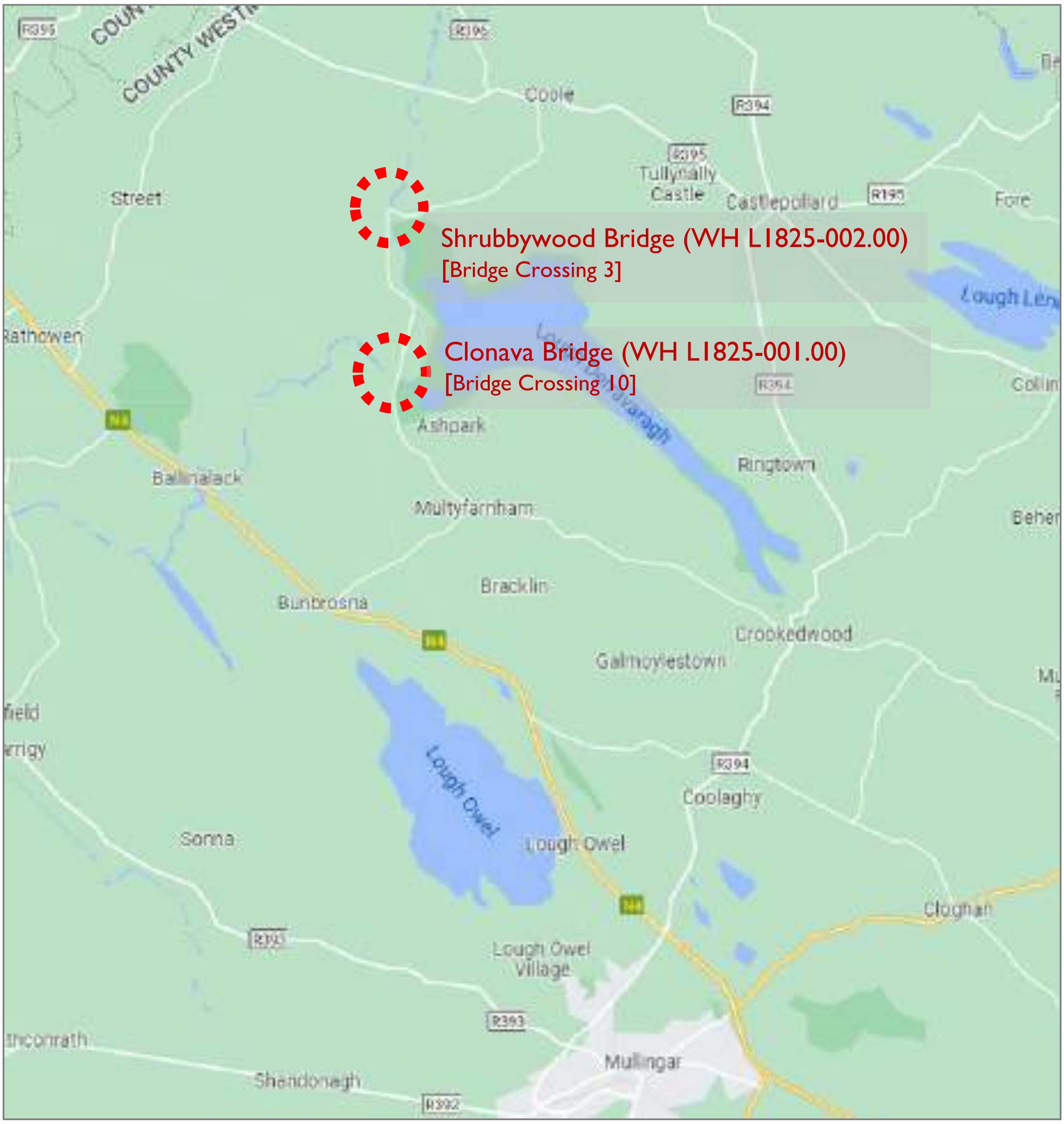

Figure 1 Bridge Location Plan

2. Bridge Crossing No. WH L1825-001.00 (Clonava Bridge)

Westmeath County Council in their submission raised issues with Option A and Option B (methods 3 and method 4 respectively as outlined in Chapter 4 Description, Section 4.8.7.5) for the Clonava Bridge on the basis that Option A could reduce capacity by reducing the effective road width and that Option A and Option B could compromise future maintenance or rehabilitation work. In their submission, the Council requested that the developer provide an alternative method for placing of the proposed ducts and electricity cables across the River Inny.

In the meeting with Westmeath County Council (10th October 2022) the Council also raised concerns regarding potential damage to the external conduit (Option B) in the case of an impact to the bridge parapet. They also raised concerns that the proposals presented during the meeting would compromise future maintenance or rehabilitation work on the bridges by leading to increased cost of the works.

As noted in the previous section, following subsequent phone calls with WCC it was agreed that prior to commencement of development security in a form to be agreed with the Planning Authority could be put in place to safeguard future maintenance or rehabilitation work at these bridge crossings. Westmeath County Council were agreeable to this proposal, and it is noted that WCC raised no objection to the proposed development in principle.

Alternative crossing options are presented below, and illustrative drawings are included in Appendix A. Option A and B were previously submitted with the original planning application and therefore are not included here again. Options C, D and E are presented in response to the Council's submission and subsequent meeting.

Method 5 Directional Drilling was set out as an option for this bridge crossing in Chapter 4 Description, Section 4.8.7.5. Following a site inspection and topographical survey completed 8th September 2022 this option has now been ruled out due to observations made of an exposed piled foundation on the south bank. The riverbank in front of and underneath the foundation had been scoured away and it was possible to see the upper sections of the driven piles at the support. It was observed that the piles were tightly and irregularly spaced. Furthermore, the driven piles were raked at random angles. As there are eight supports to the bridge with piles of unknown depth and arrangement, it is not considered feasible to drill through the piled foundations.

WCC stated in their submission that Option A was not acceptable as it will reduce the capacity of the bridge by reducing the bridge road width from 5.50m to 4.65m. The road width of 5.50m is calculated by taking the clear distance between the inside of the two parapet walls and subtracting 0.3m either side (6.1m – 0.3m – 0.3m = 5.5m). The dimension of 5.5m therefore assumes that vehicles will drive over ~0.3m of each concrete verge.

It should also be noted that the current kerb to kerb width of approximately 4.88m for two traffic lanes is below the general recommended width of 6m (2 no. lanes of 3m width). As a result, vehicles were generally observed driving close to the centre of the roadway (when no other traffic was approaching). It was also observed that vegetation was growing along sections of the kerb lines, and this indicates that the full kerb to kerb width of the road is not generally trafficked. Given the rural location of the structure, traffic levels on the road are low.

For Option A, the dimensions between the inside faces of the parapets remains the same and concrete verge are still provided. Therefore, the same useable width of 5.5m will be maintained across the structure. The concrete verge containing the ducts will be designed for vehicular wheel loading at detailed design stage, and the integrity of the concrete verges will be demonstratable by analysis and calculation.

Option A proposes reducing the kerb-to-kerb width by approximately 0.23m to 4.65m. A topographical survey was completed along the bridge and the road width between the grass verges on the structure was found to vary, but generally ranges from 4.2m to 4.5m. As noted above, the effective width of 5.5m would still be provided with Option A and therefore the capacity of the structure should not be reduced from the current scenario. It should be noted that there is also an advantage of providing a wider concrete verge on one side of the bridge, as it can act as a more effective footway across this relatively long bridge.

Figure 2 View along Clonava Bridge, showing the grass growing along the road in front of the concrete verges

In the meeting with Westmeath County Council (10th October 2022) the Council also raised concerns regarding potential damage to the external conduit (Option B) in the case of an impact to the bridge parapet. WCC also indicated a general preference not to attached utilities externally along bridges. Option B indicates the position of the conduit below the bottom of the parapet; therefore, any direct impact would not be transferred directly into the ducting conduit. The conduit and the support system will be designed to ensure the integrity of the HV cables and the safety of road users.

2.1 Option C Ducts in concrete verge (trefoil formation)

Option C for Clonava Bridge is illustrated on drawing COLE d005.3.3, refer to Appendix A. This option would involve laying the power ducts in a trefoil formation within a slightly widened and raised concrete verge. The ESBN Specification requires that a minimum 100mm cover be provided to ducting in a flat formation arrangement within a concrete footway, however given the duct arrangement increased cover may be required.

This option would necessitate slightly widening one of the concrete verges in order to provide the width required to place the ducts together in one verge. The communications and earthing ducts would be placed either side of the power ducts, or alternatively they could be split away and placed in the opposite verge (refer to Option E).

The benefit of this option would be that ducting works would be concentrated on one side of the structure and requires a relatively minimal reduction in the road carriageway. This option is not a standard EirGrid or ESBN design detail and would require a detailed review process with both parties to confirm their acceptance.

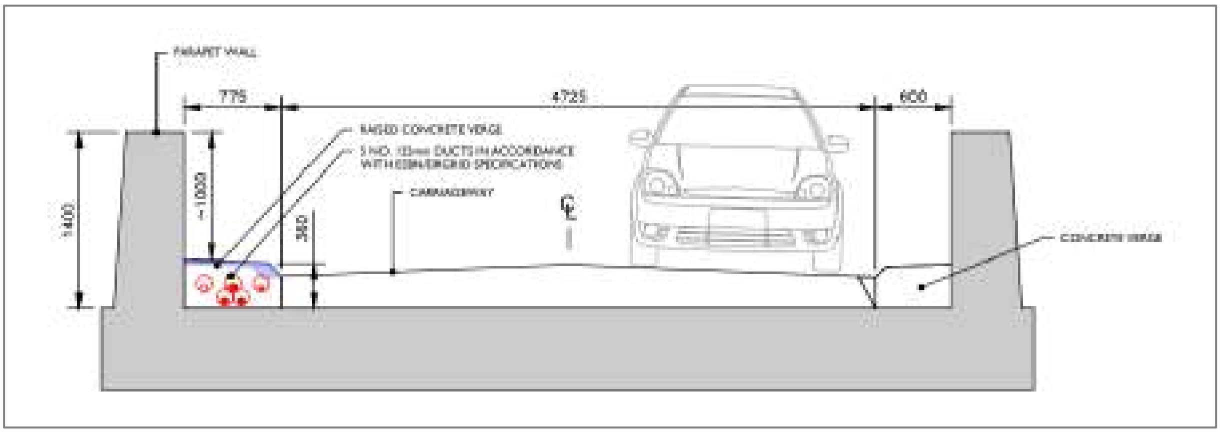

Figure 3 Clonava Bridge Option C

2.2 Option D Ducts within the road (flat formation)

Option D for Clonava Bridge is illustrated on drawing COLE d005.3.6, refer to Appendix A. This option would involve laying the ducts in a flat formation within the road carriageway. The EirGrid Specification requires that a minimum 450mm cover be provided to ducting in this arrangement (refer to Figure 5). This option would necessitate raising the road, verge and parapet wall levels across the bridge by approximately 0.3m in order to provide the minimum coverage to the ducts.

Raising the road level could result in significant additional load being applied to the bridge structure. Lightweight fill material (e.g., a foamed concrete) could be used in order to maintain a similar total applied dead load, and a structural assessment would be completed.

A parapet wall structural assessment would also be required to assess the parapet walls and determine what, if any, strengthening measures would be required for the raised parapet.

The benefit of this option would be that it maintains the current widths of the road carriageway and concrete verges.

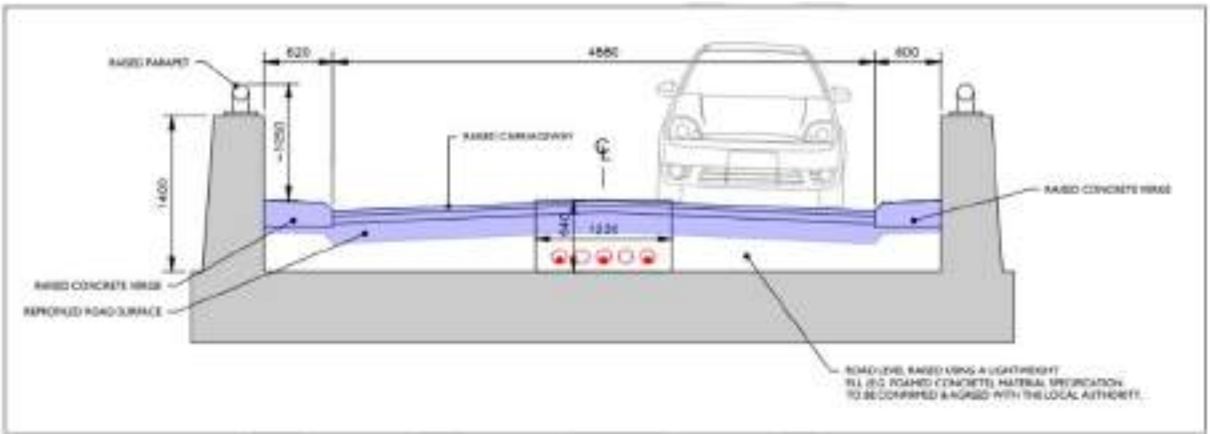

Figure 4 Clonava Bridge Option D

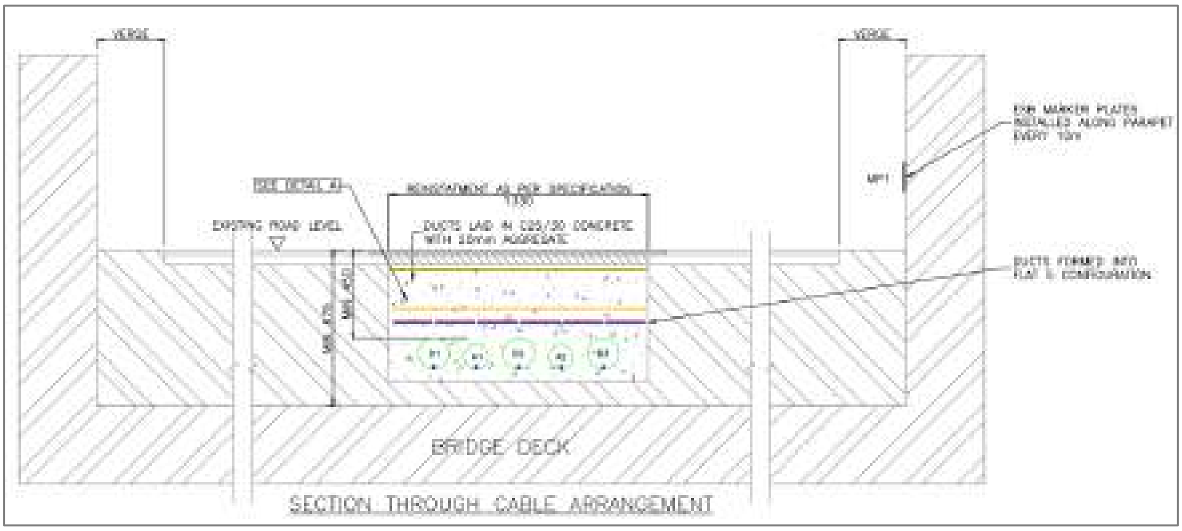

Figure 5 EirGrid standard bridge crossing detail, ducting laid within the carriageway

2.3 Option E Ducts split into both concrete verges

Option E for Clonava Bridge is illustrated on drawing COLE d005.3.7, refer to Appendix A. This option would involve laying the ducts in a flat formation within the two concrete verges. The ESBN Specification requires that a minimum 100mm cover be provided to ducting in this arrangement. This option would necessitate slightly widening one of the concrete verges in order to provide the width required to place the 3 power ducts on one side, and the communications and earthing duct in the opposite verge.

The benefit of this option would be that it effectively maintains the current widths of the road carriageway and concrete verges. This is not a standard EirGrid or ESBN design detail and would require a detailed review process with both parties to confirm their acceptance of such a proposal.

