FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

DREHID WIND FARM AND SUBSTATION, CO. KILDARE

Natura Impact Statement

Prepared for:

North Kildare Wind Farm Ltd.

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1. INTRODUCTION

Fehily Timoney and Company (FT) was commissioned by North Kildare Wind Farm Ltd. to prepare an Appropriate Assessment Screening Report and Natura Impact Statement for the proposed Drehid Wind Farm, Substation and Turbine Delivery Route (TDR), Co. Kildare.

This report presents an examination of whether the proposed upgrades are likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and is based on best available scientific knowledge. This report has been prepared to inform the competent authority in completing their statutory obligations in relation to Appropriate Assessment, as required by Article 6(3) under Council Directive 92/43/EEC (Habitats Directive).

1.1 Legislative Context

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive) provides legal protection for habitats and species of European importance. The Directive requires that where a plan or project is likely to have a significant effect on a European Site, while not directly connected with or necessary to the nature conservation management of the site, it will be subject to 'Appropriate Assessment' to identify any implications for the European site in view of the site's Conservation Objectives. Specifically, Article 6(3) of the Habitats Directive states:

> *"6(3) Any plan or project not directly connected with or necessary to the management of the site (Natura 2000 sites) but likely to have significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

The competent authority must carry out a screening for appropriate assessment to assess, in view of best scientific knowledge, if the development, individually or in combination with another plan or project is likely to have a significant effect on the European site. If it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site, an appropriate assessment of its implications for the European Site(s) in view of the Site's conservation objectives is required to be carried out.

The provisions of Article 6(3) do not apply where the proposed plan or project is 'connected with or necessary to the management of the site'. In this case, the proposed development is not directly connected with or necessary to the management of any European site(s).

1.2 Statement of Authority

This report has been prepared by Ben O'Dwyer and reviewed by Jon Kearney (Fehily Timoney Ecologists).

Ben O'Dwyer is a senior project ecologist with Fehily Timoney (FT) and has over 8 years' experience in ecological assessment and holds a BSc in Wildlife Biology from Institute of Technology Tralee. Ben has prepared Appropriate Assessment Screening reports and Natura Impact Statements for numerous large scale infrastructure projects in the commercial, energy, waste management and transport sectors.

Jon Kearney is Technical Director of Ecology at FT. He has 20 years' experience in the field of ecological assessment. He holds a BSc (Hons) in Applied Ecology from University College Cork and MSc in Ecological Management and Biological Conservation from Queens University Belfast. In his time as an ecological consultant in both the UK and Ireland, he has worked on a broad diversity of projects including NIS's for several offshore renewable energy projects, wind farms projects, solar farms, road schemes and commercial developments. Jon as the lead ecologist has been the lead expert witness for biodiversity and Appropriate Assessment at several An Bord Pleanála Oral Hearings.

1.3 Methodology

1.3.1 Guidance

The assessment was conducted in accordance with the following guidance:

- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg (European Commission, 2002).
- Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC. Commission Notice (2021) Brussels, 28.9.2021 C(2021) 6913 final (European Commission, 2021).
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin (2009, updated 2010) (Environment Heritage and Local Government, 2009).
- Managing Natura 2000 sites. The provisions of Article 6 of the Habitats Directive 92/43/EEC. European Commission (2019). Brussels, (2019/C 33/01). OJ C 33, 25.1.2019.
- Interpretation Manual of European Union Habitats. Version EUR 28. (European Commission, 2013)
- OPR Practice Note PN01 Appropriate Assessment Screening for Development Management, (Office of the Planning Regulator, 2021).
- Atkinson, S., Magee, M., Moorkens, E.A. & Heavey, M. (2024). Guidance on Assessment and Construction Management in Margaritifera Catchments in Ireland. https://e-mussels.eu/europe/conservation-guidelines

1.3.2 Process

The process of determining the likelihood of significant effects from a proposed development on European sites is an iterative process centred around a Source-Pathway-Receptor model. In order for an effect to be established, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism is sufficient to conclude that a potential effect is not of any relevance or significance.

- Source(s) – e.g., pollutant run-off, noise, removal of vegetation, etc.;
- Pathway(s) – functional link, or ecological pathway e.g., groundwater connecting to nearby qualifying wetland habitats; and,

- Receptor(s) –the qualifying habitats and species of European sites and ecological resources supporting those habitats/species.

In the context of this report, a source is any identifiable element of the proposed development that is known to interact with the receiving environment. A receptor is the Qualifying Interests (QI)[1] for an SAC or Special Conservation Interests (SCI)[2] for an SPA or an ecological feature that is known to be utilised by the QI/SCI. In practice, the term Qualifying Interests also applies to SCIs (and is used in this document for simplicity). A pathway is any connection or link between the source and the receptor.

The assessment commences with a description of the project, along with a description of the receiving environment and the associated sources for impacts to the receiving environment. All elements of the project are presented including the project location and existing baseline environment. The type of impacts that are likely due to the project (Source) are identified having regard to the spatial and temporal scale of the project, resource requirements and likely emissions. These sources are then used to define the zone of influence (ZoI) of the project as detailed in Section 2.3.

The European Commission Notice (2021) on the 'Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC, states that in identifying European sites (Natural 2000 sites), which may be affected by the project, the following should be identified:

- Any European sites geographically overlapping with any of the actions or aspects of the plan or project in any of its phases, or adjacent to them;
- Any European sites within the likely zone of influence of the plan or project. European sites located in the surroundings of the plan or project (or at some distance) that could still be indirectly affected by aspects of the project, including as regards the use of natural resources (e.g., water) and various types of waste, discharge or emissions of substances or energy;
- European sites whose connectivity or ecological continuity can be affected by the plan or project.

The zone of influence of a proposed development is the geographical area over which it could affect the receiving environment in a way that could have potential effects on the Qualifying Interests of a European site. The OPR (2021) practice note states that the Zone of Influence must be established on a case-by-case basis using the Source-Pathway-Receptor (S-P-R) framework and not by arbitrary distances (such as 15 km). Section 3.2 sets out the detailed rationale for the identification of relevant European sites within the ZoI based on the sources of impacts arising from the proposed development . Subsequently, an assessment is undertaken with respect to potential connectivity (Pathways) to European Sites and their qualifying interests/special conservation interests are identified.

The potential for in-combination effects with other plans and projects is examined in Section 3.3, having regard to the identified impacts of the project along the ecological pathways identified to European sites.

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[1] SACs are areas designated under the Habitats Directive to conserve habitats listed in Annex I of the Directive and plant and animal species listed in Annex II. Collectively these are referred to as the 'Qualifying Interests' or 'QIs' of the SAC.
[2] SPAs are sites classified under the Birds Directive to protect rare or vulnerable bird species listed in Annex I to the Directive as well as regularly occurring migratory species and wetlands. Wetland habitats that support internationally important populations of migratory birds may be coastal or inland. Collectively, these species and habitats are referred to as the 'Special Conservation Interests' of the SPA.

In section 3.4 the likelihood of significant effects of the European Sites within the ZoI is examined having regard to the sensitivity of the site with pathways for impacts associated with the project on its own and in combination with other plans and projects.

Having regard to the European Commission Communication on the Precautionary Principle (European Commission, 2021) the:

> *"absence of scientific evidence on the significant negative effect of an action cannot be used as justification for approval of this action. When applied to Article 6(3) procedure, the precautionary principle implies that the absence of a negative effect on Natura 2000 sites has to be demonstrated before a plan or project can be authorised. In other words, if there is a lack of certainty as to whether there will be any negative effects, then the plan or project cannot be approved."*

Where significant effects are determined to be likely, or where there is uncertainty regarding the likelihood of significant effects, the project will be required under law to be subjected to Appropriate Assessment.

This AA screening is based on best scientific knowledge and has utilised ecological expertise. In addition, a detailed online review of published scientific literature was conducted. This included a detailed review of the National Parks and Wildlife Website including mapping and available reports for relevant sites and in particular sensitive qualifying interests/special conservation interests described and their conservation objectives.

1.4 Consultation

The consultation process carried out for the project began with previous iterations of the Proposed Development, starting with the 2018 application. A Scoping Update Letter was issued out to all consultees in 2024 to update them of amendments to the site layout, and the inclusion of the Proposed Substation, which differed from the proposed method of connecting to the grid in the 2018 design.

Specific to ecological assessment and designated sites, the environmental stakeholders listed in Table 1-1 were contacted. Their responses are detailed in Table 1-1.

Table 1-1: Environmental stakeholder consultation

Organisation/Stakeholder	Response (2018)	Response (2024)
An Taisce	No response to date	No response to date
Bat Conservation Ireland	No response to date	No response to date
Birdwatch Ireland	No response to date	No response to date
Department of Culture, Heritage and the Gaeltacht (2018) Department of Housing, Local Government & Heritage (2024) (via DAU)	Acknowledgement of receipt of correspondence. Information on consultation to be solely administered to DAU for distribution to the National Parks and Wildlife Service and the National Monuments Service. A further response outlining details of information to be supplied in advance of any meetings, and information which should not be supplied at pre-applications stage was issued on 13 November 2018.	Response from the DAU provided generic advice on the preparation of the Cultural Heritage Impact Assessment.

Organisation/Stakeholder	Response (2018)	Response (2024)
EPA	No response to date	No response to date
Inland Fisheries Ireland	Comments and observations of a general nature provided by IFI. Observations noted include potential impacts to fisheries waters, forming part of the Eastern River Basin District. The role of smaller watercourses as contributories to downstream habitats, of which have the potential to convey deleterious matter from development works and regard should be had to this. Temporary crossing structures should follow IFI recommendations.	No response to date
Irish Peatland Conservation Council	Consultation response identifies the Mulgeeth Bog, an intact raised bog remnant that must be protected. The consultation response requests detail on how the proposed development will be hydrologically managed to enhance and conserve the bog which is a refuge for Common Frog. The response also notes a proposed Timahoe North Solar Farm, adjacent to the proposed development boundary. A response is sought for confirmation of provisioning of adequate setback from the wind turbines taking into account Curlew. Request also made for demonstrations of the proposals the developer is making to develop amenity value and how this dovetails with the solar project walk routes as proposed.	No response to date
Irish Raptor Study Group	No response to date	No response to date
Irish Red Grouse Association	No response to date	No response to date
Irish Wildlife Trust	No response to date	No response to date
South Eastern River Basin District	No response to date	No response to date

2. DESCRIPTION OF THE PROJECT

2.1 Existing Environment

2.1.1 Project location and the receiving environment

The Proposed Wind Farm is wholly located in County Kildare and includes lands in the townlands of Ballynamullagh, Kilmurry, Killyon, Coolree, Mulgeeth and Drehid. The site is accessed from the M4 motorway until Enfield, then along the R402 for ca. 7.7 km and finally along the local road (L5025) to the entrance of the site. The site lies c. 2.8 km south of the motorway M4 at Enfield and 1.2 km southeast of the regional road R402 linking the M4 to the R420 east of Tullamore in County Offaly.

The Proposed Substation, including the loop-in connection to the existing Kinnegad-Rinawade overhead line, and the access tracks approaching from the main site entrance are wholly located in County Kildare and includes lands in the townlands of Ballynamullagh, Kilmurry, Coolree and Mulgeeth.

The site of the proposed development is located in relatively low-lying, relatively flat land with the majority of proposed turbines located beneath the 80 m contour line. The landcover is classified by Tailte Eireann's National Land Cover map as improved grassland, treelines, hedgerows, transitional forest, coniferous forest, broadleaved forest and woodland, mixed forest, scrub, bare peat, bare soil and disturbed ground, and artificial surfaces (forest roads).The National Land Cover Map for the wind farm site is illustrated in Figure 2.1. The east of the site is adjacent to a cutover bog (Timahoe Bog). The Fear English River bisects the site, flowing south to north before it enters the Blackwater River at Johnstown Bridge. The landscape is classified as being of low sensitivity from a landscape perspective.

The site of the Proposed Substation is located in commercial forestry at the northern extent of the wind farm site. The proposed loop-in connection to the existing overhead line is situated in agricultural lands, approximately 415m northeast of the Proposed development compound.

The Fear English River dissects the proposed development. This is the traditional local name for the river; however it is noted that the Fear English is comprised of two EPA-named watercourses, namely the Ballynamullagh and Coolree 07. The Fear English is a tributary of the River Blackwater (Longwood). The Blackwater is a main tributary of the River Boyne.

The GSI 1:100,000 scale bedrock geology map shows that Lucan Formation (Calp) underlies the Proposed Development site. Lucan Formation comprises varied dark grey to black basinal limestone and shale beds. Fieldwork confirmed the presence of peat over a large proportion of the site area; with peat depths varying between 0.2m to 5.4m with an average depth of peat of approximately 2.2m. The Fear English River also known as the Ballynamullagh (07_982) (EPA name/segment code) dissects the proposed development. This waterbody is a tributary of the River Blackwater. The main tributary of the River Boyne is the River Blackwater and a number of its small tributaries.

2.1.1.1 Boyne Catchment

The proposed development is located within the Boyne catchment. The River Boyne main channel rises near Edenderry on the borders of Counties Offaly and Kildare and flows in a north-easterly direction for 112 km before entering the Irish Sea at Drogheda. Together with its tributaries, it drains a catchment of approximately 2,500 km2. The River Boyne corridor, together with its tributary the Kells Blackwater River, is designated as a Special Area of Conservation (SAC) (Site Code: 002299). In addition, the River Boyne main channel is also a designated salmonid river under the EU Freshwater Fish Directive (78/659/EEC).

An arterial drainage programme was undertaken throughout the Boyne catchment between 1969 and 1985 (O'Grady 1998). The only major section of this catchment which was not drained was the lower reaches of the main Boyne channel - from Navan downstream, and a section of the Kells Blackwater. The river channels affected by the proposed development were all dredged and channelised at this time and are subjected on ongoing drainage maintenance.

2.1.1.2 Water Quality

2.1.1.2.1 Blackwater (Longwood) River

The Blackwater [Longwood] River (07B02) rises south west of Enfield, Co. Meath. The total channel length is approximately 24km. From the source, the river flows north as far as survey Site 1. From here it flows north-east past Enfield and north to its confluence with the River Boyne (Segment Code: 07B04). There are six EPA biological water quality monitoring stations on the River Blackwater [Longwood] that were recently monitored. The furthest upstream (Station Code: 07B02 0060) was rated Q3 in 2020; This station was located at Site 2. Another EPA station is located where the R402 crosses the Blackwater (Longwood) river. This station (Station Code: 07B02 0100) was rated Q3-4 in 2020. There is another monitoring site (Station Code: 07B02 0200) approximately 4km downstream that was rated Q3 in 2009.

The next EPA monitoring station (Station Code: 07B02 0300) is approximately 8km downstream from here. This site was rated Q3-4 in 2020. In 2003 another site 2km from here (Station Code: 07B02 0400) was rated Q3-4. The last EPA monitoring station (Station Code: 07B02 0600) is located where the R161 crosses the river approximately 200m upstream of the confluence with the Boyne. This site was rated Q3-4 in 2020.

The EPAs most recent assessment of the Blackwater [Longwood] River is as follows: " The dominance of pollution tolerant and paucity of pollution sensitive macroinvertebrate taxa indicated unsatisfactory ecological conditions at all sites surveyed on the Blackwater (Longwood) River in 2020? Enriched conditions were evident with enhanced algal growth noted at all sites".

All waterbodies in the Blackwater [Longwood] SC_010 sub catchment, except one are considered to be at risk. The majority of the survey sites are on waterbodies with a Water Framework Directive status of 'Poor'.

2.1.1.2.2 Mulgeeth River

The Mulgeeth River (EPA Code: 07M54) is a tributary of the Blackwater [Longwood] River]. The river rises in the Dunfierth Bog which is located just east of the proposed Drehid wind farm site. From here it flows south-east before turning sharply north-east to its confluence with the Blackwater [Longwood] River. The entire channel length is approximately 8rkm (river kilometres). There are no EPA biological monitoring stations on this watercourse.

2.1.1.2.3 Coolree 07 River

The Coolree River (EPA Code: 07C23) is a tributary of the Blackwater [Longwood] River. The entire channel length is approximately 10rkm. It rises to the south-west of Enfield and flows predominantly north-west until it's confluence with the Blackwater [Longwood] River. There are no EPA biological monitoring stations on this river. A section of this river and one of its tributaries, the Ballynamullagh River (EPA code: 07B19) flows along the proposed development site.

The Coolree 07 River is also known as the Fear English River. The "Fear" part is locally pronounced "Fair" and it is understood that the name relates to the word "meadow".

2.1.1.2.4 Ballynamullagh Stream

The Ballynamullagh Stream (EPA Code: 07B19) is also a tributary of the Blackwater [Longwood] River. The entire channel length is approximately 4rkm. This stream is also known as the Fear English River locally. The Ballynamullagh Stream rises ca. 1.2rkm south of the wind farm site. Immediately upstream of the boundary of the wind farm site the 1st order Drehid stream (EPA Code: 07D13) joins this watercourse. From here the Ballynamullagh stream flows north-east through the proposed development site, before flowing north through the proposed development site. Approximately seven of the 11 proposed turbines are located in the vicinity of this watercourse, and it is proposed that access roads will cross this watercourse at three different points. Just south of the proposed Turbine 6 the Ballynamullagh Stream flows into the Coolree 07 River.

The EPA do not carry out biological monitoring on the Ballynamullagh Stream, presumably due to its small size.

2.1.1.3 Designated Salmonid Waters

The River Boyne main channel is a designated Salmonid Water under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988).

2.1.2 Ecological baseline

A suite of ecological surveys were completed for the proposed development, encompassing habitat, invasive species, mammal, bat, marsh fritillary, aquatic ecology and ornithological surveys between 2021-2024 which built upon previous surveys completed for the 2018 application and detailed FI surveys in 2019. Ornithological surveys encompassed vantage point, hinterland, barn owl, merlin, raptor, breeding bird, wintering bird, breeding wader, breeding woodcock and kingfisher surveys. The full ecological baseline including survey details is included in Appendix 1.

The habitats at the proposed development site are dominated by conifer plantation/woodland and agricultural habitats (pasture and hedgerows/treelines). Various peatland habitats and mosaics ranging from more or less intact raised bog to severely disturbed cutover bog are also present in the wider area. Bog woodland which has established on former peat harvesting areas and adjacent disturbed/drained areas is common in the area. Lowland depositing rivers are present, represented by the Fear English River and its tributaries. It is noted that the proposed grid connection is short, with the proposed high voltage line loop-in located c. 415m north of the Proposed development. As such, the grid connection habitat survey study area is encapsulated within the overall habitat survey study area for the proposed development.

The intact raised bog south of T9/T10 corresponds with the Annex I priority habitat "active raised bog [7110], and the drained but largely intact raised bog south-east of T8 contains areas with links to the Annex I habitat "Degraded raised bogs still capable of natural regeneration [7120]". Both of these habitats are outside the proposed development footprint. No areas of Annex I habitat are overlapped by any proposed infrastructure.

No rare or protected flora species were recorded during site surveys. No FPO (Flora Protection Species) were noted within the Proposed development or surrounding areas.

The following summarises the occurrence on non-native invasive plant species at the proposed development. An individual *Rhododendron ponticum* bush c. 2 x 3m in extent was recorded in mixed broadleaved/conifer woodland adjacent to a section of proposed access track south of T8. This Schedule III invasive species was also recorded in conifer plantation c. 170m north-east of T9, as indicated by the desktop record below. Sycamore and Butterfly bush also occur, along forestry tracks and within forestry blocks. Cherry laurel was recorded at two TDR points of interest (POI 1 & 3).Snowberry (Symphoricarpos albus), was recorded c. 15m from the proposed T7 - T8 access track.

During current mammal surveys the following species and/or their field signs were observed within or adjacent to the Proposed development : badger, otter, fox, red squirrel, pine marten, wood mouse, Irish hare, red deer, Irish stoat and rabbit.

Across both activity transects and static detector surveys, a total of eight bat species were recorded: common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat. Genus-level records of *Pipistrellus* and *Myotis* were also made.

Marsh fritillary surveys in 2022 recorded a total of 29 marsh fritillary larval webs in pockets of *Molinia*-dominated grassland with devil's bit scabious along the north-western edge of Timahoe North Bog. All larval web records are outside the Proposed development , which is restricted to the wooded areas to the north-west of the marsh fritillary habitat bordering the open bog. Repeat surveys in September 2023 did not detect any larval webs, but did confirm the extent and distribution of devil's bit scabious and associated marsh fritillary habitat remains similar to 2022. Smaller isolated patches of devil's bit scabious were also recorded in association with existing forestry tracks in the woodland habitats north-west of the open bog, including an area of devil's bit scabious immediately adjacent to the proposed T7 - T8 access track. These areas of devil's bit scabious along forestry tracks are sub-optimal for marsh fritillary, due to limited extent, lower density of devil's bit scabious and their location in woodland.

Surveys in 2021 and 2022 confirmed the presence of common lizard, with records concentrated in the northern part of the proposed development, particularly in recently felled/replanted conifer plantation south of the proposed development. One lizard was also observed in the vicinity of T11. This species was confirmed present again during 2023 transect surveys, when a basking lizard was flushed in raised bog 220m east of T8 during lizard transect surveys.

Observations of adult common frogs around the bog pool east of T8 (within proposed development boundary) and in recolonising cutover bog south-west of T4 (outside the proposed development boundary) reconfirmed the presence of this species in the area.

Aquatic ecology surveys results are summarised in Table 2-1:

Table 2-1: Aquatic Ecology Summary Results

Survey Site	Species Recorded/Site Description	Q Value
1	Brown trout, brook lamprey, three-spined stickleback, minnow and stone loach. No crayfish recorded during current surveys. Habitats for crayfish are very limited at this site due to the general absence of suitable refuges. This stretch of the river has been further degraded by recent arterial drainage maintenance works.	Q3 – Moderately Polluted
2	Brown trout, brook lamprey, three-spined stickleback, minnow and stone loach. White-clawed Crayfish recorded in low numbers in 2021 survey. Habitats for crayfish limited. Could still be present in very low numbers.	Q3 – Moderately Polluted

Survey Site	Species Recorded/Site Description	Q Value
	This stretch of the river has been further degraded by recent / ongoing arterial drainage maintenance works	
3	Three-spined stickleback and minnow	Q3 – Moderately Polluted
4	Three-spined stickleback	Q3 – Moderately Polluted
5	Salmon and brook lamprey were recorded in small numbers. This was the only site salmon were recorded. Brown trout, three-spined stickleback and minnow also recorded in small numbers. White-clawed crayfish were recorded at this site in 2021; numbers present are very low. Localised impacts arise from machines tracking across the river.	Q3 – Moderately Polluted
6	Brown trout, minnow, three-spined stickleback and stone loach recorded in low numbers. It is noted that brook lamprey was previously recorded in this channel (2018 EIAR surveys), but none were recorded during subsequent surveys. This stretch of the river has been further degraded by recent maintenance works.	Q3 – Moderately Polluted
7	No aquatic fauna recorded. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent maintenance works.	Not suitable for applying a Q rating (small, low gradient stream)
8	No aquatic fauna recorded. Cannot be fully excluded that some trout might move upstream into a channel like this in wet years.	Q3 – Moderately Polluted
9	No aquatic fauna recorded. The overall status of this channel is rated as 'Poor'	Not suitable for applying a Q rating (very small stream)
10	No aquatic fauna recorded. The overall status of this channel is rated as 'Poor'	Not suitable for applying a Q rating (very small stream)

In addition to the primary survey sites listed above, a further four sites (Sites A-D) were investigated in 2023 to provide fine-grained information on sections of the Ballynamullagh where proposed crossings are located. These surveys confirmed the previous assessment based on survey of sites up and downstream of Sites A-D (see Table 2-1 above) that the section where proposed crossings are located is a channelised drain-like watercourse with a mud substrate, which becomes smaller and of less value to aquatic ecology further upstream. In a wet year and in the winter months it can't be fully ruled out that some brown trout may move upstream, but this would be into degraded, marginal, and temporary habitats only.

Ornithological surveys detected activity of target species in the local area and surrounding hinterland, including buzzard, curlew, golden plover, goshawk, great black-backed gull, grey heron, hen harrier, herring gull, kestrel, kingfisher, lapwing, lesser black-backed gull, little egret, merlin, peregrine, red kite, snipe, sparrowhawk, stock dove, swift, whooper swan and woodcock. Merlin records were limited to foraging birds during the non-breeding season. The Fear English (Ballynamullagh) River was determined to support foraging kingfisher, but is unsuitable for nesting kingfisher due to dense and compact soil forming the riverbanks. Flocks of wintering whooper swan were confirmed to occur in improved agricultural grassland fields to the north and west of T1-T3 .

As part of this assessment the potential for migratory activity of migratory QI species for SPAs in the wider region was examined. A total of three potential migratory QI species which occurred at the proposed development were identified (see Table 2-2). The activity patterns and numbers of lapwing and whooper swan are not indicative of migratory movements. A resident lapwing population occurs on Timahoe North Bog c. 1.1 km south-east of T2, and lapwing flight activity at the proposed development was limited to a single observation of four birds. In the case of whooper swan, a local wintering population is present but no evidence of migratory flights over the proposed development were observed. It is noted that a population of wintering whooper swan is associated with the River Boyne and River Blackwater SAC.

While there are a number of SPAs in the wider region which include golden plover as an SCI, none occur in proximity to the proposed development, with the closest (Malahide Estuary SPA) located over 44 km north-east. Considering the absence of such SPAs in proximity to the proposed development, in addition to the dispersed locations of these SPAs relative to the proposed development, there is no indication of definitive links between golden plover occurring at the proposed development and specific SPAs listed in Table 2-2. Furthermore, the presence of wintering populations closer to the proposed development is noted, including at the Curragh where thousands of wintering golden plover are known to occur (I-WeBS counts for golden plover at the Curragh were 3,500 and 3,000 respectively during winter 20115-16 and winter 2016-17). Golden plover also occur at Lullybeg (350 recorded in winter 2016-17), at hinterland survey sites HVP4 (Hortland) and HVP6 (Ballynafagh Lake and Bog), and are also likely to occur at further (non-designated) sites dispersed across the bogs and farmland of the surrounding region.

As such, while two observations overlapped with the migration period in Spring 2023 (6th April 2023) (flocks of 25 and 50 birds), in addition to one observation on Autumn 2023 (12th September 2023) (two birds), there is no indication of large scale or regular migration over the proposed development, with the majority of activity observed being indicative of movements of the local wintering population and two records during late March 2023 overlapping both the winter and spring migration periods (activity recorded during January, February and March). Any potential migratory movements cannot be associated with specific SPAs, and any migratory movements occurring in and around the proposed development are considered to be linked to wintering populations at non-designated sites closer to the proposed development.

Table 2-2: Migratory QI species from surrounding SPAs recorded in study area

Species	No. Records	Peak Count	Qualifying Interest for SPA					
			Lough Ree SPA (66.5 km W)	North Bull Island SPA (44.5 km E)	Baldoyle Bay SPA (47.4 km E)	Malahide Estuary SPA (44.1 km NE)	River Nanny Estuary and Shore SPA (50.1 km NE)	Boyne Estuary SPA (51.1 km NE)
Golden Plover	10	200	✓	✓	✓	✓	✓	✓
Lapwing	1	4	✓	-	-	-	-	✓
Whooper Swan	9	27	✓	-	-	-	-	-

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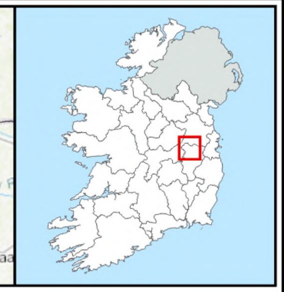

Legend

Proposed Development Boundary

TITLE: Site Location	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 2.1	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:22,500	**REVISION:** 0
DATE: 01/05/2025	**PAGE SIZE:** A3

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0 0.5 1 2 Kilometers

2.2 Project Description

2.2.1 Turbine Layout

Turbine location co-ordinates in Irish Transverse Mercator (ITM) are detailed in Table 2-2:

Table 2-3: Proposed Drehid Wind Farm Turbine Co-ordinates

Turbine ID	ITM_X_Coor	ITM_Y_Coor
1	673844	734350
2	674448	734178
3	674684	734692
4	674376	735901
5	673973	735903
6	674215	736397
7	674699	736284
8	675043	736821
9	676015	737268
10	676382	737020
11	676294	737672

2.2.2 Power Output

The Proposed Wind Farm will have a Maximum Export Capacity (MEC) of 52.8 MW. Turbines of the exact same make, model and dimensions can have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle.

A rated output of 4.8 MW has been used below to calculate the maximum power output of the Proposed Wind Farm, which would result in an estimated installed capacity of 52.8 MW. Assuming an installed capacity of 52.8 MW, the Proposed Wind Farm has the potential to produce up to 161,885 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year

where:

A = The number of hours in a year: 8,760 hours

B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A capacity factor of 35% is applied here

C = Rated output of the wind farm: 52.8 MW

The 161,885 MWh of electricity produced by the Proposed Wind Farm would be sufficient to supply approximately 38,500 Irish households with electricity per year, based on the average Irish household using 4.200 MWh of electricity (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision).

The 2022 Census of Ireland recorded a total of 88,997 households in Co. Kildare. Per annum, based on a capacity factor of 35%, the Proposed Wind Farm would therefore produce enough electricity for the equivalent of approximately 43% of all households in Co. Kildare.

EirGrid in their All Island Generation Capacity Statement (2017-2026) estimates a capacity factor of approximately 31% for onshore wind. The 35% capacity factor applied for the Proposed Wind Farm is greater than the EirGrid estimation as a result of the turbine type proposed for the site i.e. tall turbines (tip height of 147.9 to 167 m) with greater rotor diameters. This turbine type allows for the use of fewer, taller turbines with an increased efficiency and in return greater economic benefit to the consumer.