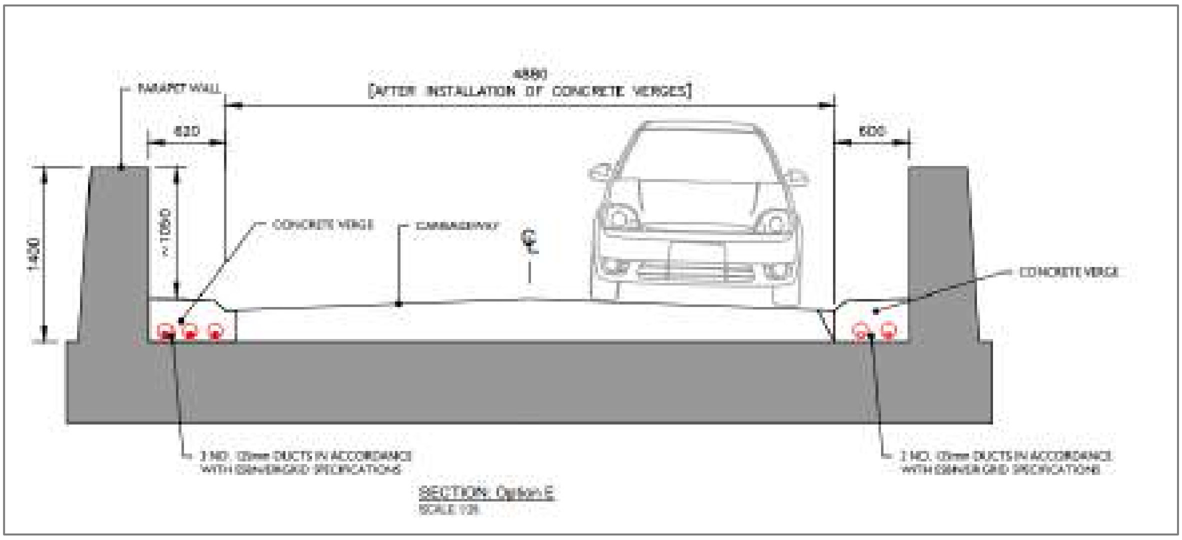

Figure 6 Clonava Bridge Option E

A site investigation including trial excavations over the bridge structures will be undertaken at detailed design stage to confirm the available depths for the options above.

2.4 Summary – Clonava Bridge (WH L1825-001.00)

As noted in the previous sections, following discussions with WCC it was agreed that prior to commencement of development security in a form to be agreed with the Planning Authority could be put in place to safeguard future maintenance or rehabilitation work at these bridge crossings.

Regarding Option A, a topographical survey of the road across the structure was completed and further clarification is provided in relation to the Council's concerns relating to this option in Section 2. This option is a standard method for ESBN for crossing bridges and is detailed on the ESBN Standard Specification for 110kV Network Ducting/Cabling.

In relation to Option B, in the meeting (10th October 2022) the Council raised concerns regarding potential damage to the external conduit and a further clarification and commitment is provided in response in Section 2. This option is a standard method for ESBN of crossing bridges with restricted space and is detailed on the ESBN Standard Specification for 110kV Network Ducting/Cabling.

Options C, D and E are presented in this report in response to the Council's submission and the subsequent meeting with WCC (10th October 2022).

Options C and E are variations of Option A, with the ducting placed within the concrete verges. While Option A requires a wider concrete verge on one side of the bridge, both of these options would allow wider concrete verges on both sides of the structure. Options C and E are non-standard EirGrid or ESBN design details and would require a detailed review process with both parties to confirm their acceptance.

Option D would allow the current road and verge widths to be maintained, thereby addressing the councils concerns regarding road capacity. The proposed duct arrangement is also a standard EirGrid design detail.

3. Bridge Crossing No. WH L1825-002.00 (Shrubbywood Bridge)

Westmeath County Council in their submission raised issues with Option A (method 4 as outlined in Chapter 4 Description, Section 4.8.7.5) for the Shrubbywood Bridge on the basis that Option A could compromise future maintenance or rehabilitation work. In the meeting with Westmeath County Council (10th October 2022), the Council also raised concerns regarding potential damage to the conduit in the case of an impact to the bridge parapet and indicated a general preference not to attached utilities externally along bridges.

In their submission, the Council requested that the developer provide an alternative method for placing of the proposed ducts and electricity cables across the River Inny.

Alternative crossing options are presented below, and illustrative drawings are included in Appendix A. Option A was previously submitted with the original planning application and therefore is not included here again. During the meeting (10th October 2022), WCC indicated that Option B, directional drilling, would be an acceptable option as it would not necessitate placing high voltage cables across the bridge.

Option B was previously submitted with the original planning application and further information on this option is provided below. Options C and D are presented in response to the Council's submission.

As noted in the previous sections, following subsequent phone calls with WCC it was agreed that prior to commencement of development security in a form to be agreed with the Planning Authority could be put in place to safeguard future maintenance or rehabilitation work at these bridge crossings. Westmeath County Council were agreeable to this proposal, and it is noted that WCC raised no objection to the proposed development in principle.

In relation to Option A, the Council also raised concerns regarding potential damage to the external conduit) in the case of an impact to the bridge parapet. Option A indicates the position of the conduit below the bottom of the parapet; therefore, any direct impact would not be transferred directly into the ducting conduit. The conduit and the support system will be designed to ensure the integrity of the HV cables and the safety of road users.

3.1 Option B Directional Drilling

During the meeting (10th October 2022), WCC indicated that Option B would be an acceptable option as it would not necessitate placing high voltage cables across the bridge.

Option B for Shrubbywood Bridge is illustrated on drawing COLE d005.3.4, refer to Appendix B. This option involves directionally drilling the ducts underneath the bridge and river. The EirGrid Specification requires that where the minimum standard "vertical cover" requirements cannot be achieved within the road, e.g., bridge crossings, then horizontal directional drilling should be investigated as an option. A topographical survey has been completed to assess the vertical and horizontal profile of the potential drill, and the drilling profile and pit locations are indicated on drawing COLE d005.3.4. Prior to detailed design stage, ground investigation will be undertaken to further assess and determine the type and depth of the bridge foundations.

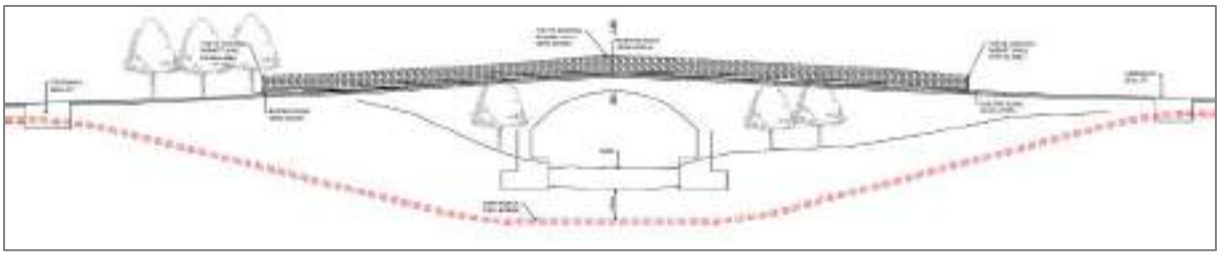

Figure 7 Shrubbywood Bridge Option B

3.2 Option C Ducts in the road (flat formation)

Option C for Shrubbywood Bridge is illustrated on drawing COLE d005.3.5, refer to Appendix B. This option would involve laying the ducts in a flat formation within the road carriageway. The EirGrid Specification requires that a minimum 450mm cover be provided to ducting in this arrangement (refer to Figure 5). This option would necessitate raising the road, verge and parapet wall levels by approximately 0.5m at the crown of the bridge, in order to provide the minimum coverage to the ducts. The roads on approach to the bridge would also be raised, in order to tie in with the higher level at the centre of the bridge.

Raising the road level could result in significant additional load being applied to the bridge structure. Lightweight fill material (e.g., a foamed concrete) could be used in order to maintain a similar total applied dead load, and a structural assessment would be completed. This option would also affect the road profile (and driver sightlines across the bridge) and a detailed road geometric design would be required at detailed design stage to establish the extent of road reprofiling required.

A parapet wall structural assessment would also be required to assess the parapet walls and determine what, if any, strengthening measures would be required for the raised parapet.

The benefit of this option would be that it maintains the current widths of the road carriageway and concrete verges, while providing a standard EirGrid cable crossing design.

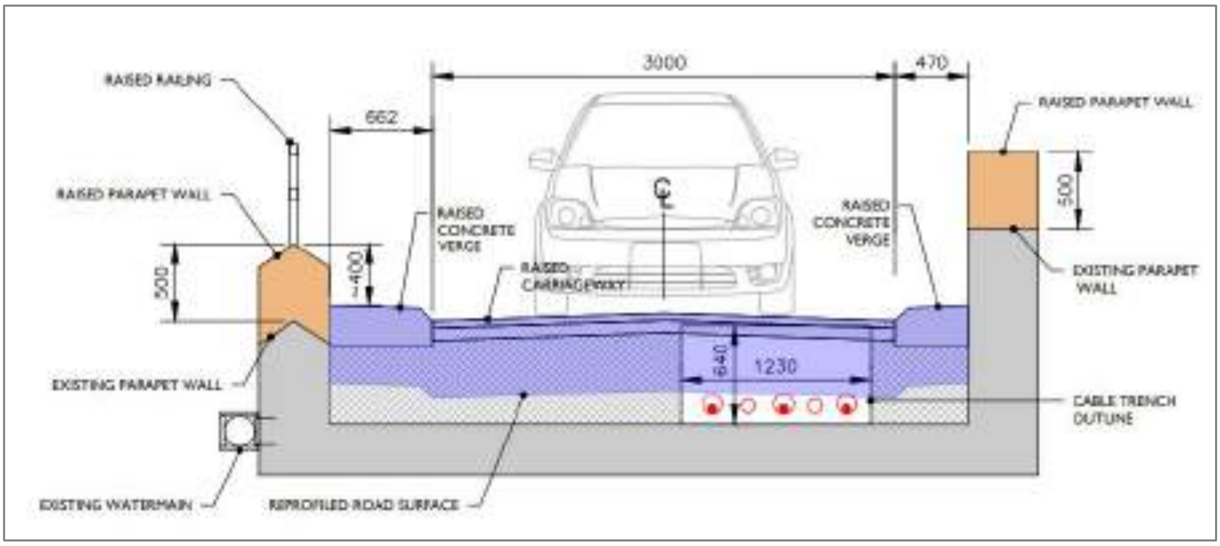

Figure 8 Shrubbywood Bridge Option C

3.3 Option D Ducts split into both concrete verges

Option D for Shrubbywood Bridge is illustrated on drawing COLE d005.3.8, refer to Appendix B. This option would involve laying the ducts in a flat formation within the two concrete verges. The ESBN Specification requires that a minimum of 100mm cover be provided to ducting in this arrangement. This option would necessitate rearranging the concrete verges, so that the wider verge is located on the north side of the bridge away from the water main. This would enable the 3 power ducts to be placed on one verge, and the communications and earthing duct in the opposite verge. The road and concrete verges would also need to be raised by approximately 150mm at the crown of the arch, with the road profile also raised on approach to the bridge in order to tie in with existing road levels.

The benefit of this option would be that it effectively maintains the current widths of the road carriageway and concrete verges and limits the depth of the raised road over the bridge. As detailed above, this option is not a standard EirGrid or ESBN design detail and would require a detailed review process with both parties to confirm their acceptance of such a proposal.

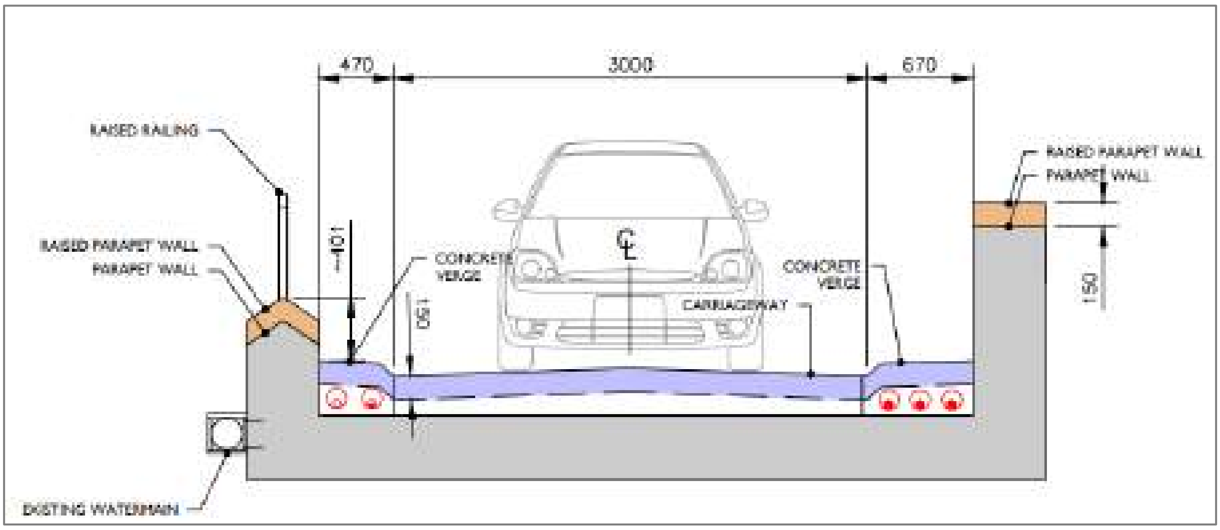

Figure 9 Shrubbywood Bridge Option D

A site investigation including trial excavations over the bridge structures will be undertaken at detailed design stage to confirm the available depths for the options above.

3.4 Summary – Shrubbywood Bridge (WH L1825-002.00)

As noted in the previous sections, following discussions with WCC it was agreed that prior to commencement of development security in a form to be agreed with the Planning Authority could be put in place to safeguard future maintenance or rehabilitation work at these bridge crossings.

In relation to Option A, in the meeting (10th October 2022) the Council raised concerns regarding potential damage to the external conduit and a further clarification and commitment is provided in response in Section 2. This option is a standard method for ESBN of crossing bridges with restricted space and is detailed on the ESBN Standard Specification for 110kV Network Ducting/Cabling.

WCC indicated (meeting of 10th October 2022) that Option B, directional drilling, would be an acceptable option as it would not necessitate placing high voltage cables across the bridge. The EirGrid Specification requires that where minimum standard "vertical cover" requirements cannot be achieved within the road, e.g., bridge crossings, then horizontal directional drilling can be utilised as an option.

Options C and D are presented in this report in response to the Council's submission and the subsequent meeting with WCC (10th October 2022).

Option C would allow the current road and verge widths to be maintained and is also a standard EirGrid design detail. However, it would involve raising the road level across the structure.

Option D places the ducting within the concrete verges. While this option requires a wider concrete verge on one side of the bridge, it would maintain concrete verges on both sides of the structure. Option D is a non-standard EirGrid or ESBN design detail and would require a detailed review process with both parties to confirm their acceptance.

4. Roadworks Guidelines & Standards

WCC in their submission raised a query in relation to compliance with the Purple Book. The planned works for the 110kV grid connection will be designed and built using the following guidelines and standards:

- Purple Book "Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads" Rev 1 (April 2017)
- Any other relevant local authority or TII standard

At detailed design stage, the grid route designer will prepare a full set of drawings and specifications covering all proposed works, and WCC will be given an opportunity to review and comment on the proposals as part of a detailed design review process.

APPENDIX A

- Bridge Crossing No. WH L1825-001.00 (Clonava Bridge) Drawings

Drawing No.	Revision	Drawing Name
COLE d005.3.3	B	Clonava Bridge Crossing WH-L1825-001.00 Proposed Option C
COLE d005.3.6	A	Clonava Bridge Crossing WH-L1825-001.00 Proposed Option D
COLE d005.3.7	A	Clonava Bridge Crossing WH-L1825-001.00 Proposed Option E

Please refer to Appendix 1 of the FI Drawings Pack (enclosed separately)

APPENDIX B

- Bridge Crossing No. WH L1825-002.00 (Shrubbywood Bridge) Drawings

Drawing No.	Revision	Drawing Name
COLE d005.3.4	C	Shrubbywood Bridge Crossing WH-L1825-002.00 Proposed Option B
COLE d005.3.5	C	Shrubbywood Bridge Crossing WH-L1825-002.00 Proposed Option C
COLE d005.3.8	B	Shrubbywood Bridge Crossing WH-L1825-002.00 Proposed Option D

Please refer to Appendix 1 of the FI Drawings Pack (enclosed separately)

APPENDIX 10

AWN TECHNICAL NOTE

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TECHNICAL NOTE

Project	**Coole Wind Farm Noise**
Subject	**Response to F.I. Request**
Author	**Mike Simms**
Date	**14 September 2022**
Ref.	**227502.0512NT01**

AWN Consulting Ltd (AWN) have been requested by MKO to provide a response to a Request for Further Information in relation to the proposed Coole Wind Farm development, planning application Ref No. ABP-309770-21 with An Bord Pleanála.

The following technical note provides a response on the topic of the range of possible turbine technologies which may be selected if the planning application is granted. The relevant sections from the FI Request are quoted below:

> 1.1 *It is noted that the development description as set out in the statutory notices refers to a maximum tip height of 175 metres. It noted that within this size envelope various configurations of hub height, rotor diameter and ground to blade tip height may be used and that the make and model of the turbine will be dictated by a competitive tender process. It is noted that a hub height of 100.5m is used as the basis of the noise assessment and that the landscape chapter references a maximum rotor diameter of up to 155m and that there is no similar reference in the biodiversity and ornithology or biodiversity chapters or in the Natura Impact Statement.*
>
> *[…]*
>
> 1.3. *If the development for which permission is sought incorporates a range of options, please indicate clearly in the application documentation the detail of all such options and confirm that each option has been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement.*

The noise assessment in the EIAR was based on Nordex N149 turbine technology with a hub height of 100.5 m. In order to address the request, two additional models of turbine have been assessed using the same methodology and guidance.

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This technical note summarises the noise assessment in the EIAR and then presents the input data and results for the two additional turbine technologies. The three different scenarios evaluated are therefore:

- Scenario 1: Nordex N149 at 100.5 m hub height (as in EIAR).
- Scenario 2: Siemens SG155 at 97.5 m hub height.
- Scenario 3: Vestas V150 at 100 m hub height.

The effect of changing the hub height has been examined and in this instance does not result in any change to the noise criteria under the Wind Energy Development Guidelines 2006.

1.0 SUMMARY OF NOISE ASSESSMENT IN EIAR

The sound power levels for the Nordex N149 with a hub height of 100.5 m are presented in Table 1 below.

Standardised 10m Height Wind Speed (m/s)	Octave Band (Hz) Sound Power Levels (dB re 10^{-12}W)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
3	77.1	83.7	86.6	87.6	88	86.2	80.5	71.3	94.0
4	78.3	84.9	87.8	88.8	89.2	87.4	81.7	72.5	95.2
5	81.0	87.6	91.3	93.4	94.7	92.8	83.2	75.3	99.7
6	85.3	91.9	95.6	97.7	99.0	97.1	87.5	79.6	104.0
7	86.9	93.4	97.1	99.2	100.5	98.7	89.1	81.2	105.5
≥8	87.3	93.5	97.2	99.8	100.5	98.0	90.4	82.4	105.6

Table 1 Scenario 1: Sound Power Levels for Nordex N149 at 100.5 m hub height

The predicted noise levels for all 198 locations assessed are presented in Table 11.22 of the EIAR. Potential exceedances of the noise criteria were noted at locations H007, H013, H014, H034, H040 and H041. As H007 and H034 are derelict and as H40 and H41 are commercial/agricultural buildings, these locations are not considered noise-sensitive. Noise at the remaining the remaining locations, H013 and H014 are re-presented in Table 2 below.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	31.1	32.3	36.6	40.9	42.4	42.6	42.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.9**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H014	Dwelling	30.4	31.6	35.9	40.2	41.7	42	42
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.2**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

Table 2 Review of Predicted Turbine Noise Levels against Relevant Criteria at H013 and H014.

As stated in the EIAR, once wind direction was taken into account, the predicted exceedances reduce as shown in Tables 11-23 and 11-24 in Section 11.5.3.1.1 of the EIAR, re-presented here:

Dwelling H013		Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
Wind Direction	Period	3	4	5	6	7	8	9
West	Daytime	--	--	--	0.2	--	--	--
	Night-time	--	--	--	--	--	--	--
Northwest	Daytime	--	--	--	0.5	--	--	--
	Night-time	--	--	--	--	--	--	--

Table 3 Scenario 1 (as in EIAR): Summary of Predicted Potential Exceedances – H013.

Dwelling H014		Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
Wind Direction	Period	3	4	5	6	7	8	9
West	Daytime	--	--	--	0.2	--	--	--
	Night-time	--	--	--	--	--	--	--

Table 4 Scenario 1 (as in EIAR): Predicted Potential Exceedances – H014.

As stated in the EIAR, in also Section 11.5.3.1.1:

> *Wind turbines can be programmed to run in reduced modes of operation (or low noise modes) in order to achieve noise criteria during certain periods (i.e. day or night) and in specific wind conditions (i.e. wind speed and direction). The turbine technology that has been assumed for this assessment offers various low noise modes of operation which typically will have an associated energy output reduction.*

In order to mitigate these exceedances, an indicative curtailment scheme was presented in Tables 11-25 and 11-26 of the EIAR, re-presented here:

Wind Direction	Period	Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)					
		4	5	6	7	8	9
Northwest	Daytime	--	--	T05: -1 dB T06: -1 dB T09: -1 dB T10: -1 dB T13: -1 dB T14: -1 dB	--	--	--
	Night-time	--	--	--	--	--	--

Table 5 Indicative Turbine Curtailment Matrix for Northwest Wind Direction

Wind Direction	Period	Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)					
		4	5	6	7	8	9
North	Daytime	--	--	T08: -1 dB T10: -1 dB T11: -1 dB	--	--	--
	Night-time	--	--	--	--	--	--

Table 6 Indicative Turbine Curtailment Matrix for North Wind Direction

Taking this into account, the predicted noise levels are within the noise criteria. In the following sections, this process is repeated for Scenario 2 and Scenario 3.

2.0 SCENARIO 2: SG155

The sound power levels for the Siemens Gamesa SG155 with a hub height of 97.5 m are presented in Table 7 below.

Standardised 10m Height Wind Speed (m/s)	Octave Band (Hz) Sound Power Levels (dB re 10^{-12}W)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
3	72.4	79.8	84.4	86.7	86.5	86.8	80.2	65.2	92.8
4	77.3	84.7	89.3	91.6	91.4	91.7	85.1	70.1	97.7
5	82.1	89.5	94.1	96.4	96.2	96.5	89.9	74.9	102.5
6	83.6	91.1	97.0	98.5	99.6	98.4	92.7	76.9	105.0
7	83.6	91.1	97.0	98.5	99.6	98.4	92.7	76.9	105.0
8	86.1	92.3	97.3	97.6	99.3	98.9	93.0	76.1	105.0
9	86.1	92.3	97.3	97.6	99.3	98.9	93.0	76.1	105.0

Table 7 Scenario 2: Sound Power Levels for SG155 at 97.5 m hub height

The predicted noise levels for all 198 locations assessed are presented in Appendix A of this technical note. Potential exceedances of the noise criteria include a similar set of locations to Scenario 1 though in this scenario (Scenario 2), two new residential locations, H023 and H024 are also showing potential exceedances:

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	29.3	34.2	39	41.6	41.6	41.5	41.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.6**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H014	Dwelling	28.7	33.6	38.4	40.9	40.9	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.9**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H023	Dwelling	28.2	33.1	37.9	40.5	40.5	40.4	40.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.5**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H024	Dwelling	27.9	32.8	37.6	40.2	40.2	40.1	40.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.2**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

Table 8 Scenario 2: Predicted Turbine Omni-directional Noise Levels against Relevant Criteria at H013, H014, H23 and H24.

Similarly, once wind direction was taken into account, these exceedances at H013, H014 and H023 reduce and the exceedances at H024 are no longer present. Tables 9 to 16 present the predicted noise levels at these noise-sensitive locations for each of the eight wind direction sectors. Note that as there are no exceedances of night-time criteria, the tables present the daytime assessment only.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28.4	33.3	38.1	40.7	40.7	40.6	40.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	0.7	--	--	--
H014	Dwelling	25.3	30.2	35	37.5	37.5	37.4	37.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	26.1	31	35.8	38.4	38.4	38.3	38.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	24.9	29.8	34.6	37.2	37.2	37.1	37.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 9 Scenario 2: Predicted turbine noise levels in the north wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	27	31.9	36.7	39.3	39.3	39.2	39.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	27.4	32.3	37.1	39.6	39.6	39.5	39.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	24.2	29.1	33.9	36.5	36.5	36.4	36.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	23.5	28.4	33.2	35.8	35.8	35.7	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 10 Scenario 2: Predicted turbine noise levels in the northeast wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	25.3	30.2	35	37.6	37.6	37.5	37.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	28.7	33.6	38.4	40.9	40.9	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	0.9	--	--	--
H023	Dwelling	23.5	28.4	33.2	35.8	35.8	35.7	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	24	28.9	33.7	36.3	36.3	36.2	36.2
	Daytime Criterion	40	40	40	40	45	45	45.4

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--

Table 11 Scenario 2: Predicted turbine noise levels in the east wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	24.8	29.7	34.5	37.1	37.1	37	37
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	28.6	33.5	38.3	40.8	40.8	40.7	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.8**	--	--	--
H023	Dwelling	24.4	29.3	34.1	36.7	36.7	36.6	36.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	25.6	30.5	35.3	37.9	37.9	37.8	37.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 12 Scenario 2: Predicted turbine noise levels in the southeast wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	25.7	30.6	35.4	38	38	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	27.8	32.7	37.5	40	40	39.9	39.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	25.9	30.8	35.6	38.1	38.1	38.1	38.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	26.5	31.4	36.2	38.8	38.8	38.7	38.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 13 Scenario 2: Predicted turbine noise levels in the south wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	27.5	32.4	37.2	39.8	39.8	39.7	39.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	26.1	31	35.8	38.3	38.3	38.2	38.2
	Daytime Criterion	40	40	40	40	45	45	45.4

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	27.6	32.5	37.3	39.9	39.9	39.8	39.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	27.6	32.5	37.3	39.9	39.9	39.8	39.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 14 Scenario 2: Predicted turbine noise levels in the southwest wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28.6	33.5	38.3	40.9	40.9	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.9**	--	--	--
H014	Dwelling	22.9	27.8	32.6	35.1	35.1	35	35
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	27.8	32.7	37.5	40.1	40.1	40	40
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.1**	--	--	--
H024	Dwelling	27.2	32.1	36.9	39.5	39.5	39.4	39.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 15 Scenario 2: Predicted turbine noise levels in the west wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28.9	33.8	38.6	41.2	41.2	41.1	41.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.2**	--	--	--
H014	Dwelling	23.1	28	32.8	35.3	35.3	35.2	35.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	27.4	32.3	37.1	39.7	39.7	39.6	39.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H024	Dwelling	26.3	31.2	36	38.6	38.6	38.5	38.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 16 Scenario 2: Predicted turbine noise levels in the northwest wind direction.

In order to mitigate these exceedances, an indicative curtailment scheme is presented in Table 17:

Wind Direction	Period	Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)					
		4	5	6	7	8	9
North	Daytime	--	--	T05: -1 dB T09: -1 dB T06: -1 dB T15: -1 dB T13: -1 dB T08: -1 dB	--	--	--
East		--	--	T11: -2 dB T10: -1 dB T08: -1 dB T12: -1 dB	--	--	--
Southeast		--	--	T11: -1 dB T10: -1 dB T08: -1 dB T12: -1 dB T09: -1 dB	--	--	--
West		--	--	T09: -2 dB T13: -2 dB T06: -2 dB T05: -1 dB	--	--	--
Northwest		--	--	T05: -2 dB T09: -2 dB T13: -2 dB T06: -2 dB T14: -1 dB	--	--	--

Table 17 Indicative Turbine Curtailment Matrix for Scenario 2

Taking this into account, the predicted noise levels are within the noise criteria for Scenario 2.

3.0 SCENARIO 3: V150

The sound power levels for the Vestas V150 with a hub height of 100 m are presented in Table 18 below.

Standardised 10m Height Wind Speed (m/s)	Octave Band (Hz) Sound Power Levels (dB re 10^{-12}W)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
3	73.6	81.3	86.1	87.9	86.7	82.5	75.3	65.1	92.7
4	76.7	84.6	89.4	91.3	90.1	86.0	78.8	68.6	96.1
5	81.1	88.9	93.7	95.6	94.5	90.3	83.2	73.0	100.4
6	84.4	92.3	97.2	99.1	98.0	93.9	86.8	76.6	103.9
7	85.1	93.1	98.0	100.0	98.9	94.8	87.7	77.5	104.8
8	85.5	93.3	98.2	100.1	99.0	94.8	87.7	77.6	104.9
9	86.3	93.7	98.2	100.0	98.9	94.8	88.0	78.2	104.9

Table 18 Scenario 3: Sound Power Levels for V150 at 100 m hub height

The predicted noise levels for all 198 locations assessed are presented in Appendix B of this technical note. Exceedances of the noise criteria include a similar set of locations as above though in this scenario: H013, H014, and H023.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	30.2	33.6	37.9	41.4	42.3	42.4	42.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.4**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H014	Dwelling	29.6	32.9	37.2	40.7	41.6	41.7	41.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.7**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H023	Dwelling	29.1	32.5	36.8	40.3	41.2	41.3	41.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.3**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

Table 19 Scenario 3: Predicted Turbine Omni-directional Noise Levels against Relevant Criteria at H013, H014, H23 and H24.

Once again, with wind direction taken into account, these exceedances at H013, and H014 reduce and the exceedances at H023 are no longer present. Tables 20 to 27 present the predicted noise levels at these noise-sensitive locations for each of the eight wind direction sectors. Note that as there are no exceedances of night-time criteria, the tables present daytime assessment only.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	29.3	32.7	37	40.5	41.4	41.5	41.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.5**	--	--	--
H014	Dwelling	26.2	29.5	33.8	37.3	38.2	38.3	38.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	27	30.4	34.7	38.2	39.1	39.2	39.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 20 Scenario 3: Predicted turbine noise levels in the north wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28	31.4	35.7	39.2	40.1	40.2	40.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	28.3	31.6	35.9	39.4	40.3	40.4	40.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H023	Dwelling	25.1	28.5	32.8	36.3	37.2	37.3	37.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 21 Scenario 3: Predicted turbine noise levels in the northeast wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	26.3	29.7	34	37.5	38.4	38.5	38.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	29.6	32.9	37.2	40.7	41.6	41.7	41.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.7**	--	--	--
H023	Dwelling	24.4	27.8	32.1	35.6	36.5	36.6	36.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 22 Scenario 3: Predicted turbine noise levels in the east wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	25.7	29.1	33.4	36.9	37.8	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	29.5	32.8	37.1	40.6	41.5	41.6	41.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.6**	--	--	--
H023	Dwelling	25.3	28.7	33	36.5	37.4	37.5	37.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 23 Scenario 3: Predicted turbine noise levels in the southeast wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	26.6	30	34.3	37.8	38.7	38.8	38.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	28.7	32	36.3	39.8	40.7	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	26.9	30.3	34.6	38.1	39	39.1	39.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 24 Scenario 3: Predicted turbine noise levels in the south wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28.5	31.9	36.2	39.7	40.6	40.7	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H014	Dwelling	27	30.3	34.6	38.1	39	39.1	39.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	28.5	31.9	36.2	39.7	40.6	40.7	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 25 Scenario 3: Predicted turbine noise levels in the southwest wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	28.6	33.5	38.3	40.9	40.9	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.9**	--	--	--
H014	Dwelling	22.9	27.8	32.6	35.1	35.1	35	35
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	27.8	32.7	37.5	40.1	40.1	40	40
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.1**	--	--	--

Table 26 Scenario 3: Predicted turbine noise levels in the west wind direction.

NSL Ref	Parameter	Sound Pressure Level, dB $L_{A90,10min}$ at Wind Speed m/s at Standardised 10 m height						
		3	4	5	6	7	8	9
H013	Dwelling	29.8	33.2	37.5	41	41.9	42	42
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.0**	--	--	--
H014	Dwelling	24	27.3	31.6	35.1	36	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
H023	Dwelling	28.3	31.7	36	39.5	40.4	40.5	40.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

Table 27 Scenario 3: Predicted turbine noise levels in the northwest wind direction.

In order to mitigate these exceedances, an indicative curtailment scheme is presented in Table 28:

Wind Direction	Period	Excesses of Criterion dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)					
		4	5	6	7	8	9
North	Daytime	--	--	T05: -1 dB T09: -1 dB T06: -1 dB T15: -1 dB	--	--	--
East		--	--	T11: -1 dB T10: -1 dB T08: -1 dB T12: -1 dB T09: -1 dB	--	--	--
Southeast		--	--	T11: -1 dB T10: -1 dB T08: -1 dB	--	--	--
West		--	--	T09: -2 dB T13: -2 dB T06: -1 dB T05: -1 dB T14: -1 dB	--	--	--
Northwest		--	--	T05: -2 dB T09: -2 dB T13: -2 dB T06: -1 dB T14: -1 dB	--	--	--

Table 28 Indicative Turbine Curtailment Matrix Scenario 3

Taking this mitigation into account, the predicted noise levels for Scenario 3 are within the noise criteria.