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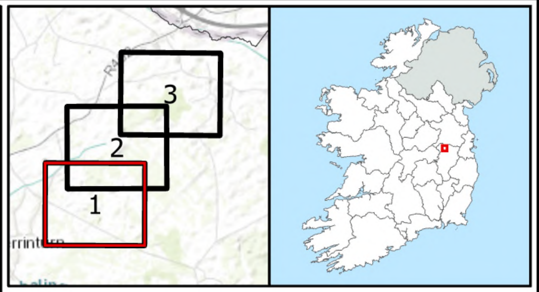

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Blade Transfer Area
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Turbine Swept Path
- Berms
- Cable Route
- Turbines

TITLE: Site Layout	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 2.2	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:10,000	**REVISION:** 0
DATE: 19/05/2025	**PAGE SIZE:** A3

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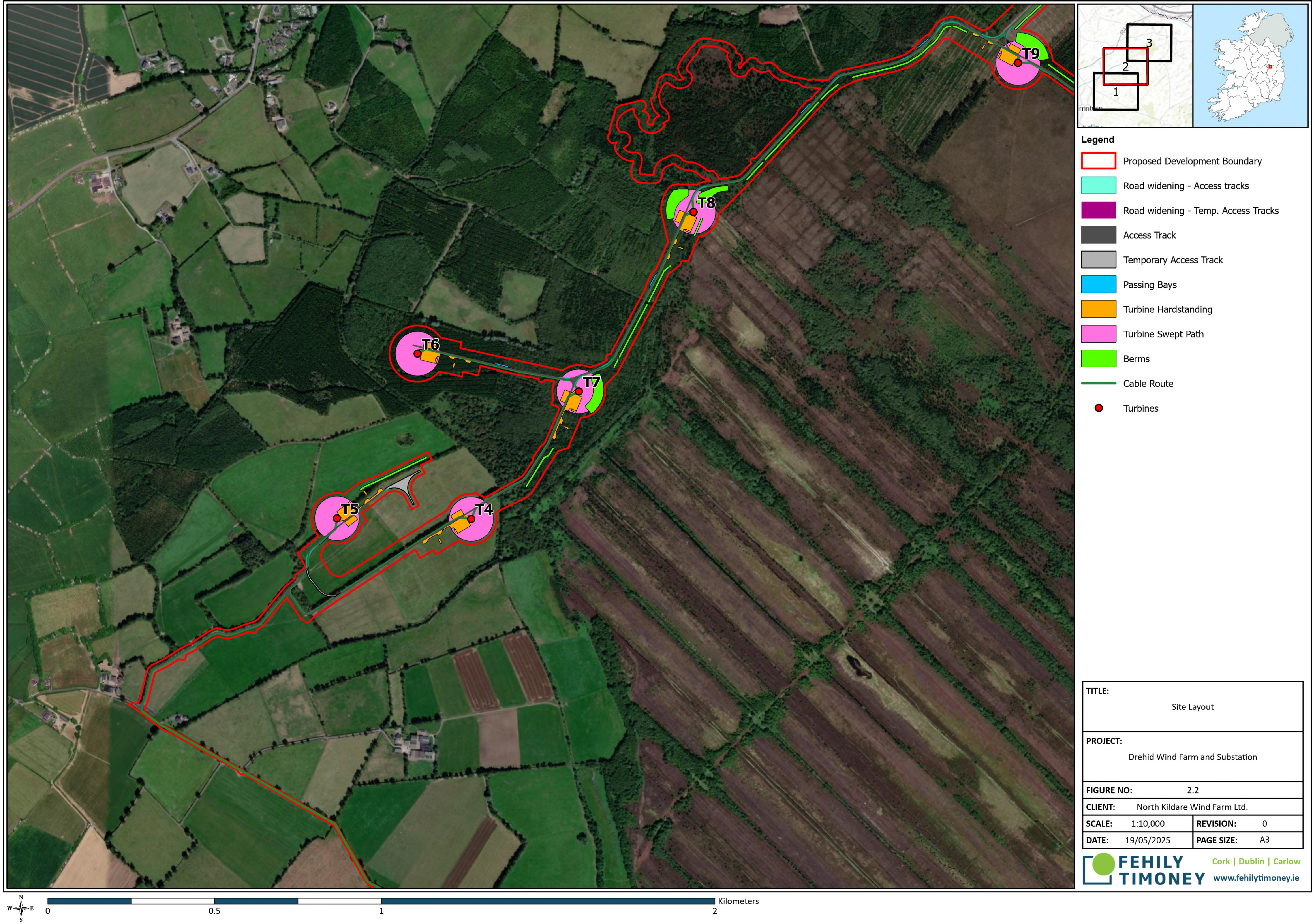

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Passing Bays
- Turbine Hardstanding
- Turbine Swept Path
- Berms
- Cable Route
- Turbines

TITLE: Site Layout	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 2.2	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:10,000	REVISION: 0
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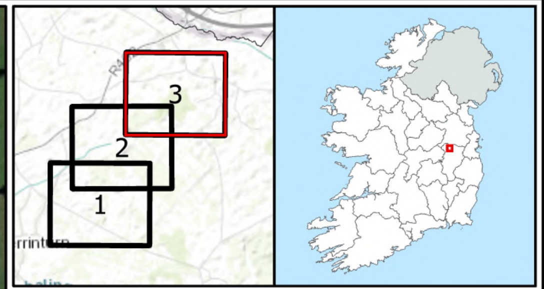

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Turbine Swept Path
- Peat Deposition Area
- Substation
- Berms
- Cable Route
- Grid Connection Route
- Turbines

TITLE:	Site Layout		
PROJECT:	Drehid Wind Farm and Substation		
FIGURE NO:	2.2		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:10,000	**REVISION:**	0
DATE:	19/05/2025	**PAGE SIZE:**	A3

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2.2.3 Turbine Description

The final choice of turbine model is a Nordex N133 model wind turbine. This turbine model has been included for the purposes of assessment and planning approval. The Nordex N133 is a conventional three-blade horizontal axis turbine with a rotor diameter of 133 m. Schematic drawings of the candidate turbine accompany the planning application. The plans and particulars are precise and provide specific dimensions for the turbine structures which have been used in this assessment. The turbine specification for T1 will have a hub height of 81.4 m and a tip height of 147.9 m; while the ten remaining turbines (T2 to T11) will have a hub height of 100.5 m and a tip height of 167 m. All eleven turbines will have a rotor diameter of 133 m.

Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic differences differentiating one from another.

The turbine will be of the generic three bladed, tubular tower model with horizontal axis. The rotor blades are bolted to the central hub, which is connected to a gearbox located in the nacelle. The nacelle holds the following turbine components:

- Generator
- Electrical components
- Control unit

A glass fibre reinforcing polyester hood covers the nacelle. This is sound insulated. Earthing and isolation protect all components from lightning strikes.

2.2.3.1 Turbine Blades

The blades of a modern turbine are typically made up of glass fibre reinforced polyester. They typically turn at between 5 and 15 revolutions per minute depending on wind speed and make of turbine. The candidate turbine for the Proposed Wind Farm is the Nordex N133.

Turbines begin generating electricity at a wind speed of 3 to 4 m/s depending on turbine type, with rated power generation at wind speeds of approximately 12 to 14 m/s.

The turbines usually shut down at wind speeds greater than 25 m/s, although some machines are designed to operate at up to 30 m/s. The Nordex N133 has a cut-in wind speed of 3 m/s and a cut-out wind speed up to 28 m/s.

The yaw machine mechanism turns the nacelle and blades into and out of the wind. A wind vane on the nacelle controls the yaw mechanism. Blades are pitched to match the wind conditions.

2.2.3.2 Turbine Tower

The tower of the turbine is a conical steel tube, with multiple paint finish. It is generally delivered to site in four or five sections. The first section is bolted to the steel base, which is cast into the concrete foundation.

The turbine foundation will be 23 m in diameter and 3 m in depth. The upper sections of the tower are bolted to the lower ones in sequence. The base of the tower is 5 m in diameter, tapering to approximately 2-3 m, where it is attached to the nacelle. The first floor of the tower is approximately 2-3 m above ground level it is accessed by a galvanised steel staircase and a steel hatch door which will be kept locked except during maintenance.

2.2.3.3 Turbine Foundation

Given the depth of peat in the northwestern portion of the Site, piled turbine foundations will be used on three of the turbines (T08, T09 and T10). Gravity foundations will be used for all other turbines.

Turbine foundations will be designed to Eurocode Standards. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design standards:

- EN 1992-1-1: Eurocode 2: Design of concrete structures.
- BS EN 61400-1:2005: Wind Turbines Design Requirements.

2.2.3.3.1 Gravity Foundation

Gravity foundation will comprise a reinforced concrete base designed to distribute the loads to the ground directly. Foundation bases will consist of circular concrete base which will be approximately 23 m in diameter and 3 m in depth with a central circular raised plinth which will be used to anchor the turbine tower at its base. Gravity foundation will be constructed as follows:

- The extent of the excavation will be marked out.
- Around the perimeter of the foundation formation a shallow interceptor drain will be formed and settlement pond / swale constructed.
- The base of the foundations will be excavated to competent bearing strata.
- A layer of concrete blinding (lean mix) will be laid 75 mm thick directly on top of the newly exposed formation to provide a level platform.
- Formwork and reinforcement will be fixed.
- Ductwork will be installed as required for cables, and formwork erected around the steel cage.
- Concrete will be placed using a concrete pump and compacted using vibrating pokers.
- Concrete (nominally 800 m3 per foundation) would typically be in two pours, the first pour being the main base, which is approximately 90% of the foundation; the second and remaining 10% forming the plinth section which sits on the top of the main base.
- Upon completion of the concreting works the foundation base will be covered against precipitation.
- Steel shutters will be used to pour the upper plinth section.
- Once the concrete is set the earthing system is put in place and the foundation is backfilled with suitable material to tie in with the required level of the hardstanding.
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation.

2.2.3.3.2 Piled Foundations

The piled turbine foundations will be constructed using standard reinforced concrete construction techniques. For the piled foundations it will be necessary to embed the piles directly into the bedrock using rock sockets. The pile toe level will depend on the depth to bedrock, expected depth is 25 m. These will be further established by detailed ground investigations prior to the construction of the Proposed Development. The piles to be constructed will be large diameter reinforced concrete piles (1m diameter).

It is intended also that the crane pads are provided with a piled foundation at turbines T8, T9 and T10. Similar concrete volumes will be required for either a gravity or piled solution at crane pad locations.

Preparatory work for piling will include the following:

- Site clearance and setting out of the works area followed by soil stripping in order to reach a suitable formation level for the piling platform.
- Around the perimeter of the foundation formation a shallow interceptor drain will be formed and settlement pond / swale constructed.
- Construction of a piling platform (also referred to as pling mat) which is a work platform used for piling rigs providing a stable base from which they can operate, and typically comprise gravels or crushed rock compacted in layers. The piling platform will be designed based on the rig size and specific ground conditions at each turbine location. The piling platform will be incorporated into the hardstand as part of construction.

Rock socket piles will be used to embed the piles into solid rock. This technique involves drilling into the rock layer to create a socket which is slightly larger than the pile. This creates a void around the outer edge of the pile which is filled with grout / cement. This 'socket' in the rock provides the pile with stability by providing resistance against lateral loads and uplift forces. The method requires that piles are bored using a continuous auger until such point as rock-head is met. The auger drill head is then changed to penetrate into the intact rock head. This is followed by rotary piles: an auger core which is followed by a temporary outer steel casing / sleeve to maintain support in the bored excavation. As the casing is inserted, an auger / core-barrel is used to excavate and 'muck-out' inside the casing. When the predetermined pile toe level has been achieved, a prefabricated reinforced steel cage is introduced into the bore, and concrete is poured by means of a tremie-pipe (such that concrete is filled from the bottom of the bore upwards). The temporary casing is then removed.

Note that for piled foundations the water level within the pile shaft will be maintained at or above the surrounding ground water level to ensure that there is no differential head encouraging piping/boiling[3] of the soil at the base of the excavation.

[3] Piping/boiling of the soil is a seepage failure due to groundwater flow

Once all the piling for base has been completed the piles are checked to ensure that their cut off level is appropriate for the required base of the foundation. If this is not the case some pile head cutting may be required. When all piles are to the required level the area is lean-mixed and the foundation base rebar is tied and concrete is poured for the foundation whereby the foundation comprises a reinforced concrete base designed to distribute the loads across the piles. The foundation base will consist of circular concrete base which will be 23 m in diameter and 3 m in depth with a central circular raised plinth which will be used to anchor the turbine tower at its base. Concrete will be placed using a concrete pump in accordance with the requirements of the Structural Engineer and compacted using vibrating pokers. Steel shutters will be used to pour the upper plinth section. Ductwork will be installed for cables. Upon completion of the concreting works the foundation base will be covered against precipitation. Once the concrete is cured the earthing system is put in place and the foundation is backfilled with suitable material to tie in with the required level of the hardstanding. The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation.

2.2.3.4 Turbine Transformer

The turbine will have a transformer located within the tower. The turbine will generate electricity at approximately 660 volts. The turbine transformer will step up the voltage to approximately 33 kV to reduce the electrical loss on the cabling connector circuits that connect to the site substation.

2.2.3.5 Turbine Colour

The turbines have a multiple coating to protect against corrosion. They are coloured off-white or light grey to blend into the sky background.

2.2.4 Access Tracks and Hardstandings

2.2.4.1 Internal Access Tracks

A total of 951 m of internal access tracks will be required to be upgraded as part of the Proposed Development and 9.67 km of new internal access tracks will be required. Figure 2-2 illustrates the internal access tracks within the Proposed Development. The proposed internal site track layout will permit access for vehicles during the construction phase, for maintenance during the operational phase and for vehicles to decommission the turbines at the end of the life of the development. Existing access tracks have been utilised where possible for the Proposed Development. The Recreational Amenity Trail will partly use the upgraded wind farm track.

All access tracks will be 4.5 m wide along straight sections and wider at bends and as required. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks.

Access tracks will be of a floating road design. Floating roads are constructed without excavating the existing ground. They will consist of a layer of combined geotextile and geogrid laid directly on the existing surface. Layers of stone will then be placed on top with additional geogrid reinforcement as required. A layer of compacted Cl 804 material will be placed on top to provide a suitable running surface.

It is anticipated that the stone required for the construction of the internal access roads will be sourced from quarries in the vicinity.

Typically, the track formation will consist of a minimum 500 mm hardcore on geo-textile membrane. The likely construction methodology for newly constructed tracks will be as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500 mm depth.
- A drainage ditch will be formed along sides of the track.
- Surplus excavated material from across the site will be placed along the side of sections of the tracks and dressed to blend in with surrounding landscaping and partially obscure sight of the track.

2.2.4.2 Site Accesses

During construction, the site will be accessed by the main site entrance on the L5025. Located to the south of the site There will also be a site entrance constructed off the L5012 (north of the site), immediately west of the existing Coillte entrance, for the purposes of turbine delivery only. However, all other construction traffic will be via the main site entrance. Turbines T04 to T11 and the Proposed Substation will be accessed via the L5025 site entrance and then through the site to the secondary site entrance off the L50242 (cul de sac road located centrally on site).

Both the main site entrance and the secondary site entrance will be of a bellmouth design, with the main site entrance achieving sight lines of 160m to the north and a sightline of 155m to the south; and the central, secondary site entrance achieves sight lines of 90 m in both directions. More details of the site entrances can be seen on the site entrance drawings P22242-0300-0015 and P22242-0300-0016.

2.2.4.3 Watercourse Crossings

There are 3 no. watercourse crossings required within the Proposed Development site. It is proposed to construct clear span bridges at these. Drawings P22242-0300-0021, P22242-0300-0022 and P22242-0300-0023 illustrate the proposed bridge structures and their locations within the site.

The bridges will be of adequate length and will be designed to ensure that no in-stream works will be required and that the existing stream banks are not disturbed during construction. Sufficient free-board will be allowed for in the proposed bridge designs to allow for 1 in 100-year fluvial flood conditions.

In order that flood flows would not be obstructed, the stream crossings will be sized to convey a 1 in 100-year flood flow with a 20 % allowance for Climate Change.

Bridge foundations will be designed and positioned at least 2.5 m from the river bank.

Rock armour will be used to provide bank protection upstream and downstream of new structures, to ensure no undercutting or destabilisation of the structure. This rock armour will be at the structure, and will not involve any in-stream works. Silt fencing will be erected at the location of each crossing.

For the construction of the bridge crossings, the following outline methodology shall apply:

- The line of the access track and crossing will be marked out on site by a site engineer.
- On approach to the crossing, flow connectivity pipe drains will be installed at 50m centres in accordance with the final drainage design.

- The extent of the excavation for bridge supports will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter. Bridge foundations will be designed and positioned at least 2.5 m from the river bank.
- A layer of concrete blinding will be laid directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface, followed by placement of the concrete blinding layer for the bridge supports.
- Steel reinforcement will be fixed in accordance with the designer's drawings & schedules and the supports will be shuttered.
- Concrete will be placed and compacted to the levels and profile indicated on the construction drawings.
- Upon completion of the concreting works the bridge supports will be covered from the elements and left to cure for a sufficient period in accordance with the design specification.
- The bridge supports will be backfilled using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material is to be approved by the project geotechnical engineer.
- Following curing, MY3 pre-cast bridge beam sections will be lifted into place by a crane or HIAB truck in accordance with an approved lifting plan.
- The bridge parapets will be steel-fixed, shuttered and poured to tie in with the pre-cast bridge deck beams and the upper section of the bridge deck will be poured and finished using ST1 concrete.
- Ductwork will be installed within the bridge deck in accordance with the design to carry the grid connection cables across the watercourse.
- A timber post and rail fence will be installed, affixed to the bridge parapets, to run the length of the bridge deck.

2.2.4.3.1 Drain Crossings

There are three large drain crossings required for the temporary turbine delivery track in the northern portion There are four drain crossings required for the turbine delivery track in the northern portion of the site. These drains are man-made drains and two of these four are part of the OPW arterial drainage network and will be crossed with temporary crossing structures which will provide a clear-span crossing of the drains. The OPW were engaged in pre-application consultations and were made aware of the intention to provide these temporary crossings.

It is expected that all other drain crossings within the site will be crossed using piped culverts. Piped culverts will only be used over very short stretches i.e. at track crossings. Pipe culverts will be sized to take the 1 in 100-year flood flow with a 20% allowance for Climate Change. Concrete or HDPE pipes may be used depending on the size of the drain to be crossed. The locations and sizes of culverts can be found in Appendix 2.

Pipe culverts will be installed in accordance with the typical design shown in planning application drawing P22242-0501-0002.

For a typical drain crossing using a piped culvert, the following outline methodology will be used.

The access track construction will finish at least 10 m from the nearside bank of the drain.

- The access track construction will finish at least 10 m from the nearside bank of the drain.
- Pipe culvert installation will only take place during dry periods.

- The bed of the drain will be prepared using a mechanical digger and hand tools to the required levels in accordance with the design.
- A bedding layer will be laid in the base of the drain using Class 6 aggregate material and blinding to the desired levels in accordance with the design.
- The pipe is laid in one lift or in sections using a crane in accordance with an approved lift plan.
- Bedding material is placed and compacted around the pipe to the desired levels in accordance with the design.
- Culverts will be installed with an invert level 500 mm below the existing watercourse bed level. The embedded section will be allowed to fill naturally.
- The pipe is covered using compacted Class 6N fill material in accordance with the design up to the levels required by the access track sub formation.
- Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.
- For small drain crossings, pipes of suitable diameter will be laid directly into the bed of the drain.

The Proposed Substation will cross a length of man-made OPW arterial drainage by way of a pipped culvert. The OPW have been engaged in pre-application consultations regarding this proposed culvert and the OPW have advised that the culvert design will be subject to a Section 50 application, post planning.

All of the drain crossings described in this section will cross drains of low ecological value.

2.2.5 Temporary Site Facilities

During the construction phase, it will be necessary to provide temporary facilities for the construction personnel. The location of the temporary site compounds are shown on Figure 2-2.

Facilities to be provided in the temporary site compounds will include the following:

- Site offices to include meeting rooms, canteen and welfare facilities complying with latest legislation, of Portacabin type construction
- Portable container toilets
- Areas for storage of materials and fuel including bunded fuel storage
- Waste management areas
- Footpaths
- Employee parking
- Potable water supply
- A water tanker to supply water used for other purposes
- Contractor lock-up facility
- Temporary power and lighting

A wheel wash facility will be provided at the main site entrance. The temporary facilities will be removed on completion of the construction phase.

2.2.6 Turbine Delivery Route

The proposed turbine delivery route is presented in Figure 3.6. A Delivery Route Selection and Assessment was carried out by Pell Frischmann to identify the optimum delivery route to site and is presented in Appendix 3. It is proposed to deliver turbines to the site from the M4 motorway and then the R402 to the junction of the L402/L5025 and follow the L5025 to the main site entrance.

From the main site entrance, the components being delivered for turbines T01, T02 and T03 can be delivered directly to their respective hardstanding locations. However, an alternative delivery route is required for delivery of the components of the remaining turbines (T04 to T11).

The proposed access route is as follows:

- Loads will depart the M4 at Junction 9 and will join the R402, southbound;
- Loads will pass through Johnstown Bridge and Kilshancoe;
- All loads will turn off the R402 onto the L5025, turning left at The Sweep Crossroads junction;
- Loads will continue on the L5025 heading southeast to the site access junction. At the site access junction, loads will turn left into a purpose designed junction;
- Blade loads for the northern turbines will be transferred onto a blade lifting trailer. All other northern turbine loads (for T4 to T11) will undertake a U-turn and will rejoin the L5025, proceed northwest;
- Northern turbine loads will turn right onto the R402 and will proceed northbound;
- At the Raven Junction, loads will turn right onto Kilshanroe Road and will continue eastbound to the northern access junction.

Due to the oversized nature of the wind turbine components, some alterations will be required along the route. These points along the route are termed points of interest (POIs). There are fifteen POIs along the route which are listed below.

- POI 1: Loads will oversail the entry verge where two road signs should be removed. Loads will require an over-run surface on the central island of the roundabout where one chevron sign should be removed. On exiting the junction, loads will over-run the splitter island where three road signs should be removed. Verge vegetation trimming is required on the exit.
- POI 2: At the roundabout with Johnstown Road, loads will over-run the entry splitter island, central island and exit splitter island of the roundabout. Load bearing surfaces are required. Two road signs on the entry splitter island, two chevron signs on the central island and two signs on the exit splitter island should be removed.
- POI 3: Loads will oversail the inside of the junction where a left turn is made off the R402 onto the L5025. Two road signs and a barrier should be removed here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 4: Loads will oversail both verges on the L5025 at the first bend along this stretch. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

- POI 5: Loads will oversail both sides of the road at the next bend along the L5025. Hedge trimming will be required on the western verge along with an area of load bearing surfacing. Tree canopy trimming is required. A minor area of load bearing surface is required in the eastern verge along with the removal of a utility pole. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 6: Further along the L5025, north of the Kilooney Bridge, loads will oversail both verges. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 7: Further along the L5025, south of the Kilooney Bridge, loads will oversail both verges. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 8: At the main site entrance, the delivery will require the removal of a section of fence, access gate and hedge (to enable construction of the site entrance). All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 9: At Raven Junction on the R402, loads will oversail the inside of the junction where verge vegetation trimming will be required.
- POI 10: On Kilshanroe Road, loads will oversail both verges at the first bend along this road. Tree canopy trimming will be required here. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 11: Further along Kilshanroe Road, loads will oversail both verges at the second bend. Tree canopy trimming will be required here. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 12: Further along Kilshanroe Road, loads will oversail both verges at the third bend. Tree canopy trimming will be required here. A section of verge hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 13: Further along Kilshanroe Road, loads will oversail both verges at the fourth bend. Tree canopy trimming will be required here. Two lengths of hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 14: Further along Kilshanroe Road, loads will oversail both verges at the fifth bend. Tree canopy trimming will be required here. A minor area of load bearing surface is required in the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 15: Where the delivery route enters the northern, temporary site entrance, removal of a number of trees will be required to construct the temporary site entrance. The loads will oversail both verges and therefore tree canopy trimming will also be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

2.2.7 Hardstandings

A hardstanding area, including temporary areas, is 192 x 58.5 m in size. This area will accommodate a main crane and an assist crane during the assembly of the turbine, as well as during occasional maintenance during the operation of the wind farm. The area of the hardstanding provided is deemed suitable for the assembly of a turbine with the dimensions proposed. Figure 3-1 illustrates a hardstanding area.

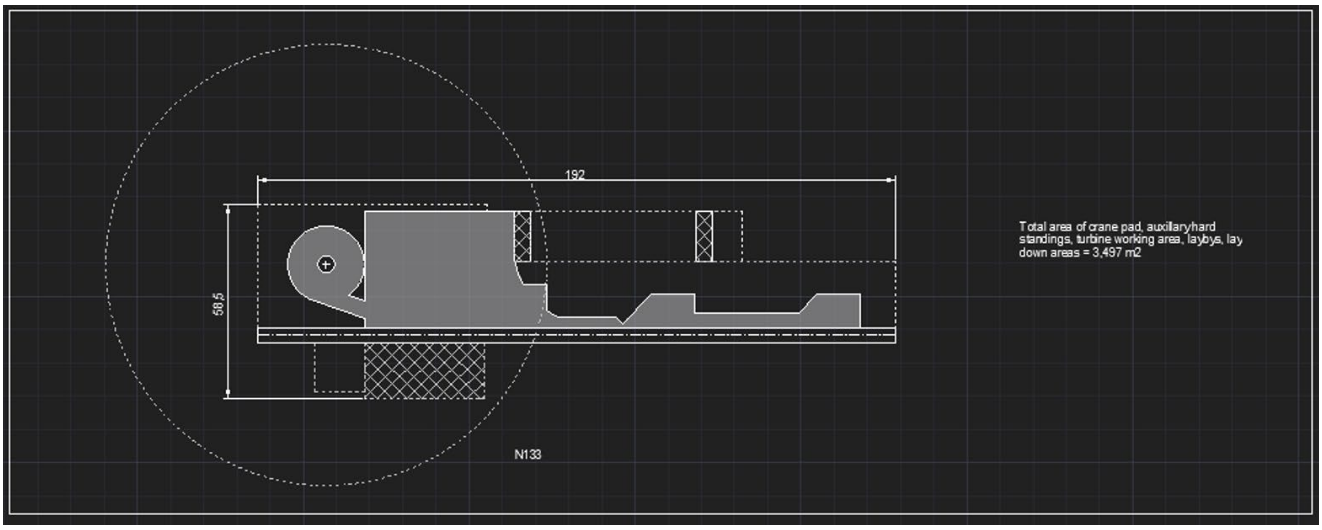

Plate 2-1: Turbine hardstanding

2.2.8 Berms

Any peat excavated for the construction of infrastructure within the site will be re-used on site as landscaping berms; within the clearfell areas around turbines and along the margins of the access roads. A peat deposition area is also provided adjacent to the Proposed Substation, as shown in the Planning Drawings which accompany the application for the Proposed Substation. More information is provided in Section 2.2.10.3.

2.2.9 Recreation and Amenity Trail

It is proposed to enhance the existing walking trail from the local road (L5012) to the north of the site. Access to the amenity trail will be from the existing Coillte entrance off the L5012. The trail will consist of 2 routes – a shorter 1.2km loop in the northern section of the site and a longer route incorporating this route and other existing tracks and new site roads which is ca. 4km. The Amenity Trail will include an area for safely storing bikes and picnic areas with interpretative information provided to add to the experience. The amenity trail route is illustrated on the layout drawings in the planning pack and details of the benches, signage and bike storage can be seen the planning drawing P22-242-0501-0004.

2.2.10 Proposed Substation and Grid Connection

It is proposed to construct 1 no. onsite electricity substation within the Proposed Development site as shown It is proposed to construct 1 no. onsite electricity substation within the Proposed Development site as shown in Figure 2-3. This will provide a connection point, via loop-in/loop-out infrastructure, between the Proposed Wind Farm and the 110 kV Kinnegad-Rinawade overhead line.

The Proposed Substation will comprise of two separate compounds and buildings, an Eirgrid compound and an Independent Power Producer (IPP) compound, necessary to export the electricity generated from the Proposed Wind Farm to the national grid. The compounds are made up of a hardstanding permeable crushed stone surface and surrounded by a palisade fence. The hardstanding area measures approximately 1.32 hectares.

The Eirgrid substation building will cover a footprint of approximately 450 sq.m with a pitched roof and an overall height of 8.55 m. The IPP switchgear room will consist of a building of approximately 160 sq.m with a pitched roof and an overall height of 5.85 m.

The substation compound is surrounded by a 2.6 m high palisade fence with associated gates for access. Eirgrid specification lightning masts will also be included as a safety measure. These will consist of 20 m monopoles.

A wastewater holding tank will be provided within the IPP Compound. The wastewater holding tank will be a sealed storage tank with all wastewater tankered off site as required by an authorised waste collector to a wastewater treatment plant. When the final destination of the wastewater is known (following the appointment of an authorised waste collector), this information can be submitted to the Kildare County Council where required.

An Operations Compound will be provided with the Proposed Substation. This compound will comprise:

- Welfare facilities, in accordance with the Safety Health and Welfare at Work Regulations 2013 and the appropriate regulations pursuant to that act
- Storage area (i.e. one 20-foot storage container and one 20-foot bunded container)
- Waste area (containers and skips)
- Power and communications (fibre optics to the substation)
- Parking facility

2.2.10.1 Grid Connection

The Proposed Development will have a Maximum Export Capacity (MEC) of 52.8 MW. Connection for this project was granted through the Enduring Connection Process (ECP), ECP-2.1, the first of a number of annual batches part of the second stage of the ECP policy. The project received an offer for a new loop-in connection to the Kinnegad-Rinawade 110 kV overhead line in September 2021.

To connect to the existing Kinnegad-Rinawade OHL, a new outdoor 110 kV substation will be constructed on site in order to ramp up the voltage to the 110 kV voltage required to loop-in to the existing OHL. 2 no. line-cable interface masts are necessary to enable this loop-in connection to the existing OHL. The steel lattice masts will extend to a height of 16 m above existing ground level. A 998 m length of 110kV underground cable will be required to connect the new 110 kV substation and interface masts, into the existing OHL. The proposed grid connection is shown in Figure 2-3.

2.2.10.2 Substation Drainage

The substation will be drained by a network of piped stormwater drains to a full retention interceptor. Foulwater will be directed to a holding tank as described in 3.4.10. A drainage layout drawing for the substation is presented as planning drawing 23727 MWP 00 00 DR C 2100.

The access tracks approaching the substation will be drained by a network of swales and stilling ponds.

2.2.10.3 Peat Deposition

The peat excavated for the construction of the substation foundation will be deposited adjacent to the substation compound, in an area shown on the planning drawings as the “Peat Deposition Area”. The Peat Deposition Area will be 100 m by 68 m in area, 2 m in height and will be enclosed by engineered rock berms of 2m height and 3 m top width. More details of the Peat Deposition Area can be seen in the Compound Layout drawings (23727 MWP 00 00 DR C 0101) and Peat Deposition Area section drawings 23727 MWP SS ZZ DR C 1010 and 23727 MWP SS ZZ DR C 1011.

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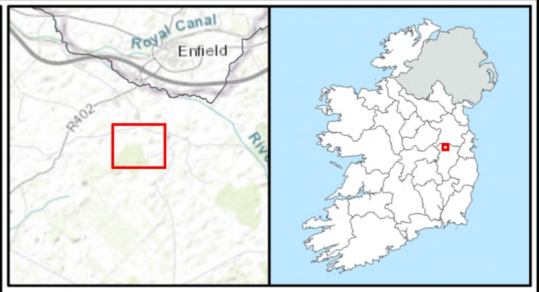

Legend

- Proposed Development Boundary
- Peat Deposition Area
- Substation
- Existing 110kV Overhead Line
- Grid Connection Route

TITLE: Substation and Grid Connection			
PROJECT: Drehid Wind Farm and Substation			
FIGURE NO:	2.3		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:5,500	**REVISION:**	0
DATE:	10/06/2025	**PAGE SIZE:**	A3

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2.2.11 Electrical cabling

Proposed Substation

Underground electrical cables will connect the wind turbines to the Proposed Substation which will then connect to the existing Kinnegad-Rinawade 110 kV OHL. The proposed cable route from the Proposed Substation to the existing overhead line is presented in Figure 3-8 and measures 998 m in length.

The electricity will be transmitted as a three-phase power supply so there will be three individual conductors (or individual cables) in each cable circuit. The three conductors will each be laid in separate ducts (within the same trench) which will usually be laid in a trefoil formation but may also be laid in a flat formation. The specification for the cables and cable-laying will be in accordance with EirGrid requirements. A copy of the EirGrid requirements is available in Appendix 4.

Internal Proposed Wind Farm cabling

The typical width of a cable trench with a trefoil formation will be approximately 650 to 850 mm, a flat formation would require a wider trench width. Cables will primarily be laid within the wind farm site, with a section of cable between the southern portion of the site and the northern portion of the site on the L50242 public road (1.38 km) and will be laid to a minimum depth of 950 mm to the top of the upper duct in field locations. The diameter of the ducting will be selected to suit the range of cross-sectional areas of electrical cables and is likely to be either 125 mm or 160 mm in diameter.

2.2.11.1 Joint Bays

Joint bays are pre-cast concrete chambers where individual lengths of cables are joined to form one continuous cable. joint bays will be located at various points along the ducting route at approximately 500 m – 1000 m intervals.

A joint bay will be constructed in a pit. The bay will be 6.0 m x 2.53 m x 1.2 m deep. A reinforced concrete slab will be constructed in the bay to accommodate the jointing enclosure.

Communication chambers, which are similar to small manholes, will also be installed at the joint bay locations to facilitate connection of fibre-optic communication cables. There will be a requirement to install two joint bays on the L50242 as shown on planning drawings 22-242-0101-0010 and 22-242-0101-0011.

2.2.12 Drainage

The drainage system for the Proposed Wind Farm will be constructed alongside all turbines, internal access tracks, hardstandings, substation, the blade transfer area and the temporary construction compounds. The drainage system for the existing tracks and roads will largely be retained. Where the roads require widening, this will involve the slight re-location of existing roadside swales to allow for widening. Further details on the hydrology and drainage are contained in the CEMP in Appendix 5 and in the Planning Drawings.

The drainage system for the Proposed Substation has been described above in 2.2.10.2.

2.2.13 Temporary Stockpile Areas

Due to the possibility of soil-borne diseases, all topsoil recovered from each farm property will remain on site. These stockpiles will be covered and where required, temporary silt fencing will be put in place. The topsoil will be re-used for landscaping and will also be used for reinstatement purposes around turbine bases and hardstanding areas.

2.2.14 Tree Felling

An area of the Proposed Development site comprises of commercial coniferous forestry. Felling of approximately 28.4 ha of wooded habitats (comprised of 21.2 ha of woodlands dominated by or mainly comprised of conifers, and 7.2 ha of broadleaved wooded habitats) is required within and around the wind farm infrastructure to accommodate the construction of some turbines, hardstands, crane pads, access tracks and the proposed onsite substation. Turbines T6, T7, T8, T9, T10 and T11 are located within forestry and consequently tree felling will be required as part of the project.

It is proposed to fell approximately 28.4 ha of wooded habitats for the Proposed Development, which will be the subject of a Felling Licence Application to the Forest Service prior to construction as per the Forest Service's policy on granting felling licenses for wind farm developments. The proposed areas to be felled are illustrated on Figure 3.10.