4.0 CONCLUSION

Paragraph 1.3 of the Request for Further Information is repeated here:

> *1.3. If the development for which permission is sought incorporates a range of options, please indicate clearly in the application documentation the detail of all such options and confirm that each option has been fully assessed within the application documentation including within the Environmental Impact Assessment Report and Natura Impact Statement.*

The EIAR was prepared on the basis of the Nordex N149 turbine technology; the outcome of assessment is that while there were potential exceedances, noise levels from the proposed wind farm development can be brought within criteria using curtailment of the wind turbines under the stated wind conditions (speed and direction). The scenario assessed in the EIAR is labelled ‘Scenario 1’ in this technical note.

Sections 2 and 3 of this technical note provide an assessment of two alternative turbine technologies, and in each case a similar situation arises, i.e. that there are a small number of potential exceedances but with consideration of wind direction and wind turbine curtailment, noise levels are within criteria, and the description of residual effects would remain the same as stated in the EIAR Section 11.6.3.1.1.

It is therefore considered that a range of options has been assessed for environmental noise and that in each case a compliant solution has been found. In respect of the final selection of turbine technology, a compliance report including a further environmental noise assessment will be completed and issued to the local authority for review. The applicant would welcome a planning condition requiring such a compliance noise report.

APPENDIX A – SCENARIO 2 PREDICTED NOISE LEVELS

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H001	Predicted	23.5	28.4	33.2	35.8	35.8	35.7	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H002	Predicted	23.9	28.8	33.6	36.1	36.1	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H003	Predicted	24.3	29.2	34	36.5	36.5	36.5	36.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H004	Predicted	24.2	29.1	33.9	36.4	36.4	36.3	36.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H005	Predicted	23.4	28.3	33.1	35.7	35.7	35.6	35.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H006	Predicted	24	28.9	33.7	36.2	36.2	36.2	36.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H007 (Derelict)	Predicted	32.2	37.1	41.9	44.4	44.4	44.3	44.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**1.9**	**4.4**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	**1.4**	**1.4**	**1.3**	--
H008	Predicted	22.8	27.7	32.5	35	35	35	35
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H009	Predicted	24.1	29	33.8	36.3	36.3	36.2	36.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H010	Predicted	24.4	29.3	34.1	36.7	36.7	36.6	36.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H011	Predicted	26.1	31	35.8	38.4	38.4	38.3	38.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H012	Predicted	26.3	31.2	36	38.6	38.6	38.5	38.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H013	Predicted	29.3	34.2	39	41.6	41.6	41.5	41.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.6**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H014	Predicted	28.7	33.6	38.4	40.9	40.9	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.9**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H015	Predicted	25.5	30.4	35.2	37.8	37.8	37.7	37.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H016	Predicted	25.4	30.3	35.1	37.6	37.6	37.5	37.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H017	Predicted	26.9	31.8	36.6	39.2	39.2	39.1	39.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H018	Predicted	27.6	32.5	37.3	39.9	39.9	39.8	39.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H019	Predicted	27.8	32.7	37.5	40	40	39.9	39.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H020	Predicted	27.7	32.6	37.4	40	40	39.9	39.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H021	Predicted	27.7	32.6	37.4	39.9	39.9	39.8	39.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H022	Predicted	27.6	32.5	37.3	39.8	39.8	39.8	39.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H023	Predicted	28.2	33.1	37.9	40.5	40.5	40.4	40.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.5**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H024	Predicted	27.9	32.8	37.6	40.2	40.2	40.1	40.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.2**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H025	Predicted	22.3	27.2	32	34.5	34.5	34.5	34.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H026	Predicted	22.1	27	31.8	34.3	34.3	34.3	34.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H027	Predicted	26.8	31.7	36.5	39	39	38.9	38.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H028	Predicted	23.5	28.4	33.2	35.7	35.7	35.7	35.7

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H029	Predicted	24.6	29.5	34.3	36.8	36.8	36.7	36.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H030	Predicted	26	30.9	35.7	38.2	38.2	38.2	38.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H031	Predicted	23.7	28.6	33.4	35.9	35.9	35.9	35.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H032	Predicted	25.4	30.3	35.1	37.7	37.7	37.6	37.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H033	Predicted	22.1	27	31.8	34.3	34.3	34.3	34.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H034 (Derelict)	Predicted	31.4	36.3	41.1	43.7	43.7	43.6	43.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**1.1**	**3.7**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	**0.7**	**0.7**	**0.6**	--
H035	Predicted	22.8	27.7	32.5	35	35	35	35
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H036	Predicted	25.2	30.1	34.9	37.4	37.4	37.4	37.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H037	Predicted	25.8	30.7	35.5	38.1	38.1	38	38
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H038	Predicted	27.5	32.4	37.2	39.8	39.8	39.7	39.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H039 (Comm er-cial)	Predicted	28.5	33.4	38.2	40.7	40.7	40.6	40.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.7**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H040 (Comm er-cial)	Predicted	30.7	35.6	40.4	42.9	42.9	42.8	42.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**0.4**	**2.9**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H041 (Comm er-cial)	Predicted	34.9	39.8	44.6	47.1	47.1	47	47
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**4.6**	**7.1**	**2.1**	**2.0**	**1.6**
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	**1.6**	**4.1**	**4.1**	**4.0**	**1.5**
H042	Predicted	27.8	32.7	37.5	40	40	39.9	39.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H043 (Derelic t)	Predicted	28.2	33.1	37.9	40.5	40.5	40.4	40.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.5**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H044	Predicted	23.5	28.4	33.2	35.7	35.7	35.7	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H045	Predicted	22.3	27.2	32	34.5	34.5	34.5	34.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H046	Predicted	25.3	30.2	35	37.5	37.5	37.5	37.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H047	Predicted	22.8	27.7	32.5	35	35	35	35
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H048	Predicted	22.4	27.3	32.1	34.6	34.6	34.6	34.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H049	Predicted	24.6	29.5	34.3	36.8	36.8	36.8	36.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H050	Predicted	21.7	26.6	31.4	34	34	33.9	33.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H051	Predicted	20.8	25.7	30.5	33	33	33	33
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H052	Predicted	19.5	24.4	29.2	31.6	31.6	31.7	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H053	Predicted	21.5	26.4	31.2	33.7	33.7	33.7	33.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H054	Predicted	22.4	27.3	32.1	34.6	34.6	34.6	34.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H055	Predicted	21.2	26.1	30.9	33.4	33.4	33.4	33.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H056	Predicted	20.9	25.8	30.6	33.1	33.1	33.1	33.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H057	Predicted	20.2	25.1	29.9	32.4	32.4	32.5	32.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H058	Predicted	18.7	23.6	28.4	30.9	30.9	30.9	30.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H059	Predicted	20.1	25	29.8	32.3	32.3	32.3	32.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H060	Predicted	20.8	25.7	30.5	33	33	33	33
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H061	Predicted	20.6	25.5	30.3	32.8	32.8	32.8	32.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H062	Predicted	20.1	25	29.8	32.3	32.3	32.3	32.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H063	Predicted	19.9	24.8	29.6	32.1	32.1	32.1	32.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H064	Predicted	20	24.9	29.7	32.2	32.2	32.3	32.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H065	Predicted	20	24.9	29.7	32.2	32.2	32.2	32.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H066	Predicted	20.1	25	29.8	32.3	32.3	32.4	32.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H067	Predicted	18.1	23	27.8	30.3	30.3	30.4	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H068	Predicted	20.7	25.6	30.4	32.8	32.8	32.9	32.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H069	Predicted	19.7	24.6	29.4	31.8	31.8	31.9	31.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H070	Predicted	19.4	24.3	29.1	31.6	31.6	31.7	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H071	Predicted	19.2	24.1	28.9	31.3	31.3	31.4	31.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H072	Predicted	19	23.9	28.7	31.1	31.1	31.2	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H073	Predicted	19.2	24.1	28.9	31.4	31.4	31.4	31.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H074	Predicted	18.5	23.4	28.2	30.6	30.6	30.7	30.7

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H075	Predicted	19	23.9	28.7	31.2	31.2	31.3	31.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H076	Predicted	18.8	23.7	28.5	30.9	30.9	31	31
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H077	Predicted	18.6	23.5	28.3	30.7	30.7	30.8	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H078	Predicted	18.4	23.3	28.1	30.5	30.5	30.6	30.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H079	Predicted	18.6	23.5	28.3	30.7	30.7	30.8	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H080	Predicted	18.3	23.2	28	30.4	30.4	30.5	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H081	Predicted	18.3	23.2	28	30.5	30.5	30.6	30.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H082	Predicted	17.9	22.8	27.6	30	30	30.1	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H083	Predicted	18.1	23	27.8	30.3	30.3	30.4	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H084	Predicted	18.3	23.2	28	30.5	30.5	30.5	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H085	Predicted	17.7	22.6	27.4	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H086	Predicted	15.8	20.7	25.5	27.9	27.9	28	28
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H087	Predicted	18.2	23.1	27.9	30.3	30.3	30.4	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H088	Predicted	16.2	21.1	25.9	28.3	28.3	28.4	28.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H089	Predicted	18	22.9	27.7	30.2	30.2	30.3	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H090	Predicted	18	22.9	27.7	30.2	30.2	30.3	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H091	Predicted	17.8	22.7	27.5	29.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H092	Predicted	17.7	22.6	27.4	29.8	29.8	29.9	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H093	Predicted	18.5	23.4	28.2	30.6	30.6	30.7	30.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H094	Predicted	18.2	23.1	27.9	30.3	30.3	30.4	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H095	Predicted	17.9	22.8	27.6	30	30	30.1	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H096	Predicted	18	22.9	27.7	30.1	30.1	30.2	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H097	Predicted	17.8	22.7	27.5	30	30	30.1	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H098	Predicted	18.4	23.3	28.1	30.6	30.6	30.7	30.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H099	Predicted	17.8	22.7	27.5	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H100	Predicted	17.6	22.5	27.3	29.8	29.8	29.9	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H101	Predicted	17.7	22.6	27.4	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H102	Predicted	17.6	22.5	27.3	29.7	29.7	29.8	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H103	Predicted	16.6	21.5	26.3	28.7	28.7	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H104	Predicted	16.4	21.3	26.1	28.5	28.5	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H105	Predicted	15.7	20.6	25.4	27.8	27.8	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H106	Predicted	18.1	23	27.8	30.2	30.2	30.3	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H107	Predicted	15.6	20.5	25.3	27.8	27.8	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H108	Predicted	18.2	23.1	27.9	30.4	30.4	30.5	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H109	Predicted	18	22.9	27.7	30.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H110	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H111	Predicted	15.6	20.5	25.3	27.8	27.8	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H112	Predicted	17.7	22.6	27.4	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H113	Predicted	17.4	22.3	27.1	29.5	29.5	29.7	29.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H114	Predicted	17.4	22.3	27.1	29.5	29.5	29.7	29.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H115	Predicted	16.4	21.3	26.1	28.5	28.5	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H116	Predicted	15.5	20.4	25.2	27.6	27.6	27.7	27.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H117	Predicted	16.2	21.1	25.9	28.3	28.3	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H118	Predicted	17.5	22.4	27.2	29.6	29.6	29.7	29.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H119	Predicted	17.3	22.2	27	29.5	29.5	29.6	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H120	Predicted	16.8	21.7	26.5	29	29	29.1	29.1

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H121	Predicted	16.8	21.7	26.5	28.9	28.9	29	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H122	Predicted	15.3	20.2	25	27.4	27.4	27.6	27.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H123	Predicted	16.8	21.7	26.5	28.9	28.9	29	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H124	Predicted	15.5	20.4	25.2	27.6	27.6	27.7	27.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H125	Predicted	17.7	22.6	27.4	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H126	Predicted	16.7	21.6	26.4	28.9	28.9	28.9	28.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H127	Predicted	15.7	20.6	25.4	27.8	27.8	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H128	Predicted	17.7	22.6	27.4	29.9	29.9	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H129	Predicted	17.8	22.7	27.5	30	30	30.1	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H130	Predicted	16.7	21.6	26.4	28.8	28.8	28.9	28.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H131	Predicted	16.6	21.5	26.3	28.7	28.7	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H132	Predicted	16.3	21.2	26	28.5	28.5	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H133	Predicted	17.7	22.6	27.4	29.8	29.8	29.9	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H134	Predicted	15.1	20	24.8	27.2	27.2	27.4	27.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H135	Predicted	16.1	21	25.8	28.2	28.2	28.4	28.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H136	Predicted	17	21.9	26.7	29.1	29.1	29.3	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H137	Predicted	16.5	21.4	26.2	28.6	28.6	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H138	Predicted	15.4	20.3	25.1	27.5	27.5	27.6	27.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H139	Predicted	17.3	22.2	27	29.4	29.4	29.5	29.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H140	Predicted	15.1	20	24.8	27.2	27.2	27.3	27.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H141	Predicted	15.5	20.4	25.2	27.6	27.6	27.8	27.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H142	Predicted	17	21.9	26.7	29.1	29.1	29.3	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H143	Predicted	15	19.9	24.7	27.1	27.1	27.2	27.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H144	Predicted	17.3	22.2	27	29.5	29.5	29.6	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H145	Predicted	15.1	20	24.8	27.2	27.2	27.3	27.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H146	Predicted	17.3	22.2	27	29.5	29.5	29.6	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H147	Predicted	16.6	21.5	26.3	28.7	28.7	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H148	Predicted	16.9	21.8	26.6	29	29	29.1	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H149	Predicted	16.8	21.7	26.5	28.9	28.9	29.1	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H150	Predicted	16.3	21.2	26	28.4	28.4	28.5	28.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H151	Predicted	16.7	21.6	26.4	28.9	28.9	29	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H152	Predicted	17.2	22.1	26.9	29.3	29.3	29.5	29.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H153	Predicted	17.5	22.4	27.2	29.6	29.6	29.8	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H154	Predicted	17.2	22.1	26.9	29.4	29.4	29.5	29.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H155	Predicted	16.7	21.6	26.4	28.8	28.8	29	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H156	Predicted	16.1	21	25.8	28.2	28.2	28.4	28.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H157	Predicted	17.1	22	26.8	29.2	29.2	29.4	29.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H158	Predicted	16	20.9	25.7	28.1	28.1	28.3	28.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H159	Predicted	17	21.9	26.7	29.1	29.1	29.3	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H160	Predicted	16.6	21.5	26.3	28.7	28.7	28.9	28.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H161	Predicted	15.5	20.4	25.2	27.6	27.6	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H162	Predicted	16.6	21.5	26.3	28.7	28.7	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H163	Predicted	17.1	22	26.8	29.3	29.3	29.4	29.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H164	Predicted	16.5	21.4	26.2	28.7	28.7	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H165	Predicted	17.2	22.1	26.9	29.3	29.3	29.5	29.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H166	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H167	Predicted	16.9	21.8	26.6	29	29	29.2	29.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H168	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H169	Predicted	16.5	21.4	26.2	28.6	28.6	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H170	Predicted	16.5	21.4	26.2	28.6	28.6	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H171	Predicted	16.4	21.3	26.1	28.6	28.6	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H172	Predicted	16.3	21.2	26	28.4	28.4	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H173	Predicted	16.4	21.3	26.1	28.5	28.5	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H174	Predicted	17.2	22.1	26.9	29.4	29.4	29.5	29.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H175	Predicted	16.4	21.3	26.1	28.5	28.5	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H176	Predicted	16.3	21.2	26	28.5	28.5	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H177	Predicted	16.3	21.2	26	28.4	28.4	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H178	Predicted	16.3	21.2	26	28.4	28.4	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H179	Predicted	16.8	21.7	26.5	28.9	28.9	29.1	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H180	Predicted	16.2	21.1	25.9	28.4	28.4	28.5	28.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H181	Predicted	16.1	21	25.8	28.2	28.2	28.4	28.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H182	Predicted	15.2	20.1	24.9	27.3	27.3	27.5	27.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H183	Predicted	16.7	21.6	26.4	28.8	28.8	29	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H184	Predicted	16.6	21.5	26.3	28.7	28.7	28.9	28.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H185	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H186	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H187	Predicted	15.7	20.6	25.4	27.8	27.8	28	28
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H188	Predicted	16.5	21.4	26.2	28.6	28.6	28.8	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H189	Predicted	15.8	20.7	25.5	27.9	27.9	28.1	28.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H190	Predicted	15.6	20.5	25.3	27.7	27.7	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H191	Predicted	16.4	21.3	26.1	28.5	28.5	28.7	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H192	Predicted	16.3	21.2	26	28.4	28.4	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H193	Predicted	16.2	21.1	25.9	28.3	28.3	28.5	28.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H194	Predicted	15.7	20.6	25.4	27.8	27.8	28	28
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H195	Predicted	16.3	21.2	26	28.4	28.4	28.6	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H196	Predicted	15.6	20.5	25.3	27.7	27.7	27.9	27.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H197	Predicted	15.7	20.6	25.4	27.8	27.8	28	28
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H198	Predicted	15.3	20.2	25	27.4	27.4	27.6	27.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

APPENDIX B – SCENARIO 3 PREDICTED NOISE LEVELS

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H001	Predicted	24.6	28	32.3	35.8	36.6	36.8	36.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H002	Predicted	25	28.3	32.7	36.1	37	37.1	37.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H003	Predicted	25.4	28.7	33.1	36.5	37.4	37.5	37.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H004	Predicted	25.2	28.6	32.9	36.4	37.2	37.4	37.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H005	Predicted	24.5	27.9	32.2	35.7	36.5	36.7	36.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H006	Predicted	25	28.4	32.7	36.2	37	37.2	37.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H007 (Derelict)	Predicted	32.7	36.1	40.4	43.9	44.8	44.9	44.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**0.4**	**3.9**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	**0.9**	**1.8**	**1.9**	--
H008	Predicted	24	27.3	31.6	35.1	36	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H009	Predicted	25.2	28.5	32.9	36.3	37.2	37.3	37.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H010	Predicted	25.6	28.9	33.2	36.7	37.6	37.7	37.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H011	Predicted	27.2	30.5	34.9	38.3	39.2	39.3	39.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H012	Predicted	27.4	30.7	35	38.5	39.4	39.5	39.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H013	Predicted	30.2	33.6	37.9	41.4	42.3	42.4	42.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**1.4**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H014	Predicted	29.6	32.9	37.2	40.7	41.6	41.7	41.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.7**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H015	Predicted	26.6	29.9	34.2	37.7	38.6	38.7	38.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H016	Predicted	26.4	29.8	34.1	37.6	38.4	38.6	38.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H017	Predicted	27.9	31.2	35.6	39	39.9	40	40
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H018	Predicted	28.5	31.9	36.2	39.7	40.6	40.7	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H019	Predicted	28.7	32	36.4	39.8	40.7	40.8	40.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H020	Predicted	28.7	32	36.4	39.8	40.7	40.8	40.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H021	Predicted	28.6	32	36.3	39.8	40.6	40.8	40.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H022	Predicted	28.5	31.9	36.2	39.7	40.6	40.7	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H023	Predicted	29.1	32.5	36.8	40.3	41.2	41.3	41.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.3**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H024	Predicted	28.8	32.2	36.5	40	40.9	41	41
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H025	Predicted	23.5	26.8	31.1	34.6	35.5	35.6	35.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H026	Predicted	23.2	26.6	30.9	34.4	35.2	35.4	35.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H027	Predicted	27.8	31.1	35.4	38.9	39.8	39.9	39.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H028	Predicted	24.7	28	32.3	35.8	36.7	36.8	36.8

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H029	Predicted	25.7	29	33.3	36.8	37.7	37.8	37.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H030	Predicted	27	30.4	34.7	38.2	39	39.2	39.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H031	Predicted	24.8	28.1	32.5	35.9	36.8	36.9	37
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H032	Predicted	26.5	29.8	34.1	37.6	38.5	38.6	38.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H033	Predicted	23.3	26.6	30.9	34.4	35.2	35.4	35.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H034 (Derelict)	Predicted	32.2	35.6	39.9	43.4	44.2	44.4	44.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**3.4**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	**0.4**	**1.2**	**1.4**	--
H035	Predicted	23.9	27.3	31.6	35.1	35.9	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H036	Predicted	26.2	29.6	33.9	37.4	38.3	38.4	38.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H037	Predicted	26.8	30.2	34.5	38	38.8	39	39
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H038	Predicted	28.5	31.8	36.2	39.6	40.5	40.6	40.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H039 (Commer-cial)	Predicted	29.4	32.7	37.1	40.5	41.4	41.5	41.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.5**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H040 (Commer-cial)	Predicted	31.4	34.8	39.1	42.6	43.5	43.6	43.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**2.6**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	**0.5**	**0.6**	--
H041 (Commer-cial)	Predicted	35.5	38.8	43.1	46.6	47.5	47.6	47.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	**3.1**	**6.6**	**2.5**	**2.6**	**2.2**
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	**0.1**	**3.6**	**4.5**	**4.6**	**2.1**
H042	Predicted	28.7	32	36.4	39.9	40.7	40.9	40.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H043 (Derelict)	Predicted	29.1	32.4	36.8	40.3	41.1	41.3	41.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	**0.3**	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H044	Predicted	24.6	27.9	32.2	35.7	36.6	36.7	36.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H045	Predicted	23.5	26.8	31.1	34.6	35.5	35.6	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H046	Predicted	26.3	29.6	33.9	37.4	38.3	38.4	38.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H047	Predicted	23.9	27.2	31.5	35	35.9	36	36
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H048	Predicted	23.5	26.8	31.1	34.6	35.5	35.6	35.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H049	Predicted	25.7	29.1	33.4	36.9	37.7	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H050	Predicted	22.9	26.2	30.5	34	34.9	35	35.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H051	Predicted	21.9	25.3	29.6	33.1	33.9	34.1	34.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H052	Predicted	20.7	24	28.3	31.8	32.6	32.8	32.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H053	Predicted	22.6	26	30.3	33.8	34.6	34.8	34.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H054	Predicted	23.6	26.9	31.2	34.7	35.5	35.7	35.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H055	Predicted	22.4	25.7	30.1	33.5	34.4	34.6	34.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H056	Predicted	22.1	25.4	29.8	33.2	34.1	34.2	34.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H057	Predicted	21.5	24.8	29.1	32.6	33.5	33.6	33.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H058	Predicted	19.9	23.3	27.6	31.1	31.9	32.1	32.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H059	Predicted	21.4	24.7	29	32.5	33.3	33.5	33.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H060	Predicted	22	25.4	29.7	33.2	34	34.2	34.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H061	Predicted	21.8	25.1	29.4	32.9	33.8	33.9	34
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H062	Predicted	21.3	24.6	29	32.4	33.3	33.4	33.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H063	Predicted	21.1	24.5	28.8	32.3	33.1	33.3	33.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H064	Predicted	21.3	24.6	28.9	32.4	33.3	33.4	33.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H065	Predicted	21.2	24.6	28.9	32.4	33.2	33.4	33.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H066	Predicted	21.4	24.7	29	32.5	33.4	33.5	33.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H067	Predicted	19.4	22.7	27	30.5	31.3	31.5	31.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H068	Predicted	21.9	25.2	29.5	33	33.9	34	34.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H069	Predicted	20.9	24.3	28.6	32.1	32.9	33.1	33.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H070	Predicted	20.7	24	28.3	31.8	32.7	32.8	32.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H071	Predicted	20.4	23.8	28.1	31.6	32.4	32.6	32.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H072	Predicted	20.3	23.6	27.9	31.4	32.2	32.4	32.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H073	Predicted	20.5	23.8	28.1	31.6	32.4	32.6	32.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H074	Predicted	19.8	23.1	27.4	30.9	31.7	31.9	32

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H075	Predicted	20.3	23.6	27.9	31.4	32.3	32.4	32.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H076	Predicted	20	23.4	27.7	31.2	32	32.2	32.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H077	Predicted	19.8	23.2	27.5	31	31.8	32	32
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H078	Predicted	19.7	23	27.3	30.8	31.6	31.8	31.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H079	Predicted	19.8	23.2	27.5	31	31.8	32	32
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H080	Predicted	19.5	22.9	27.2	30.7	31.5	31.7	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H081	Predicted	19.6	23	27.3	30.7	31.6	31.7	31.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H082	Predicted	19.2	22.5	26.8	30.3	31.1	31.3	31.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H083	Predicted	19.4	22.8	27.1	30.5	31.4	31.6	31.6
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H084	Predicted	19.6	22.9	27.2	30.7	31.5	31.7	31.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H085	Predicted	19	22.3	26.7	30.1	31	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H086	Predicted	17.1	20.4	24.7	28.2	29	29.2	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H087	Predicted	19.5	22.8	27.1	30.6	31.4	31.6	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H088	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H089	Predicted	19.3	22.7	27	30.5	31.3	31.5	31.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H090	Predicted	19.3	22.7	27	30.4	31.3	31.5	31.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H091	Predicted	19.1	22.4	26.7	30.2	31.1	31.2	31.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H092	Predicted	19	22.3	26.6	30.1	30.9	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H093	Predicted	19.7	23.1	27.4	30.9	31.7	31.9	31.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H094	Predicted	19.5	22.8	27.1	30.6	31.4	31.6	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H095	Predicted	19.2	22.5	26.8	30.3	31.1	31.3	31.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H096	Predicted	19.3	22.6	26.9	30.4	31.2	31.4	31.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H097	Predicted	19.1	22.5	26.8	30.2	31.1	31.3	31.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H098	Predicted	19.7	23	27.3	30.8	31.7	31.8	31.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H099	Predicted	19.2	22.5	26.8	30.3	31.1	31.3	31.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H100	Predicted	18.9	22.3	26.6	30	30.9	31.1	31.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H101	Predicted	19	22.3	26.7	30.1	31	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H102	Predicted	18.9	22.2	26.5	30	30.8	31	31.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H103	Predicted	17.9	21.2	25.5	29	29.9	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H104	Predicted	17.7	21	25.3	28.8	29.7	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H105	Predicted	16.9	20.2	24.5	28	28.8	29	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H106	Predicted	19.4	22.7	27	30.5	31.3	31.5	31.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H107	Predicted	16.9	20.2	24.5	28	28.8	29	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H108	Predicted	19.5	22.9	27.2	30.6	31.5	31.7	31.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H109	Predicted	19.3	22.6	26.9	30.4	31.3	31.4	31.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H110	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H111	Predicted	16.9	20.3	24.6	28.1	28.9	29.1	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H112	Predicted	19	22.4	26.7	30.1	31	31.2	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H113	Predicted	18.7	22	26.4	29.8	30.7	30.8	30.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H114	Predicted	18.7	22	26.3	29.8	30.7	30.8	30.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H115	Predicted	17.7	21.1	25.4	28.8	29.7	29.8	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H116	Predicted	16.8	20.1	24.4	27.9	28.7	28.9	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H117	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H118	Predicted	18.8	22.1	26.4	29.9	30.7	30.9	31
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H119	Predicted	18.6	22	26.3	29.7	30.6	30.8	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H120	Predicted	18.1	21.4	25.8	29.2	30.1	30.2	30.3

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H121	Predicted	18.1	21.4	25.7	29.2	30	30.2	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H122	Predicted	16.6	19.9	24.3	27.7	28.6	28.7	28.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H123	Predicted	18	21.4	25.7	29.2	30	30.2	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H124	Predicted	16.7	20	24.3	27.8	28.6	28.8	28.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H125	Predicted	19	22.4	26.7	30.2	31	31.2	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H126	Predicted	18	21.3	25.6	29.1	30	30.1	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H127	Predicted	17.1	20.5	24.8	28.2	29.1	29.3	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H128	Predicted	19	22.4	26.7	30.1	31	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H129	Predicted	19.1	22.4	26.8	30.2	31.1	31.2	31.3
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H130	Predicted	18	21.3	25.6	29.1	30	30.1	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H131	Predicted	17.9	21.2	25.5	29	29.8	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H132	Predicted	17.8	21.2	25.5	29	29.8	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H133	Predicted	19	22.3	26.6	30.1	30.9	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H134	Predicted	16.4	19.7	24	27.5	28.3	28.5	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H135	Predicted	17.4	20.8	25.1	28.5	29.4	29.6	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H136	Predicted	18.3	21.6	25.9	29.4	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H137	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H138	Predicted	17.5	20.8	25.2	28.6	29.5	29.6	29.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H139	Predicted	18.6	21.9	26.2	29.7	30.5	30.7	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H140	Predicted	16.3	19.6	23.9	27.4	28.2	28.4	28.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H141	Predicted	16.8	20.2	24.5	28	28.8	29	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H142	Predicted	18.3	21.7	26	29.4	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H143	Predicted	16.3	19.6	23.9	27.4	28.2	28.4	28.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H144	Predicted	18.6	22	26.3	29.8	30.6	30.8	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H145	Predicted	16.4	19.7	24	27.5	28.4	28.5	28.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H146	Predicted	18.7	22	26.3	29.8	30.6	30.8	30.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H147	Predicted	17.9	21.2	25.5	29	29.8	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H148	Predicted	18.2	21.5	25.8	29.3	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H149	Predicted	18.1	21.4	25.8	29.2	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H150	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H151	Predicted	18.1	21.4	25.7	29.2	30	30.2	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H152	Predicted	18.5	21.9	26.2	29.6	30.5	30.7	30.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H153	Predicted	18.8	22.1	26.5	29.9	30.8	30.9	31
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H154	Predicted	18.6	21.9	26.2	29.7	30.5	30.7	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H155	Predicted	18	21.3	25.6	29.1	30	30.1	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H156	Predicted	17.4	20.7	25.1	28.5	29.4	29.5	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
H157	Predicted	18.4	21.7	26.1	29.5	30.4	30.5	30.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H158	Predicted	17.4	20.7	25	28.5	29.3	29.5	29.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H159	Predicted	18.3	21.6	25.9	29.4	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H160	Predicted	17.9	21.2	25.5	29	29.8	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H161	Predicted	16.9	20.2	24.5	28	28.8	29	29.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H162	Predicted	17.9	21.2	25.5	29	29.8	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H163	Predicted	18.4	21.8	26.1	29.6	30.4	30.6	30.6
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H164	Predicted	17.9	21.2	25.5	29	29.8	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H165	Predicted	18.5	21.9	26.2	29.6	30.5	30.6	30.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H166	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H167	Predicted	18.2	21.5	25.8	29.3	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H168	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H169	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H170	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H171	Predicted	17.8	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H172	Predicted	17.7	21.1	25.4	28.9	29.7	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H173	Predicted	17.7	21.1	25.4	28.8	29.7	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H174	Predicted	18.6	21.9	26.2	29.7	30.5	30.7	30.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H175	Predicted	17.7	21	25.3	28.8	29.6	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H176	Predicted	17.7	21	25.3	28.8	29.6	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H177	Predicted	17.7	21	25.3	28.8	29.6	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H178	Predicted	17.7	21	25.3	28.8	29.6	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H179	Predicted	18.1	21.4	25.7	29.2	30	30.2	30.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H180	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H181	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H182	Predicted	16.5	19.8	24.1	27.6	28.5	28.6	28.7
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H183	Predicted	18	21.4	25.7	29.2	30	30.2	30.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H184	Predicted	17.9	21.2	25.5	29	29.9	30	30.1
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H185	Predicted	17.8	21.2	25.5	29	29.8	30	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H186	Predicted	17.8	21.1	25.5	28.9	29.8	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H187	Predicted	17.1	20.4	24.7	28.2	29	29.2	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H188	Predicted	17.8	21.1	25.4	28.9	29.8	29.9	30
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H189	Predicted	17.2	20.5	24.9	28.3	29.2	29.3	29.4
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H190	Predicted	16.9	20.3	24.6	28.1	28.9	29.1	29.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H191	Predicted	17.7	21.1	25.4	28.8	29.7	29.9	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H192	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H193	Predicted	17.6	20.9	25.2	28.7	29.5	29.7	29.8
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5

House	Parameter	Noise Level, dB L_{A90} at Standardised Wind Speed, m/s						
		3.0	4.0	5.0	6.0	7.0	8.0	9.0
	Night-time Excess	--	--	--	--	--	--	--
H194	Predicted	17	20.3	24.7	28.1	29	29.1	29.2
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H195	Predicted	17.7	21	25.3	28.8	29.6	29.8	29.9
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H196	Predicted	17.1	20.4	24.7	28.2	29	29.2	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H197	Predicted	17.1	20.4	24.7	28.2	29	29.2	29.3
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--
H198	Predicted	16.7	20.1	24.4	27.8	28.7	28.9	29
	Daytime Criterion	40	40	40	40	45	45	45.4
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.5
	Night-time Excess	--	--	--	--	--	--	--

APPENDIX 11

SHADOW FLICKER ASSESSMENT RESULTS

APPENDIX - 11

SHADOW FLICKER ASSESSMENT RESULTS

Project Reference	200445-g Coole ABP Further Information
Date & Time	19.10.2022
Subject	Shadow Flicker Assessment Results
Author(s)	Emily Lynch, James Newell, Ellen Costello

Introduction

MKO has been commissioned to conduct a Shadow Flicker Assessment of 3 no. scenarios (Scenarios 1, 2 and 3) in relation to turbine dimensions for the Proposed Coole Wind Farm Development following receipt of a request for Further Information from An Bord Pleanála (ref: ABP-309770-21).