The Forest Service Policy requires that a copy of the planning permission for the wind farm be submitted with a felling licence application therefore the felling licence cannot be applied for until planning permission is received for the Proposed Development site. The licence will include the provision of relevant replant lands to be planted in lieu of the proposed tree felling on the site as discussed in Section 2.2.15 below. It should be noted that the forestry within the Proposed Wind Farm site was originally planted as a commercial crop and will be felled in the coming years should the wind farm proceed or not.

2.2.15 Replant Lands

Replacement replanting of forestry in Ireland is subject to license in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by the Forestry Regulations 2017 (S.I. No. 191 of 2017). The total amount of felling proposed for the project is 28.4 hectares. It should be noted that the clearfelling of trees in the State requires a felling licence. The associated afforestation of alternative lands equivalent in area to those lands being permanently clearfelled is also subject to licensing ('afforestation licensing').

The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing. The Applicant commits to not commencing the project until both felling and afforestation licences are in place, and this ensures the afforested lands are identified, assessed and licensed appropriately by the relevant consenting authority.

2.2.16 Project Decommissioning

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process.

The foundation pedestals will be covered over and allowed to re-vegetate naturally. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise, vibration and dust.

It is proposed that all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for forestry and agriculture. Turbine foundation and hardstanding areas will be covered over with topsoil previously stripped and used for landscaping purposes during the construction stage and left to revegetate naturally.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.

Grid connection infrastructure including the on-site substation and ancillary electrical equipment will form part of the national grid and will be left in situ.

It is expected that the decommissioning phase will take no longer than 6 months to complete.

It is important to note the limitation that we do not know what methodologies and efficiencies will have evolved in the decommissioning of wind farms by the year the Proposed Wind Farm would be decommissioned, but an impact assessment will be made throughout this EIAR based on assumptions. In general, it is assumed that the impacts associated with decommissioning are similar to those associated with the construction stage, but of a lesser magnitude.

2.2.16.1 Wind Turbines

Prior to any works being undertaken on wind turbines, they will be disconnected from the grid by the site operator in conjunction with ESB Networks and EirGrid. The dismantling and removal of wind turbines of this scale is a specialist operation which will be undertaken by the turbine supplier that completed the installation where possible. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction. A number of large-scale cranes will be brought back to site utilising the existing hard stand areas. The dismantling of turbines will be bound by the same safety considerations as was the case during construction in terms of weather conditions where works will not be undertaken during adverse weather conditions and in particular not during high winds.

On decommissioning, the turbine blades will most likely be broken down on site, negating the requirement for extended articulated trucks that would have been necessary to deliver the blades to site for construction. The destination of the turbines post decommissioning is unclear at this time and will be subject to an assessment of potential for recovery of parts.

The transport of disassembled turbines from the site will be undertaken in accordance with a Transport Management Plan which will be issued to and agreed with the competent authority at that time as part of a permit application for the delivery of abnormal loads using the local roads under the Road Traffic (Special Permits for Particular Vehicles) Regulations 2007. The Transport Management Plan will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

2.2.16.2 Turbine Foundations

On the dismantling of turbines, it is not intended to remove the concrete foundation from the ground. The eleven turbine foundations will be backfilled and covered with soil material from areas of earthworks. The soil will be spread and graded over the foundation using a tracked excavator and revegetation allowed to occur naturally.

2.2.16.3 On-site Underground Cabling (for Turbines)

The electrical and fibre optic cabling that connects each turbine will be removed from the cable ducting. The cabling will be pulled from the cable duct using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at each of the joint bays/pull pits along the cable. The road will be excavated using a mechanical excavator at each cable pulling pit location and will be fully re-instated once the cables are removed. The cable ducting will be left in-situ, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible.

The 110 kV cable and substation will remain in situ and will become an ESB/Eirgrid networks asset and will be part of the national electricity grid and therefore it is not proposed to remove this cable.

2.2.16.4 Transport Route Accommodation Works

During the construction of the Proposed Development, a number of minor accommodation works are proposed on the public road to facilitate the delivery of turbines to the site at construction stage. It is not envisaged that these accommodation areas will require re-use during decommissioning as the accommodation works are primarily associated with delivery of the largest components i.e. the blades. It is expected that during decommissioning the blades will be split on site into smaller pieces for recycling or disposal, depending on the recycling and waste streams available at the time of decommissioning. As the tower of the turbine can be disassembled into its component parts during decommissioning, it is not anticipated that any abnormal loads will be such that they would require re-use of the accommodation works associated with the construction phase.

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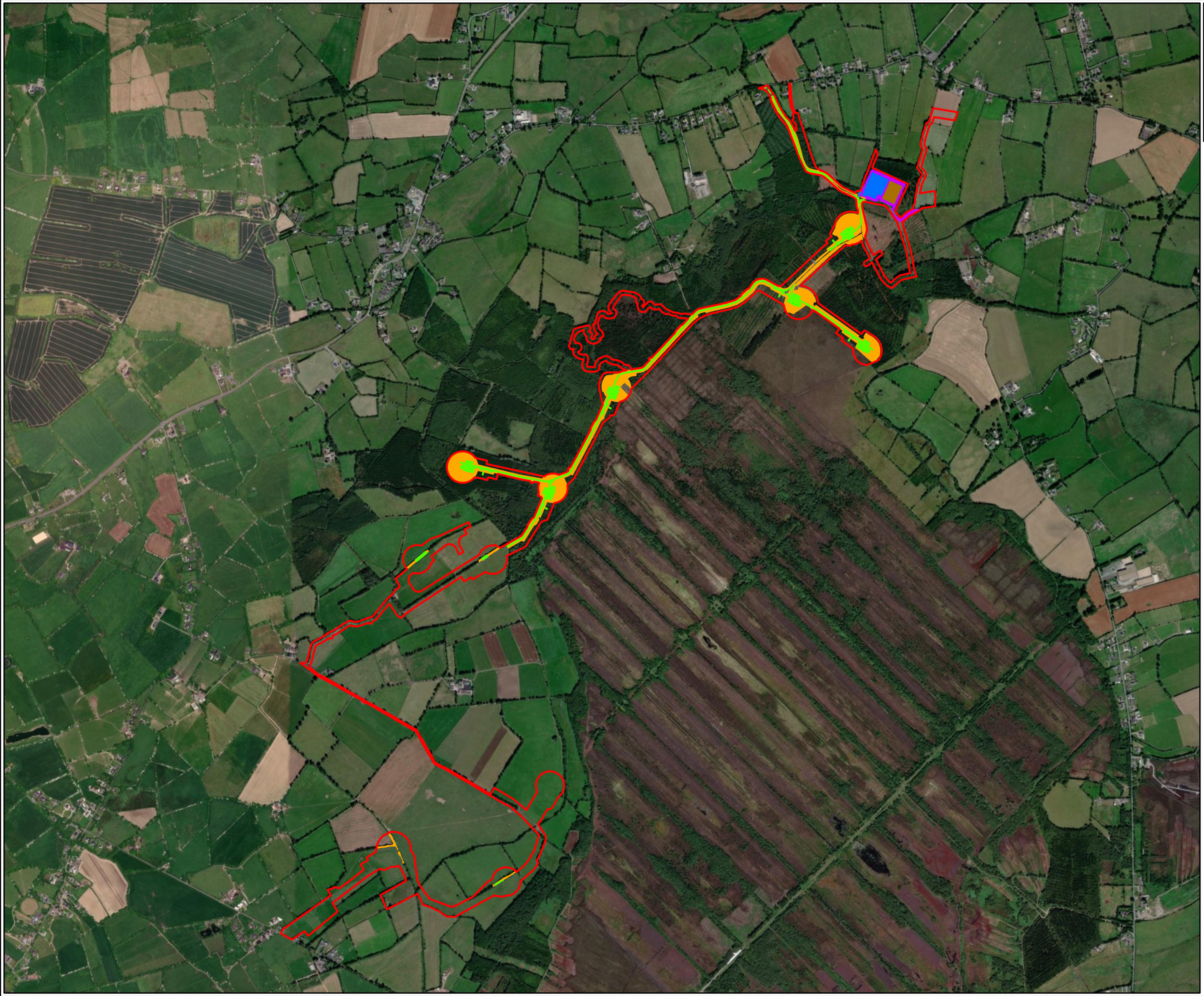

Legend

- Proposed Development Boundary
- Wind Farm Felling outside infrastructure
- Wind Farm Infrastructure Felling
- Substation Felling Outside Infrastructure Footprint
- Peat Deposition Area Permanent Footprint
- Substation Grid Permanent Footprint

TITLE: Felling Area	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 2.4	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:20,000	**REVISION:** 0
DATE: 26/05/2025	**PAGE SIZE:** A3

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2.3 Potential Interactions of the Proposed development with the receiving environment

Having regard to the European Commission (2021) guidance document and the OPR (2021) practice note, the potential impacts of the project on the receiving environment at source are set (in Table 2-3) out relative to the following criteria:

- Habitat destruction/fragmentation/deterioration;
- Surface water run-off carrying suspended silt and contaminants, into local watercourses;
- Changes to groundwater quality, yield and/or flow paths associated with the proposed development ;
- Project related activities (noise, vibration, lighting, human presence, structures, etc) leading to disturbance / displacement of species;
- Project related activities leading to a reduction in species populations / density;
- Air pollution due to dust and other airborne emissions; and
- Disturbance and potential spread of invasive species during the proposed works

These impacts are further examined in defining the Zone of Influence (ZoI) of the project to identify likely significant effects through the Source-Pathway-Receptor assessment (Section 3.2).

Table 2-4: Identification of sources for impacts arising from the proposed development that have potential for interactions with the receiving environment.

Criteria	Potential sources of impact	Conclusion
Habitat destruction / fragmentation / deterioration	*Construction Phase* Site clearance and land take resulting in the removal of areas of : • BL3 - Buildings and artificial surfaces • GS2 - Dry meadows and grassy verges • WD1 - (Mixed) broadleaved woodland • WD2 - Mixed broadleaved/conifer woodland • WD3 - (Mixed) conifer woodland • WD4 - Conifer plantation • WN7 - Bog woodland • WS1 - Scrub • WS2 - Immature woodland • BC3 - Tilled land • GA1 - Improved agricultural grassland • WN7/WS1 - Bog woodland/Scrub Mosaic • WS1/PB1 - Scrub/Raised bog Mosaic • WD4/WN7 - -Conifer plantation/Bog woodland Mosaic Deterioration of nearby aquatic habitats receiving runoff from proposed works areas. Construction of watercourse crossings.	No Annex I habitat is present within the proposed footprint. All proposed works are located outside European Sites. Vegetation clearance of wooded habitats will reduce habitat and foraging opportunities for some mammal, bat and bird species. Potential for surface water flows to transport sediment or contaminants into the river network; potentially resulting in deterioration of downstream aquatic habitats. Potential for works at watercourse crossings to cause destruction / fragmentation / deterioration of aquatic habitats at and in the vicinity of crossing points, and potential for transport of sediment or contaminants downstream. Deterioration of aquatic habitats may affect otter, kingfisher and fish species.

Criteria	Potential sources of impact	Conclusion
	Operational Phase Periodic maintenance of bat felling buffers affecting Scrub and semi-natural successional habitat mosaics establishing in felling buffers. *Decommissioning Phase* Land take associated with the decommissioning phase will be minimal and habitat loss will be limited to trimming or felling of limited areas of wooded habitats at the proposed development site to facilitate clear passage of turbine parts being removed. Turbine components will be broken down prior to removal, resulting in reduced clearance requirements and therefore reduced effects arising from transport off site.	
Surface water run-off carrying suspended silt and contaminants into local watercourses.	*Construction Phase* Soil disturbance caused by heavy machinery tracking, earth works and construction activities. Leaks of hydrocarbons such as fuel or lubricating oils. Washout of wet cement. Construction of watercourse crossings. *Operational Phase* Periodic maintenance of bat felling buffers could give rise to discharges of silted surface water. Potential hydrocarbon pollution from vehicles or transformer oils.	Potential for surface water flows to transport sediment or contaminants into the river network; potentially resulting in deterioration of downstream aquatic habitats. Potential for works at watercourse crossings to cause destruction / fragmentation / deterioration of aquatic habitats at and in the vicinity of crossing points, and potential for transport of sediment or contaminants downstream.

Criteria	Potential sources of impact	Conclusion
	Decommissioning Phase There is potential for similar effects to those associated with construction to arise from soil disturbance and reinstatement activities; however the potential magnitude of decommissioning effects is much lower than construction stage effects.	
Changes to groundwater quality, yield and/or flow paths associated with the proposed development .	*Construction Phase* Excavations for turbine foundations may result in localised effects on groundwater. The dewatering of excavations could potentially have indirect impacts such as reduction of yields to the groundwater source protection zone (SPZ) within the site boundary, any nearby wells, reduction to the baseflow of streams or affect the groundwater hydrology of remnant bog. There is potential for reductions in groundwater quality in the event of pollution (e.g. hydrocarbon or cement spillage). *Operational Phase* The presence of turbine foundations may result in localised effects on groundwater. *Decommissioning Phase* There is limited potential for reductions in groundwater quality in the event of pollution (e.g. hydrocarbon spillage).	Any potential alterations to groundwater quality, yield and/or flow paths will be localised (affecting the proposed site and adjacent areas) and are unlikely to give rise to effects to surface or groundwater at greater distances. It is noted that any groundwater pumped from excavations will be discharged to the hydrological network following treatment, and as such there will be no significant net loss to the stream baseflow.

Criteria	Potential sources of impact	Conclusion
Project related activities (noise, vibration, lighting, human presence, structures, etc.) leading to disturbance / displacement of species.	*Construction Phase* During the construction phase (18 Months) there will be human presence and machinery on site, typically during sociable working hours (no regular night-time or early morning work is proposed, however occasional late night or early morning activities may occur). Piling work for turbine foundations in lower density soils will consist of auguring (drilling), followed by insertion of concrete to form the piled foundations. No percussive or vibratory piling is proposed. *Operational Phase* Intermittent inspection and maintenance of the proposed infrastructure is unlikely to result in high or sustained levels of disturbance. *Decommissioning Phase* There is potential for similar effects to those associated with construction to arise; however the potential magnitude of decommissioning effects is much lower than construction stage effects.	Noise, vibration and human presence during the construction phase of the proposed development could potentially affect otter breeding or resting places. Night time activities requiring artificial lighting could affect bats and otter using the site. Noise, vibration and human presence during the construction phase of the proposed development may cause fauna to avoid the immediate area. Grazing whooper swans using the fields north of T1 - T3 could potentially be affected by construction disturbance.
Project related activities leading to a reduction in species populations / density.	*Construction Phase* Soil disturbance caused by heavy machinery tracking, earthworks and construction activities. Leaks of hydrocarbons such as fuel or lubricating oils.	Potential for surface water flows to transport sediment or contaminants into the river network; potentially resulting in deterioration of downstream aquatic habitats. Deterioration of aquatic habitats may affect otter, kingfisher and fish species.

Criteria	Potential sources of impact	Conclusion
	Washout of wet cement. *Operational Phase* Periodic maintenance of bat felling buffers could give rise to discharges of silted surface water. Potential hydrocarbon pollution from vehicles or transformer oils. Potential turbine collision risk affecting bird species. *Decommissioning Phase* There is potential for similar effects to those associated with construction to arise; however the potential magnitude of decommissioning effects is much lower than construction stage effects.	Collision risk posed by operational turbines could potentially affect the local wintering whooper swan population. The risk of collision associated with short sections of proposed overhead line linking the underground grid connection loop in to the existing high voltage lines is negligible due to the limited scale of the above ground infrastructure and location adjacent to/under existing pylons.
Air pollution due to dust and other airborne emissions.	*Construction Phase* During earthworks, dust from vehicular movements/earthworks could be generated as well as emissions from plant and machinery. *Operational Phase* Intermittent maintenance activities are unlikely to result in significant airborne emissions.	There is potential for dust generated onsite to settle on vegetation and also to enter the hydrological network.

Criteria	Potential sources of impact	Conclusion
	Decommissioning Phase There is potential for similar effects to those associated with construction to arise; however the potential magnitude of decommissioning effects is much lower than construction stage effects.	
Disturbance and potential spread of invasive species during the proposed works.	*Construction Phase* A small growth (2 x 3m area) *of Rhododendron ponticum* is present c. 100m from a section of proposed access track, and *Rhododendron* was also recorded in conifer plantation c. 170m north-east of T9. Cherry laurel *Prunus laurocerasus* was recorded at two TDR points of interest (POI 1 & 3). Snowberry *Symphoricarpos albus* was recorded c. 15m from the proposed T7 - T8 access track. Butterfly bush *Buddleja davidii* was recorded along existing forestry tracks north of T9 and south of the proposed development . Sycamore *Acer pseudoplatanus* was recorded within mixed broadleaved/conifer woodland within the proposed development footprint, and was also recorded in hedgerows at TDR points of interest.	There is potential for effects from the spread of invasive plant species during construction and also during maintenance.

Criteria	Potential sources of impact	Conclusion
	Operational Phase In the event that invasive species spread naturally to turbine locations from areas outside the proposed site during operation, maintenance of bat felling buffers could accelerate the spread of these invasive species. *Decommissioning Phase* There is potential for similar effects to those associated with construction to arise; however the potential magnitude of decommissioning effects is much lower than construction stage effects.	

3. SCREENING FOR APPROPRIATE ASSESSMENT

3.1 Introduction

This section of the report examines if the Proposed Development is likely to have a significant effect upon European sites, either alone or in combination with other plans or projects.

3.2 Identification of European Sites within the Zone of Influence of the Proposed development

The OPR (2021) AA Screening practice note states that the Zone of Influence must be established on a case-by-case basis using the Source-Pathway-Receptor model. The S-P-R model has been used to identify the ZoI to ensure that relevant European sites are identified. The S-P-R model minimises the risk of overlooking distant or obscure effect pathways, while also avoiding an over reliance on buffer zones (e.g. 15 km), within which all European sites should be considered. This approach follows the DoEHLG (2009 rev 2010) guidance on AA which states that:

> *"For projects, the distance could be much less than 15 km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects".*

As detailed in section 1.2.2, for an effect to occur, all three elements of this mechanism must be in place. The absence of one of the elements of the mechanism means there is no likelihood for the effect to occur. The potential impacts of the proposed development are set out in Section 2.3 of this report. The impact is essentially the 'source' in the S-P-R model.

These impacts may be very localised and confined to the proposed development site with no potential connectivity to a European site and therefore no potential for effects. Alternatively, where an ecological or functional pathway exists, they may give rise to a potential effect to a Qualifying Interest of a European site. This section of the report identifies the potential pathways to European sites emanating from these potential sources of impact.

The dominant ecological pathways to consider are:

- Direct physical interactions or changes to the local environment;
- Air dispersal (noise, dust, odour, emissions etc.);
- Hydrological interactions; and
- Dispersal patterns of mobile species.

The potential impacts of the works for the proposed development on the receiving environment (identified in Table 2-3) are as follows:

- Habitat destruction / fragmentation / deterioration;
- Changes to groundwater quality, yield and/or flow paths associated with the proposed development .
- Project related activities (noise, vibration, lighting, human presence, structures, etc) leading to disturbance / displacement of species.

- Project related activities leading to a reduction in species populations / density.
- Air pollution due to dust and other airborne emissions.

These impacts are assessed under the following criteria below:

- Release of pollutants and sedimentation to watercourses with hydrological connectivity to European sites.
- Potential effects to groundwater / hydrogeology.
- Potential effects to mobile SCI from surrounding SPAs.
- Potential effect to mobile QI species.
- European sites geographically overlapping or adjacent to any of the actions or aspects of the proposed development (noise, lighting and dust).
- Disturbance and potential spread of invasive species during the proposed development.

3.2.1 Release of pollutants and sedimentation to watercourses with hydrological connectivity to European sites;

Surface water connections between the Proposed Development and any European sites were examined based on site surveys and using Geographic Information System (GIS) mapping. The Proposed Development drains to the River Boyne via the Blackwater (Longwood) and its tributaries which dissect the proposed site.

3.2.2 Potential effects to groundwater / hydrogeology

A GIS search was conducted to identify any European sites with Groundwater Dependent Ecosystems within the catchment area of the Proposed Development.

3.2.3 Potential effect to mobile SCIs from surrounding SPAs

The habitats within the subject lands and the surrounding area could offer potential resources for mobile SCI bird species from SPAs. As Identified in Table 2-3 there is potential for direct and indirect impacts to these local habitats. Therefore, the assessment has considered the potential pathways for effects to these bird species. Generally, the core foraging range for SCI birds species is less than 15km. However, SNH (2016)[4] core foraging range for some geese species can be larger. Namely:

- Greylag goose Core range of 15-20km* Greylag Geese feed mostly on cereal stubble and grassland in their wintering areas.
- Barnacle goose Core range of 15km, with maximum recorded distance of up to 25km.

Therefore, as a precautionary approach in defining the ecological receptors that may be affected, all SPAs within 15 km and SPAs within 25 km designated for Greylag and Barnacle Geese were examined using Geographic Information System (GIS) mapping. The conservation objectives of these European sites were assessed to identify potential physical or ecological connectivity to the proposed site.

[4] Scottish Natural Heritage. (2016). Assessing Connectivity with Special Protection Areas (SPAs) Guidance.

As detailed in Section 2.1.2 and Table 2-2, potential for links between migratory species recorded at the proposed development and SPAs in the wider region which include these species as SCIs has also been examined.

3.2.4 Potential effect to mobile QI species

Lesser horseshoe bats tend to forage in summer in broadleaved woodland and around riparian vegetation (Bontadina et al., 2002; Biggane, 2003). In 2016, the Bat Conservation Trust (BCT) carried out a review of literature pertaining to mean and maximum bat foraging distances (BCT, 2016). In their review, a Core Sustenance Zone (CSZ) refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. For the BCT review, lesser horseshoe bat data was available from 83 radio-tracked individuals from four separate studies. The weighted average maximum foraging distance for lesser horseshoe bats was 2.02km. The BCT noted that for Annex II species there is justification for increasing the CSZ to reflect use of the landscape by all bats in a population. Some researchers have found that lesser horseshoe bats normally forage in woodlands/scrub within 2.5 km of their roosts (Bontadina et al., 2002); thus, for each roost, a 2.5 km zone is considered an appropriate distance to foraging areas for the purpose of the current SSCO targets. The 2.5 km zone around each known roost is mapped and potential foraging grounds within the zone are identified and mapped for each SAC using the Forestry Inventory and Planning System (FIPS) (2007/2012) spatial dataset. The target is that there is no significant decline in potential foraging habitat within 2.5 km of qualifying roosts. However, Collins et al. (2016) also note that seasonal movements between summer and winter roosts are reported to be between 5 to 10 km in distance.

As a precautionary approach in defining the ecological features that may be affected, all SACs designated for Lesser Horseshoe bats within 10 km were first examined using Geographic Information System (GIS) mapping and the conservation interests of these European sites were examined in order to ascertain whether there could be potential physical or ecological connectivity to the project and the associated impacts from the proposed works.

Potential effects to mobile aquatic QI species (e.g. Otter, Lamprey sp. Atlantic Salmon, etc) are considered under this heading, and are also relevant to Sections 3.2.1 and 3.2.2 above.

3.2.5 European sites geographically overlapping or adjacent to any of the actions or aspects of the proposed development (noise, lighting and dust)

There are no European site adjacent to the proposed development. The closest European site is the Long Derries SAC (000925), located 7.3 km south-west of the Proposed Development.

The Institute of Air Quality Management 'Guidance on the Assessment of dust from demolition and construction' (Holman et al, 2014) states that for sensitive ecological receptors, sensitivity to dust is 'High' up to 20m from the source and reduces to 'Medium' over 50m from the source. Holman et al, 2014 also stipulates that trackout[5] may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites. Dust from soiling (excavation works) can occur up to 25 m, 50 m and 100 m, at minor, moderate, and major construction sites respectively (NRA, 2011). Considering the distance of over seven kilometres separating the Proposed Development and the closest European site, no effects in this category are predicted.

[5] The movement of dust and dirt from a construction/demolition site onto the public road network.

Disturbance due to noise impact varies between species and is dependent on the nature of the noise source and sensitivity of the species in question e.g., the potential effects of anthropogenic sound on fish can range from direct mortality to no obvious behavioural responses and are dependent on the class of sound i.e., either continuous or impulsive (Popper and Hawkins, 2019). Similarly, the disturbance response of birds (e.g., becoming alert or a flight response) can vary depending on season, species sensitivity, and weather. Goodship and Furness (2022) provides estimates of species-specific buffer zones to protect birds from human disturbance during breeding and non-breeding seasons. Therefore, a precautionary Zone of Influence of 1 km was identified. This 1 km buffer also accounts for noise disturbance to otters and other aquatic species.

It is noted that the disturbance distance for whooper swan identified by Goodship and Furness (2022) is lower (155m, disturbance caused by surveyor on foot).

Other emissions source identified in Table 2-3 (e.g. Lighting) are likely to be more localised than the distances stated for noise impacts.

Considering the actions or aspects of the Proposed Development, a precautionary ZoI of 2 km has been adopted.

3.2.6 Disturbance and potential spread of invasive species during the proposed works.

Invasive species can spread from an infested area to other habitats by the transportation of plant fragments or soil containing seeds / plant material. This typically can occur during excavation and vegetation clearance. Machinery, vehicles and personnel coming into contact with infested areas can spread these species outside of the site. The ZOI of this potential impact requires the consideration of European sites near the footprint of works. As a precautionary approach a ZoI of 2 km has been adopted.

Hydrologically connected European sites will also need to be considered e.g. soil containing invasive species material washing downstream to a European site. The spread of invasive plant species vector material overlaps with the category of potential effects to hydrologically connected European sites considered in Section 3.2.1 above.

The invasive non-native plant species *Rhododendron ponticum*, cherry laurel, snowberry, butterfly bush and sycamore are present in the area the area in which the proposed development is located.

3.2.7 Summary of the Zone of Influence of the proposed development

The ZoI of the Proposed development has been identified as:

- Any European sites hydrologically connected to the Proposed development;
- Any European sites with groundwater dependent habitats within the catchment area of the Proposed development;
- All SACs designated for Lesser Horseshoe bats within 10 km of the Proposed development;
- All SPAs within 15 km, and SPAs designated for Greylag and Barnacle Geese within 25km of the Proposed development;
- SPAs in the wider region with migratory SCI species which have been recorded at the proposed development;
- Any European sites within 2 km of the Proposed development; with potential susceptibility to impacts from habitat loss, noise, lighting, invasive species and dust.

The findings of the ZoI assessment are presented in Table 3-1.

The are no European sites identified within the proposed development ZoI for the following criteria:

- No SACs for Lesser Horseshoe Bats are present within 10 km;
- No SPAs for Greylag and/or Barnacle Geese are present within 25 km;
- No SACs or SPAs are present within 2 km.

Table 3-1: Identification of European Sites within the Zone of Influence of the Proposed Development

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
The Long Derries SAC (000925)	• [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	7.3 km	None applicable; outside ZoI	None identified	N
Ballynafagh Lake SAC (001387)	• [7230] Alkaline Fens • [1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*) • [1065] Marsh Fritillary (*Euphydryas aurinia*)	7.9 km	Hydrologically connected European Sites (surface water) (groundwater) Groundwater dependent QIs Mobile Species	SAC is in different sub-catchment and different aquifer to the proposed development and substation. No pathway identified for surface or groundwater effects. As such, there are no effects pathways for QIs which could potentially be affected by changes in surface or groundwater conditions (Alkaline fens and Desmoulin's Whorl Snail). Although most females remain close to established breeding locations, some individuals can travel	Y

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				further afield and as such there is a potential effect pathway for Marsh Fritillary via population exchange/local migration between the SAC and Proposed Development.	
Ballynafagh Bog SAC (000391)	• [7110] Active raised bogs* • [7120] Degraded raised bogs still capable of natural regeneration • [7150] Depressions on peat substrates of the Rhynchosporion Site synopsis (NPWS, 2013) notes presence of breeding merlin, curlew and snipe.	8.6 km	Mobile Species	None identified. While merlin was recorded at the proposed development, observations were limited to the winter season. No evidence of breeding merlin was recorded during dedicated merlin surveys. Any potential effects on foraging merlin are assessed as minor. It is noted that the foraging range of breeding merlin is 5km (SNH, 2016), putting the proposed development beyond the range of any breeding merlin occurring at Ballynafagh Bog SAC.	N

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				Similarly, curlew and snipe breeding at Ballynafagh Bog would be restricted to the SAC and it's immediate surroundings. Snipe have been confirmed to breed adjacent to the proposed development; however, there is no link between the local breeding population and birds breeding at Ballynafagh Bog SAC. No breeding curlew were recorded at or near the proposed development site. There is abundant suitable snipe foraging habitat at the SAC, and curlew are noted to have a respective core/maximum foraging range of 1km/2km during the breeding season.	

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				As such, the breeding activity of breeding snipe and curlew associated with the SAC would be focused within and in the immediate surroundings of the SAC.	
River Boyne and River Blackwater SAC (002299)	• [1099] River lamprey (*Lampetra fluviatilis*) • [1106] Salmon (*Salmo salar*) • [1355] Otter (*Lutra lutra*) • [7230] Alkaline fens • [91E0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) Site synopsis (NPWS, 2014) notes presence of wintering whooper swans.	9.6 km	Hydrologically connected European Sites (surface water) (groundwater) Mobile Species	The proposed works may cause temporary effects on surface water quality due to sediment and nutrient runoff, concrete washout, and potential oil spills from plant and machinery. Wastewater generated onsite during construction could affect surface water quality if improperly disposed of. Mobile species including otter, Atlantic salmon and river lamprey could be subject to disturbance and/or effects arising from pollution.	Y

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				Silt and pollution entering the river network could have a direct impact downstream on physical habitat. A decrease in water quality could affect otter due to reduction in prey availability. Potential disturbance to otter arising from works along or near the riparian zone. Periodic vegetation clearance to maintain the bat felling buffers carries a risk of siltation via surface water flows towards the river network. There is a risk that machinery or materials brought onto the site could act as a vector for introducing or dispersing non-native invasive species.	

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				There is also a risk of invasive species spread associated with vegetation trimming works for the TDR, vegetation clearance at the Proposed development and Substation, and during bat buffer felling and maintenance. Spread of invasive species via the hydrological network.	
River Boyne and River Blackwater SPA (004232)	• [A229] Kingfisher (*Alcedo atthis*)	9.6 km	Hydrologically connected European Sites (surface water) (groundwater) Mobile Species	The proposed works may cause temporary effects on surface water quality due to sediment and nutrient runoff, concrete washout, and potential oil spills from plant and machinery. Wastewater generated onsite during construction could affect surface water quality if improperly disposed of.	Y

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				Mobile species (kingfisher) could be subject to disturbance and/or effects arising from pollution. Silt and pollution entering the river network could have a direct impact downstream on physical habitat. A decrease in water quality could affect kingfisher due to reduction in prey availability. Potential disturbance to kingfisher arising from works along or near the riparian zone. Periodic vegetation clearance to maintain the bat felling buffers carries a risk of siltation via surface water flows towards the river network.	