Three turbine scenarios have been assessed, the results of which are presented below:

- **Scenario 1** as modelled and assessed in Chapter 5 of the Environmental Impact Assessment Report (EIAR) lodged and as submitted to An Bord Pleanála in 2021 (2021 EIAR).
- **Scenario 2**
- **Scenario 3**

Table 1 Turbine Scenarios

Label	Tip Height (m)	Hub Height (m)	Blade Length (m)	Rotor Diameter (m)
Scenario 1 (2021 EIAR)	175	97.5	77.5	155
Scenario 2	175	100	75	150
Scenario 3	175	100.5	74.5	149

The Shadow Flicker Assessment was carried out by Emily Lynch an Environmental Scientist, and James Newell a Graphics Technician, both of MKO. This Shadow Flicker Assessment has been reviewed by Ellen Costello, a Project Environmental Scientist of MKO.

Shadow Flicker Prediction Methodology

Shadow Flicker occurs only under certain, combined circumstances. Where shadow flicker does occur, it is generally short-lived.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft) or WindFarmer (DNV.GL) or AWS OpenWind or WindPro.

The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

Any potential impact can be precisely modelled to give the start and end time (accurate to the second) of any incidence of shadow flicker, at any location, on any day or all days of the year when it might occur. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days.

For the purposes of this shadow flicker assessment, the software package ReSoft WindFarm Version 5.0.1.2 has been used to predict the level of shadow flicker associated with the Coole Wind Farm Development.

The total annual shadow flicker calculated for each property assumes 100% sunshine during daytime hours. However, weather data for this region shows that the sun shines on average for 30.1% of the daylight hours per year. This percentage is based on Met Eireann data recorded at Mullingar over the 30-year period from 1981 to 2010 (www.met.ie). The actual sunshine hours at the Coole Wind Farm Site and therefore the percentage of time shadow flicker could actually occur is 30.1%.

The shadow flicker model does not consider that the turbine will not always be yawed such that the rotor is in the worst-case orientation. In order to include the probability of the rotor being orientated within the sun turbine vector, a wind directionality factor has also been applied. Three-years wind direction frequency distribution has been collected from the Coole met mast (Pl ref 18/1624) and correlated with MERRA 5 node data from a 20 year period to produce an estimate of the long-term wind direction frequency in the region of the Wind Farm Site. Using this data, it is possible to estimate the probability of the rotor being orientated within 30 degrees of a vector parallel to the sun turbine vector. This probability is estimated at a reduction of 37% based on the most onerous wind direction.

The assessment tables below therefore lists the annual shadow flicker calculated for each property when corrected for the regional average of 30.1% sunshine and wind reduction factor of 37%, to give a more accurate annual average shadow flicker prediction.

The assessment tables below outlines whether a shadow flicker mitigation strategy is required for any property within the study area which may be impacted by shadow flicker.

Guidance

The current, adopted guidance for shadow flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006'* (DoEHLG), and the '*Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The DoEHLG 2006 wind energy guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day. As detailed in Chapter 5 Population & Human Health, Section 5.7.2, there are no occupied dwellings within 500m of any proposed turbine location. The closest occupied dwelling H14 (i.e. dwelling not involved with the proposed development) is located at a distance of approx. 700 metres from the nearest proposed turbine T11. There are 2 no. dwellings, H18 and H24 which are located at distances of 638m and 679m fromT15 respectively however these are individuals involved with the proposed development.

The adopted 2006 DoEHLG guidelines are currently under review. The DoHPLG released the 'Draft Revised Wind Energy Development Guidelines' in December 2019 for public consultation. The Draft 2019 guidelines recommend local planning authorities and/or An Bord Pleanála impose conditions to ensure that:

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"no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required."

The Draft 2019 Guidelines are based on the recommendations set out in the 'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review' (December 2013) and the 'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach' (June 2017).

The applicant is aware that the Department of the Environment, Heritage and Local Government (DoEHLG) Wind Energy Development Planning Guidelines (2006) are currently being revised. The assessment herein is based on compliance with the DoEHLG Guidelines limit (30 hours per year or 30 minutes per day) however in line with the commitment made for the permitted development and following continuing engagement with the local community, Coole Wind Farm Ltd is committing to zero shadow flicker at occupied residential receptors within 10 rotor diamaters of the proposed development.

Study Area

The study area for the shadow flicker assessment is ten times rotor diameter, as set out in the '*Wind Energy Development Guidelines for Planning Authorities'*, DoEHLG, 2006. The study area for the Proposed Coole Wind Farm under all three scenarios modelled is as follows:

Table 2: Study Area

Label	Rotor Diameter (m)	Study Area (m)
Scenario 1 (2021 EIAR)	155	1550
Scenario 2	150	1500
Scenario 3	149	1490

All residential properties located within ten rotor diameters of the Coole Wind Farm have been included within this assessment.

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Processing Results

Scenario 1 – Maximum Rotor Diameter of 155m

Table 1 Maximum Potential Daily and Annual Shadow Flicker for Scenario 1 (2021 EIAR)

Building No.	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Turbine	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine and Wind Direction (hrs:min:sec)	Turbine(s) Giving Rise to Exceedance	Mitigation Strategy Required?
1	640265	773572	Dwelling	1189	14	00:00:00	0:00:00	0:00:00	-	No
2	638979	775866	Dwelling	1127	11	00:35:24	52:42:00	10:59:22	8, 10, 11	Yes
3	639016	775795	Dwelling	1054	11	00:37:12	55:18:00	11:31:54	8, 10, 11	Yes
4	640289	773649	Dwelling	1113	14	00:00:00	0:00:00	0:00:00	-	No
5	640330	773542	Dwelling	1175	14	00:00:00	0:00:00	0:00:00	-	No
6	640947	773562	Dwelling	956	14	00:00:00	0:00:00	0:00:00	-	No
7	641116	774222	Derelict	323	14	00:40:12	44:42:00	9:19:17	12	No
8	640084	773521	Dwelling	1264	12	00:00:00	0:00:00	0:00:00	-	No
9	642272	774530	Dwelling	1237	15	00:30:00	13:00:00	2:42:39	14	No
10	642185	774543	Dwelling	1200	14	00:31:48	26:30:00	5:31:34	13, 14	Yes
11	641937	774707	Dwelling	970	14	00:39:00	52:18:00	10:54:22	9, 13, 14	Yes
12	641910	774724	Dwelling	948	14	00:39:36	54:06:00	11:16:53	9, 13, 14	Yes
13	641664	775254	Dwelling	822	5	01:14:24	217:24:00	**45:20:04**	8, 9, 10, 12, 13, 14, 15	Yes
14	639601	775807	Dwelling	703	11	01:17:24	190:18:00	**39:41:00**	7, 8, 9, 10, 11, 12, 13	Yes

15	642951	776614	Dwelling	970	15	00:39:00	55:06:00	11:29:24	3, 4, 5	Yes
16	642901	776844	Dwelling	910	4	00:47:24	67:36:00	14:05:48	2, 3, 4, 5	Yes
17	642806	776444	Dwelling	784	15	00:43:12	91:12:00	19:01:05	3, 4, 5, 15	Yes
18	642756	776340	Dwelling	679	15	00:39:36	89:24:00	18:38:33	3, 4, 5	Yes
19	642706	776361	Dwelling	703	15	00:39:00	87:06:00	18:09:47	3, 4, 5	Yes
20	642682	776398	Dwelling	743	15	00:54:36	98:18:00	20:29:55	2, 3, 4, 5, 6, 15	Yes
21	642653	776542	Dwelling	754	4	00:53:24	115:42:00	24:07:37	2, 3, 4, 5	Yes
22	642667	776522	Dwelling	776	4	00:51:36	109:36:00	22:51:18	2, 3, 4, 5	Yes
23	642579	776502	Dwelling	713	4	00:58:12	109:12:00	22:46:17	2, 3, 4, 5, 6	Yes
24	642733	776298	Dwelling	638	15	00:46:12	88:00:00	18:21:02	3, 4, 5	Yes
25	642155	778365	Dwelling	1322	2	00:25:48	13:42:00	2:51:25	2	No
26	642239	778362	Derelict	1368	2	00:27:36	18:48:00	3:55:13	2	No
27	642260	775081	Derelict	774	15	00:28:12	38:30:00	8:01:42	6, 9, 13, 14	No
28	638928	775869	Dwelling	1169	11	00:34:12	37:42:00	7:51:42	10, 11	Yes
29	639065	775820	Dwelling	1032	11	00:38:24	61:36:00	12:50:44	8, 10, 11	Yes
30	639192	775658	Derelict	831	11	00:46:12	81:42:00	17:02:13	8, 10, 11, 12	No
31	640310	773582	Derelict	1154	14	00:00:00	0:00:00	0:00:00	-	No
32	642886	776870	Derelict	893	4	00:45:00	68:48:00	14:20:49	2, 3, 4, 5	No
33	643163	777432	Dwelling	1282	4	00:30:36	15:36:00	3:15:11	4	Yes
34	641308	775128	Derelict	564	13	01:27:36	193:18:00	**40:18:32**	10, 11, 12, 13, 14	No
42	642644	776514	Dwelling	761	4	00:55:48	117:00:00	24:23:53	2, 3, 4, 5, 6	Yes
43	642454	777256	Derelict	577	4	01:27:36	123:48:00	25:48:58	2, 3, 4, 5	No
44	640763	773492	Dwelling	1049	14	00:00:00	0:00:00	0:00:00	-	No
46	643256	776221	Dwelling	740	15	00:49:12	109:48:00	22:53:48	4, 5, 15	Yes
47	643616	775360	Dwelling	896	15	00:43:12	45:18:00	9:26:47	15	Yes
48	643678	776105	Dwelling	1009	15	00:37:48	25:36:00	5:20:18	15	Yes

49	642295	774677	Dwelling	1094	15	00:29:24	13:00:00	2:42:39	14	No
50	643720	776266	Dwelling	1125	15	00:34:48	23:06:00	4:49:01	15	Yes
51	643849	775245	Dwelling	1155	15	00:34:12	26:24:00	5:30:19	15	Yes
52	644046	775197	Dwelling	1356	15	00:29:24	17:36:00	3:40:12	15	No
53	640421	773230	Dwelling	1406	14	00:00:00	0:00:00	0:00:00	-	No
54	642467	774281	Dwelling	1414	15	00:25:48	8:00:00	1:40:06	14	No
55	640496	773182	Dwelling	1422	14	00:00:00	0:00:00	0:00:00	-	No
56	640508	773129	Dwelling	1468	14	00:00:00	0:00:00	0:00:00	-	No
57	641611	773183	Dwelling	1474	14	00:00:00	0:00:00	0:00:00	-	No
58	644197	775241	Dwelling	1486	15	00:27:00	13:00:00	2:42:39	15	No
59	643867	776669	Dwelling	1489	15	00:28:12	22:18:00	4:39:01	15	No
60	643363	777513	Dwelling	1497	4	00:26:24	11:24:00	2:22:38	4	No
61	640609	773065	Dwelling	1500	14	00:00:00	0:00:00	0:00:00	-	No
62	643862	776714	Dwelling	1516	15	00:27:36	24:12:00	5:02:47	15	No
63	641588	773109	Dwelling	1532	14	00:00:00	0:00:00	0:00:00	-	No

Scenario 2 - Median Rotor Diameter of 150m

Table 2 Maximum Potential Daily and Annual Shadow Flicker

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Annual)
1	640265	773572	Dwelling	1189	14	00:00:00	0:00:00	0:00:00		No
2	638979	775866	Dwelling	1127	11	00:34:12	40:06:00	8:21:43	11	Yes
3	639016	775795	Dwelling	1054	11	00:36:00	42:00:00	8:45:30	11	Yes
4	640289	773649	Dwelling	1113	14	00:00:00	0:00:00	0:00:00		No
5	640330	773542	Dwelling	1175	14	00:00:00	0:00:00	0:00:00		No
6	640947	773562	Dwelling	956	14	00:00:00	0:00:00	0:00:00		No
7	641116	774222	Derelict	323	14	00:39:00	42:36:00	8:53:00	12	Yes
8	640084	773521	Dwelling	1264	12	00:00:00	0:00:00	0:00:00		No
9	642272	774530	Dwelling	1237	15	00:28:48	12:36:00	2:37:39		No
10	642185	774543	Dwelling	1200	14	00:30:36	14:24:00	3:00:10	14	Yes
11	641937	774707	Dwelling	970	14	00:37:48	50:06:00	10:26:50	13,14	Yes
12	641910	774724	Dwelling	948	14	00:38:24	51:42:00	10:46:52	13,14	Yes
13	641664	775254	Dwelling	822	5	01:12:00	208:36:00	**43:29:58**	9,13,14,15	Yes
14	639601	775807	Dwelling	703	11	01:15:36	155:06:00	**32:20:35**	8,10,11	Yes
15	642951	776614	Dwelling	970	15	00:37:48	53:06:00	11:04:23	4	Yes
16	642901	776844	Dwelling	910	4	00:40:12	53:36:00	11:10:38	4	Yes
17	642806	776444	Dwelling	784	15	00:42:00	87:12:00	18:11:02	4,5	Yes
18	642756	776340	Dwelling	679	15	00:37:48	85:24:00	17:48:30	4,5,15	Yes
19	642706	776361	Dwelling	703	15	00:36:36	82:36:00	17:13:28	4,5,15	Yes
20	642682	776398	Dwelling	743	15	00:40:12	82:18:00	17:09:43	3,4,5	Yes

21	642653	776542	Dwelling	754	4	00:52:12	110:36:00	23:03:48	3,4,5	Yes
22	642667	776522	Dwelling	776	4	00:50:24	104:42:00	21:49:59	3,4,5	Yes
23	642579	776502	Dwelling	713	4	00:57:00	102:48:00	21:26:13	3,4,5	Yes
24	642733	776298	Dwelling	638	15	00:45:00	83:54:00	17:29:44	5,15	Yes
25	642155	778365	Dwelling	1322	2	00:25:12	13:24:00	2:47:39		No
26	642239	778362	Derelict	1368	2	00:27:36	18:36:00	3:52:43		No
27	642260	775081	Derelict	774	15	00:27:00	26:48:00	5:35:19		No
28	638928	775869	Dwelling	1169	11	00:33:00	35:54:00	7:29:10	11	Yes
29	639065	775820	Dwelling	1032	11	00:37:12	59:24:00	12:23:12	11	Yes
30	639192	775658	Derelict	831	11	00:45:00	78:36:00	16:23:26	10,11	Yes
31	640310	773582	Derelict	1154	14	00:00:00	0:00:00	0:00:00		No
32	642886	776870	Derelict	893	4	00:40:48	54:30:00	11:21:54	4	Yes
33	643163	777432	Dwelling	1282	4	00:29:24	15:00:00	3:07:41		No
34	641308	775128	Derelict	564	13	01:26:24	185:42:00	**38:43:26**	10,12,13,14	Yes
42	642644	776514	Dwelling	761	4	00:51:00	101:24:00	21:08:42	3,4,5	Yes
43	642454	777256	Derelict	577	4	01:26:24	117:00:00	24:23:53	2,3,4	Yes
44	640763	773492	Dwelling	1049	14	00:00:00	0:00:00	0:00:00		No
46	643256	776221	Dwelling	740	15	00:47:24	95:36:00	19:56:08	15	Yes
47	643616	775360	Dwelling	896	15	00:42:00	42:54:00	8:56:45	15	Yes
48	643678	776105	Dwelling	1009	15	00:36:36	24:24:00	5:05:17	15	Yes
49	642295	774677	Dwelling	1094	15	00:28:12	12:30:00	2:36:24		No
50	643720	776266	Dwelling	1125	15	00:33:36	22:06:00	4:36:31	15	Yes
51	643849	775245	Dwelling	1155	15	00:33:00	25:18:00	5:16:33	15	Yes
52	644046	775197	Dwelling	1356	15	00:28:48	16:54:00	3:31:27		No
53	640421	773230	Dwelling	1406	14	00:00:00	0:00:00	0:00:00		No
54	642467	774281	Dwelling	1414	15	00:25:12	7:54:00	1:38:51		No
55	640496	773182	Dwelling	1422	14	00:00:00	0:00:00	0:00:00		No
56	640508	773129	Dwelling	1468	14	00:00:00	0:00:00	0:00:00		No
57	641611	773183	Dwelling	1474	14	00:00:00	0:00:00	0:00:00		No
58	644197	775241	Dwelling	1486	15	00:25:48	12:30:00	2:36:24		No