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
				There is a risk that machinery or materials brought onto the site could act as a vector for introducing or dispersing non-native invasive species. There is also a risk of invasive species spread associated with vegetation trimming works for the TDR, vegetation clearance at the Proposed development and Substation, and during bat buffer felling and maintenance. Spread of invasive species via the hydrological network.	
Mouds Bog SAC (002331)	• [7110] Active raised bogs* • [7120] Degraded raised bogs still capable of natural regeneration • [7150] Depressions on peat substrates of the Rhynchosporion	14.4 km	None applicable; outside ZoI	None identified	N

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
Mount Hevey Bog SAC (002342)	• [7110] Active raised bogs* • [7120] Degraded raised bogs still capable of natural regeneration • [7150] Depressions on peat substrates of the Rhynchosporion	14.8 km	None applicable; outside ZoI	None identified	N
Malahide Estuary SPA (004025)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140]	44.1 km	Mobile Species	None identified	N
North Bull Island SPA (004006)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140] •	44.5 km	Mobile Species	None identified	N
Baldoyle Bay SPA (004016)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140]	47.4 km	Mobile Species	None identified	N

European Site (Code)	List of Qualifying Interests	Distance from the proposed development (km)	Criteria	Pathway for potential effects	Considered further in screening (Y/N)
River Nanny Estuary and Shore SPA (004158)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140]	50.1 km	Mobile Species	None identified	N
Boyne Estuary SPA (004080)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142]	51.1 km	Mobile Species	None identified	N
Lough Ree SPA (004064)	[restricted to SCI species recorded at proposed development] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Whooper Swan (*Cygnus cygnus*) [A038]	66.5 km	Mobile Species	None identified	N

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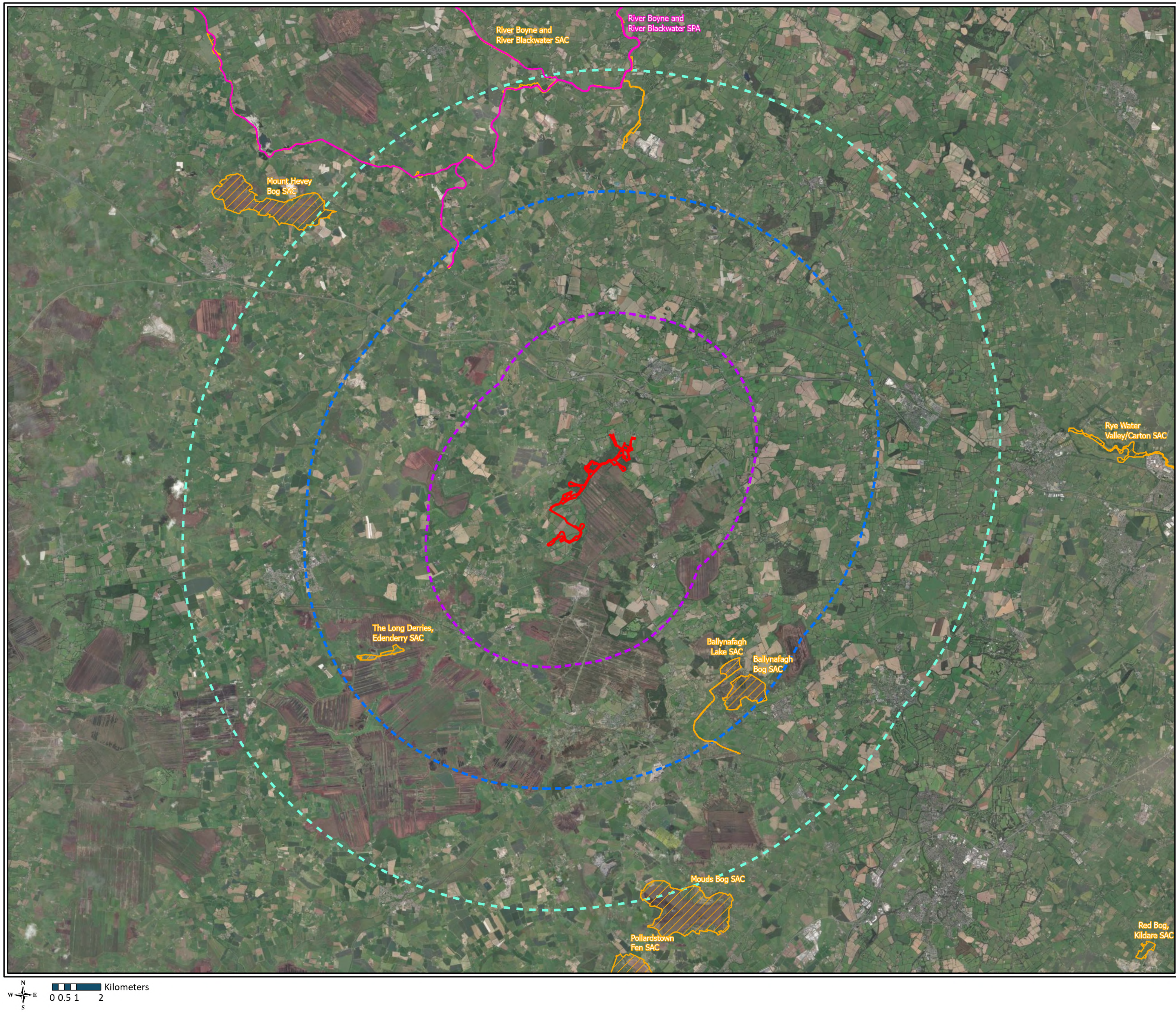

Legend

- Proposed Development Boundary
- 5km
- 10km
- 15km
- Special Protection Areas
- Special Area of Conservation

TITLE:	European Designated Sites Within Potential Zone of Influence
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	3.1
CLIENT:	North Kildare Wind Farm Ltd.
SCALE:	1:150,000
REVISION:	0
DATE:	01/05/2025
PAGE SIZE:	A3

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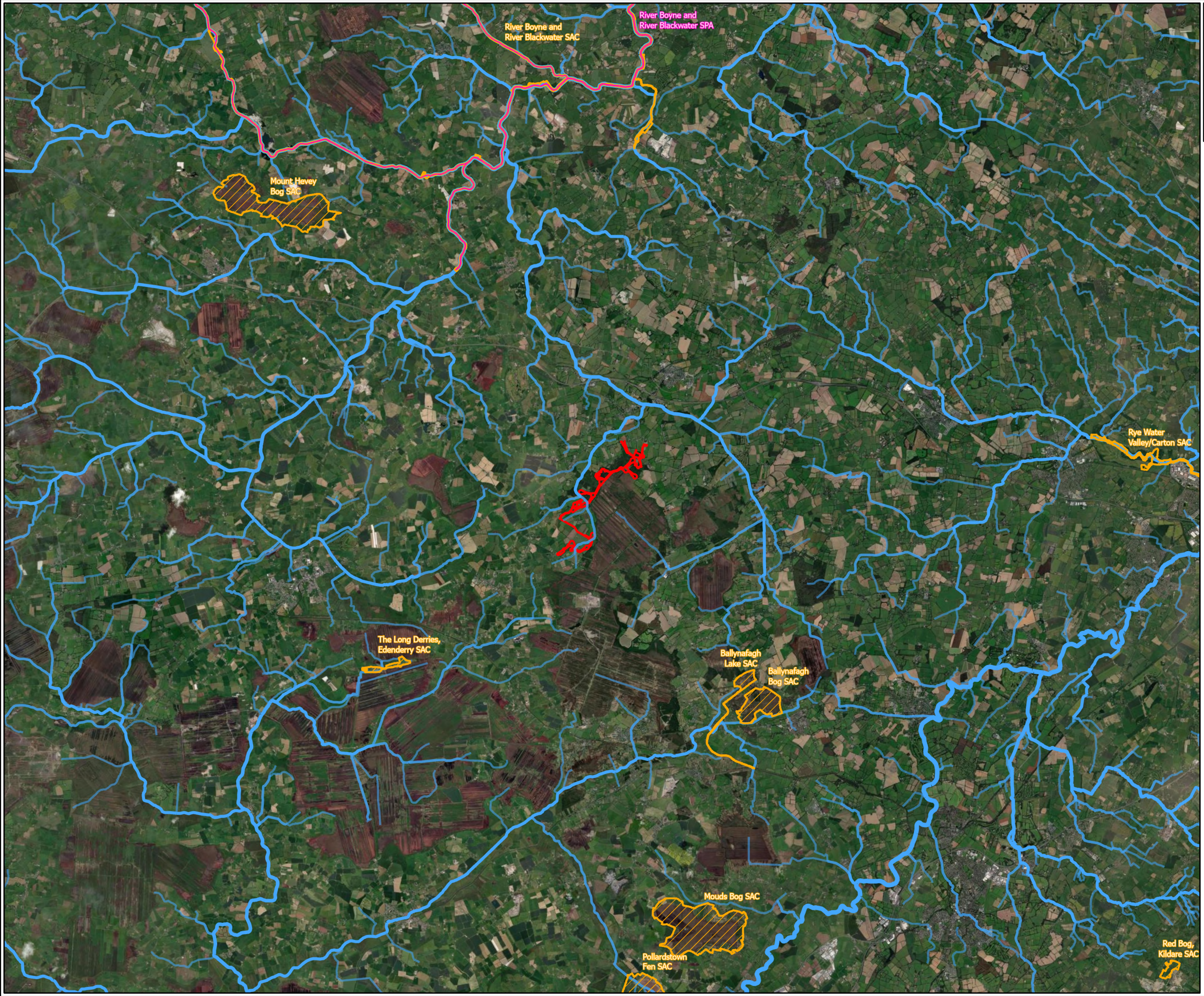

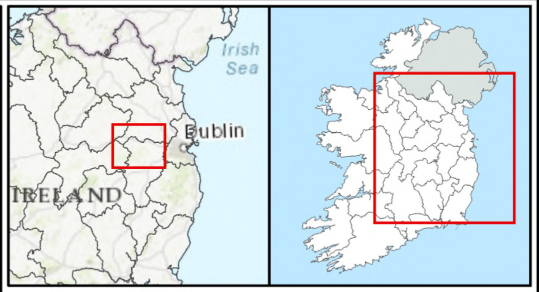

Legend

- Proposed Development Boundary
- Special Protection Areas
- Special Area of Conservation
- Rivers

TITLE: Hydrological Links to European Sites	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 3.2	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:150,000	REVISION: 0
DATE: 01/05/2025	PAGE SIZE: A3

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3.3 Consideration of in-combination Effects with other plans or projects

Article 6(3) of the Habitats Directive requires that:

> *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives".*

It is therefore required that the likely significant effects of the proposed development are considered in-combination with any other plans or projects within the zone of influence.

The consideration of in-combination effects with other plans or projects, focused on the sources of impacts identified for the proposed development in section 2.3 and ecological pathways identified in section 3.2.

The following sources were referred to:

- Kildare Co. Council Planning Enquiry System https://webgeo.kildarecoco.ie/planningenquiry
- Meath Co. Council Planning Enquiry System https://www.meath.ie/council/council-services/planning-and-building/planning-permission/view-or-search-planning-applications
- Westmeath Co. Council Planning Enquiry System https://www.westmeathcoco.ie/en/ourservices/planning/planningapplications/viewaplanningapplication/
- Offaly Co. Council Planning Enquiry System https://www.offaly.ie/planning-search/
- Geohive datasets – Planning Application Sites (Planning Registers of participating Irish Local Authorities and includes Planning Applications received since February 2019) https://www.geohive.ie/datasets/d78667c678d543b3b82c424c11ac24cc_1/about
- An Bord Pleanála (Strategic infrastructure development (SID) applications and Strategic Housing Development (SHD) applications) (https://www.pleanala.ie/en-ie/home);
- Department of Department of Housing, Local Government and Heritage's EIA Portal (https://www.gov.ie/en/publication/9f9e7-eia-portal/).

3.3.1 Overview of Cumulative Impact Sources

The planning search encompassed a search for wind farm developments within 25 km, and a search for solar farm and other large-scale developments within 5 km. The results of these searches are summarised in Table 3-2 to Table 3-4. The ongoing forestry management applicable to the northern part of the Proposed development is also considered.

3.3.1.1 Wind Farm Developments

Cushaling Wind Farm is currently under construction and when complete will comprise a 9-turbine wind farm; it is located 10.2 km southwest of the Proposed Wind Farm. The 21- turbine operational Cloncreen Wind Farm is located 15.2 km southwest of the Proposed Wind Farm. Mount Lucas wind farm, located c. 22.7 km southwest of the Proposed Wind Farm.

The Yellow River wind farm located north of Rhode Co Offaly is a 29-turbine wind farm (17.4 km north-west of Proposed Wind Farm) is operational. The consented Ballivor Wind Farm is located 17.3 km north-west of the Proposed Development and comprises 26 turbines. Both of these wind farms are located within the same catchment (River Boyne) as the Proposed Wind Farm, with drainage from Yellow River, Ballivor and the Proposed Development site ultimately draining to the River Boyne.

While Yellow River wind farm, Ballivor wind farm and the Proposed Development are all located in the Boyne catchment, the in-stream distance between these projects and the section of the Boyne where the downstream flows from these project locations converge is such that any potential cumulative effects on water quality are assessed as short-term imperceptible. As such, potential effects on kingfisher inhabiting the Boyne River are also assessed as short-term imperceptible. In addition, it is unlikely that the construction phases for these wind farms will overlap.

There is potential for cumulative effects arising from these wind farm developments from to occur at construction, operational and decommissioning stages.

Table 3-2: Wind Farm Developments within 25 km of the Proposed development

Development	Distance/Direction	Catchment	(No. of Turbines)	Current Status
Cushaling Wind Farm	10.2 km South-west	Barrow	9	Under Construction
Cloncreen Wind Farm	15.2 km South-west	Barrow	21	Operational
Yellow River Wind Farm	17.4 km North-west	Boyne	29	Operational
Ballivor Wind Farm	17.3 km North-west	Boyne	26	Consented
Mount Lucas Wind Farm	22.7 km South-west	Barrow	28	Operational

3.3.1.2 Solar Developments

A number of solar farm developments are located within 5 km. These include projects which are operational, under construction, consented and in planning. All of these developments are located within the same catchment (River Boyne) as the Proposed development . There is potential for cumulative effects arising from these wind/solar farm developments to occur at construction, operational and decommissioning stages.

Table 3-3: Solar Farm Developments within 5 km of the Proposed development

Development	Distance/Direction	Catchment	Development Site Size (ha)	Current Status
Mulgeeth Solar Farm	95m East of T10	Boyne	81 ha	Refused Feb. 2025 - may be appealed
Timahoe North Solar Farm	220m South-east of T3	Boyne	200 ha	Operational
Dysart Solar Farm	2.5 km North-east	Boyne	35 ha	Consented
Coolcarrigan Solar Farm	3.7 km South-east	Boyne	114 ha	Consented
Hortland Solar Farm	3.9 km East	Boyne	31 ha	Operational

3.3.1.3 Other Large-Scale Developments

There are a number of larger scale developments in the vicinity of the Proposed development including a number of large housing developments, mixed use developments, landscaping developments and the extension of the existing Drehid Landfill. Details of these cumulative developments are presented in Table 3-4.

Potential cumulative effects arising from these developments are most likely to be applicable to the construction phase, in the event of any of these developments being constructed concurrently with the Proposed development . There is also potential for operational and decommissioning phase cumulative effects in this category, although they are predicted to be of lower magnitude than potential construction stage cumulative effects.

Table 3-4: Other Developments within 5 km

Development	Direction from Proposed development site	Distance from Proposed development site (km)	Status
A number of residential developments	North	2.8 km	Granted consent
There are a number of consented large residential developments in Enfield which have been integrated into one large project. The planning references are Meath Co. Co. Reg Ref. 21/1449, 21/1461, 21/1462, 23/272. The consents include 99 residential units (21/1449), 67 residential units (21/1461) 77 residential units (21/1462) and a further 77 residential units (23/272); all with ancilliary infrastructure such as public open space, car parking, bicycle parking etc.			

Development	Direction from Proposed development site	Distance from Proposed development site (km)	Status
Johnstown Estate Renovations	North	2 km	Granted consent
Kildare planning reference 23/613. The proposed works are principally to the existing banquet hall and conference centre located to the south of the main hotel building and associated external landscaped areas. The proposed external works comprise: (i) the provision of a new 210 sq.m. store room extension; (ii) a 136 sq.m. extension to the south east corner of the building to provide a new glazed orangery bar; (iii) demolition of existing single storey draught lobby (30 sq.m.) and construction of a new 60 sq.m. extension (4.050m in height) on the northern side of the building to provide for a bar area (44 sq.m.) and 2 no. store rooms (8sq.m. each); (iv) a new 20 sq.m. entrance lobby with an external canopy to the southern side of the building; (v) 2 no. new external seating areas to the east and west of the proposed entrance lobby; (vi) a new vehicular circulation layout with roundabout and water feature to the front of the proposed entrance lobby, loading bay, access ramp, external stair case, footpaths; (vii) relocation of the approved bike store located in the service yard (Reg. Ref. 22/1089) underneath proposed store building; and, (viii) the provision of a landscaped seating deck to the south of the building. Proposed internal works comprise reconfiguration of existing conference and banqueting accommodation to provide (a) 2 no. conference banqueting suites (320sq.m. and 280 sq.m.), (b) 2 no. meeting rooms (180 sq.m. and 110 sq.m.). (c) reception lobby (135 sq.m.) and (d) associated toilets, storage, cloakrooms and staff areas. Retention permission is sought for 4 no. accessible car parking spaces provided to the front of the hotel (southwest facade) and existing landscaping works comprising an existing timber pergola structure to south of the hotel development. The development also includes all other associated engineering works, landscaping, and ancillary works necessary to facilitate the development.			
Restoration of 5 ha of agricultural land	North	3.2 km	Granted Consent
Meath planning reference TA200121. The development comprises: a) use of existing stockpiles for site restoration (b) importation of inert excavation spoil comprising natural materials of clay, silt, sand, gravel or stone for the purposes of restoration of a previously extracted area (QY/54) to restore the site to a beneficial agricultural and ecological afteruse (5.85 hectares) (c) Temporary Portacabin Offices and Staff Facilities 100sqm. (d) Wheel Wash and weighbridge 134m2 (e) Site entrance and access road (f) Lockable access gate at the pit entrance (g) All other ancillary buildings, plant and facilities for the restoration, and all ancillary site works. The application is accompanied by an Environmental Impact Statement (Environmental Impact Assessment Report) and associated documents. The application relates to a restoration development for the purpose of an activity requiring a Waste Permit to be issued by the Meath County Council. Significant further information/revised plans submitted on this application.			

Development	Direction from Proposed development site	Distance from Proposed development site (km)	Status
Blackwood Equestrian Centre	South-East	2.5 km	Granted consent
Kildare planning reference 191031. Proposed two storey stable block, consisting of 6 no. horse stables & 7 no. pony stables, a wheelchair accessible toilet & two no. stairwells at ground floor level, tack room, kitchen/dining/lounge area for refreshment purposes (for staff and patrons of the livery centre only), male and female changing rooms and toilets and an office at first floor level (total floor area 494.6 sq.m), proposed horse walker (305.8 sq.m) and horse lunge (305.8sq.m) with proposed dungheap/effluent tank (18.5 sq.m). Existing concrete slab to be demolished and removed off site to authorised waste facility and to install proposed exercise area (1732 sq.m) to include 6 no. floodlights & equine fencing along the existing driveway and proposed exercise area. Permission is sought to install a septic tank and percolation area, 8 no. car parking spaces, gravel pathway to forest, proposed signage (2m sq) at existing gate and all associated site works at the above address. Permission is also sought to retain existing storage shed (24sq.m) and existing driveway.			
Drehid Landfill Extension	South	0.5 km	Granted consent
ABP reference 317292. Increase in waste material at disposal facility at Drehid Waste Management Facility to accept 440,000 tonnes per annum of non-hazardsous waste material.			
Mixed Use Development in Enfield	North	3.9 km	Granted consent
The development will consist of: The construction of a mixed-use development including a 4 storey over ground floor level mixed use building (c.7,953 sq. m) comprising ground floor lobby (c.169 sq. m), bulky goods retail at ground (c.1,062sq,m) and first floor (c.l,219sq.m), ground floor cafe (c.304 sq. m), ground floor gym (c.352sq. m), first floor health centre (c.822 sq. m), second, third and fourth floor office and conference space (c.2,733 sq. m), core, circulation and plant facilities across all levels (c.1,292 sq.m) and 227 no. car and 80 no. cycle parking spaces to serve the building; 80 no. residential units comprising 1 3 no. 2 storey four-bedroom terraced housing units, 67 no. 2 storey three bedroom terraced housing units with associated private open space in the form of rear gardens and terraces, 164 no. car and 320 no. cycle residential parking spaces plus 60 visitor cycle parking spaces; c.4,224 sq. m of landscaped public open space; a 2 storey creche facility (c.400 sq. m) with 12 no. car parking spaces; green roofs; solar panels; a two-lane access road linking the development to the roundabout where the R148 meets Dublin Road, providing 2 no. multimodal, priority-controlled junctions and segregated pedestrian and cyclist facilities with a controlled crossing; provision of roadway to access the development from the south via the existing roundabout on the Dublin Road; an internal road and shared surface network, including walkways and its associated infrastructure; watermain, foul and surface water drainage, extension to the proposed foul network and connection to the pump station (permitted under ABP-308357- 20), extension to the proposed watermain, connecting to the existing DN 300 HDPE adjacent to the R148 roundabout, an attenuation pond at the north east of the site (1770 sq.m); and all other ancillary site development works including hard and soft landscaping, boundary treatments, lighting, SuDs, and above and below ground services to facilitate the development.			
Royal Oaks Residential Development	North	3.9 km	Granted consent
Meath planning reference 2492, which is an extension of duration of reference SH304296. Construction of 133 no. dwelling units, creche and associated site works.			

Development	Direction from Proposed development site	Distance from Proposed development site (km)	Status
68 residential units in Johnstown Bridge	North	1.8 km	Granted consent
Kildare planning reference 22488. Development of 68 No residential units comprising 59 No houses (10 No. 2 bed, 31 No. 3 bed and 18 No. 4 bed) and 9 No. maisonette apartments (8 No. 1 bed and 1 No. 2 bed) and a retail unit/cafe measuring 77.2 sq m, with heights ranging from two storeys to two storeys with attic accommodation over. The development also proposes a new vehicular entrance off Johnstown Road, ancillary car-parking; cycle parking; a pump station; hard and soft landscaping; lighting ;balconies; solar panels; boundary treatments; bin storage; ESB substation and all associated site works above and below ground.			

3.3.1.4 Forestry Management

The blocks of woodland overlapped by the northern section of the Proposed development are subject to various forestry management interventions. These range from clear-felling and replanting commercial conifer areas to removing confers and replanting with broadleaved species, primarily pedunculate oak. Scots pine is also prevalent in more recently replanted areas. Forestry management can give rise to negative effects such as disturbance associated with harvesting, habitat loss, establishment of densely-shaded low-biodiversity conifer monoculture woodland, sedimentation and nutrient runoff. However, other aspects of forestry management can have positive ecological effects, particularly when close to nature silviculture is used or where the aim of management is to restore more natural woodland types and improve biodiversity. For example, replacement of commercial conifer blocks with native broadleaved species as recorded during current habitat surveys, or invasive species management to improve ecological functioning of woodland ecosystems.

In some cases, unintentional positive affects can also arise during intensive timber production, such as increased structural diversity and complex habitat mosaics during the pre-thicket stage, and establishment of semi natural woodland in areas which escape management such as marginal areas and wind thrown stands. Red squirrel also notably benefits from the presence of conifers as a food source.

3.3.1.5 Rehabilitation of Adjacent Bord Na Móna Bog

The draft rehabilitation plan for Timahoe North Bog concluded that the progress of natural revegetation is sufficiently advanced to forego interventions such as drain blocking and rewetting. The Proposed development is not anticipated to give rise to significant indirect effects on this bog, due to the road setback distance, use of floating road construction and presence of existing drainage. As such, no cumulative effects in this regard are predicted.

3.4 Assessment of Likely Significant Effects

3.4.1 Assessment of Likely Significant Effects

This section of the report explains the metrics used when assessing if the potential effects (previously identified) are likely to be significant on European sites.

The European sites with evident pathways for potential effects arising from the sources for impact from the proposed development - either alone or in combination with other projects or plans - are:

- River Boyne and River Blackwater SAC (002299);
- River Boyne and River Blackwater SPA (004232); and
- Ballynafagh Lake SAC (001387)

The EC (2021) guidance document notes that the significance of the effects will vary depending on factors such as the magnitude of impact, the type, extent, duration, intensity, timing, probability, in-combination effects and the vulnerability of the habitats and species concerned.

These sites are now examined for the potential for likely significant effects. The following parameters are described when characterising impacts (following guidance from the Chartered Institute of Ecology and Environmental Management, Environmental Protection Agency and National Roads Authority):

- Direct and Indirect effects - An effect can be caused either as a direct or as an indirect consequence of a Plan/Project.
- Magnitude - Magnitude measures the size of an impact, which is described as high, medium, low, very low or negligible.
- Extent - The area over that the effect occurs – this should be predicted in a quantified manner.
- Duration - The time that the effect is expected to last prior to recovery or replacement of the resource or feature.
  - Temporary: Effects up to 1 Year;
  - Short Term: Effects lasting 1-7 years;
  - Medium Term: Effects lasting 7-15 years;
  - Long Term: Effects lasting 15-60 years; and
  - permanent: Effects lasting 60 years.

The EC (2021) outlines the following potential changes that may occur at a European site, which may result in effects on the function of the site:

- Reduction of habitat area, habitat degradation or fragmentation;
- Disturbance to species, reduction in species populations and density;
- Changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species (e.g. water quality and quantity);
- Interference with the key relationships that define the structure and function of the site.

The guidance document outlines the following criteria for assessing significance, indicators of significance, in view of the site-specific conservation objectives e.g.:

- Degree of habitat loss (absolute, relative), changes in habitats structure;
- Risk of species populations' displacement, level of disturbance, reduction of species home range, feeding area, refuge areas, alteration of favourable condition for breeding;
- Importance of the habitats and species affected, e.g. representativeness, local variety;
- Importance of the site (e.g. limit of distribution area for certain habitats and species, stepping stone, important for ecological connectivity);
- Disruption or alteration of ecological functions;
- Changes to key ecological features of the site (e.g. water quality).

The potential for the Proposed development to have likely significant effects on the River Boyne and River Blackwater SAC, River Boyne and River Blackwater SPA and Ballynafagh Lake SAC is examined in Table 3-5 on the basis of the source-pathway-receptor connectivity, and the sensitivity of the European sites qualifying interests to the effects of the impacts.

Table 3-5: Description of likely significant effects on the European sites within the Zone of Influence of the Proposed Development

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
River Boyne and River Blackwater SAC (002299)	Reduction of habitat area, habitat degradation or fragmentation.	There will be no direct reduction of Annex I habitat or habitat fragmentation within the SAC. Habitat degradation could occur via spread of invasive species and/or reductions in water quality. Habitat degradation via the spread of invasive species vector material could affect QI habitats through competition with native species, in addition to potential for bank destablisation (caused by prolific invasive species growth followed by dieback exposing riverbank soils). The latter could cause reductions in water quality, negatively affecting aquatic habitats and species. These effects could occur during construction, operation and decommissioning. Reductions in water quality could occur, arising from emissions of sediment or pollutants potentially transmissible to the SAC via the river network particularly during the construction and decommissioning phases of the proposed development.	Reductions in water quality could affect aquatic habitats and species, including spawning grounds for QI species. The potential transport of invasive plant species material towards the SAC via the hydrological network could contribute to habitat degradation. The proposed works could give rise to airborne dust emissions which could affect receptors in the local area including terrestrial and aquatic habitats adjacent to the site and roads/tracks used for site access. This effect will be localised and short-term (construction phase is c. 18 months; decommissioning phase is c. 6 months).	Likely Significant Effects

[6] Taken from the EC (2021) Guidelines

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
		There is potential for dust to affect both terrestrial and aquatic habitats in the vicinity of works particularly during the construction and decommissioning phases of the proposed development.		
	Disturbance to species, reduction in species populations and density.	There is potential for disturbance to breeding otter during construction and decommissioning due to the presence of a holt within c. 128m of proposed works and another within 160m. The holt within 128m is classified as a non-breeding holt (burrow with obstructing root with low potential for use as a holt). The holt within 160m could potentially be used as a breeding holt due to suitability and signs of use by otter. Otter is sensitive to light, noise and vibrations. Reductions in population sizes and densities for aquatic species including Atlantic salmon and lamprey species in the event of reductions in water quality and aquatic habitats. Effects in these categories would also indirectly affect otter which preys on these species.	Disturbance to breeding otter (if present during construction) is not predicted to occur due to the location of the potential breeding holt beyond the 150m otter disturbance buffer (NRA, 2008). Engineering works at bridges or streams can potentially affect breeding or resting sites of otter. Although the Proposed Development is outside the boundary of the River Boyne and River Blackwater SAC, otters are known to have large home ranges (can extend to 20-30km) and otters which occur in the vicinity of the Proposed Development are likely to share links with the River Boyne and River Blackwater SAC otter population (via population exchange and/or movement of the SAC population beyond the SAC boundary). Disturbance to otters associated with the SAC which may forage upstream towards the Proposed Development is unlikely as most foraging takes place at night.	Likely Significant Effects

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
		Although whooper swan are not a QI for the SAC, the presence of a wintering whooper swan population associated with the Boyne and Blackwater rivers is noted in the SAC site synopsis. Whooper swan occurring in and around the Proposed Development could potentially be subject to disturbance during construction, decommissioning or collision mortality during operation.	In addition, unpublished observations by Kruuk et al. (1998) and colleagues indicate that otters will rest under roads, in industrial buildings, close to quarries, and at other sites close to high levels of human activity. These observations indicate that otters are very flexible in their use of resting sites and do not automatically avoid ‘disturbance’ in terms of noise or proximity to human activity. Due to the sensitivity of aquatic habitats used by aquatic QI species to pollution and sedimentation, potential declines in water quality could give rise to likely significant effects. Silt and pollution entering the river network could affect physical habitat downstream, for example the spawning or nursery areas of salmon and lamprey (resulting in displacement) and potentially fish kills. A fish kill and decrease in water quality could result in the displacement of otter due to reduction in prey availability. Disturbance of grazing whooper swans potentially associated with the SAC during construction and decommissioning could potentially occur, resulting in moderate to significant effects.	

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
			Similarly, disturbance/displacement during the operational phase could affect grazing whooper swans; however, these effects are predicted to reduce with habituation. There is potential for significant effects to the SAC whooper swan population to occur due to collision mortality.	
	Changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species (e.g. water quality and quantity).	Sediment, hydrocarbons or cement have potential for negative impacts, as they can enter surface water and travel to sensitive receptors (aquatic species and habitats) potentially reaching these receptors downstream within the SAC during construction and decommissioning. There is potential for a negative impact on groundwater quality in the event of a spill (oil or fuel from machinery; or concrete), potentially transmissible to surface water flowing towards the SAC.	As water from the site drains ultimately towards the SAC, silt or pollutant inputs arising from proposed works could contribute to degradation of aquatic habitats within the SAC, negatively affecting ecological functions.	Likely Significant Effects
	Interference with the key relationships that define the structure and function of the site.	Potential declines in water quality within the SAC could interfere with relationships that define the structure and function of the site, e.g. siltation of spawning gravels, pollution of aquatic habitats, disruption of the food chain and associated reductions in prey availability affecting QI species.	In the event of siltation or pollution of watercourses resulting from uncontrolled run-off from the Proposed Development, the River Blackwater and tributaries could be indirectly damaged by changes to water turbidity and water quality.	Likely Significant Effect

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
			There is also potential for indirect impacts to salmon and river lamprey due to water quality changes. Changes in water quality could in turn reduce prey availability for breeding otter in the SAC and reduce breeding sites for salmon and river lamprey.	
River Boyne and River Blackwater SPA (004232)	Reduction of habitat area, habitat degradation or fragmentation.	There will be no reduction of Annex I habitat or habitat fragmentation within the SPA. Habitat degradation could occur via spread of invasive species and/or or reductions in water quality. Habitat degradation via spread of invasive species vector material could affect QI habitats through competition with native species, in addition to potential for bank destablisation (caused by prolific invasive species growth followed by dieback exposing riverbank soils). The latter could cause reductions in water quality, negatively affecting aquatic habitats and species. These effects could occur during construction, operation and decommissioning.	Reductions in water quality could affect aquatic habitats and species, including spawning grounds for QI species. The potential transport of invasive plant species material towards the SAC via the hydrological network could contribute to habitat degradation. The proposed works could give rise to airborne dust emissions which could affect receptors in the local area including terrestrial and aquatic habitats adjacent to the site and roads/tracks used for site access. This effect will be localised and short-term (construction phase is c. 18 months; decommissioning phase is c. 6 months).	Likely Significant Effects

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
		Reductions in water quality could occur, arising from emissions of sediment or pollutants potentially transmissible to the SPA via the river network particularly during the construction and decommissioning phases of the proposed development There is potential for dust to affect both terrestrial and aquatic habitats in the vicinity of works particularly during the construction and decommissioning phases of the proposed development.		
	Disturbance to species, reduction in species populations and density.	While kingfisher are confirmed to be active along the minor watercourses draining the Proposed Development, no nest sites have been recorded in this area and surveys observed that riverbanks along the Fear English are unsuitable for nesting kingfisher due to compaction and heavy soils. Kingfisher territories in Ireland are estimated to be 1.5 - 4 km in length (O'Clery and Lusby, 2015), and as such there is no potential for direct disturbance to the SPA population located 19.7 km downstream.	Disturbance to breeding kingfisher associated with the SPA will not occur due to the distance separating the SPA and the Proposed Development (9.6 km direct-line/19.7 km instream). Due to the sensitivity of aquatic habitats used by kingfisher aquatic prey species to pollution and sedimentation, potential declines in water quality could give rise to likely significant effects. Silt and pollution entering the river network could affect physical habitat downstream, for example the spawning	Likely Significant Effects

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
		Potential reductions in population sizes and densities for aquatic prey species of kingfisher could result in displacement and effective reductions in SPA population density, particularly during the construction and decommissioning phases of the proposed development. In addition, any potential effects on the local kingfisher population could be linked to the SPA population via changes to the non-SPA populations which are likely to contribute genetic resources and recruitment of new adults which would help maintain the SPA population.	or nursery areas of salmon and lamprey (resulting in displacement) and potentially fish kills. A fish kill and decrease in water quality could result in the displacement of kingfisher due to reduction in prey availability.	
	Changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species (e.g. water quality and quantity).	Sediment, hydrocarbons or cement have potential for negative impacts, as they can enter surface water and travel to sensitive receptors (aquatic species and habitats) potentially reaching these receptors downstream within the SPA during construction and decommissioning. There is potential for a negative impact on groundwater quality in the event of a spill (oil or fuel from machinery; or concrete), potentially transmissible to surface water flowing towards the SPA.	As water from the site drains ultimately towards the SPA, silt or pollutant inputs arising from proposed works could contribute to degradation of aquatic habitats within the SPA, negatively affecting ecological functions.	Likely Significant Effects

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
	Interference with the key relationships that define the structure and function of the site.	Potential declines in water quality within the SPA could interfere with relationships that define the structure and function of the site, e.g. siltation of spawning gravels, pollution of aquatic habitats, disruption of the food chain and associated reductions in prey availability affecting kingfisher.	In the event of siltation or pollution of watercourses resulting from uncontrolled run-off from the Proposed Development, the River Blackwater and tributaries could be indirectly damaged by changes to water turbidity and water quality. There is also potential for indirect impacts to aquatic species due to water quality changes. Changes in water quality could in turn reduce prey availability for kingfisher in the SPA and reduce breeding sites for fish species.	Likely Significant Effects
Ballynafagh Lake SAC (001387)	Reduction of habitat area, habitat degradation or fragmentation.	The Proposed Development will not give rise to any reduction of habitat area, habitat degradation or fragmentation affecting the SAC, which is located 7.9 km from the Proposed Development.	There is no mechanism whereby the Proposed Development could cause habitat reduction, degradation or fragmentation affecting the SAC.	No Likely Significant Effects
	Disturbance to species, reduction in species populations and density.	The Proposed Development will not give rise to any disturbance, reduction in populations or density of marsh fritillary associated with the SAC due to the location SAC, which is located 7.9 km from the Proposed development . Suitable marsh fritillary breeding habitat which is present in the vicinity of (outside) the Proposed Development could	There is no potential for effects on marsh fritillary habitat outside the SAC in the vicinity of the Proposed Development, due to suitable marsh fritillary breeding habitat in the area all being located outside the Proposed Development and associated zone of influence.	No Likely Significant Effects

Site Name (Site Code)	Criteria for assessing potential changes that may occur at a European site, which may result in effects on the function of the site:[6]	Assessment of effects on the European sites functionallity	Assessment of the significance of effects either alone and in-combination with other plans or projects	Likely Significant Effect
		constitute a potential link with the SAC via dispersal/exchange of individuals between the SAC and this habitat near the Proposed Development.		
	Changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species (e.g. water quality and quantity).	The Proposed Development will not cause changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species, due to the location SAC, which is located 7.9 km from the Proposed development and absence of mechanisms whereby ecological functions and features could be affected.	There is no mechanism whereby the Proposed Development could cause changes in ecological functions and/or features that are essential for the ecological requirements of habitats and species associated with the SAC.	No Likely Significant Effects
	Interference with the key relationships that define the structure and function of the site.	The Proposed Development will not result in interference with the key relationships that define the structure and function of the site, due to the location SAC 7.9 km from the Proposed development . Suitable marsh fritillary breeding habitat which is present in the vicinity of (outside) the Proposed Development could constitute a potential link with the SAC via dispersal/exchange of individuals between the SAC and this habitat near the Proposed Development.	There is no potential for effects on marsh fritillary habitat outside the SAC in the vicinity of the Proposed Development, due to suitable marsh fritillary breeding habitat in the area all being located outside the Proposed Development and associated zone of influence. Due to confirmation via surveys that suitable breeding habitat and larval webs are located outside the proposed development footprint and associated ZoI, this potential link is conclusively disproved.	No Likely Significant Effects

3.5 Screening Conclusion

In the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA cannot be excluded on the basis of objective scientific information.

A Natura Impact Statement has been completed (See Section 4) in respect of:

- River Boyne and River Blackwater SAC (002299)
- River Boyne and River Blackwater SPA (004232)

The results of the s-p-r modelling process identified that - given the scale and nature of the potential sources identified in Table 2-3 - there are no likely significant effects identified for any other European sites not listed above. The AA screening process has considered potential effects which may arise during all phases of the proposed development (construction, operation and decommissioning). Through an assessment of the pathways for effects and an evaluation of the sources for impacts, taking account of the processes involved and the distance of separation from European sites, it has been evaluated that there are no likely significant effects on the qualifying interests, special conservation interest or the conservation objectives of any other European site.

4. NATURA IMPACT STATEMENT

4.1 Introduction

The Appropriate Assessment screening could not exclude the possibility of likely significant effects on the qualifying interests of the River Boyne and River Blackwater SAC (002299) and River Boyne and River Blackwater SPA (004232). The reasoning is detailed below:

River Boyne and River Blackwater SAC

- Habitat degradation due to invasive species spread or potential reductions in water quality
- Disturbance to whooper swan during construction/decommissioning, potential collision mortality during operation
- Reductions in population sizes and densities of QI fish species and otter
- Changes in ecological functions and/or features essential for the ecological requirements of habitats and species, due to potential surface water and/or groundwater pollution
- Interference with the key relationships that define the structure and function of the site, due to potential surface water pollution

River Boyne and River Blackwater SPA

- Habitat degradation due to invasive species spread or potential reductions in water quality
- Disturbance or displacement affecting kingfisher occurring close to the Proposed Development could potentially be linked to kingfisher within the SPA at population level
- Changes in essential ecological functions due to potential reductions in water quality
- Interference with key relationships defining the structure and function of the site due to potential reductions in water quality affecting kingfisher prey availability

Further consideration is given in this Natura Impact Statement (NIS) to the elements of the proposed development with the potential to adversely affect the integrity of the River Boyne and River Blackwater SAC and/or River Boyne and River Blackwater SPA or with respect to these sites conservation objectives.

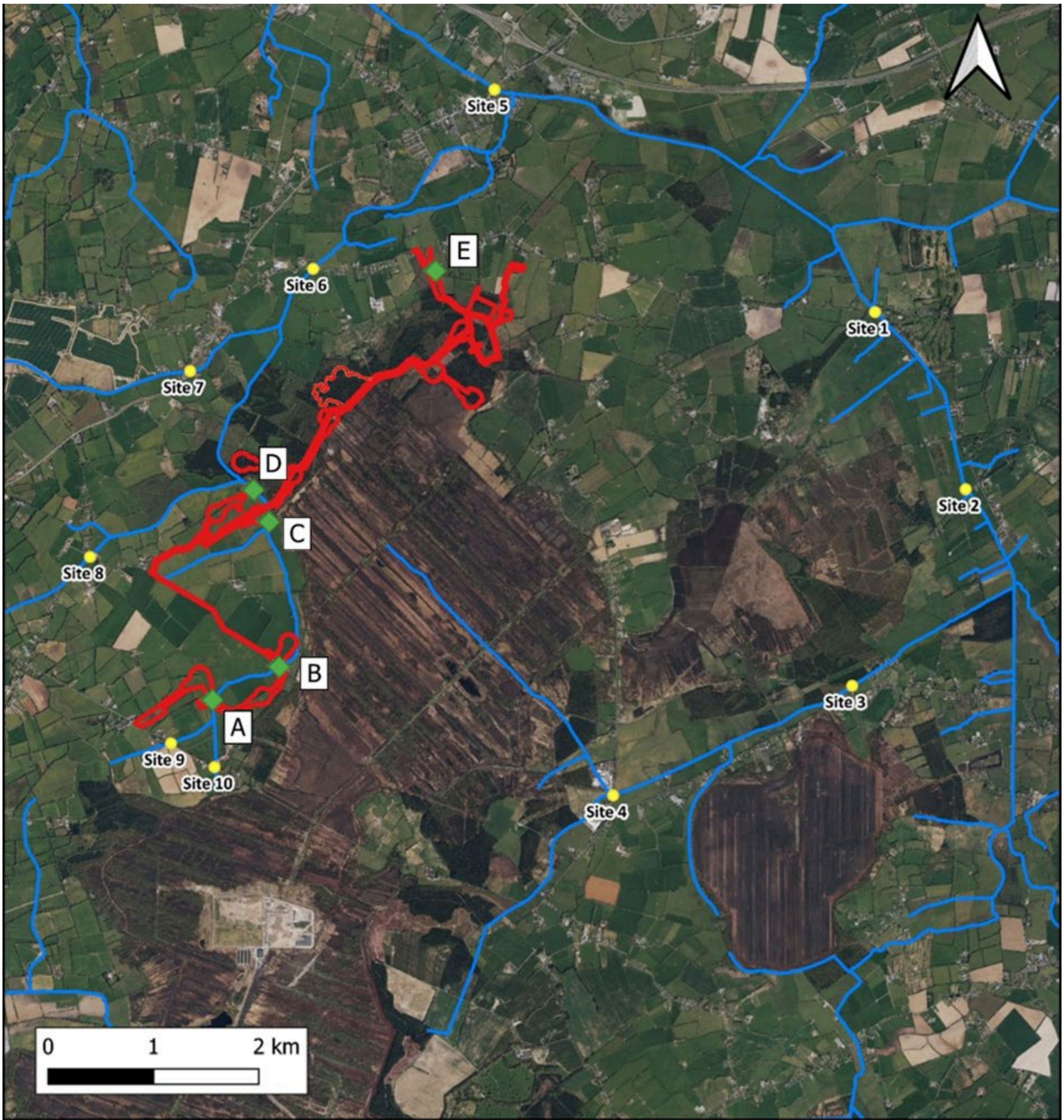
Refer to Section 2 for the project description and baseline environment.

4.2 Survey Results

4.2.1 Aquatic Ecology Surveys

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. drain areas close to the site) were considered as part of the aquatic ecology appraisal. Aquatic habitat surveys were completed on all watercourses draining the proposed development site and a total of 10 sites were selected for detailed assessment. The location of the sites is shown in Figure 4-1. 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. All watercourses on the site were viewed during the 2018, 2019, 2021, and 2023 walkover surveys.

During the December 2023 survey, five additional sites were also surveyed – Sites A, B, C, D, and E. The location of these sites is shown in Figure 4-1 . These sites are within areas already encompassed by the previous assessments, and were added to provide additional fine-grained detail at and around proposed watercourse crossings.



Site Boundary Watercourse Aquatic Ecology Survey Sites December 2023 survey areas	Date: 14.05.25	Drawn by: Ecofact GIS Checked by: William O'Connor
	Location of the Proposed Drehid Wind Farm and aquatic ecology survey sites.	ecofact biodiversity + ecology

Figure 4-1: Aquatic Ecology Survey Sites

4.2.2 Aquatic Ecology Results

4.2.2.1 Site 1

Site 1 is located on the 3rd order Blackwater [Longwood] River (EPA segment code: 07_925). The site is located approximately 4km south-east of Enfield, Co. Meath just off the L1004 road. The EPA do not monitor water quality this part of the river. There are three EPA stations upstream from here but they have not been monitored in recent years.

The section of river this site is located on is classified by the Water Framework Directive (WFD) as an “at risk” waterbody. The watercourse also has a WFD (2016-2021) Ecological Status or Potential status of `Poor’. This survey site is located to the north-east of the proposed development.

This site is located on a low gradient section of the 3rd order Blackwater (Longwood) River. This stretch of the river has been deepened and channelised in the past. The site was previously well shaded by riparian trees which overhung the watercourse along high banks. During the December 2023 survey it was apparent that extensive maintenance works had been undertaken along the channel at this site and the overhanging trees has been removed. There is no instream vegetation in the river at this location. The water is silted and slow flowing at this site. It was considered that the maintenance works had been completed recently.

This stretch of the river does not have any suitable spawning or nursery habitats for salmonids. There is potential lamprey nursery habitats and trout rearing and foraging habitats present. This channel has been further degraded by the recent maintenance works.

Brown Trout, Brook Lamprey, Three-spined Stickleback, Minnow (*Phoxinus Phoxinus*), and Stone Loach (*Barbatula barbatula*) were recorded during the 2019-2021 electro fishing surveys. These species are all still likely to be present. However, the removal of the overhanging trees will have negatively affected fish habitats and has caused further siltation in the river. Although White-clawed Crayfish have been recorded in this river previously, none found to be present at the site during the 2021 survey. Habitats for crayfish are very limited at this site due to the general absence of suitable refuges.

The estimated current Q-rating for this site based on 2023 surveys is ‘Q3 – Moderately Polluted’. The overall status of this channel is rated as ‘Moderate’. This stretch of the river has been further degraded by recent arterial drainage maintenance works.

4.2.2.2 Site 2

Site 2 is located 2km upstream of Site 1 on the Blackwater (Longwood) River (EPA segment code: 07_2240). The Blackwater [Longwood] River rises approximately 4km upstream of Site 2. The EPA carry out biological monitoring at this site (Station Code: 07B020060). It was rated as Q3 in 2020, which corresponds to WFD ‘Poor’ status. The site is classified by the WFD as an “at risk” waterbody and has a Water Framework Directive (2016-21) waterbody status of “Poor”. The proposed development site is located to the west this site.

The water channel at this site is very narrow and channelised, flowing through agricultural land. It is evident that this section of the river has been well maintained in the past, and further channel maintenance works had recently been completed at the site. There was evidence of recent bank works and tree clearance, and a tracked machine was still present at the site when it was visited in December 2023. The gradient at this site was very low and siltation levels were high. This is a relatively featureless channel with no pool, riffle, glide sequences. This is an artifact of the arterial drainage scheme. The river is lined by high spoil heaps of material that was previously dredged from the river.

Brown Trout, Brook Lamprey, Minnow, Three-spined Stickleback, and Stone Loach were recorded during the 2021 electro fishing survey. The results were very similar to the previous 2019 survey and the numbers of all species recorded was low. These species are all still likely to be present – but this is a very degraded stretch of river and is subject to regular disturbance by maintenance activities. White-clawed Crayfish were recorded here in low numbers during the 2021 survey. Habitats for crayfish are very limited at this site due to the low instream physical diversity, and regular disturbance. They could still be present in very low numbers.

The estimated current Q-rating for this site based on 2023 surveys is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent / ongoing arterial drainage maintenance works.

4.2.2.3 Site 3

Site 3 is located on the 2nd order Mulgeeth River (EPA segment code: 07_1720). This watercourse rises in the Dunfierth Bog. This site is located approximately 3km upstream of Site 2. There is no EPA water quality monitoring station on this river. The section of river this site is located on is assessed by the WFD as an "at risk" waterbody. The watercourse has a Water Framework Directive (2016-2021) waterbody status of "Poor". The site is located to the south-east of the proposed development.

The Mulgeeth River channel at Site 3 is also subject to regular arterial drainage maintenance, and impacts and disturbance was apparent again in the December 2023 survey. The banks are hight and the gradient is low. The site is heavily silted, as was similarly noted in previous surveys.

The only species that was recorded at this site in the 2021 electrofishing survey were Three-spined Stickleback and Minnow which were recorded in small numbers. Lampreys and crayfish were never recorded at this site. It is unlikely that this has changed and the landowner at this site informed as that there were no fish at this site.

The estimated current Q-rating for this site based on 2023 surveys is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. There have not been any significant changes at this site since the 2021 survey.

4.2.2.4 Site 4

Site 4 was located on the 2nd order Mulgeeth River (EPA segment code: 07_1320). This site is approximately 2.5km upstream of Site 3. There are no EPA monitoring stations on this stretch of river. The site is assessed by the WFD as being an "at risk" waterbody. The watercourse has a Water Framework Directive (2016-2021) waterbody status of "Poor". This site is located to the south-east of the proposed development.

This channel has been dredged and channelised in the past, and is well maintained. The condition of this site is much the same as it was during the 2021 survey. The only species recorded at this site during the 2021 electrofishing survey was Three-spined Stickleback. This species was common at this location. This site is considered to be unsuitable for lampreys, salmonids, and crayfish.

The estimated current Q-rating for this site based on 2023 surveys is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. There have not been any significant changes at this site since the 2021 survey.

4.2.2.5 Site 5

Site 5 is located in Johnstown bridge on the 4th order Blackwater [Longwood] River (EPA segment code: 07_350). It is located downstream of an existing bridge where the R402 road crosses this watercourse. The EPA carries out biological monitoring at this site (Station Code: 07B020100). It was rated Q3 in 2020, corresponding to WFD status 'Poor'. The section of river this site is located on is classified by the WFD as an "at risk" waterbody. The watercourse also has a Water Framework Directive (2016-2021) waterbody status of "Poor Ecological Status (or Potential)". The site is located to the north of the proposed development.

The river at the site has been drained and channelised in the past, and water quality has declined since 2018. There were construction works underway with the building of a new sewage treatment works downstream of the site. There was evidence that machinery had crossed the river at the 2021 electrofishing site with tracks on both sides of the river leading to the waterline. This location was heavily impacted by cattle accessing the river for drinking in September 2021. The site is heavily silted.

During the 2021 electrofishing survey Salmon and Brook Lampreys were recorded in small numbers. This was the only site Salmon were recorded during the baseline surveys for the proposed development. Brown Trout, Three-spined stickleback, and Minnow were also recorded in small numbers. White-clawed Crayfish were recorded at this site in 2021, but not in 2019 and 2018. The numbers present are very low.

The estimated current Q-rating for this site based on 2023 surveys is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. There have not been any significant changes at this site since the 2021 survey, apart from the localised impacts of machines tracking across the river.

4.2.2.6 Site 6

Site 6 is located on the 3rd order Coolree 07 River (EPA segment code: 07_1848). It is located approximately 3 km upstream of Site 5. This site is assessed as an "at risk" waterbody by the WFD. The watercourse has a Water Framework Directive (2016-2021) waterbody status of "Poor". This site is located to the north-east of the proposed development.

This site is heavily silted and was recently subjected to arterial drainage maintenance. Dredging and removal of vegetation has occurred since the last survey. There is cattle access to the river which was also evident during previous surveys. Indeed, cattle were recorded in the river during both the 2019 and 2021 surveys. The heavy siltation at this site is due to livestock entering the river, and the upstream maintenance works.

Brown Trout, Minnow, Three-spined Stickleback and Stone Loach were recorded in low numbers during the September 2021 electrofishing survey. Nominal numbers of Brook lampreys were recorded at this site in 2018, but not in the subsequent surveys. This site was first surveyed by Ecofact in 2005 when it was considered to be "visibly polluted at the time of the survey".

The estimated current Q-rating for this site based on 2023 surveys is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent maintenance works.

4.2.2.7 Site 7

Site 7 was located on the 1st order Clonkeeran River (EPA segment code: 07_1287). There are no EPA monitoring stations on this river. The section of river this site is located on is classified as an "at risk" waterbody. The watercourse has a waterbody status of 'Poor'. This site is located to the west of the proposed development. The site is highly modified.

This site on the 1st order Clonkeeran River does not provide optimal aquatic habitat. The Clonkeeran River is also known locally as the “Sweep River”. The origins of this name are unknown and it is a very small and low gradient stream, and does not have a significant flow. During the 2018 survey the site was dry. In 2019 there was a very small flow in the river, but not enough to provide substantial aquatic habitat. In 2021 the site was again dry and overgrown with briars and overhanging vegetation. In December 2023 there was a moderate flow in the river. It was obvious that recent maintenance works had been completed - vegetation cleared from the banks and some dredging had been undertaken. The channel was heavily silted.

The estimated current rating for this site based on 2023 surveys is “at risk”. It is not suitable for applying a Q rating. The overall status of this channel is rated as ‘Poor’. This stretch of the river has been further degraded by recent maintenance works.

4.2.2.8 Site 8

Site 8 is located a further c. 4km upstream from Site 6 on the first order Coolree 07 River (EPA segment code: 07_1230). There are no EPA biological water quality monitoring stations here. This section of the river is classified as an “at-risk” waterbody by the EPA and has a ‘Poor’ status. This site is located to the west of the proposed development.

The banks of the river at this site are high and overgrown with heavy vegetation. There is significant siltation at this site, and it is accessible to cattle, which are trampling through the watercourse and exacerbating the sediment issue. The only fish species recorded at this site during the 2019 and 2021 electrofishing surveys were Three-spined Sticklebacks.

During December 2023, water levels at this site were higher than in the previous year. There are a few areas of the channel in the upper Coolree 07 River catchment where there is at least some gradient and some run-type habitat present. It cannot be fully excluded that some trout might move upstream into a channel like this in wet years (like 2023). However, this would provide temporary habitat only in a wet year, and the trout present would be expected to leave or perish when more normal conditions return. Brown trout were not recorded in the two previous electrofishing surveys. The summer and autumn of 2023 were record wet periods, and it is to be expected that all watercourses were higher as a result. Obviously, a stream with more water provides better potential habitat. However, at best this watercourse could provide a marginal habitat for trout, and considering more typical water levels and water quality it would be a temporary one only.

The estimated current Q-rating for this site based on 2023 surveys is ‘Q3 – Moderately Polluted’. The overall status of this channel is rated as ‘Poor’. Water levels in this stretch were higher than what was observed in previous surveys. However, the overall evaluation of the channel/site remains the same.

4.2.2.9 Site 9

Site 9 was located on the 1st order Ballynamullagh Stream (EPA Segment Code: 07_801) approximately 590rm upstream of the proposed development site. There are no EPA monitoring stations on this watercourse. The EPA classifies this watercourse as being ‘At Risk’. The Ballynamullagh Stream flows through the proposed development site and approximately 7 of the proposed 11 turbines are located in the lands surrounding this watercourse. Proposed access roads also cross the Ballynamullagh Stream at three different points.

The stream is very small at this site with overgrown banks. It does not provide suitable habitat for aquatic species. No fish were recorded during the electrofishing surveys completed in 2019 and 2021. The stream was slightly higher in December 2023 than in the previous surveys – but it was still very obvious that it could not provide a suitable habitat for fish.

The estimated current rating for this site based on 2023 surveys is “at risk”. It is not suitable for applying a Q rating. The overall status of this channel is rated as ‘Poor’. There have not been any significant changes at this site since the 2021 survey.

4.2.2.10 Site 10

Site 10 was located on the 2nd order Drehid River (EPA segment code: 07_800) approximately 570rm upstream of the proposed development site. There are no EPA monitoring stations on this watercourse. The section of river this site is located on is classified as an 'at risk' waterbody and has a Water Framework Directive (2016-2021) waterbody status of ‘Poor’.

The Drehid River watercourse is largely concealed under heavy vegetation overhanging from high banks at both sides of the river. The site was dry during the 2021 current survey. In 2019 there was very little water and it was heavily silted. No fish were recorded and it was concluded that this stream does not provide any suitable habitat for any fish species. During the December 2023 survey the stream was higher than we had seen before, and there was a flow.

The estimated current rating for this site based on 2023 surveys is “at risk”. It is not suitable for applying a Q rating. The overall status of this channel is rated as ‘Poor’. This channel was dry during the 2021 survey, and there was a flow during December 2023. However, the site remains in a poor condition and does not provide a sufficient aquatic habitat to support any fish or other important aquatic organisms.

4.2.2.11 Sites A-D

Sites A-D were additional sites considered during the December 2023 survey at the request of the client. In the previous surveys in 2018, 2019, and 2021 sites located both downstream and upstream of these points were surveyed.

Site 6 is located downstream of Sites A-D on the 3rd order Coolree 07 River. Sites 8, 9, and 10 are located upstream of Sites A-D on the Coolree 07 stream, Ballynamullagh stream, and Drehid stream respectively. Sites A-D are all located on the Ballynamullagh stream between Sites 6 and 8-10. It is considered that this stretch of river has already been fully assessed and evaluated. However, the current December 2023 updated survey provides an updated and a higher resolution survey. Sites A-D are all located on the same EPA river segment (07_864).

During December 2023 the channels between Sites 6, 8,9, and 10 were investigated, including Sites A-D. Water levels in this channel were higher than during the previous surveys. This was due to the current survey being completed in the winter when rainfall levels are generally higher. Moreover, the preceding 6 months had also been very wet and this resulted in most watercourses in the study area being much higher than during the previous visits. This was the case even though the current survey was preceded by a relatively dry two-week period. Therefore these channels were viewed at their best, with higher base flows and die back of algae/instream vegetation. However, they were still rated as being marginal habitats for salmonids, and unsuitable for species such as lampreys and crayfish.

There are a few areas of channel in the upper Coolree 07 River catchment where there is at least some gradient; for example, downstream of Site 8 on the Clonkeeran stream. It can't be fully excluded that some trout could move upstream into these areas in wet years. However, this would provide temporary habitat only and the trout present would be expected to leave or perish when more normal conditions occur. The Clonkeeran stream runs very slow in the summer and had obvious agricultural impacts when previously visited. Streams often look their best in the winter months when there is more water, but this stream is still, at best, a marginal salmonid habitat. Moreover, Sites A,B,C,D are located upstream of where the Clonkeeran stream joins the Ballynamullagh Stream. There is no salmonid habitat present at Sites A, B, C, D, or E. The Ballynamullagh Stream itself is very unlikely to be ever used by salmonids and the areas at Sites A,B,C, and D are not of any potential value to fish or other sensitive aquatic organisms. This is because of the small size of the stream, its degraded physical status, and unsatisfactory water quality. Even when viewed in the winter months this the same conclusion has been reached.

The Coolree 07 River at Site 6 is a salmonid nursery channel (albeit a very marginal one) so the overall evaluation and assessment of this aquatic area does not change. Water quality in the Ballynamullagh Stream will of course influence water quality in the Coolree 07 River. Similarly, the water quality in the downstream River Boyne is ultimately strongly influenced by the water quality in the smaller catchment feeder streams. Therefore, despite its degraded status it was already accepted that the upper reaches of the Coolree 07 River would need to be fully protected during the construction and decommissioning of the proposed development.

Overall, the conclusion of the current updated survey of the upper Coolree 07 River is that the evaluation is the same. There are really no suitable salmonid habitats upstream of Kilshanroe bridge. Similarly, lampreys and crayfish have been confirmed absent from this area. The character of the river changes above Site 6 to a channelised drain-like watercourse with a mud substrate, and it becomes smaller and of less value to aquatic ecology as you move further upstream. In a wet year and in the winter months it can't be fully ruled out that some Brown Trout may move upstream. But this would be into degraded, marginal, and temporary habitats only.

The estimated quality rating for EPA river segment (07_864) where sites A-D are all located is "at risk". None of the sites are suitable for applying a Q rating. The overall status of this channel is rated as 'Poor'. There have not been any significant changes on this section of river since the 2021 survey, when sites both upstream and downstream of this river segment were surveyed using electrofishing.

4.2.2.12 Site E

This site was located on an unregistered watercourse. This means that it is not included in the EPA watercourse maps. Very small, ephemeral, watercourses are sometimes not included in the EPA maps. This is often the case for very small artificially created watercourses (e.g. drains) also. This site was visited during December 2023 and a watercourse is present at the site. This is a very small watercourse that is heavily modified and more like a drain than a stream. Even during December 2023 there was a minimal flow and this 'watercourse' can be expected to dry up. This site can't really be rated under any biological monitoring scheme as it does not qualify as a watercourse. But by any measures this would not meet anything higher than 'Poor Status'. This site does not provide any habitat that could support fish or other important aquatic organisms.

4.2.3 Otter

Otters are present along the Fear English River, as demonstrated by the presence of one holt, one potential holt and a number of field signs (holts are located outside development boundary). Although the fisheries value and overall aquatic habitat quality are low along the Fear English where it runs through the Proposed Development, the remoteness of the area, in addition to connectivity to higher value aquatic habitats downstream and connectivity to other catchments via bog drains associated with Timahoe North Bog make the area favourable for use by otter. The use of Timahoe North Bog in addition to the river network is demonstrated by the observation of otter signs at the bog pool near T8, and also by the otter sighting at the artificial pool in the southern part of Timahoe North Bog.

The location of the potential holts along the Fear English River relative to proposed infrastructure and potential for effects are detailed in Table 4-1.

As per Table 4-1 below, Holt 1 (holt with potential signs of use indicated by nearby spraint) which is outside the potential zone of influence for disturbance effects to breeding otter (outside 150m buffer of infrastructure). Holt 2 (burrow with obstructing root with low potential for use as a holt) is located 142m from a turbine base, and 128m from the associated turbine hard standing, resulting in the possibility of disturbance to otter using Holt 2. However, holt 2 was observed to be inactive across multiple surveys, and to be of reduced suitability for otter due to a root restricting access. Considering the lack of evidence of otter use, in addition to the obstructing root combined with the small opening size, holt 2 is assessed as being highly unlikely to offer suitable conditions for use as a breeding holt.

Table 4-1: Otter Holts: potential effects

Holt	Distance from Construction/Decommissioning Activities	Potential for effects
1	Access track felling buffer (167m) Access track (160m) Turbine Hard Stand (196m) Turbine T4 (221m)	No
2	Access track felling buffer (178m) Access track (161m) Turbine Hard Stand (128m) Turbine T4 (142m)	Yes

4.2.4 Kingfisher

A total of 2 no. kingfisher observations were recorded during vantage point (VP) surveys on the Fear English River throughout the monitoring period and are summarised in Table 3.1 and Figure 3.1 in Appendix 8. VP surveys resulted in single observations on the 25th April (flying & perching) and 19th May 2022 visits (flying), at VP2 and VP4, respectively (Table 3.1 in Appendix 8). Birds were also recorded at these locations in October and May 2019, respectively (Triturus, 2019; Figure 3.2 in Appendix 8). No kingfishers were observed during the VP surveys in mid-April or mid-June 2022.

Bank transect surveys undertaken in August 2022 along approx. 6.9 km length of riverine channel resulted in a total of 1 no. additional kingfisher observation (Table 3.2, Figure 3.1 in Appendix 8). An adult bird was recorded in flight along the Fear English River channel near the confluence of the Kilcooney River (aka Clonkeeran Stream) on the 15th August 2022.

No kingfisher nesting sites (active or inactive) were located during bank transect surveys in 2022 or the 2019 surveys. The surveyor noted that the dense and compacted soils along the banks of the Fear English River are unsuitable for kingfisher burrows.

4.2.5 Whooper Swan

Whooper swan were observed during winter VP surveys and hinterland surveys.

4.2.5.1 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of four records of Whooper Swan were made during the 2021/22 winter VP surveys. Three of these overlapped the 500m buffer zone. On December 21st 2022, a flock of seven adults and three juveniles were observed feeding in an agricultural field within the buffer zone near turbine 3. No flight activity occurred during this observation. Later that day, a flock of ten individuals was observed flying away from this the same area in a southeasterly direction. This is likely to be the same group noted feeding in the same area earlier. On January 22nd 2022, two individuals were sighted flying at rotor-swept height in the northern portion of the Site.

The remaining record occurred outside of the 500m buffer zone, near the south of the Site. This record noted a flock of 18 - 19 Whooper Swan feeding in an agricultural field immediately west of the 500m buffer zone near turbines 1, 2 and 3.

During the 2022/23 winter VP surveys, three records of Whooper Swan were made. One of these records involved a flock of 13 whooper swans flying within the 500m buffer near turbine 1 before landing in a field to the south of VP1 and feeding on January 24th 2023.

The remaining two records were located outside of the 500m buffer zone, to the south-west of the Site, where flocks of 13 individuals were sighted landing and feeding in agricultural fields near VP1 on December 21st 2022 and February 13th 2022.

4.2.5.2 Hinterland Surveys (2021, 2022 and 2023)

Whooper swan were observed twice during hinterland surveys. Both of which occurred at HVP 3 (1.8km E) during the 2022/23 non-breeding season. In January 2023, a flock of 13 individuals, six of which were first-winters was observed. In February 2023, a flock of twelve individuals was sighted.

4.2.5.3 *Incidental Observations (Winter 2023-24)*

Whooper swan flocks were observed grazing in fields north of T1/west of T2-T3 during ecological surveys in March 2024. A flock of 27 adults was observed grazing in improved agricultural grassland c. 430m from T1 and T2 on 6th March 2024; a flock of 23 adults was observed grazing in the same habitat (in different field) c. 590m north-west of T3 on 20th March 2024.