59	643867	776669	Dwelling	1489	15	00:27:00	21:36:00	4:30:15		No
60	643363	777513	Dwelling	1497	4	00:25:48	11:06:00	2:18:53		No
61	640609	773065	Dwelling	1500	14	00:00:00	0:00:00	0:00:00		No
62*	643862	776714	Dwelling	1516						
63*	641588	773109	Dwelling	1532						

*Property is beyond the shadow flicker study area limit of 1500m

Scenario 3 - Minimum Rotor Diameter of 149m

Table 3 Maximum Potential Daily and Annual Shadow Flicker

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Annual)
1	640265	773572	Dwelling	1189	14	00:00:00	0:00:00	0:00:00		No
2	638979	775866	Dwelling	1127	11	00:34:12	39:42:00	7:21:52	11	Yes
3	639016	775795	Dwelling	1054	11	00:36:00	41:30:00	7:41:54	11	Yes
4	640289	773649	Dwelling	1113	14	00:00:00	0:00:00	0:00:00		No
5	640330	773542	Dwelling	1175	14	00:00:00	0:00:00	0:00:00		No
6	640947	773562	Dwelling	956	14	00:00:00	0:00:00	0:00:00		No
7	641116	774222	Derelict	323	14	00:39:00	42:12:00	7:49:41	12	Yes
8	640084	773521	Dwelling	1264	12	00:00:00	0:00:00	0:00:00		No
9	642272	774530	Dwelling	1237	15	00:28:48	12:30:00	2:19:08		No
10	642185	774543	Dwelling	1200	14	00:30:36	14:18:00	2:39:10	14	Yes
11	641937	774707	Dwelling	970	14	00:37:12	49:42:00	9:13:10	13,14	Yes
12	641910	774724	Dwelling	948	14	00:38:24	51:06:00	9:28:45	13,14	Yes
13	641664	775254	Dwelling	822	5	01:11:24	206:36:00	**38:19:27**	9, 13, 14, 15	Yes
14	639601	775807	Dwelling	703	11	01:15:00	153:42:00	28:30:41	8, 10, 11	Yes
15	642951	776614	Dwelling	970	15	00:37:12	42:24:00	7:51:55	4	Yes
16	642901	776844	Dwelling	910	4	00:40:12	53:06:00	9:51:00	4	Yes
17	642806	776444	Dwelling	784	15	00:41:24	86:24:00	16:01:38	4,5	Yes
18	642756	776340	Dwelling	679	15	00:37:12	84:30:00	15:40:29	4, 5,15	Yes

19	642706	776361	Dwelling	703	15	00:36:00	81:42:00	15:09:19	4, 5,15	Yes
20	642682	776398	Dwelling	743	15	00:39:36	81:12:00	15:03:45	3,4,5	Yes
21	642653	776542	Dwelling	754	4	00:51:36	109:36:00	20:19:51	3,4,5	Yes
22	642667	776522	Dwelling	776	4	00:49:48	103:42:00	19:14:11	3,4,5	Yes
23	642579	776502	Dwelling	713	4	00:56:24	101:36:00	18:50:48	3, 4,5	Yes
24	642733	776298	Dwelling	638	15	00:45:00	82:54:00	15:22:41	5, 15	Yes
25	642155	778365	Dwelling	1322	2	00:25:12	13:18:00	2:28:02		No
26	642239	778362	Derelict	1368	2	00:27:36	18:30:00	3:25:54		No
27	642260	775081	Derelict	774	15	00:27:00	12:48:00	2:22:28		No
28	638928	775869	Dwelling	1169	11	00:33:00	35:36:00	6:36:14	11	Yes
29	639065	775820	Dwelling	1032	11	00:37:12	58:42:00	10:53:20	11	Yes
30	639192	775658	Derelict	831	11	00:45:00	77:48:00	14:25:55	10,11	Yes
31	640310	773582	Derelict	1154	14	00:00:00	0:00:00	0:00:00		No
32	642886	776870	Derelict	893	4	00:40:48	54:06:00	10:02:08	4	Yes
33	643163	777432	Dwelling	1282	4	00:29:24	14:54:00	2:45:50		No
34	641308	775128	Derelict	564	13	01:26:24	184:06:00	**34:09:02**	10, 12, 13, 14	Yes
42	642644	776514	Dwelling	761	4	00:51:00	100:24:00	18:37:27	3, 4,5	Yes
43	642454	777256	Derelict	577	4	01:25:48	115:36:00	21:26:38	2,3,4	Yes
44	640763	773492	Dwelling	1049	14	00:00:00	0:00:00	0:00:00		No
46	643256	776221	Dwelling	740	15	00:46:48	94:42:00	17:34:01	15	Yes
47	643616	775360	Dwelling	896	15	00:42:00	42:24:00	7:51:55	15	Yes
48	643678	776105	Dwelling	1009	15	00:36:36	24:06:00	4:28:14	15	Yes
49	642295	774677	Dwelling	1094	15	00:28:12	12:30:00	2:19:08	15	No
50	643720	776266	Dwelling	1125	15	00:33:36	21:54:00	4:03:45	15	Yes
51	643849	775245	Dwelling	1155	15	00:33:00	25:00:00	4:38:15	15	Yes
52	644046	775197	Dwelling	1356	15	00:28:12	16:42:00	3:05:52		No
53	640421	773230	Dwelling	1406	14	00:00:00	0:00:00	0:00:00		No
54	642467	774281	Dwelling	1414	15	00:00:00	0:00:00	0:00:00		No
55	640496	773182	Dwelling	1422	14	00:00:00	0:00:00	0:00:00		No

56	640508	773129	Dwelling	1468	14	00:00:00	0:00:00	0:00:00		No
57	641611	773183	Dwelling	1474	14	00:00:00	0:00:00	0:00:00		No
58	644197	775241	Dwelling	1486	15	00:25:48	12:24:00	2:18:01		No
59	643867	776669	Dwelling	1489	15	00:27:00	21:30:00	3:59:18		No
60*	643363	777513	Dwelling	1497	4					
61*	640609	773065	Dwelling	1500	14					
62*	643862	776714	Dwelling	1516	15					
63*	641588	773109	Dwelling	1532	14					

*Property is beyond the shadow flicker study area limit of 1490m

Summary

As presented in the summary tables the variance in results between each of the scenarios is minimal (± 1 no. dwellings) with the greatest number of exceedances of the DoEHLG 2006 wind energy guidelines daily (30 minutes) and annual (30-hours) limits occurring from Turbine Scenario 1. Turbine Scenario 1, which has been assessed within the EIAR using the precautionary principle, has the largest proposed rotor diameter (155m – based on the longest rotor blade) and the minimum hub height (97.5m) (therefore providing a tip height of 175m). Daily and annual shadow flicker exceedances arise at a reduced number of properties for remaining Turbine Scenarios (Scenario 2 and 3) which is to be expected considering their reduced rotor diameter. Irrespective of which Turbine Scenario (combination of hub height and rotor diameter) within the range outlined above is installed on site, the significance of residual landscape and visual effects will not be altered

It should also be noted that the phenomenon of Shadow Flicker is entirely controllable, and that in the event of favourable consideration it is standard practice for an appropriate planning condition to be imposed. Any future turbine installed on site in the event of favourable consideration must comply with any such condition, and as detailed in Section 5.7.2 of the EIAR, in line with the commitment made for the permitted Coole Wind Farm development and following continuing engagement with the local community requirements Coole Wind Farm Ltd. is committing to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

APPENDIX 12

FI MWP RESPONSE

Response to RFI Item Number 4.1

Coole Wind Farm

Coole Wind Farm Ltd.

September 2022

MWP

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Appendices

Appendix A – Summary of Factual Ground Investigation Information at T12

Appendix B - Drawing of Existing Ground Levels at T12 from LiDAR data

MWP

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23249	6001	A	15/08/2022	P Curran	D Cagney	P Curran	DRAFT
23249	6001	B	19/08/2022	P Curran	D Cagney	P Curran	DRAFT
23249	6001	C	08/09/2022	P Curran	D Cagney	P Curran	DRAFT

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QUALITY
I.S. EN ISO 9001:2015
NSAI Certified

HEALTH & SAFETY
I.S. ISO 45001:2018
NSAI Certified

ENVIRONMENT
I.S. EN ISO 14001:2015
NSAI Certified

1. Introduction

Malachy Walsh and Partners Limited (MWP) was appointed by Coole Wind Farm Limited to provide a response to item 4.1 of a Request for Further Information (RFI) from An Bord Pleanála on Case Number ABP-309770-21 dated 21 April 2022. This item is reproduced below for clarity:

"4.1 In section 8.3.2.1 of the EIAR it is stated that the recorded peat depth at T12 is given as 12.5m - from the 2020 rotary core boreholes while the peat depth within 50m is 4.5m based on table 8-4. You are requested to justify the location of the turbine in very deep peat and at a location where the slope angle is 3 degrees and to consider whether there is a more suitable alternative."

The following was undertaken to inform the response to the above RFI:

- A review of the ground investigation atT12
- A site visit and peat probing at T12 to supplement the available ground investigation information at T12
- A review of the slope angles and peat stability assessment at T12

2. Review of Ground Investigation

A review of ground conditions at T12 was carried out based on the following information:

- Rotary Core Borehole T12 from Ground Investigations Ireland Ltd. Report Number 9373-01-20, November 2020 Peat Probe and window sample information from Appendix 8-1 of the EIAR by MKO titled "Geotechnical and Peat Stability Report"
- Peat Probes complete by MWP on 28th July 2022

The relevant information from the above-listed investigations is provided in Appendix A of this document

The following is noted regarding the peat depths identified in the various investigations listed above.

- The rotary core borehole at T12 identified a peat depth of 12.5m
- The peat probes identified a peat depth of 8.7m at the closest probe to the centre of the turbine foundation and a maximum of 9.0m in the vicinity of the turbine and hardstand.

A variety of peat depths have been provided from various techniques. The peat depth affects peat stability calculations which are used as part of the justification of turbine positions. Therefore, selection of an appropriate and representative peat depth is important. From experience, the peat probes provide the most reliable representation of the peat depth at T12 for the reasons detailed below.

- The peat probe used has a small auger at the end of the probe which was used to extract samples of the material at the base of the peat. This allowed for visual confirmation that the interface between the peat and the underlying stratum had been reached, hence verifying the depth of the peat.
- The rotary core drilling technique used at T12 was focused on identifying the depth to a competent stratum (such as limestone at Coole). This technique flushes water through the borehole as drilling progresses. At Coole, the peat is underlain by soft clays. The flushing of water makes the determination of the interface between the peat and soft clay difficult to identify as the two materials become mixed. The peat gets washed down into the clay underneath as the borehole casing advances. Rotary core

drilling was a technique used to identify the depth to a solid stratum (Limestone) at Coole and was not used to determine the interface between two soft materials such as peat and clay.

Following a review of the available ground investigation information and peat probes, the following can be noted:

- The Rotary Core Borehole at T12 overestimates the depth of peat (the borehole log suggests a peat depth of 12.5m).
- The peat probes completed to inform this RFI response suggest the peat depth to be 8.7m at the centre of T12 and a maximum peat depth of 9m in the vicinity of the turbine and hardstand.
- The rotary coring technique used at T12 is not suitable for accurately determining the interface between two soft materials such as peat and clay and was used to identify the depth to a solid stratum (Limestone) at Coole.
- The depths provided by the peat probes are considered to provide the most accurate peat depths and should be used for assessment purposes.

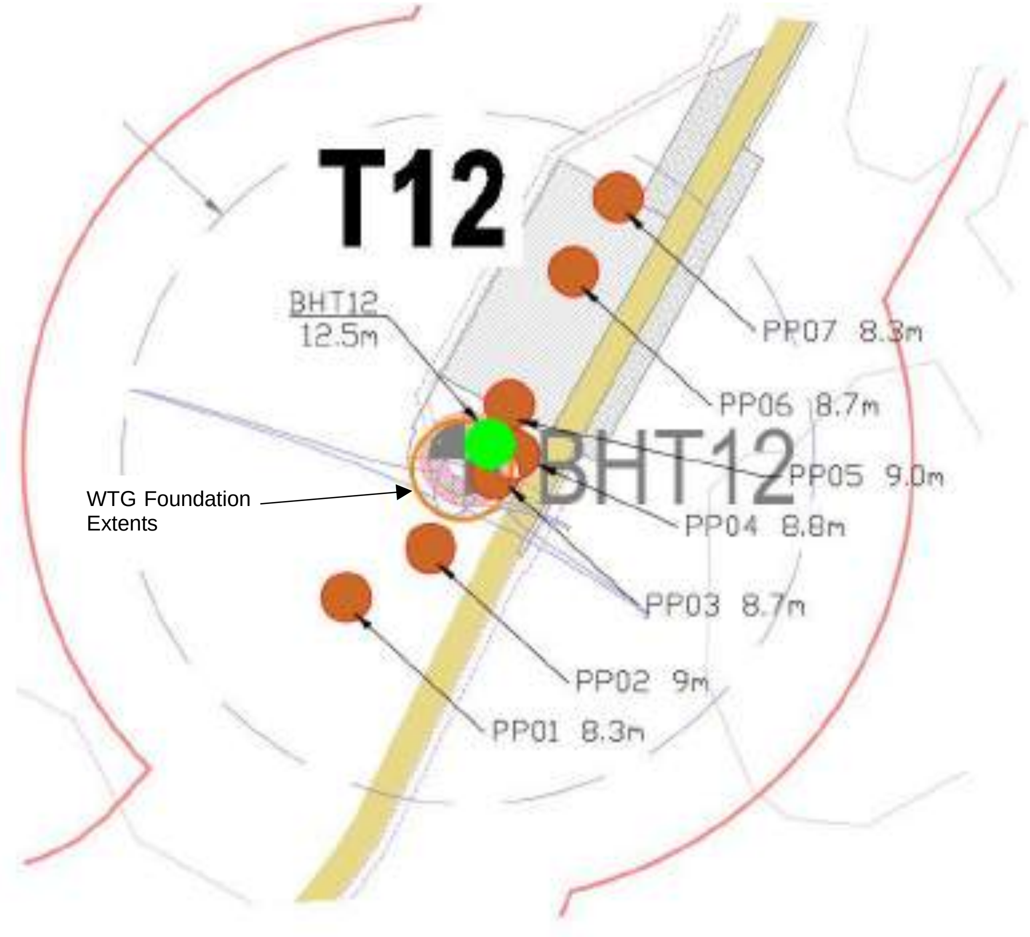


Figure 2-1 Plan of ground investigation at T12 with recorded peat depths shown

3. Slope at T12 location

The slope of 3 degrees at T12 presented in EIAR was obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master and from contour survey plans for the site.

Further investigation of the slope at T12 was carried out to inform the response to this RFI. This included a review of LiDAR which was procured specifically to provide a response to this RFI.

The LiDAR is considered more accurate than the methodologies used which originally yielded a slope angle of 3 degrees. The steepest slope angle derived from the LiDAR is 1.51 degrees. The average angle is 0.24 degrees. A drawing showing two cross sections and profiles of the existing ground at T12 is provided in Appendix B.

The maximum angle of 1.51 degrees and average angle of 0.24 degrees from the LiDAR data aligns with what was noted onsite, ie that the site is close to flat.

The peat stability assessment has been revised with the updated peat depth (maximum of 9m) and maximum slope angle from LiDAR at T12 (1.51^0). The updated factors of safety against slope instability are summarised in Table 3-1.

A Factor of Safety (FOS) of 1.3 is the minimum required by "BS 6031:2009 Code of practice for earthworks". All of the calculated FOS values in Table 3-1 are greater than 1.3.