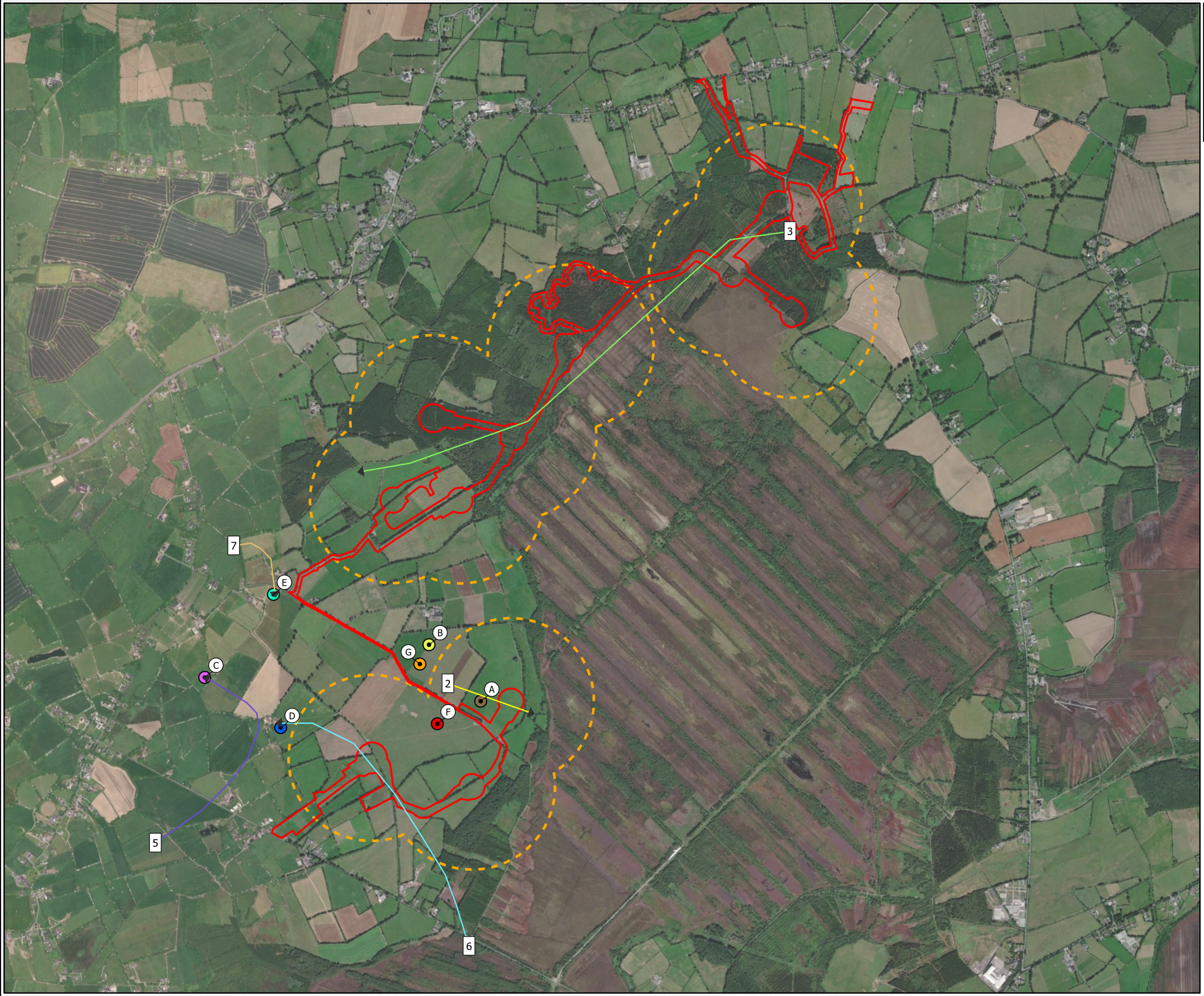
4.2.5.4 *Summary of Whooper Swan Grazing*

Table 4-2 details the occurrence of grazing whooper swans relative to proposed turbine locations. The location of these records are shown in Table 4-2, alongside whooper swan flight activity across all survey seasons.

Table 4-2: Whooper swan: occurrence in fields near proposed development

Record ID	Number of Swans	Description	Date	Distance to closest turbine
A	10	7 adults and 3 juveniles feeding in field. Flew off east after.	21/12/2021	183m (T3)
B	18-19	Swans feeding in field.	14/02/2022	600m (T3)
C	13	Flew in from south-west, turned north-west to land in field.	21/12/2022	1,115m (T1)
D	13	Flew in from south-east, landed in field, then feeding in field.	24/01/2023	577m (T1)
E	13	Flew in from west/north, feeding in field after landing.	13/02/2023	917m (T5)
F	27	Adults grazing in GA1 field.	06/03/2024	432m (T2)
G	23	Adults grazing in GA1 field.	20/03/2024	593m (T3)

Path: C:\Users\gavan.wallace\AppData\Local\Temp\ArcGISProTemp23908\Untitled\Untitled.aprx



0 0.5 1 2 Kilometers

Legend

Proposed Deveopment Boundary

SNH Buffer

Bird ID, Date, Time

- 2, 21/12/2021, 16:43
- 3, 22/01/2022, 08:48
- 5, 21/12/2022, 13:10
- 6, 24/01/2023, 11:27
- 7, 13/02/2023, 09:00

Grazing Whooper Flocks

Record ID, Date

- A, 21/12/2021
- B, 14/02/2022
- C, 21/12/2022
- D, 24/01/2023
- E, 13/02/2023
- F, 06/03/2024
- G, 20/03/2024

TITLE: Whooper Swan Activity			
PROJECT: Drehid Wind Farm			
FIGURE NO:	4.2		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:22,500	**REVISION:**	0
DATE:	08/05/2025	**PAGE SIZE:**	A3

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4.2.6 Invasive Species

A total of eight non-native invasive plant species were recorded at the proposed site. Their occurrence in areas overlapped by proposed infrastructure is detailed in Table 4-3.

4.2.6.1 Invasive Species Recorded During Surveys

An individual *Rhododendron ponticum* bush c. 2 x 3m in extent was recorded in mixed broadleaved/conifer woodland adjacent to a section of proposed access track south of T8. This Schedule III invasive species was also recorded in conifer plantation c. 170m north-east of T9.

Sycamore was recorded within mixed broadleaved/conifer woodland within the proposed development footprint, and was noted to be common in open parts of recently replanted conifer plantation to the south of the proposed development. It was also recorded in hedgerows at TDR points of interest.

Butterfly bush was recorded along existing forestry tracks north of T9 and south of the proposed development.

Cherry laurel was recorded at two TDR points of interest (POI 1 & 3).

Snowberry (*Symphoricarpos albus*), another invasive species, was identified during ecological survey. This record is c. 15m from the proposed T7 - T8 access track. Snowberry is a medium impact invasive species.

Table 4-3: Invasive Species recorded onsite

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
Sycamore	*Acer pseudoplatanus*	In substation footprint and replanted conifer blocks in north of site TDR POIs: 5, 6, 7 & 14	None	Medium Impact
Cherry Laurel	*Prunus laurocerasus*	Existing Coillte entrance in north (adjacent domestic property boundary) TDR POIs: 1 & 3	None	High Impact
Rhododendron	*Rhododendron ponticum*	c. 100m east of Proposed development /c. 170m north-east of T9 In woodland c. 25m from access track south of T8	Schedule III	High Impact
Butterfly-bush	*Buddleja davidii*	N760 373 - overlapping existing access track north of T9	None	Medium Impact

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
		N766 375 & N766 374 - c. 230m south of proposed development		
Snowberry	*Symphoricarpos albus*	ITM 0674913 0736546 - c. 15m from proposed T7 - T8 access track	None	Medium Impact

Further details are included in the Ecological Baseline (Appendix 1).

The locations of invasive species stands relative to proposed infrastructure are shown in Figure 1.1 in Appendix 9.

4.3 European Sites Description

4.3.1 River Boyne and River Blackwater SAC

This site comprises most of the freshwater element of the River Boyne from upriver of the Boyne Aqueduct at Drogheda, the Blackwater River as far as Lough Ramor and the principal Boyne tributaries, notably the Deel, Stoneyford and Tremblestown Rivers. The rivers flow through a landscape dominated by intensive agriculture, mostly of improved grassland but also cereals. Much of the river channels were subject to arterial drainage schemes in the past. Natural flood-plains now exist along only limited stretches of river, though often there is a fringe of reed swamp, freshwater marsh, wet grassland or deciduous wet woodland. Along some parts, notably between Drogheda and Slane, are stands of tall, mature mixed woodland. Substantial areas of improved grassland and arable land are included in site for water quality reasons.

The main channel of the Boyne contains a good example of alluvial woodland of the Salicetum albo-fragilis type which has developed on three alluvium islands. Alkaline fen vegetation is well represented at Lough Shesk, where there is a very fine example of habitat succession from open water to raised bog. The Boyne and its tributaries is one of Ireland's premier game fisheries and offers a wide range of angling, from fishing for spring salmon and grilse to sea trout fishing and extensive brown trout fishing.

The site is one of the most important in eastern Ireland for Salmon (*Salmo salar*) and has very extensive spawning grounds. The site also has an important population of River Lamprey (*Lampetra fluviatilis*), though the distribution or abundance of this species is not well known. Otter (*Lutra lutra*) is widespread throughout the site. Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of Whooper Swan (*Cygnus Cygnus*).

Several Red Data Book plants occur within the site, with Pyrola rotundifolia, Poa palustris and Juncus compressus. Also occurring are a number of Red Data Book animals, notably Badger (*Meles meles*), Pine Marten (*Martes martes*) and *Rana temporaria*. The River Boyne is a designated Salmonid Water under the EU Freshwater Fish Directive

The main threats and pressures which may impact the River Boyne and River Blackwater SAC are set out in the Natura 2000 Data Form and are presented in Table 4-4.

The features of interest of the site include a number of Annex I habitats, priority habitats and Annex II species under the EU Habitats Directive as shown in ***Table** 4-12: Conservation Objectives and Targets for Relevant Qualifying Interests with Potential for adverse Effects on the Site Integrity of the River Boyne and River Blackwater SAC*

Table 4-4: Threats, Pressures and Activities with Impacts on the River Boyne and River Blackwater SAC as recorded in Table 4.3 of the standard data form[7]

Code	Threats & Pressures	Rank (H-high, M-medium, L-low)	Inside (i)/ outside (o)/ both(b)
J02.11	Siltation rate changes, dumping, depositing of dredged deposits	M	i
E03.02	Disposal of industrial waste	M	i
D01.05	Bridge, viaduct	L	i
A07	Use of biocides, hormones and chemicals	M	i
J02.15	Other human induced changes in hydraulic conditions	H	i
G02.10	Other sport / leisure complexes	M	i
J02.10	Management of aquatic and bank vegetation for drainage purposes	M	i
A01	Cultivation	M	i
G05	G05 Other human intrusions and disturbances	L	i
G01	G01 Outdoor sports and leisure activities, recreational activities	L	i
E01.04	Other patterns of habitation	M	i
H01	Pollution to surface waters (limnic, terrestrial, marine & brackish)	H	i
A10.01	Removal of hedges and copses or scrub	M	i
A05.02	Stock feeding	M	o
D01.02	Roads, motorways	M	i
G05.06	Tree surgery, felling for public safety, removal of roadside trees	L	i
E05	Storage of materials	M	i
E02	Industrial or commercial areas	H	i
A08	Fertilisation	M	i
I01	I01 Invasive non-native species	H	i
C01.01	C01.01 Sand and gravel extraction	M	i

[7] Standard data Form for the River Boyne and River Blackwater SAC: http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=IE0002299 (accessed 11/02/2025)

Code	Threats & Pressures	Rank (H-high, M-medium, L-low)	Inside (i)/ outside (o)/ both(b)
J02	Human induced changes in hydraulic conditions	M	i
B01.02	Artificial planting on open ground (non-native trees)	M	i
E03.04	Other discharges	H	i
A10.01	Removal of hedges and copses or scrub	M	i

Table 4-5: Summary of the potential occurrence of qualifying interests within the zone of influence of the proposed development

Qualifying Interest Code	Description	Occurrence[8]
7230	Alkaline fens	Alkaline fen has not been mapped in detail for River Boyne and River Blackwater SAC and thus the exact total current area of the qualifying habitat in the SAC is currently unknown. The main areas of alkaline fen in the SAC are documented to occur in the vicinity of Lough Shesk, Freekan Lough, Newtown Lough in the upper reaches of the Stonyford River. At Lough Shesk, the habitat is particularly well-represented and there is a good example of succession from open water to fen-type habitat.
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* is present within River Boyne and River Blackwater SAC. As part of the National Survey of Native Woodlands (NSNW), the sub-sites Grove Island (NSNW site code 688) and Yellow Island (752) were surveyed by Perrin et al. (2008). Yellow Island (code 752) was also included in national monitoring surveys (O'Neill and Barron, 2013; Daly et al., in prep.). Map 3 shows the minimum area of alluvial forests within the SAC, which is estimated to be 16.7ha (Perrin et al., 2008; Daly et al., in prep.). Grove Island and Yellow Island are located at/upstream of the M1 Boyne crossing upstream of Drogheda. It is important to note that further unsurveyed areas may be present within the SAC.
1099	River Lamprey *Lampetra fluviatilis*	Artificial barriers can block or impede the passage of upstream migrating lamprey, thereby restricting access to spawning areas (Gargan et al., 2011; Rooney et al., 2015). There are a number of weirs along the lower sections of the Boyne main channel, the most substantial of these are located at Slane and downstream of Navan at Blackcastle. Efforts to trap adult river lamprey were undertaken at four locations throughout the catchment during November 2014 to April 2015. This was augmented in April 2015 by an extensive fyke-netting survey (n=26 sites). No adult river lamprey were encountered, with the only record to date being a dead individual from the River Boyne at Slane in late March 2015 (Gallagher et al., 2016). On the Boyne main channel, there is ideal spawning habitat both upstream and downstream of the weir at Blackcastle but spawning has not been observed at these locations to date. The NPWS site synopsis notes river lamprey are present in the lower reaches of the Boyne. No river lamprey were recorded during aquatic surveys.

8 - Occurrence of species and habitats was informed by the Conservation Objectives of the Lower River Shannon SAC, (https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002165.pdf) (accessed 09/02/2024).

Qualifying Interest Code	Description	Occurrence[8]
1106	Atlantic Salmon *Salmo salar*	The NPWS conservation objectives note that 'Artificial barriers block salmons’ upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There are multiple barriers to fish migration in the Boyne system.' The site synopsis notes the importance of the Boyne salmon fishery, and also notes the River Blackwater is still recovering from the effects of the 1970s arterial drainage scheme, and that salmon stocks in the Blackwater have not recovered to the numbers that existed pre-drainage. It is noted that salmon are present in the Blackwater (Longwood) as confirmed by fisheries surveys, and as such there is some degree of migration into the upper catchment.
1355	Otter *Lutra lutra*	The NPWS site synopsis notes that otter can be found throughout the SAC, and their presence in the catchment in which the Proposed development and Substation are located is confirmed by current surveys.

Having regard to Table 4-4, the qualifying interests of the SAC which may potentially be within the zone of influence of the project are:

- Atlantic salmon (*Salmo salar*) – juvenile salmon recorded in the Blackwater (Longwood) downstream of the Proposed Development. Salmonid habitats including spawning and other stages are known to occur downstream in the Boyne and Blackwater and may be affected by reductions in water quality.
- River Lamprey (*Lampetra fluviatilis*) - this species is currently confined to the lower reaches of the Boyne due to the presence of weirs, with large barriers at Slane Castle and Blackcastle (Navan). Since Blackcastle Weir is over 55 km downstream of the Proposed Development and river lamprey are known to be effectively absent upstream of this weir, potential for effects on spawning habitat and juveniles due to reductions in water quality is minimal.
- Otter (*Lutra lutra*) – Otter holts are present in the vicinity of the Proposed development , and signs of otter activity were recorded throughout study area. The SAC QI otter population could potentially be affected by reductions in water quality causing decreased prey availability. Potential disturbance or displacement of otters occurring near the Proposed development could be linked to the SAC population due to potential for large home ranges and mixing of individuals from the SAC population and surrounding areas.
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) along the Boyne may potentially be affected by reductions in water quality. While the largest and highest conservation value areas of this habitat are known to be present near the M1 bridge (over 80 km downstream of the Proposed development and Substation), there is potential for unmapped pockets of this habitat to occur along the banks of the Boyne closer to the Proposed Development.

The main areas of alkaline fen in the SAC are documented to occur in the vicinity of Lough Shesk, Freekan Lough, Newtown Lough in the upper reaches of the Stonyford River and as such these areas are upstream of the Proposed Development and as such not subject to potential indirect pollution effects. Since no significant alterations to groundwater are predicted, there is no potential for effects in this category. Based on detailed assessment of orthophotography, in combination with the fact that fens by their nature are associated with the headwaters of rivers due to their requirements for the emergence of groundwater, it is considered extremely unlikely that any alkaline fens occur in association with the lowland/depositing mid to lower reach riverine habitats which occur in the SAC downstream of the Proposed Development

Atlantic salmon

The Atlantic salmon is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. The Atlantic salmon is an anadromous species. Atlantic salmon populations in Ireland have been recently assessed as being 'inadequate' by NPWS in the 2019 Article 17 Conservation Status Assessments (2019a). The Salmon Conservation Limit (CL) in any river is the number of spawning salmon required to maintain a sustainable population and is used to indicate the number of salmon in a river system above which a harvestable surplus can be considered.

Artificial barriers block upstream migration of salmon, thereby restricting access to spawning areas. The large weirs at Slane and Blackcastle present considerable obstructions to upstream passage of salmon on the Boyne main channel. While both have fish passes installed, upstream migration of salmon is still problematical. Further weirs upstream on the Shannon also restrict access to spawning habitat. Despite the presence of weirs, the headwaters and tributaries of the Boyne are known to be used as salmon spawning grounds.

The conservation status of salmon in the Boyne is dependent on good water quality status; as this species requires clean water (Q4) for spawning and early life stages. The main threat to the salmon population is the pollution of surface water, which severely impacts spawning. NPWS (2013) notes the 'high importance' threats and pressures on the salmon population as being – Agricultural intensification, disposal of household/ recreational facility waste, poaching, diffuse pollution to surface waters due to agricultural and forestry activities diffuse pollution to surface waters due to household sewage and waste waters.

River Lamprey

River lamprey is an anadromous species, spending part of it's life cycle in the marine environment and returning to natal watercourses to spawn. It spawns in fresh waters, and juveniles, known as ammocoetes, are found within the same catchments, using similar microhabitats, but with varying geographical distribution. Lampreys show a preference for gravel-dominated substratum for spawning, and mainly silt and sand-dominated substratum for nursery habitat (Harvey & Cowx, 2003). Barriers to migration are present in the Boyne, restricting river lamprey to the lower reaches.

The NPWS (2019a) overall assessment of the conservation status of river lamprey is 'Unknown' but the habitat for the species is assessed as 'Favourable'.

Otter

The otter is listed on Annex II and Annex IV of the EU Habitats Directive (Council Directive 92/43/EEC), thus making it a species of European importance. The River Boyne and River Blackwater SAC is one of 44 SACs designated for Otter in Ireland.

A survey was conducted in 2010/2011 (Reid et al., 2013) to determine the national distribution of otter, including SACs. This included the River Boyne and River Blackwater SAC. A total of 852 sites were successfully surveyed throughout the Republic of Ireland during 2010/11. Flowing freshwater (i.e. rivers, streams and canals) accounted for 694 sites of which 450 (64.8%) had signs of otters. Static freshwater (i.e. lakes and reservoirs) accounted for 24 sites of which 13 (54.2%) had signs of otters and the coast (i.e. the marine environment) accounted for 134 sites of which 76 (56.7%) had signs of otters. Special Areas of Conservation (SACs) accounted for 237 sites of which 159 (67.1%) had signs of otters. The survey confirmed that otters are widespread.

The known range of the otter increased by 31% from 1993-2006 to 2007-11. The population estimate of 7,800 [95%CI 7,200 – 10,200] breeding females during 2010/11 was not significantly different from that established as a baseline. Modelling of species-habitat associations suggested that available habitat was not limiting and no putative pressures recorded at survey sites negatively impacted species occurrence. Thus, under the statutory parameters for assessing a species' conservation status, i.e. range, population, habitat and future prospects, the otter was judged to be in Favourable or 'Good' status. Any apparently improving trend from the previous 'Poor' status (NPWS, 2008) was due to improved knowledge and more accurate data rather than a real temporal trend.

Alluvial forests with Alnus and Fraxinus

This is a generic term for a number of different woodlands. The principal communities within the SAC are:

- Gallery woodland (Salicion albae) (classified as WN5 by Fossitt (2000)) dominated by tree willows forming small, narrow stands on the river banks and islands where the trees are subject to frequent flooding and/or have their roots permanently in water. They occur principally upstream of Limerick.
- Wet willow-alder-ash woodland (WN6) in valley bottoms and locally in flushed areas on the side of steep valleys in the upper reaches of the tributaries.

The canopy within gallery woodland is dominated by white willow (*Salix alba*) with occasional alder (*Alnus glutinosa*). The shrub layer consists of various willow species with grey willow (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis*. The herbaceous layer consists of tall perennial herbs with creeping bent (*Agrostis stolonifera*), bindweed, goosegrass (*Galium aparine*), canary reed-grass (*Phalaris arundinacea*), nettle (*Urtica dioica*) and the invasive annual Himalayan balsam (*Impatiens glandulifera*) being the most important. Other species include yellow flag (*Iris pseudacorus*), pendulous sedge (*Carex pendula*) and meadowsweet (*Filipendula ulmaria*). A fringe of reedmace (*Typha* sp.) occurs on the riverside of some of the woodland.

Wet willow-alder-ash woodland (classified in Perrin et al. 2008 as Alder-meadowsweet woodland) is dominated by alder and grey willow accompanied by ash on flushed slopes. The field layer is species-rich with species such as remote sedge (*Carex remota*), creeping buttercup (*Ranunculus repens*), herb-robert (*Geranium robertianum*), meadowsweet, water mint (*Mentha aquatica*), wood avens (*Geum urbanum*), enchanter's nightshade (*Circaea lutetiana*) and various ferns, e.g. *Dryopteris dilatata*, *Athyrium filix-femina*.

4.3.2 River Boyne and River Blackwater SPA

The River Boyne and River Blackwater SPA is a long, linear site that comprises stretches of the River Boyne and several of its tributaries; most of the site is in County Meath, but it extends also into Counties Cavan, Louth and Westmeath.

It includes the following river sections: the River Boyne from the M1 motorway bridge, west of Drogheda, to the junction with the Royal Canal, west of Longwood, County Meath; the River Blackwater from its junction with the River Boyne in Navan to the junction with Lough Ramor in County Cavan; the Tremblestown River/Athboy River from the junction with the River Boyne at Kilnagross Bridge west of Trim to the bridge in Athboy, County Meath; the Stoneyford River from its junction with the River Boyne to Stonestown Bridge in County Westmeath; the River Deel from its junction with the River Boyne to Cummer Bridge, County Westmeath. The site includes the river channel and marginal vegetation.

The site is a Special Protection Area (SPA) under the EU Birds Directive of special conservation interest for the following species: Kingfisher (*Alcedo atthis*).

Table 4-6: Threats, Pressures and Activities with Impacts on the River Boyne and River Blackwater SPA as recorded in Table 4.3 of the standard data form[9]

Code	Threats & Pressures	Rank (H-high, M-medium, L-low)	Inside (i)/ outside (o)/ both(b)
E01.03	Dispersed habitation	o	H
D01.02	Roads, motorways	o	H
J02	Human induced changes in hydraulic conditions	i	M
E01	Urbanised areas, human habitation	o	H
D01.02	Roads, motorways	i	H

[9] Standard data Form for the River Boyne and River Blackwater SPA: https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=IE0004232 (accessed 11/02/2025)

Table 4-7: Summary of the potential occurrence of special conservation interests within the zone of influence of the proposed development

SCI Code	Description	Occurrence
A229	Kingfisher (*Alcedo atthis*)	Kingfisher is a small plunge-diving bird, largely resident and monogamous in the breeding season, found typically along shallow freshwater systems, with some local movement to coastal areas in winter (Snow and Perrins, 1997; Crowe et al., 2010). Widespread in Ireland (NPWS, 2019), it requires slow-moving water that contains thriving prey populations of small fish, and look-out perches from which it can hunt (Snow and Perrins, 1997). The all-Ireland population is estimated at 1,300- 2,100 pairs (NPWS, 2013). A survey of six SAC river catchments in 2010 identified this SPA as supporting 15-19 breeding territories/pairs, or up to 1.4% of the all-Ireland population. The measure 'breeding territories' is as per Cummins et al. (2010) and these were estimated based on registrations of birds, birds' activities, and nest holes seen, primarily on the first two survey visits (out of three).

Having regard to Table 4-6, the qualifying interests of the SPA which may potentially be within the zone of influence of the project are:

- Kingfisher (*Alcedo atthis*) due to hydrological connectivity and potential for effects via reductions in water quality. In addition, population level effects are possible due to potential for links and population exchange between the SPA and surrounding areas including the river network in the vicinity of the Proposed Development.

4.4 Potential for Effects on Whooper Swan associated with River Boyne and River Blackwater SAC

Potential for disturbance/displacement of grazing whooper swans during construction, decommissioning and operation is assessed as slight to moderate, reducing with predicted habituation during construction, decommissioning and operation.

Collision mortality on Whooper Swans is considered and appraised on a precautionary basis in respect of the River Boyne and River Blackwater SAC.

4.4.1 Collision Risk Assessment for Whooper Swans

Effects on avifauna can be assessed following guidance in Percival 2007. As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this the significance of potential impacts are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely impact occurring. The criteria for defining Magnitude, Probability of Impact and consequent Significance as outlined in the above referenced guidance (Percival, 2003) are outlined in Table 4-8 to Table 4-10.

Table 4-8: Determination of Magnitude Effects (Percival, 2003)

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Guide: < 20% of population / habitat remains
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. Guide: 20-80% of population/ habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. Guide: 5-20% of population/ habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/ habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the “no change” situation. Guide: < 1% population/ habitat lost

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, very low and low should not normally be of concern however normal design care should be undertaken to minimise effects, medium represents a potentially significant effect that requires careful individual assessment, while very high and high represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented in Table 4-9.

Table 4-9: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

Significance		Sensitivity			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Medium
	High	Very High	Very High	Medium	Low
	Medium	Very High	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

Table 4-10: Potential collision risk to whooper swan

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Whooper Swan (Very High)	Observations of this species were primarily of grazing flocks and birds flying in or out of grazing areas near T1-T3 and also further north/west near VP1. Local movements are often likely to occur at lower heights depending on topography. Studies on wintering swans have found low levels of collision mortality, even in sites with a high degree of transit flights (n=1664 in one case) through operational wind farms and relatively high numbers (>500) of birds regularly present (Fijn et al., 2012). In a review of swan and goose fatalities at wind farms only one whooper swan fatality was recorded from monitoring undertaken at 46 different wind farms across 8 countries (Hötker et al., 2006). Recommended avoidance rates from SNH are 99.5% (SNH, 2010), based on literature reviews of recorded fatalities; this suggests a high micro-avoidance of turbines. In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). Best scientific knowledge suggests comparable if not higher avoidance rates by wildfowl during perceived periods of poor visibility. Best scientific knowledge therefore suggests overall a high avoidance rate and consequent low fatality estimate for wind turbines in relation to Whooper Swans both in relation to diurnal flight activity and activity in crepuscular and nocturnal periods. **The predicted collision risk for whooper swan is 0.1 per year. This equates to 0.370% of the local population/0.029% of county population and 0.001% of national population.**	**Sensitivity:** Very High. **Magnitude (National/County/Local):** Negligible. **Overall significance:** Low (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Not significant** effect (Criteria: EPA, 2022).

4.5 In-Combination Effects

Refer to Section 3.3 which details the assessment of in-combination effects associated with this proposed development.

4.6 Potential for Adverse Effects on Site Integrity

The conservation interests of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA are which may potentially be affected by the proposed development are identified in Section 4.3.

The conditions required by these conservation interests are defined by attributes and targets set out in the Conservation Objectives Documents. No other conservation interests of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA were determined to be within the zone of influence of the proposed development having regard to the potential for the affected areas to support the conservation interests of these EU sites.

NPWS, in their Article 17 reporting (NPWS, 2019) define the favourable conservation status of an Annex I habitat or Annex II species as achieved when:

- its natural range, and area it covers within that range, are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of an Annex II species (Habitats Directive) and Annex I species (Birds Directive) is achieved through the maintenance or restoration of conservation status according to the Conservation Objectives of the site.

4.6.1 Potential Adverse Effects

The elements of the proposed development that were identified as posing pressure on the special conservation interests/qualifying interests of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA within the ZoI stated above are identified as:

4.6.1.1 Habitat Destruction/Fragmentation/Deterioration

No habitat fragmentation or destruction is predicted to occur. No habitats within the SAC or SPA will be directly affected, however the potential for habitat degradation due to pollution exists (e.g. pollution of aquatic habitats or alluvial woodland).

4.6.1.2 Emissions to Surface Water

Sediment-laden runoff may result from excavation, earthworks, use of aggregate and vehicle movements. Pollution from concrete washout and oil/fuel spills from machinery or use of wet cement could pollute surface water.

4.6.1.3 Emissions to Groundwater

Pollution from concrete washout and oil/fuel spills from machinery could pollute groundwater.

4.6.1.4 Emissions to Air (Dust)

During construction and decommissioning, dust will arise from excavation, earthworks and vehicles traffic and may disperse to the immediate environment.

4.6.1.5 Disturbance to Fauna from Noise and Vibration

Due to the presence of a holt within 150m of proposed works, there is a risk that resting otter could be disturbed by noise and vibration from construction and decommissioning activities, including piling and general works. This holt is sub-optimal for use as a breeding holt due to an obstructing root and has not shown any signs of occupancy during surveys. A higher quality holt potentially suitable for use as a breeding holt is present nearby, but outside the 150m breeding otter disturbance buffer. As such, effects on breeding otter are not predicted, and in the event of the sub-optimal holt being disturbed, an alternative holt is present nearby.

4.6.1.6 Spread of invasive species

Proposed construction, decommissioning and operational activities could result in invasive species material entering the river network and potentially being transported towards the SAC and SPA. None of the invasive species recorded onsite (sycamore, cherry laurel, *Rhododendron ponticum*, butterfly bush and snowberry) have the potential to destabilise bankside soils due to colonisation and winter dieback, however their introduction to semi-natural habitats can negatively affect phytosociology and/or potentially affect aquatic habitats via shading.

4.6.1.7 Distance from European sites

The proposed development is not in close proximity to any European sites but is hydrologically connected with the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA.

Assessment of the potential for the proposed works to adversely affect the integrity of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA are presented hereunder in Table 4-8 and with respect to the conservation interests which have been identified to be within the likely zone of influence of the project.

Duration of effects are defined in Table 4-11.

Table 4-11: Duration of Effects (EPA, 2022)

Duration of Effect	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years
Permanent Effects	Effects lasting over sixty years

Table 4-12: Conservation Objectives and Targets for Relevant Qualifying Interests with Potential for adverse Effects on the Site Integrity of the River Boyne and River Blackwater SAC[10]

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
River Lamprey *Lampetra fluviatilis*	To restore the favourable conservation condition of River Lamprey	Distribution	% of river accessible	Access to all water courses down to first order streams	The Proposed Development will not impact river accessibility so there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Distribution of larvae	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	Not less than 50% of sample sites with suitable habitat positive for larval brook/river lamprey	While river lamprey are known to be confined to the lower reaches of the Boyne due to the presence of weirs (over 55 km downstream of the Proposed development), the potential for pollution or siltation to affect this target cannot be ruled out.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Population structure of larvae	Number of age/size classes	At least three age/size groups of brook/river lamprey present	While river lamprey are known to be confined to the lower reaches of the Boyne due to the presence of weirs (over 55 km downstream of the Proposed development), the potential for pollution or siltation to affect this target cannot be ruled out.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Larval lamprey density in fine sediment	Larval lamprey/m²	Mean density of brook/river larval lamprey in sites with suitable habitat more than 5/m²	While river lamprey are known to be confined to the lower reaches of the Boyne due to the presence of weirs (over 55 km downstream of the Proposed development), the potential for pollution or siltation to affect this target cannot be ruled out.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Extent and distribution of spawning nursery habitat	m² and occurrence	No decline in extent and distribution of spawning and nursery beds	While river lamprey are known to be confined to the lower reaches of the Boyne due to the presence of weirs (over 55 km downstream of the Proposed development), the potential for pollution or siltation to affect this target cannot be ruled out.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
Atlantic Salmon *Salmo salar*	To restore the favourable conservation condition of Salmon	Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary	The Proposed Development will not introduce barriers to rivers, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded	Potential for indirect adverse effects through reductions in water quality thereby restricting regeneration of the adult population.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.