Table 3-1 Summary of Factors of Safety at T12

	Condition 1 (No surcharge)	Condition 2 (10kPa surcharge)
Undrained Case	2.53	2.28
Drained Case	1.68	3.28

4. Summary and Conclusion

The following has been undertaken in order to provide a response to item 4.1 of the RFI related to Coole Wind Farm (An Bord Pleanála reference Case Number ABP-309770-21 dated 21 April 2022)

- A detailed review of the ground conditions at T12.
- Further ground investigation in the form of peat probing.
- Reinterpretation of the available site investigation data in conjunction with the additional peat probing.
- A detailed review of topography at T12.
- Procurement of further topographical data in the form of LiDAR.
- Update of the peat stability assessment based on the above.

It is concluded that the location of T12 is justified as the peat stability assessment provides an adequate factor of safety.

Appendix A

Ground Investigation Information for T12

Peat Probes from T12 at Coole WF (28-07-2022)

Peat Probe Number	ITM E	ITM N	Peat Depth (m)	Shear (Kpa)
PP01	640238	774744	8.3	
PP02	640255	774754	9	15
PP03	640268	774769	8.7	12
PP04	640272	774773	8.8	
PP05	640271	774783	9	14
PP06	640284	774810	8.7	
PP07	640293	774825	8.3	

Ground Investigations Ireland Ltd www.gii.ie	Site: Coole Wind Farm	Borehole Number: BHT12

Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 102mm to 24.50m	**Ground Level (mOD)** 68.58	**Client** Statkraft	**Job Number** 9373-01-20
	Location 240320 E 274754 N	**Dates** 16/07/2020-17/07/2020	**Project Contractor** GII	**Sheet** 1/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	20							Poor Recovery. Driller notes: Black PEAT. Recovery consists of dark brown fibrous PEAT. (Very soft.)			
2.00 2.00-2.45	37				0,0/1,1,1,2 SPT(C) N=5						
3.50 3.50-3.95	67				1,0/0,2,0,0 SPT(C) N=2						
5.00 5.00-5.45	67				2,2/1,1,0,1 SPT(C) N=3		(12.50)				
6.50 6.50-6.95	20				0,2/1,0,1,0 SPT(C) N=2						
8.00 8.00-8.45	20				0,2/0,0,1,0 SPT(C) N=1						
9.50 9.50-9.95					0,0/0,0,0,1 SPT(C) N=1						

Remarks
Standpipe installed, slotted from 15.00m to 1.00m BGL with a pea gravel surround, sealed from 1.00m to GL with plain pipe and a benthonite surround, finished with a rasied cover.

Scale (approx)	Logged By
1:50	Tmcl

Figure No. 9373-01-20.BH12

Ground Investigations Ireland Ltd www.gii.ie	Site: Coole Wind Farm	Borehole Number: BHT12

Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 102mm to 24.50m	**Ground Level (mOD)** 68.58	**Client** Statkraft	**Job Number** 9373-01-20
	Location 240320 E 274754 N	**Dates** 16/07/2020-17/07/2020	**Project Contractor** GII	**Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	20										
11.00 11.00-11.45	47				0,0/0,0,0,0 SPT(C) N=0						
12.50 12.50-12.95	43				6,5/6,5,4,4 SPT(C) N=19	56.08	12.50 (1.50)	Poor Recovery. Driller notes: Grey Silt. Recovery consists of grey silty CLAY.(Stiff)			
14.00	67	43	43			54.58	14.00 (0.85)	Poor Recovery. Driller notes: GRAVEL and Cobbles. Recovery consists of grey sub-angular to sub-rounded coarse GRAVEL with occasional cobbles. (Dense)			
14.85				6		53.73	14.85 (2.35)	Weak thickly bedded brown/grey fine grained LIMESTONE. Distinctly weathered. (14.85m - 17.00m) One fracture set. F1: 10-30 Degrees, close to medium spaced, stepped rough with some brown clay infill. (17.00m - 20.00m) Two fracture sets. F1: 0-15 Degrees, close to medium, planar rough with some clay infill. F2: 80-90 Degrees, stepped rough, clean.			
15.50	100	70	43								
17.00	100	70	33	15		51.38	17.20 (2.80)	Weak to medium strong thickly bedded dark grey fine grained argillaceous LIMESTONE. Partially weathered to unweathered. (20.00m - 24.50m) One fracture set. F1: 0-10 Degrees, close to wide, planar to undulating rough with some clay staining.			
18.50	100	77	53								
20.00											

Remarks	Scale (approx): 1:50	Logged By: Tmcl
	Figure No.: 9373-01-20.BH12	

Ground Investigations Ireland Ltd www.gii.ie	Site: Coole Wind Farm	Borehole Number: BHT12

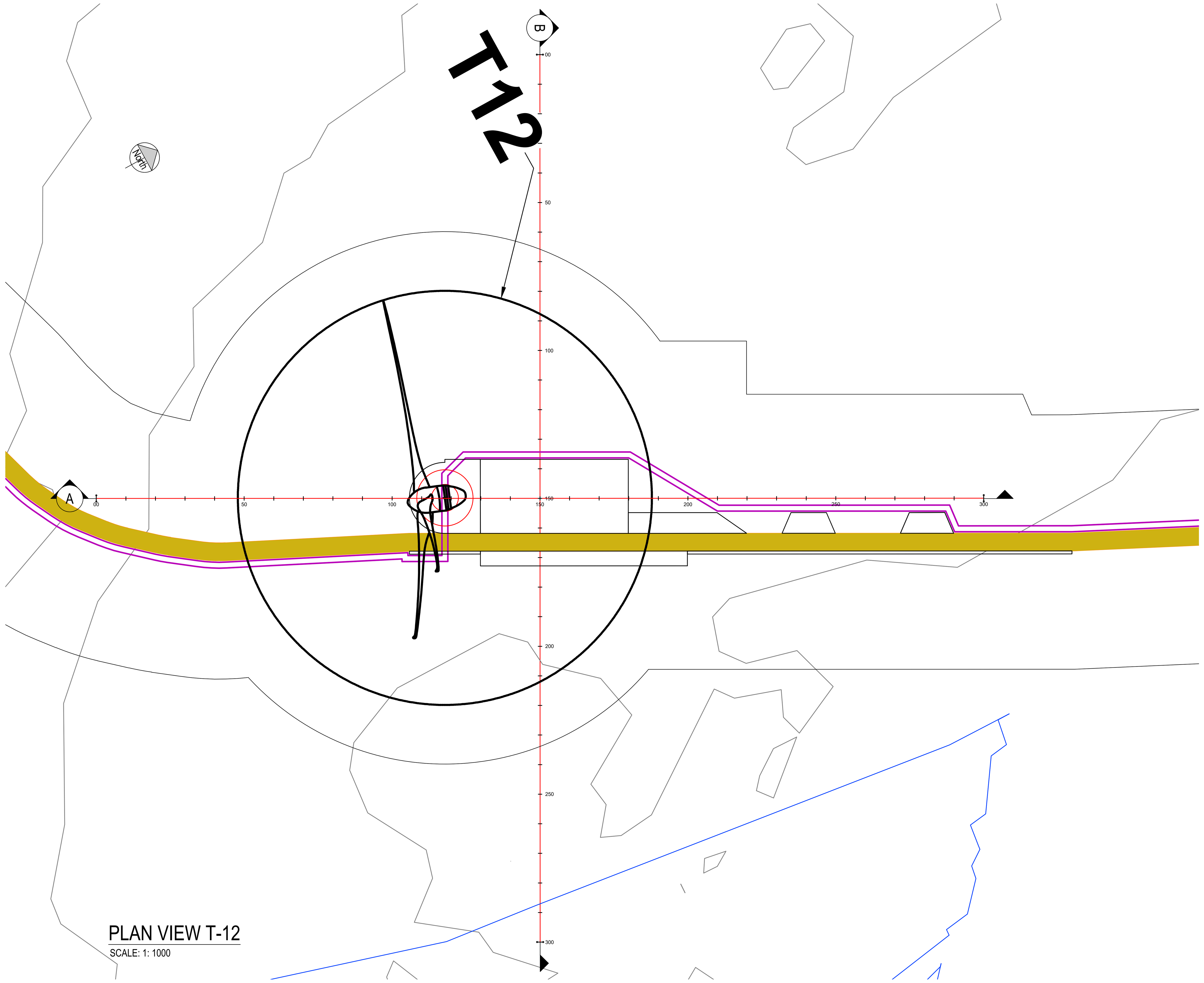
Machine : Beretta T44	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : Water	102mm to 24.50m	68.58	Statkraft	9373-01-20
Core Dia : 63.5 mm	**Location**	**Dates**	**Project Contractor**	**Sheet**
Method : Rotary Cored	240320 E 274754 N	16/07/2020-17/07/2020	GII	3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						48.58	20.00	Medium strong to strong thickly bedded dark grey fine grained LIMESTONE. Partially weathered to unweathered.			
	93	90	77								
21.50											
	97	93	87	4			(4.50)				
23.00											
	97	97	93								
24.50						44.08	24.50	Complete at 24.50m			

Remarks	Scale (approx)	Logged By
	1:50	Tmcl
	Figure No. 9373-01-20.BH12	

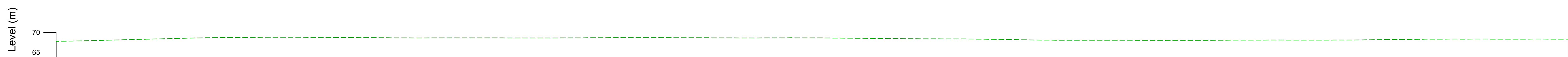
Appendix B

Topographical Data from LiDAR



PLAN VIEW T-12

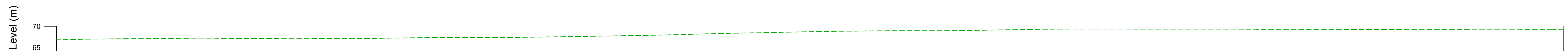
SCALE: 1: 1000



Chainage	Existing Levels
0.000	68.256
10.000	68.467
20.000	68.717
30.000	68.955
40.000	68.967
50.000	68.964
60.000	68.984
70.000	68.923
80.000	68.936
90.000	68.918
100.000	68.923
110.000	68.965
120.000	68.968
130.000	68.942
140.000	68.922
150.000	68.935
160.000	68.838
170.000	68.761
180.000	68.721
190.000	68.584
200.000	68.467
210.000	68.466
220.000	68.435
230.000	68.461
240.000	68.498
250.000	68.490
260.000	68.549
270.000	68.652
280.000	68.687
290.000	68.679
300.000	68.676

SECTION A-A

SCALE: H:1500, V1:500. DATUM 65.00



Chainage	Existing Levels
0.000	67.330
10.000	67.507
20.000	67.572
30.000	67.655
40.000	67.595
50.000	67.624
60.000	67.581
70.000	67.715
80.000	67.813
90.000	67.801
100.000	67.925
110.000	68.088
120.000	68.264
130.000	68.527
140.000	68.732
150.000	68.935
160.000	69.072
170.000	69.134
180.000	69.170
190.000	69.328
200.000	69.455
210.000	69.473
220.000	69.446
230.000	69.455
240.000	69.412
250.000	69.417
260.000	69.386
270.000	69.407
280.000	69.415
290.000	69.423
300.000	69.419

SECTION B-B

SCALE: H:1500, V1:500. DATUM 65.00

REV	DATE	DESCRIPTION	BY	APP
P01	19/08/22	ISSUED FOR INFORMATION	MG	PC

PROJECT: COOLE WIND FARM

TITLE: SECTIONS T-12

CLIENT: STATKRAFT

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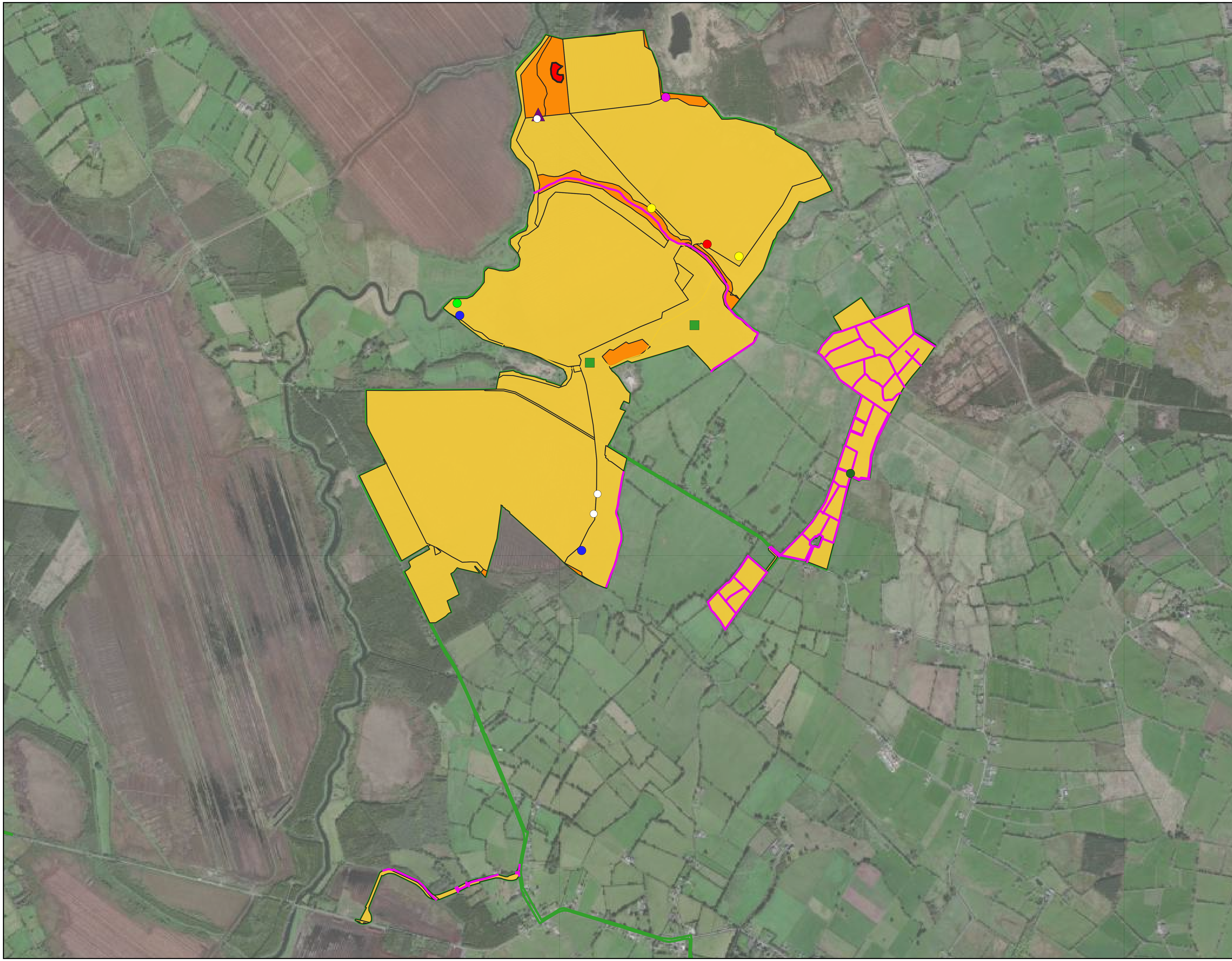
DRAWN:	CHECKED:	APPROVED:
MG	PC	PC
PROJECT NUMBER: 22777	DATE: 19/08/22	SCALE @ A1: AS SHOWN

STATUS DESCRIPTION: FOR INFORMATION
STATUS: S2

DRAWING NUMBER: 23249 - MWP - 00 - 00 - SK - S - 0201
REV: P01

APPENDIX 13

UPDATED FIGURE 6-7 MAMMAL SURVEY AND HABITAT SIGNIFICANCE



Map Legend

MKO Surveys 2016 and 2020

- Badger prints
- Badger snuffle holes and print
- Fox dropping
- Freal goats - three grazing
- Irish Hare specimen observed
- Otter prints
- Otter spraint
- Red Fox prints
- Greenwire Surveys (2013) Badger droppings and tracks
- Local Importance (higher value)
- Local Importance (lower value)
- National Importance
- Local Importance (higher value)
- EIAR Site Boundary

N

Drawing Title	
Mammal Surveys and Habitat Significance	
Project Title	
Coole Wind Farm, Co. Westmeath - EI	
Drawn By	Checked By
L Kelly	P Roberts
Project No.	Drawing No.
200445	Figure 6-7
Scale	Date
1:20000	13.09.2022

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