[10] The conservation objectives for the Lower River Shannon SAC can be found here: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002165.pdf

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
		Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	Potential for indirect adverse effects through reductions in water quality or pollutants affecting spawning habitat.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Out-migrating smolt abundance	Number	No significant decline	Potential for indirect adverse effects through reductions in water quality or pollutants affecting spawning habitat which would in turn reduce smolt recruitment.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	As sedimentation could occur prior to mitigation, areas of salmon spawning habitat may potentially be impacted. Therefore, there is potential for adverse effects.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
		Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Impacts to water quality from the Proposed Development have potential to cause adverse effects.	Yes	Short term	There is potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects.
Otter *Lutra lutra*	To maintain the favourable conservation condition of Otter	Distribution	Percentage positive survey sites	No significant decline	This target is unlikely to be affected by the Proposed Development.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 447.6 ha along river banks/ lake shoreline/around ponds	This target is unlikely to be affected by the Proposed Development.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Extent of freshwater (river) habitat	Kilometers	No significant decline. Length mapped and calculated as 263.7 km	The Proposed Development will not affect the extent of freshwater river habitat of value to otter, so there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
		Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 31.6ha	The Proposed Development will not affect the extent of freshwater lake/lagoon habitat, so there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Couching sites and holts	Number	No significant decline	The two otter holts in the vicinity of the Proposed Development are outside the SAC and will not be directly affected by proposed works and will be retained in their current location. Potential disturbance or interruption to use of the sub-optimal holt by otter would be temporary. No disturbance to the potential breeding holt is predicted due to it's location outside the 150m disturbance buffer. Since the holts are outside the SAC and located c. 10 km from the SAC, this target will not be affected.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Fish biomass available	Kilograms	No significant decline	Potential effects on water quality arising from the Proposed Development could result in adverse effects on prey biomass availability within the Boyne or Blackwater Rivers.	Yes	Short term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Barriers to connectivity	Number	No significant increase	The Proposed Development will not result in any barriers to connectivity.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*	To restore the favourable conservation condition of Alluvial forests	Habitat area	Hectares	Area stable or increasing, subject to natural processes	The Proposed Development will not cause a reduction in habitat area, and as such does not have the capacity to affect this target.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Habitat distribution	Occurrence	No decline, subject to natural processes	The Proposed Development will not cause a reduction in habitat distribution, and as such does not have the capacity to affect this target.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
		Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The Proposed Development will not cause a reduction in woodland size, and as such does not have the capacity to affect this target.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Woodland structure: cover and height	Woodland structure: cover and height	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover at least 20% and height at least 20cm; bryophyte cover at least 4%	The Proposed Development will not alter the structure of any woodlands, and as such does not have the capacity to affect this target.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	There is potential for the spread of invasive species to arise as a result of proposed works. These could potentially affect this attribute.	Yes	Long term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy	There is potential for the spread of invasive species such as cherry laurel and rhododendron to occur as a result of proposed works. These species form dense stands which can outcompete native vegetation including native tree seedlings. As such there is potential for this attribute to be affected by invasive species spread.	Yes	Long term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	The Proposed Development will not alter the required hydrological regime, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Woodland structure: dead wood	Number per hectare	At least 19 stems/ha of dead wood of at least 20cm diameter	The Proposed Development does not have the capacity to affect this attribute, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
		Woodland structure: veteran trees	Number per hectare	No decline	The Proposed Development does not have the capacity to affect this attribute, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Woodland structure: indicators of local distinctiveness	Occurrence; population size	No decline in distribution and, in the case of redlisted and other rare or localised species, population size	There is potential for this attribute to be affected by invasive species spread reducing natural regeneration as detailed above.	Yes	Long term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Woodland structure: indicators of overgrazing	Occurrence	All five indicators of overgrazing absent	The Proposed Development does not have the capacity to affect this attribute, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Vegetation composition: native tree cover	Occurrence	At least 1 target species for 91E0* woodlands present; at least 6 positive indicator species for 91E0* woodlands present	There is potential for this attribute to be affected by invasive species spread outcompeting typical native species as detailed above.	Yes	Long term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Vegetation composition: negative indicator species	Occurrence	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	There is potential for this attribute to be affected by invasive species spread as detailed above.	Yes	Long term	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Vegetation composition: problematic native species	Percentage	Cover of common nettle (*Urtica dioica*) less than 75%	The Proposed Development does not have the capacity to affect this attribute, therefore there is no potential for adverse effects.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.

Table 4-13: Conservation Objectives and Targets for Relevant Qualifying Interests with Potential for adverse Effects on the Site Integrity of the River Boyne and River Blackwater SPA[11]

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
Kingfisher *Alcedo atthis*	To maintain the favourable conservation condition of kingfisher in the SPA	Population size	Number of breeding territories/pairs	No significant decline in the long term	This target is unlikely to be affected by the Proposed Development.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Productivity rate	Number of fledged young per confirmed breeding pair	Sufficient productivity to maintain the population trend as stable or increasing	There is some potential for reductions in water quality associated with the Proposed Development to affect this target via temporary reductions in prey abundance.	Yes	Temporary	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Spatial distribution of territories	Numbers and distribution of occupied territories across site	No significant loss of distribution in the long term, other than that occurring due to natural patterns of variation	Potential pollution events would be temporary and do not have the potential to cause a significant decline in the number or area of breeding colonies.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Extent and quality of nesting banks and other suitable nesting features	Hectares; condition assessment	Sufficient area of high quality nesting habitat to support the population target	This target is unlikely to be affected by the Proposed Development. There will be no land take within the SPA.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Forage spatial distribution, extent, abundance and availability	Location, hectares, and forage biomass	Sufficient number of locations, area of suitable forage habitat and available forage biomass to support the population target	There is some potential for reductions in water quality associated with the Proposed Development to affect this target via temporary reductions in prey abundance.	Yes	Temporary	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists

[11] The conservation objectives for the River Shannon and River Fergus Estuaries SPA can be found here: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004077.pdf

Species/Habitat	Conservation Objective	Attribute	Measure	Target	Potential for Adverse Effects on Site Integrity from the Proposed development	In-combination effects	Duration of Effect in the Absence of Mitigation	Conclusion
		Water quality	Water quality indicators	Both biotic (i.e. Q-value) and abiotic indices reflect overall good-high quality status	There is some potential for reductions in water quality associated with the Proposed Development to affect this target.	Yes	Temporary	Potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists
		Barriers to connectivity	Number, location, shape and hectares	No significant increase	This target will not be affected by the Proposed Development since no barriers to connectivity are proposed.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.
		Disturbance to breeding sites	Intensity, frequency, timing and duration	Disturbance occurs at levels that do not significantly impact upon breeding Kingfisher	Due to distance from the SPA and absence of breeding sites in the area of The Proposed Development, this target is unlikely to be affected by the Proposed Development.	N/A	N/A	No potential for the Proposed Development to affect this target either alone or in-combination with other plans or projects exists.

The potential for adverse effects due to the proposed works have been identified for the following QI species/habitats of the River Boyne and River Blackwater SAC:

- River Lamprey
- Atlantic Salmon
- Otter
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior**

The potential for adverse effects due to the proposed works have been identified for the following SCI species of the River Boyne and River Blackwater SPA:

- Kingfisher

4.7 Mitigation

4.7.1 Mitigation by Avoidance and Design

With regard to the proposed development, the following measures were undertaken to reduce impacts on designated sites through avoidance and design:

- The hard-standing areas of the wind farm have been kept to the minimum necessary, including all site clearance works to minimise land take of habitats and flora.
- Larger turbines have been utilised to minimise the number of turbines, reducing the total rotor envelope (less turbines) and footprint of the proposed development.
- Site design and layout deliberately avoided direct impacts on designated sites.
- All cabling with the exception of the locations of the high voltage line loop in is to be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).
- Care has been taken to ensure that sufficient buffers are in place between proposed development infrastructure and hydrological features such as rivers, lakes and streams. Access roads were the exception to the rule in that river crossings will have to take place. However, where possible, existing crossings have been utilised. Clear span brides are to be used at the three stream crossing points on site to reduce the potential impact to the stream beds and to avoid instream works (foundation will be located 2.5m from the river edge).
- Any works in or around watercourses will adhere to best practice as per NRA and IFI guidance for works potentially affecting watercourses.
- The grid connection route has been selected with cognisance to ecological features. The cable route will utilise private agricultural grassland, and areas of forestry plantation, thereby minimising land take of potentially sensitive habitats.
- Floating roads will be utilised to minimise impact on the peat, particularly peat hydrology. As there is no excavation required for floating roads, no peat arisings are generated.
- It is proposed to construct clear span bridges at the 3 no. watercourse crossings required within the Proposed Development site to minimise the environmental impacts and avoid any instream works.

- So as not to interfere in any way with the bed or bank of the watercourse, bridge foundations will be designed and positioned at least 2.5 m from the river bank.

Further mitigation measures prescribed to reduce and/or avoid the potential for the proposed works to have an adverse effect on the integrity of the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA are prescribed hereunder.

Table 4-14: Details of Mitigation Measures to be Implemented for the proposed Flood Relief and Drainage Upgrade Works

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
MITIGATION MEASURES TO BE IMPLEMENTED PRIOR TO CONSTRUCTION (AND DECOMMISIONING)				
1	Adherence to the mitigation measures and methodologies specified in the Construction Environmental Management Plan (CEMP) (Appendix 2)	This measure will ensure the mitigation, methodologies and procedures prescribed for the prosed development are implemented correctly at construction stage.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The developer will ensure the CEMP is provided to the contractor. The ECoW will monitor implementation of the CEMP to ensure all measures are carried out correctly and effectively.
2	A preconstruction otter survey will be completed prior to construction.	Reconfirm the baseline conditions relating to otter, informing avoidance and/or implementation of mitigation measures as necessary. Monitoring of all holts located within 150m of works will be undertaken to reconfirm their status prior to construction.	A suitably qualified ecologist will undertake surveys and holt monitoring. The ecologist shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.
3	Preconstruction ornithological surveys shall be carried out during the winter season to record the presence of whooper swan within the site. In the event that whooper swan is recorded as roosting within the site an exclusion zone for works within 500m of a winter roost shall be maintained for the winter period (Oct - the end of March).	Prevent disturbance of roosting whooper swans if present.	A suitably qualified ecologist will undertake surveys. The ecologist shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
4	An invasive species survey will be carried out to confirm the baseline prior to treatment measures and determine the specific volumes and extents of invasive species material requiring treatment.	This measure will provide the detailed information and site familiarisation required by the invasive species contractor to implement the ISMP prior to construction.	A suitably qualified ecologist or invasive species contractor will undertake the surveys and holt monitoring. The ecologist/invasive species contractor shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.
5	A suitably qualified Ecological Clerk of Works (ECoW) will be appointed to supervise works, undertake monitoring and reporting as required, and carry out water sampling. The ECoW will have full stop-works authority at all times to ensure immediate action can be taken in the event of mitigation failure.	Ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process; supervise works in sensitive areas; undertake water sampling to monitor water quality in the receiving environment during construction.	An Ecological Clerk of Works (ECoW) will be engaged prior to invasive species management and for the duration of construction. All mitigation will be implemented in full. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
6	Invasive species management shall be undertaken by a suitably qualitied contractor in accordance with the invasive species management plan (ISMP) (Appendix 9). This shall include as required the control and removal of invasive species from the works area and adjacent areas, in addition to any measures required to prevent re-infestation prior to and during construction.	Remove invasive species from the area of proposed works to allow works to proceed without the risk of causing or accelerating the spread of invasive species to European sites.	The ECoW shall supervise and inspect invasive species management activities, ensuring adherence to the ISMP and protection of sensitive ecological receptors. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	Cordons and signage will be erected to highlight areas which have been treated, in order to facilitate ongoing monitoring and to aid in implementation of any additional restrictions required for these areas during construction. Disposal of any plant material arising from invasive species management will be disposed of in accordance with the ISMP and in a manner which prevents further spread. Any Schedule III material proposed to be disposed of site will only be transported and disposed of under the required licenses.			Regular reporting to developer and contractor as per each management plan.
7	A further invasive species survey/check covering treated areas will be completed prior to construction to reconfirm if control measures need to be reapplied.	Confirm that invasive species have been removed from all works areas prior to construction.	The ECoW or a suitably qualified ecologist under their supervision shall carry out the survey and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
8	The ECoW will establish contact with IFI & NPWS staff, and facilitate any site inspections they wish to carry out.	Facilitate site access and communication with key stakeholders, and provide additional oversight of mitigation implementation.	ECoW will open lines of communication upon appointment. High probability of success.	ECoW to provide reports of communication and/or site visit findings to update the developer and contractor of input from key stakeholders.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
9	As part of a detailed water quality monitoring programme, turbidity meters will be installed prior to construction at five locations within the watercourses draining the site. Levels of turbidity will be monitored pre-construction (post planning) to determine existing levels in the water bodies. These levels will be used to set trigger levels for each location. Should these trigger levels be exceeded during construction, the source of the turbidity will be identified, and immediate action will be taken to identify, contain and eliminate siltation/pollution at the source. See Figure 4-3 for more information.	This measure will reduce the risk of sediment runoff or pollutants reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. High probability of success.	Mitigation measures will be implemented by the developer through the mechanism of its contract with the Contractor. All required mitigation measures will be included as a contractual obligation on the contractor, in combination with competent supervisory staff overseeing the works.
10	The ECoW will establish representative water quality monitoring points up and downstream and undertake baseline physico-chemical water quality sampling.	This will define monitoring locations and establish baseline conditions for construction phase monitoring.	Mitigation measure will be implemented in full by the Developer. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer prior to initiation of construction.
11	Baseline Q sampling will be completed at suitable representative water quality monitoring points up and downstream.	This will establish a baseline for further periodic monitoring during construction. The use of Q sampling is included to detect any potential longer-term changes to water quality which may not be evident from physico-chemical water quality sampling.	Mitigation measure will be implemented in full by the Developer. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
12	A suitably qualified Environmental Manager will be engaged to ensure successful implementation of all mitigation measures for water control and management, and to oversee the day-to-day implementation of mitigation measures onsite.	A suitably qualified Environmental Manager (competent in the implementation and management of environmental mitigation measures for construction sites) will be appointed to ensure the effective operation and maintenance of drainage and other mitigation measures associated with water control and management during the construction process. The operations management of the proposed development will include regular monitoring of the drainage system and maintenance in line with all management plans within the CEMP (Appendix 2). The Environmental Manager will be awarded the authority to stop construction activity if there is potential for adverse effects to water control and/or management.	An environmental manager will be engaged by the Developer through the Contractor appointed to construct the proposed development . High probability of success.	The Environmental Manager in co-operation with the ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP ensuring successful implementation. Regular reporting to developer and contractor as per each management plan.
13	Prior to vegetation clearance, secure (dug in) double silt fencing and check dams will be installed in or around any drains which could receive runoff or where surface flows may occur during vegetation clearance and subsequent construction, and will remain in place subject to monitoring and maintenance until revegetation is complete	Prevent the escape of silt to European sites via drains or overland flow during vegetation clearance.	Mitigation measure will be implemented in full by the Environmental Manager, subject to supervision and sign-off by the ECoW. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	The ECoW will survey the site and specify as required where these silt arrest measures are to be placed, and will supervise their installation.			
14	The ECoW will conduct pre-clearance checks and supervise vegetation clearance. In the event that a new holt is discovered during vegetation clearance, works will cease, applicable guidance will be followed and NPWS will be notified.	Ensure clearance is carried out in accordance with ecological requirements and avoid disturbance to areas outside the construction zone and avoid activities which risk causing indirect effects (e.g. excessive soil disturbance and siltation). Ecological supervision is also required in case sensitive features such as holts are discovered in densely vegetated areas during clearance works.	Mitigation measure will be implemented in full by the by the ECoW. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.
15	Toolbox Talks Toolbox talks will be undertaken with construction staff on the sensitivity of the receiving environment, central role of ecological supervision, and implementation and maintenance of mitigation measures.	Toolbox talks will ensure all staff working on site are aware of mitigation procedures and potential hazards and will be able to comply with measures.	Toolbox talks will be provided to all staff upon induction and at site meetings thereafter. High probability of success.	The ECoW, Environmental Manager and Project Manager will deliver talks as required.
MITIGATION MEASURES TO BE IMPLEMENTED DURING CONSTRUCTION				
16	Monitoring of construction activities and mitigation measures by ECoW.	The ECoW will carry out weekly inspections of the site to ensure mitigation measures are functioning as intended. In addition to weekly inspections, the ECoW will attend the site as required for the following:	The ECoW in conjunction with the developer will ensure that the contractor implements all mitigation measures in full. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
		-Supervise construction of bridges to ensure potential effects on water quality are minimised.		as per each management plan.
17	Water quality monitoring	Physico-chemical water quality monitoring will be undertaken on a weekly basis during the site clearance and earthworks stage of the construction period. Following site clearance and earthworks stage of the construction period, sampling will be taken on a monthly basis for the remainder of the construction period.	The ECoW will ensure that this measure is carried out in full and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
18	Q Sampling/Biological water quality sampling	Biological water sampling will be carried out during the site clearance and earthworks stage of the construction period on a monthly basis during the construction phase. Following site clearance and earthworks stage of the construction period, samples will be taken on a quarterly basis, until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.	The ECoW will ensure that this measure is carried out in full and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
19	Weekly reports detailing the results of water sampling and operation of on-site mitigation measures will be sent to all stakeholders	Allow any potential water quality or general mitigation issues to be flagged to determine remedial action.	The ECoW will ensure that this measure is carried out in full to facilitate coordination and communication with the	The ECoW will monitor the implementation of the mitigation measures detailed herein and in

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	including the client, contractor and (if requested) IFI and NPWS.		developer/construction contractor. High probability of success.	accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
20	The ECoW will establish contact with IFI & NPWS staff, and facilitate any site inspections they wish to carry out.	Maintain communication with IFI & NPWS, facilitate site inspections.	The ECoW will ensure that this measure is carried out in full to facilitate communication with these stakeholders. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
21	Existing silt fencing and check dams will be inspected on a daily basis and maintained/repaired as required. Any additional sediment control measures identified by the site manager and/or ECoW during construction will be installed as required as works progress across the site. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off and for repairs. All silt protections will remain in place subject to monitoring and maintenance until revegetation is complete.	Prevent the escape of silt to European sites via drains or overland flow during construction.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
22	Where access tracks pass close to drainage ditches, double silt fencing will be used to protect these features by retaining silt runoff within the access corridor.	Prevent the escape of silt to the river network via drains or overland flow during construction.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
23	Weather forecasts will be reviewed daily, and earthworks will not be undertaken during periods of heavy rainfall (>10mm/hour). A regular review of weather forecasts of heavy rainfall is required.	This measure will minimise the generation of suspended solids, dust and any other contaminant mobilisation which may be washed towards sensitive receptors via surface runoff.	Mitigation measure will be implemented in full by the Environmental Manager. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
24	Drains and rivers receiving runoff from the proposed development and outfalls will be visually inspected on a daily basis. Any indication of elevated sediment levels, pollution, or evidence of defective sediment control measures will trigger remedial	This measure will monitor the effectiveness of mitigation measures to protect water quality, by ensuring any changes in water quality in the receiving environment which could potentially indicate requirement for remedial action are detected.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	measures, and if required, works will cease until all issues have been resolved.			Regular reporting to developer and contractor as per each management plan.
25	All access tracks will be capped as soon as possible with material with low content of fines.	Prevent silt generation arising from vehicular disturbance of soil, ensure track capping material does not act as a source of sediment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
26	Stilling ponds will be put in place in advance as construction progresses across the site.	The stilling ponds will have a diffuse outflow and will mitigate any increase in run-off. This will prevent reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.
27	The site drainage has been designed to complement existing overland flow and	This measure will reduce the risk of sediment runoff or pollutants reaching the waterways within the catchment of the proposed	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	existing bog, agricultural and forestry drainage. A three-stage treatment train (swale – stilling pond – diffuse outflow) is proposed to retain and treat the discharges from hard surface areas.	development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	to inspection and any corrective actions required by the ECoW. High probability of success.	
28	The increase in the rate of run-off along the route of the site access roads and hard-standing areas will be mitigated by the proposed drainage system which includes the provision of stilling ponds to reduce the concentration of suspended solids in the run-off from these areas, and the addition of silt fencing where deemed necessary. Drains around hard-standing areas will be shallow to minimise the disturbance to sub-soils. Cross-drains of 450mm diameter will be provided to prevent a risk of clogging for crossings conveying flows from bog drains, agricultural drains and forestry drains across the access roads.	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
29	During excavation of drains , gravel check dams with silt barrier material will be placed in the swales at 50m intervals. These will be left in place until soils within the swales have stabilised.	This measure will provide an additional layer of protection during and immediately after excavation of drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW.	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
			High probability of success.	
30	Interceptor cut-off drains will be provided on the upslope side of the site access roads. These interceptor drains will discharge diffusely over land.	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
31	Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction.	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
32	Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept	Will reduce the concentration of suspended solids being conveyed in the surface water run-off into watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW.	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	upstream of outfalls. to allow a buffer zone to the outfall.		High probability of success.	
33	Bank protection will be installed as necessary during construction of watercourse crossings to ensure that the existing stream banks are not disturbed during construction.	Will ensure that stream banks are not disturbed during construction.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
34	The excavated material generated during construction of watercourse crossings will be stored at agreed locations within the site in accordance with the Soil Management Plan.	Will ensure that excavated material is stored in a manner and location which prevents siltation of watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
35	Trenches for installation of underground cables will be excavated and re-covered in short sections. During installation, (where required) berms will be formed in open sections of the trench to prevent the trench acting as a conduit for flows of water and to	These measures will ensure that trenches excavated for installation of underground cables do not act as drainage channels conveying silted runoff towards the hydrological network.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	prevent large accumulations of water at the downslope end.			Regular reporting to developer and contractor as per each management plan.
36	Any water pumped out of excavations will be directed to the onsite settlement ponds for treatment before being discharged to the surface drainage network.	Prevent sediment arising from de-watering of excavations from being discharged into the hydrological network.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
37	Where necessary, temporary pumps and sumps may be required to maintain a dry, clean formation during installation of gravity foundations.	Prevent washout of foundation materials during construction thus avoiding/minimising potential pollution at the source.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
38	Where the appointed geotechnical engineer or engineering geologist for the works deems that there is a risk of concrete wash-	Prevent potential pollutants arising from piling of excavations from being	Mitigation measure will be implemented in full by the Project manager and	The ECoW will monitor the implementation of the mitigation measures

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	out into the environment during piling, the bored pile will be cast within a permanent casing or geotextile sock/bag to prevent the loss of concrete or drilling fluids such as bentonite and vinyl-polymer.	discharged into the hydrological network.	Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
39	Earthworks and exposed excavation surfaces will be compacted to minimise potential for washout of loose material.	Reduce potential for washout of sediment from exposed soils.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
40	Where immediate erosion prevention is required for exposed soils, hessian coverings will be installed to minimise potential for erosion.	Reduce potential for washout of sediment from exposed soils.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				as per each management plan.
41	Where existing drains will be covered with hardcore or infilled, the surface water will be diverted into new drains which will connect to the existing drainage system.	Prevent flooding and introduction of pluvial water contaminated with silt laden water from entering nearby watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
42	No excavation work will be undertaken during or immediately after heavy rainfall.	Will mitigate against erosion and the production of silt laden run-off. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
43	Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion by covering during adverse	To protect against the ingress of water or erosion and resulting silt runoff. This in turn will avoid adverse impacts on the River Boyne and River	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject	The ECoW will monitor the implementation of the mitigation measures detailed herein and in

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	weather. Where necessary sheet piling or other measures will be used to provide integrity for unstable excavations, particularly within peat, alluvial, gravel or for excavations below the water table.	Blackwater SAC and the River Boyne and River Blackwater SPA downstream	to inspection and any corrective actions required by the ECoW. High probability of success.	accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
44	Surplus soil, peat or rock excavated during the course of the works will be temporarily stored in a level area and will be re-used on site in the form of landscaping and berms (during construction). Temporary storage within the site may also be required after excavation and prior to transportation within the site. Temporary material storage areas will be covered with impermeable sheeting and surrounded with silt fencing, which will be monitored to manage any potential loss of suspended solids to surface waters. Temporary material storage areas will be a minimum of 50m from the bank edge of any watercourse.	Will reduce silt run-off reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
45	No spoil stockpiles will be left on site after construction.	Will reduce silt run-off reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
		SAC and the River Boyne and River Blackwater SPA downstream.	to inspection and any corrective actions required by the ECoW. High probability of success.	relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
46	All exposed soil within 50m of watercourses will be planted with a native grass seed and wildflower mix of native provenance to accelerate revegetation and stabilise the soil.	Accelerate revegetation of bare soil, minimising potential for washout of sediment from exposed soils, while also encouraging the growth of native species including plants of value to pollinators.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
47	No construction lighting shall be left on overnight during the construction period.	To minimise the disturbance to nocturnal species including otter.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				as per each management plan.
48	Compact surface of stored soils during works	This measure will minimise the generation of suspended solids, dust and any other contaminant mobilisation which may be transported to sensitive receptors via wind, surface water runoff or groundwater movement.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
49	Temporary silt fences will be installed around soil stockpiles, and stockpiles will be covered to prevent washout of fine sediment. A twin layer of silt fencing will be installed at all locations. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off and for repairs. A buffer zone will remain between silt trap(s) and watercourses with natural vegetation left intact so as to assist silt interception.	This measure will minimise movement of suspended solids via surface water runoff.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
50	No soil or any material containing sediment may be stored within 50m of drains.	This measure will minimise the risk of discharges of silted water from stored materials to storm and surface water drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
			High probability of success.	relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
51	Branches, logs or debris from tree felling will not be allowed to accumulate in aquatic zones and will be removed as soon as possible. Additional silt fencing will be erected along the banks of any streams at the location of proposed tree felling to provide additional protection to the watercourses.	Prevent leachate from tree felling entering nearby waterbodies. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
52	Brash mats will be topped up in sections when they become heavily used or worn. Where damage or serious rutting has started to occur, extraction will be suspended immediately. Relocation of the extraction rack or additional brash will be used to remedy the situation.	To avoid extraction racks acting as a conduit for surface water flows. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
53	A risk assessment will be prepared by the contractor prior to any wet concrete operations being carried out. All concreting works are fully detailed in the CEMP and will be minimised, particularly adjacent to the aquatic environment. Pre-cast concrete will be used whenever possible to reduce the risk to all forms of aquatic life. Concrete mixing and pours onsite will be timed to occur during periods where no rainfall (0mm/hour) would be expected. A regular review of weather forecasts is required (weather forecasts will be checked at least 24 hours in advance of works).	This measure will prevent washout of concrete into the surrounding environment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
54	Washout of concrete chutes will only take place in a designated washout area within the site compound which will be self-contained. A designated concrete wash-down area will be constructed 100m away from waterbodies (streams and drainage ditches). Every concrete truck delivering concrete to the site must use this facility prior to leaving the site. Chutes will be washed out, at a designated washout pit. A settlement lagoon will be provided to receive all runoff from the concrete wash	This measure will prevent washout of concrete into the surrounding environment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	down area (to be located no closer than 100m away from waterbodies. Details of settlement lagoons are as follows: • Topsoil and subsoil, where necessary, will be stripped out and placed adjacent to the temporary compound area; • An impermeable membrane will be installed directly onto the topsoil and or subsoil, to form the impermeable concrete wash-out settlement pond; • A designated truck wash-down concrete apron shall be constructed next to this settlement pond; • Impermeable lined drains will direct the wash-out flow to the wash-out settlement pond; and • The wash water and solids will be disposed of off-site at an appropriate licenced facility. Following construction, any solids, the liner and any remaining wash water in will be removed and disposed of/recycled appropriately and the settlement lagoon will then be reinstated.			

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
55	Refueling of plant will be carried out at the designated refueling station which will be located in the temporary site compound. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. On demand refueling of plant during construction will only be carried out by trained personnel. Any on-demand refueling of machinery/ plant outside of the designated refueling station will be carried out using a mobile double skinned fuel bowser. Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed for licensed disposal off-site.	This measure will minimise ingress of hydrocarbons into groundwater.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
56	Any diesel, fuel or hydraulic oils stored at the site compound will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.	This measure will reduce the risk of hydrocarbons reaching the groundwater within the groundwater body of the proposed remediation works.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
57	Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.	This measure will reduce the risk of hydrocarbons reaching the groundwater within the groundwater body of the proposed remediation works.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
58	Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel at the site compound. Sanitary waste will be removed by a licensed waste disposal contractor.	This measure will ensure that no sanitary waste enters the groundwater within the groundwater body of the proposed remediation works.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
59	Daily road sweeping and maintenance of roads in the vicinity of site access points will prevent soil and mud from earthworks from accumulating on the local road network.	This measure will minimise the potential for sediment to be deposited on the road network where it would constitute a source of silt ingress via roadside storm drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				as per each management plan.
60	Wheel cleaning will prevent soil from earthworks accumulating on the local road network. It will also prevent vegetative material of invasive plant species leaving site. Wash water and any material washed off will be removed to a licensed waste facility.	This measure will minimise generation of suspended solids and dust. It will also prevent the spread of invasive species.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
61	In order to remove the remote chance of the transmission of biohazards/invasive species during the construction of culverts over drainage ditches: • All previously used tools, equipment, PPE are to be visually checked for mud, plant matter, animal mater and invertebrates – if found they are to be removed prior to the construction of culverts. • All tools, equipment, PPE that have been previously used in an area of invasive species or within a waterbody are to be sanitised prior to the construction of culverts.	Prevent the introduction of invasive species/biohazards into the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
OPERATIONAL PHASE MITIGATION MEASURES				
62	Site inspections to check revegetation/soil erosion measures. Revegetation will be monitored by an ecologist in the growing season(s) following construction. If monitoring indicates the need for any remedial measures such as additional planting or additional hessian sacking erosion protection, these will be actioned in accordance with the specifications of the ecologist carrying out the inspections.	This measure will ensure that revegetation and long-term soil stabilisation are implemented successfully.	This survey will be carried out by a suitably qualified ecologist who will report their findings to the developer and if required will specify and supervise any necessary remedial measures. High probability of success.	The planning authority will seek confirmation that this mitigation measure has been completed as a condition of planning.
63	Quarterly visual inspections of outfalls/drains/rivers will be continued during the operation period until satisfactory vegetation is established on site.	Ensure that any potential sources of siltation or pollution are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
64	Substation transformers, oil storage tanks, diesel generator and any diesel or fuel oils stored at the substation will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total	Prevent fuel laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines)			Regular reporting to developer.
65	During the operational period, quarterly physico-chemical water sampling will be undertaken until full re-vegetation has occurred, unless otherwise directed by the Planning Authority or Inland Fisheries Ireland (IFI).	Ensure that any potential water quality issues arising post-construction are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
66	Biological water quality samples will be taken on a quarterly basis until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.	Ensure that any potential water quality issues arising post-construction are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
67	A petrol and oil interceptor will be installed to deal with all substation surface water drainage.	Will reduce the concentration of fuel/oil contaminated run-off. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer.
68	The conceptual drainage has been designed to operate effectively during the operation period. The stilling ponds will be a permanent feature and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.	To limit silt laden runoff from reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
69	During the operation period the swales will have vegetated and will serve to attenuate flows and remove suspended solids from run-off.	To limit soil erosion and resulting silt laden runoff from entering the Blackwater River and tributaries. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
70	During operation, wastewater generated at the substation compound will be collected in a storage tank for disposal offsite. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007, will be employed to transport wastewater away from the site. The proposed wastewater storage tank will	Prevent wastewater pollution at the proposed development and any wastewater generated during operation is stored, transported and treated in a manner which prevents negative effects on the environment.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely.			Regular reporting to developer.
DECOMMISSIONING PHASE MITIGATION MEASURES				
All construction phase mitigation will be implemented during the decommissioning phase				

4.7.2 Water Quality Monitoring Programme

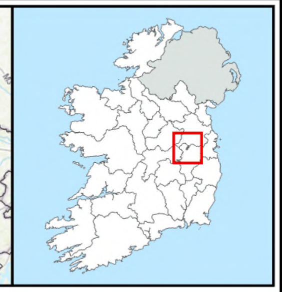
A monitoring programme will be established to ensure that the water quality is maintained and to ensure the effectiveness of designed control and other mitigation measures. The details of this programme are outlined below.

- Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering the streams and rivers of the site, to identify any obstructions to channels, and to allow for appropriate maintenance of the drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.
- Quarterly visual inspections will be continued during the operation period until satisfactory vegetation is established on site.
- Prior to construction, turbidity monitors will be put in place downstream of the site and a baseline will be formed of existing levels in the water bodies (See Figure 4-3 for more information). These levels will be used to set trigger levels for each location. Should these trigger levels be exceeded during construction, works in the area of the effected watercourse will be stopped until the source of the turbidity can be identified. Any additional mitigation will be implemented if necessary to reduce turbidity to acceptable levels.
- Chemical water quality sampling will be undertaken from a representative number of locations upstream and downstream to provide a baseline against which samples taken during the construction stage can be assessed. Trigger values will be defined based on the pre-construction monitoring results however maximum guideline values are provided in Table 4-15 below; and are based on S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988.
- Chemical water sampling will be taken from several sample sites; both up and downstream of watercourses. Water samples will be analysed according to the Salmonid Regulations via a licensed laboratory for the following parameters: pH, dissolved oxygen, suspended solids, non-ionized ammonia, total ammonia, nitrites, biochemical oxygen demand (BOD), total ammonium and total residual chlorine.
- Chemical water sampling will be taken on a weekly basis during the site clearance and earthworks stage of the construction period.
- Following site clearance and earthworks stage of the construction period, sampling will be taken on a monthly basis during the remainder of the construction period.
- During the operational period, quarterly sampling will be undertaken until full re-vegetation has occurred, unless otherwise directed by the Planning Authority or Inland Fisheries Ireland (IFI).
- Biological water sampling will be undertaken from the same representative number of locations upstream and downstream to provide a baseline against which samples taken during the construction stage can be assessed.
- Biological sampling will be undertaken via kick sampling, using Q-Value or Small Stream Risk Assessment (whichever is the most appropriate for the available habitat). Macroinvertebrates will be identified where possible on the banks of sample site.
- Biological water sampling will be carried out during the site clearance and earthworks stage of the construction period on a monthly basis during the construction phase.
- Following site clearance and earthworks stage of the construction period, samples will be taken on a quarterly basis, until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.

Table 4-15: Water Quality Monitoring Parameters – Salmonid Regulations

Parameter	Maximum Guideline Value
pH	≥6 ≤9
Dissolved Oxygen (mg/litre O2)	50% ≥ 9
Suspended Solids (mg/l)	≤25
Non-ionized Ammonia (mg/l NH3)	≤0.02
Total Ammonia (mg/l NH4)	≤1
Biochemical Oxygen Demand BOD (mg/l O2)	≤5
Nitrites (mg/l NO2)	≤0.05
Total residual Chlorine (mg/l HOC1)	≤0.005

Path: R:\Map Production\2020\P20-326\Workspaces\P20_326_Additional_Figures\P20_326_Additional_Figures.aprx



Legend

- Proposed Development Boundary
- Berms
- Access Track
- Temporary Access Track
- Blade Transfer Area
- Construction Compound
- Passing Bays
- Peat Deposition Area
- Substation
- Turbine Hardstanding
- Turbine Swept Path
- Cable Route
- Grid Connection Route
- Rivers
- Turbidity Meter Locations
- Turbines

TITLE:	Turbidity Meter Locations
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	4.3
CLIENT:	North Kildare Wind Farm Ltd.

SCALE:	1:30,000	REVISION:	0
DATE:	23/05/2025	PAGE SIZE:	A3

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4.8 Residual Effects on the Integrity of the Sites within the Potential Zone of Influence of the Proposed Development

Taking cognisance of measures incorporated into the project design and mitigation measures to avoid effects that are considered in the preceding section, the proposed development works will not adversely affect the integrity of the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA.

4.9 Conclusion

For the reasons set out in detail in this NIS, in the light of the best scientific knowledge in the field, all aspects of the proposed development which, by itself, or in combination with other plans or projects, may affect the relevant European Sites have been considered.

The NIS contains information which the competent authority, may consider in making its own complete, precise and definitive findings and conclusions and upon which it is capable of determining that all reasonable scientific doubt has been removed as to the effects of the proposed development works on the integrity of the relevant European sites.

In the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed development works will not adversely affect the integrity of any European site.

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DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

APPENDIX 1

Terrestrial Ecology Baseline

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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

DREHID WIND FARM, CO. KILDARE

Ecological Baseline

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1. HABITATS, FLORA, MAMMALS, BATS, OTHER SPECIES

1.1.1 Habitats

1.1.1.1 Wind Farm, Substation and Grid Connection

The habitats at the Proposed Wind Farm site are dominated by conifer plantation/woodland and agricultural habitats (pasture and hedgerows/treelines). Various peatland habitats and mosaics ranging from more or less intact raised bog to severely disturbed cutover bog are also present in the wider area. Bog woodland (WN7) (not Annex I habitat) which has established on former peat harvesting areas and adjacent disturbed/drained areas is common in the area.

Lowland depositing rivers are present, represented by the Fear English River and its tributaries.

It is noted that the proposed grid connection is short, with the proposed high voltage line loop-in located c. 415m north of the Proposed Substation. As such, the grid connection habitat survey study area is encapsulated within the overall habitat survey study area for the Proposed Wind Farm.

The intact raised bog south of T9/T10 corresponds with the Annex I priority habitat “active raised bog [7110], and the drained but largely intact raised bog south-east of T8 contains areas with links to the Annex I habitat "Degraded raised bogs still capable of natural regeneration [7120]". No areas of Annex I habitat are overlapped by any proposed infrastructure.

1.1.1.1.1 WD4 Conifer plantation

Conifer plantation is widespread in the northern part of the Proposed Wind Farm. There is considerable variation in the age and character of forestry blocks, ranging from recently replanted areas to mature stands. Mature blocks contain Sitka spruce *Picea sitchensis*, lodgepole pine *Pinus contorta* and occasionally eastern hemlock *Tsuga canadensis* and larch *Larix* Sp. Less mature blocks are typically dominated by Scots pine *Pinus sylvestris* and Sitka.

The ground flora of more recently re-planted blocks is characteristic of recolonisation following disturbance. Downy birch *Betula pendula* and sycamore *Acer pseudoplatanus* saplings form dense growths in some areas. Raspberry *Rubus idaeus* is also common in open areas. Soft rush *Juncus effusus* and horsetail Equisetum Sp. are present in wetter areas. Rosebay willowherb *Chamaenerion angustifolium* and bramble *Rubus fruticosus* are also present. Birch polypore *Fomitopsis betulina* was recorded growing on birch in replanted conifer plantation

One block with wetter ground conditions north-east of T9 recently replanted with Scots pine contained hare's tail cottongrass *Eriophorum vaginatum*, red bogmoss *Sphagnum capillifolium*, purple moor-grass *Molinia caerulea,* heath plait moss *Hypnum jutlandicum,* common haircap moss *Polytrichum commune,* ling heather *Calluna vulgaris* and cross-leaved heath *Erica tetralix*, in addition to oak *Quercus* Sp. seedlings and raspberry.

Blunt-leaved bogmoss *Sphagnum palustre* was recorded in wet mature conifer plantation east of T9. Tamarisk moss *Thuidium tamariscinum* was also recorded in mature plantations, and immature downy birch *Betula pendula* and ling are present in some clearings within mature conifer plantation.

The Schedule III invasive species *Rhododendron ponticum* was recorded in conifer plantation c. 170m north-east of T9. Another non-native species, Lawson cypress *Chamaecyparis lawsoniana* was observed invading a block of conifer plantation c. 320m west of T11.

Conifer plantation is assessed as **Local Importance Lower Value**.

It is overlapped by proposed internal access tracks, hard standings, wind turbines, the onsite substation and T6, T7, T9, T10 and T11 bat felling buffers.

Sections of conifer plantation comprised of mature lodgepole pine and recently replanted Scots pine are encompassed by the Dunfierth Coillte Biodiversity area.

Plate 1-1: WD4 Conifer plantation

1.1.1.1.2 WD2 Mixed broadleaved/conifer woodland

Mixed stands of broadleaved/conifer woodland are also present at the Proposed Wind Farm. Tree species present in this habitat include Sitka spruce, eastern hemlock, lodgepole pile, larch, downy birch, grey willow, holly *Ilex aquifolium*, rowan *Sorbus aucuparia*, beech *Fagus sylvatica*, sycamore and hazel *Corylus avellana*. Other flora present include broad buckler-fern *Dryopteris dilitata*, honeysuckle *Lonicera periclymenum*, bilberry *Vaccinium myrtillus*, bramble, tamarisk moss *Thuidium tamariscinum*, big shaggy-moss *Rhytidiadelphus triquetrus*. Reindeer lichen *Cladonia rangiferina* and red bogmoss were recorded in a clearing in one location.

A growth of the Schedule III invasive species *Rhodoendron ponticum* c. 2x3m in extent was recorded in this habitat at one location c. 15m east of the T8 hard standing.

This woodland type is likely to have originated from a mix of intentional planting and establishment of native broadleaved species in unmanaged conifer blocks and gaps between replanted conifer blocks.

This habitat type is **Local Importance Higher value**.

It is overlapped by proposed internal access tracks, hard standings, wind turbines, the onsite substation and T7, T8, and T11 bat felling buffers.

A section of mixed conifer/broadleaved woodland is encompassed by the Dunfierth Coillte Biodiversity area. This area is overlapped by a section of proposed access track felling buffer.

Plate 1-2: WD2 Mixed broadleaved/conifer woodland

1.1.1.1.3 WD3 (Mixed) Conifer woodland

Areas dominated by self-seeded conifer stands and dense conifer woodland lacking drains and linear patterns associated with conifer plantation present at the Proposed Wind Farm fit within this category, which is distinct form WD4 Conifer plantation.

Tree species present include Sitka spruce and lodgepole pine. Ling heather is present in clearings and parts where the canopy is thinner, indicating the establishment of conifer woodland on peatland.

This habitat type is **Local Importance Higher value**.

It is overlapped by a section of proposed internal access track.

This habitat is overlapped by the Kilmurry Coillte Biodiversity area.

Plate 1-3: WD3 (Mixed) Conifer woodland

1.1.1.1.4 WS2 Immature woodland

Areas in the northern part of the Proposed Wind Farm which previously supported conifer plantation (during 2018 EIAER surveys) have since been felled and replanted with broadleaved species including pedunculate oak *Quercus robur*, rowan and hazel (current trees are c. 3 years old). Older self-seeded ash *Fraxinus excelsior* downy birch trees are also present in some areas. Other species present include bramble, rosebay willowherb, soft rush, raspberry, tufted hairgrass *Deschampsia cespitosa*, herb-Robert *Geranium robertianum*, Yorkshire fog *Holcus lanatus* and meadowsweet *Filipendula ulmaria*. Common reed *Phragmities australis* is present in some waterlogged areas. Stagshorn fungus *Calocera viscosa* was recorded in one area with desiccated peaty soil.

The diamond shaped polygon traversed by existing and proposed north-western access tracks is depicted as woodland in 1st edition OS mapping (1829-1842). As noted above however, prior to being replanted recently with oak, it supported conifer plantation. As such, while it has been wooded for a long period, it has also been subjected to intensive management and periodically undergone drastic changes during this period.

This habitat type is **Local Importance Higher value**.

It is overlapped by a section of proposed internal access track.

Plate 1-4: WS2 Immature woodland

1.1.1.1.5 WN7 Bog woodland

Bog woodland dominated by downy birch is distributed across the Proposed Wind Farm. Other tree species including grey willow, holly, pedunculate oak and hazel were present in isolated pockets. Scots pine and eastern hemlock were also recorded within this habitat. The field and shrub layers are typically species-poor with bramble and ivy dominating. Bracken *Pteridium aquilinum* is also present in clearings and marginal areas. Tamarisk moss and Glittering Wood-moss *Hylocomium splendens* were also recorded.

The bog woodland recorded in the area of the Proposed Wind Farm has all established on former peat cutting areas and drained peatland, and excepting downy birch and grey willow, there are no other species in the bog woodland onsite which are listed as typical bog woodland species in relevant guidance (NPWS, 2019). Typical moss species associated with the Annex I habitat such as *Hylocomium splendens, Aulacomnium palustre* and *Sphagnum* species are absent. As such it is not representative of the Annex I habitat *Bog Woodland* [91D0]* which occurs on intact bogs. These findings concur with previous assessments including the 2019 FI response.

This habitat type is **Local Importance Higher value**.

It is overlapped by proposed internal access tracks, hard standings, turbine T8 and T7, T8, and T11 bat felling buffers.

A small area of this habitat is overlapped by the Kilmurry Coillte Biodiversity area.

Plate 1-5: WN7 Bog woodland

1.1.1.1.6 WN7/WS1 Bog woodland/Scrub Mosaic

Bog woodland also occurs as a mosaic with scrub. This mosaic is similar to the bog woodland described above, but is lower-growing and is interspersed with numerous clearings and scrub-type vegetation. Bramble and bracken are the dominant species in clearings and areas with lower/open canopy.

This habitat type is **Local Importance Higher value**.

It is overlapped by a section of proposed internal access track.

Plate 1-6: WN7/WS1 Bog woodland/Scrub Mosaic

1.1.1.1.7 WD4/WN7 Conifer plantation/Bog woodland Mosaic

This habitat mosaic occurs where conifer plantations is interspersed with birch woodland thickets which have colonised gaps and outcompeted conifers. Downy birch, Sitka spruce and Scots pine are the dominant tree species. Lodgepole is also present. Bracken, bramble and ivy were also recorded.

This habitat type is **Local Importance Higher value**.

It occurs adjacent to a section of existing forestry access track between T9 and T11 and is overlapped by the access track felling buffer.

Plate 1-7: WD4/WN7 Conifer plantation/Bog woodland Mosaic

1.1.1.1.8 WD1 Mixed broadleaved woodland

Mixed broadleaved woodland occurs in a number of areas.

An area of mature woodland in the northern part of the Proposed Wind Farm (abutting the eastern flank of the proposed substation footprint) is dominated by mature pedunculate oaks. Mature beech and birch trees area also present. Oak saplings, dense thickets of birch saplings and brambles are present in the shrub layer. This area is depicted as woodland in 1st edition OS mapping (1829-1842).

A number of elongated linear areas of mixed broadleaved woodland in the northern part of the Proposed Wind Farm are influenced by planting, with a high proportion of mature beech present. Other tree species recorded include ash, alder *Alnus glutinosa*, downy birch, eastern hemlock and Scots pine. Ivy, bramble and honeysuckle were also recorded in these areas. The linear area of broadleaved woodland extending to the east (towards the L5013) of the northern part of the Proposed Wind Farm is depicted as woodland in 2nd edition OS mapping (1898-1902). The linear section of broadleaved woodland extending to the north-west of the Proposed Wind Farm (existing Coillte access) is also depicted as woodland in 1st edition OS mapping. Neither of these linear blocks are overlapped by the Proposed Wind Farm.

This habitat occurs in a more semi-natural state in the central section of the Proposed Wind Farm. In this area, a former agricultural field adjacent to the bog has been recolonised by woodland and scrub, with grey willow being the dominant species. Hawthorn *Crataegus monogyna* is common, and beech saplings are common in parts. Elder *Sambucus nigra*, meadowsweet, bramble, wavy hairgrass *Deschampsia flexuosa* and fox-tail feather moss *Thamnobryum alopecurum* are also present. Elf-cup fungus *Sarcoscypha coccinea* and honey fungus *Armillaria mellea* were also recorded in this area. This stand of woodland is not overlapped by any proposed infrastructure.

Semi-mature oak plantation is present along the access proposed access route into the northern section of the site. This is dominated by 5-6m tall pedunculate oak trees, with rows of downy birch running through the blocks of oak. Occasional hazel trees are present, and ash saplings are abundant in some areas of the woodland floor. Ivy, nettle *Urtica dioica*, greater stitchwort *Stellaria holostea* common hogweed *Heracleum sphondylium*, wood avens *Geum urbanum*, hart's tongue fern *Asplenium scolopendrium*, swan's-neck thyme-moss *Mnium hornum* and fox-tail feather-moss *Thamnobryum alopecurum* are present in the field and ground layers. Hedgerows from remnant field boundaries comprised of elder, hawthorn, alder, grey willow and wild plum *Prunus domestica* have been subsumed by the plantation woodland. The proposed northern site access road traverses this habitat, making use of grassy/scrubby marginal areas but marginal sections of this woodland are overlapped by the proposed road footprint.

This habitat type is **local importance higher value**.

Plate 1-8: WD1 Mixed broadleaved woodland

1.1.1.1.9 WD1/WD4 Mixed broadleaved woodland/Conifer plantation Mosaic

In this habitat mosaic, remnants of mature woodland are interspersed with areas of semi-mature Scots pine.

This block is comprised of scattered mature oak, beech and eastern hemlock, with 5-10 year old Scots pine planted in open areas and underplanted around the older trees. Dense bramble, raspberry, and hedge bindweed *Calystegia sepium* are present in the shrub layer. This area is connected to the area of mixed broadleaved woodland described above and forms part of the same area depicted as woodland in 1st edition OS mapping (1829-1842).

It is likely that mature trees which have fallen or blown over have been replaced by conifer planting after gaps opened up.

This habitat type is **Local Importance Higher value.**

This habitat mosaic is not overlapped by any proposed infrastructure.

Plate 1-9: WD1/WD4 Mixed broadleaved woodland/Conifer plantation Mosaic

1.1.1.1.10 WS1/GS2 Scrub/Dry meadows and grassy verges Mosaic

A ringfort in the agricultural field north of T5 supports this habitat mosaic. Scrub around the margins is formed by hawthorn, blackthorn *Prunus spinosa*, bramble, elder, ivy and field rose *Rosa arvensis*. The grassy element is formed by cocksfoot *Dactylis glomerata*, bent-grass *Agrostis* Sp., yarrow *Achillea millefolium*, red clover *Trifolium pratense*, common knapweed *Centaurea nigra* and ribwort plantain *Plantago lanceolata*.

This habitat is also present along the margins of the oak plantations and conifer plantations along the proposed northern access track route. Grey willow, bramble, Yorkshire fog and cocksfoot are present throughout this Mosaic. Devil's bit scabious was also recorded in one location c. 50m south of the proposed northern access track.

This mosaic is **Local Importance Higher Value**.

It is overlapped by the proposed northern entrance access track.

Plate 1-10: WS1/GS2 Scrub/Dry meadows and grassy verges Mosaic

1.1.1.1.11 GA1 Improved agricultural grassland

Improved agricultural grassland is present across large areas of the southern part of the Proposed Wind Farm. The dominant species is perennial ryegrass *Lolium perenne*. Yorkshire fog is also present in some areas. Meadow buttercup *Ranunculus acris*, sorrel *Rumex acetosa*, dandelion *Taraxacum officinalis* Agg. and white clover *Trifolium repens* are also present. The stubble rosegill mushroom *Volvopluteus gloiocephalus* was recorded in one location.

Soils in some areas are prone to waterlogging, and peaty soil is prevalent closer to the bog.

This intensively managed habitat type is **Local Importance Lower Value**.

It is overlapped by proposed internal access tracks, construction access tracks, hard standings, wind turbines, and the temporary site compound.

Plate 1-11: GA1 Improved agricultural grassland

1.1.1.1.12 GA2 Amenity grassland

Small areas of amenity grassland were recorded in the north of the site. These are not subject to grazing by livestock but are mown. The dominant grass species were grasses such as annual meadow-grass *Poa annua*, and Yorkshire fog *Holcus lanatus*. Perennial rye-grass *Lolium perenne* was recorded in this habitat but is not abundant. Broadleaved herbs such as dandelion *Taraxacum* spp., *white clover* Trifolium repens, red clover *Trifolium pratense*, daisy *Bellis perennis*, common mouse-ear *Cerastium fontanum*, and self-heal *Prunella vulgaris* were also recorded.

This intensively managed habitat type is **Local Importance Lower Value**.

This habitat is not overlapped by any proposed infrastructure.

Plate 1-12: GA2 Amenity grassland

1.1.1.1.13 GA1/GS2 Improved agricultural grassland/ Dry meadows and grassy verges Mosaic

A field with muddy/peaty soil adjacent to Timahoe North Bog is used for horse grazing. There is some evidence of agricultural management intervention due to the presence of perennial ryegrass. Cocksfoot is also present. A number of forbs including ruderal species are present: Broadleaved dock *Rumex obtusifolius*, yarrow, greater plantain *Plantago major*, ribwort plantain, knapweed, field thistle *Cirsium arvense*, redshank *Persicaria maculosa*, ragwort *Jacobaea vulgaris*, meadowsweet, silverweed *Potentilla anserina*, white clover, creeping buttercup and knotgrass *Polygonum aviculare*.

This mosaic is **Local Importance Higher Value**.

It is not overlapped by any proposed infrastructure.

Plate 1-13: GA1/GS2 Improved agricultural grassland/ Dry meadows and grassy verges Mosaic

1.1.1.1.14 GA1 /GS4 Improved agricultural grassland/Wet grassland Mosaic

A field adjacent to the bog supports this habitat type. Grass species include perennial ryegrass, cocksfoot and Yorkshire fog. Soft rush, broadleaved dock, purple loosestrife *Lythrum salicaria* and marsh thistle *Cirsium palustre* are also present.

This habitat type is **Local Importance Higher value**.

It is not overlapped by any proposed infrastructure.

[Photo not available.]

1.1.1.1.15 HD1 Dense bracken

Dense bracken in present in a number of areas, typically associated with marginal cutover bog habitats and field boundaries.

This mosaic is local **importance lower value**.

It is not overlapped by any proposed infrastructure.

[Photo not available.]

1.1.1.1.16 WS1/HD1 Scrub/Dense bracken Mosaic

This mosaic is present in the transitional zone between woodland/scrub and adjacent peatland habitats. Species include bracken, grey willow, buckthorn *Rhamnus cathartica*, wavy hairgrass and glaucus sedge *Carex flacca*.

This habitat type is **Local Importance Higher value**.

It is not overlapped by any proposed infrastructure.

Plate 1-14: WS1/HD1 Scrub/Dense bracken Mosaic

1.1.1.1.17 GS2/GS3 Dry meadows and grassy verges/Dry-humid acid grassland Mosaic

This mosaic is present in an area bordering a former peat harvesting area on the northern edge of Timahoe North Bog. Grass species include purple moor-grass, cocksfoot and Yorkshire fog. Other species include devil's bit scabious *Succisa pratensis*, knapweed, nettle, bracken, gorse, downy birch and heath plait moss.

This mosaic is atypical, containing elements of both GS2 and GS3 and results from disturbance caused by drainage and peat cutting. Devil's bit scabious is abundant in this mosaic, and this in conjunction with physical characteristics make this a habitat of high suitability for marsh fritillary butterfly breeding.

This mosaic is **Local Importance Higher value**.

It is not overlapped by any proposed infrastructure.

Plate 1-15: GS2/GS3 Dry meadows and grassy verges/Dry-humid acid grassland Mosaic

1.1.1.1.18 GS2 Dry meadows and grassy verges

This habitat is present in a small field at the proposed northern site entrance. It is dominated by cocksfoot, and nettles are abundant in patches. Yorkshire fog, creeping bent-grass *Agrostis stolonifera*, Timothy grass *Phleum pratense,* bramble, common field-speedwell *Veronica persica*, creeping buttercup, meadow buttercup, marsh woundwort *Stachys palustris*, hard rush *Juncus inflexus*, spear thistle *Cirsium vulgare*, and rosebay willowherb *Chamaenerion angustifolium*.

This mosaic is **Local Importance Higher value**.

It is overlapped by the proposed northern entrance access track.

Plate 1-16: GS2 Dry meadows and grassy verges

1.1.1.1.19 PB1 Raised bog

This habitat is present adjacent to the Proposed Wind Farm in a number of different conditions.

Intact Raised Bog

The most intact and highest-quality example of this habitat is present to the south and south-west of T9 and T10. This area is known as Mulgeeth Bog, and would historically have formed part of the northern tip of the much larger Timahoe North Bog. While some drains are present in the southern part and marginal areas of this peat mass, the drains are well-vegetated and as such their effectiveness is reduced. Industrial peat cutting previously occurred in the main part of Timahoe North Bog to the south. Another adjacent section of Timahoe North Bog to the west and south-west was drained but not harvested. It is likely that this area of bog has become progressively wetter since cessation of peat harvesting in Timahoe North Bog and also due to the marginal drains not being maintained (these drains are visible in a more open state in 1996 orthophotography but more recent imagery and field observation show they are being reclaimed by peatland vegetation).

Ling heather is the dominant species in this area; common cottongrass *Eriophorum angustifolium* and hare's tail cottongrass are common. Other species include bog asphodel *Narthecium ossifragum*, bell heather *Erica cinerea*, bog rosemary *Andromeda polifolia*, cranberry *Vaccinium oxycoccos* and white-beaked sedge *Rhynchospora alba*. The latter was noted to be abundant in a shallow marginal drain recolonised by vegetation, and was also recorded growing in patches on the bog in association with Sphagnum mosses and areas of low open vegetation. Round-leaved sundew *Drosera rotundifolia* was also noted in one location. Sphagnum species present include *Sphagnum cuspidatum*, *S.papillosum, S.magellanicum, S.capillifolium* and *S. subnitens*. Sphagnum cover is high in parts, but not uniformly high across the entire habitat area.

Reindeer lichen was common, and devil's matchsticks lichen *Cladonia floerkeana*, a species which is indicative of disturbance was found in one location. The north-eastern side of the bog is being invaded by lodgepole pine spreading from the adjacent forestry plantation. This negatively impacts the overall conservation condition of the bog.

Due to the high degree of wetness, typical species, large extent, high sphagnum cover in parts, low number and ineffectiveness of drains, this area is classified as active raised bog and as such corresponds to the Annex I priority habitat “active raised bog [7110]”. This finding reconfirms the assessment of this area detailed in previous reports and with in the 2019 FI response.

The edges of this habitat are clearly delineated by the abutting conifer plantations and drains running along it's north-western and north-eastern boundaries. These were mapped using up-to date aerial imagery and portable GIS technology confirmed by onsite observations.

Due to links with priority Annex I habitat, this area is of **International importance**. It is not overlapped by any proposed infrastructure but is in close proximity to T9 (27m), T10 (31m) and a short section of access road passes within 4m of this habitat. The main hard stand for T10 is located 9m form this habitat. A minor peripheral pad of the T10 hard standing measuring 15m x 5m is also located 3m from this habitat. The remainder (and majority) of the access track and hard standing areas located near this habitat range from 9m to 40m from this habitat.

This area is overlapped by the Dunfierth Coillte Biodiversity area.

<u>Note on *Rhynchospora alba* and 'Depressions on peat substrates of the *Ryhnchosporion* [7150]</u>

Patches of *Rhynchospora alba* were recorded throughout this area of bog during current surveys. However, these areas do not correspond to the Annex I habitat 'Depressions on peat substrates of the *Ryhnchosporion* [7150]' due to a lack of other typical/indicator species required to form the Annex I vegetation community, in addition to the absence of characteristic conditions. The only other indicator plants recorded in association with *Rhynchospora alba* were limited to *Sphagnnum* mosses, and as such there were no well-developed examples of this community. It is noted that the list of typical species for this habitat in raised bog was updated in 2019 (NPWS, 2019) and no longer includes *Drosera rotundifolia*.

Article 17 Reporting (NPWS, 2019) notes that 'In raised bogs, *Rhynchospora* vegetation communities are considered to qualify as the Annex I habitat when they occur in their most developed form in the wettest sections of active raised bogs, corresponding with pools, Sphagnum lawns and hollows', and also notes 'Only when the Rhynchospora species are associated with plant communities of the most sensitive and undisturbed parts of blanket bog and associated wetland habitats are they considered to correspond with the Annex I habitat'. Considering the absence of typical species other than *Sphagnum*, occurrence in areas which are not wetter than other parts of the bog, and occurrence in disturbed areas (drains), it can be concluded that the areas of *Rhynchospora alba* vegetation in the intact raised bog are not representative of the Annex I habitat 'Depressions on peat substrates of the *Ryhnchosporion* [7150]'.

These observations and findings align with the assessment contained in the 2019 FI response, and current surveys have confirmed that conditions in this habitat remain unchanged. The absence of any proposed infrastructure in this habitat also remains unchanged.

Plate 1-17: Intact Raised Bog (Mulgeeth Bog)

Intact Raised Bog - Drained

An area of raised bog dissected by small drains and also containing several larger arterial drains is present to the west and south-west of the more intact bog described above. This bog is still largely intact and retains natural characteristics despite drainage.

Vegetation is dominated by taller-growing ling closer to large drains. In wetter areas further from the large drains, more open vegetation dominated by hare's tail cottongrass and lower-growing heather. Bog asphodel, common cottongrass, bell heather, round-leaved sundew and bog rosemary area also present. White-beaked sedge is abundant in open waterlogged areas. *S. capillifolium* is present, and *S. cuspidatum* is present in wet depressions. Sphagnum cover is moderate to high but sporadically distributed. Reindeer lichen is common.

The vegetation is lower-growing than the more intact bog and microtopography is less pronounced but there is still a mosaic of heather-dominated vegetation and open pools/sedge/sphagnum-dominated vegetation. Areas closer to the margins where cut banks are present are drier and eroded.

Due to the wet conditions, semi-natural vegetation characteristics and potential for expansion of Sphagnum cover, this section of the bog contains areas with links to the Annex I habitat "Degraded raised bogs still capable of natural regeneration [7120]".

Due to potential links with Annex I habitat and potential for regeneration, this area is of **National Importance**.

It is not overlapped by any proposed infrastructure. A section of access track traversing the adjacent conifer woodland runs parallel to this area, set back c. 40m from the bog. Turbine T8 is located c. 80m from this area of bog. A marginal area of this habitat is overlapped by the Proposed Wind Farm boundary south of T8. Further areas of this habitat (located south-east of the T8-T9 access track) are overlapped by the optioned lands boundary.

A marginal part of this area is overlapped by the Kilmury Coillte Biodiversity area.

Note on *Rhynchospora alba* vegetation

Similarly to the more intact raised bog described above, patches of *Rhynchospora alba* were recorded throughout this area of bog during current surveys. Similarly to the above, these do not correspond to Annex I habitat due to absence of the majority of indicator species, absence of well-developed vegetation communities, and occurrence in areas subject to historical disturbance.

As noted above, these areas are not within the footprint of any proposed infrastructure.

Plate 1-18: Intact (Drained) Raised Bog

Intact Bog Margin Remnant

A marginal area of Timahoe North Bog which was never harvested is present near the southern part of the Proposed Wind Farm. This habitat area is formed by mound of peat which rises above the adjacent agricultural land and cutover bog.

It is connected to and forms part of a grazed area comprised primarily of an adjacent field of GA1/GS2 grassland (used for horse grazing). Species present include Yorkshire fog, ling heather, creeping buttercup, mouse ear *Cerastium fontanum*, European gorse, bracken, heath-plait moss, red-stemmed feather moss *Pleurozium scherberei*, reindeer lichen and sphagnum mosses *S. capillifolium* and *S. subnitens* in waterlogged areas on top of the mound.

This area is mapped as bog in 1st edition ordnance survey mapping.

While it is an intact part of the original bog extent, it's limited size and disturbance of adjacent peatland means it is of **County Importance**.

It is not overlapped by any proposed infrastructure and is located outside the Proposed Wind Farm and optioned lands boundaries.

Plate 1-19: Intact Bog Margin Remnant

1.1.1.1.20 HH3 Wet heath

Areas of recolonising cutover bog to the east/south-east of T8 are representative of this habitat. The area is within a strip of cutaway bog surrounded by raised bog, bog woodland and conifer woodland.

Purple moor-grass is the dominant species; hare's-tail cottongrass, Yorkshire fog, lesser spearwort *Ranunculus flammula*, *Sphagnum papillosum*, and heath plait-moss are also present.

Due to it's potential to continue regenerating and contribute to suitable conditions for regeneration of surrounding raised bog areas, this habitat is of **Local Importance Higher value**.

This habitat, forming part of the habitat complex referred to as the 'Bog Pool Area' is an atypical example which represents an early successional stage in the recolonisation of previously bare cutover peat. The process of regeneration has begun and there is potential for this habitat to succeed to fen and eventually raised bog over very large timescales; however, this habitat is not representative of degraded raised bog capable of natural regeneration, as detailed in the he FI response submitted in 2019 clarifying the absence of links with Annex I habitat for this habitat type which noted the following:

" *This Annex I habitat* [Degraded raised bogs still capable of natural regeneration 7120] *contains species typical of active raised bogs with a higher prevalence of Trichophorum cespitosum and Narthecium ossifragum. Neither of these species were recorded at the bog pool area. The absence of typical raised bog species such as Calluna vulgaris, Erica tetralix, Drosera rotundifolia, Rhynchospora alba, lichen spp. and the presence of just one sphagnum species demonstrates that this habitat does not correspond with the aforementioned Annex I habitat. None of the species recorded during the relevés are present on the species list for this Annex I habitat, as outlined in the 'Interpretation Manual of European Union Habitats' (EC, 2013). Only two species recorded during the relevés are listed on the 28- species long list for this Annex I habitat as outlined in "The Status of EU Protected Habitats and Species in Ireland' (NPWS, 2019)*.

Furthermore, it is stated that in the Irish context this Annex I habitat does not include secondary degraded raised bog which relates to, among others, cutover bog. As the bog pool area is part of the adjacent cutover bog, this habitat does not correspond with the Annex 1 habitat."

This habitat is not overlapped by any proposed infrastructure. It is located c. 24m from T8 and c. 10m from the T8 hard standing footprint.

Plate 1-20: HH3 Wet heath

1.1.1.1.21 FL1 Dystrophic lake

A flooded cutaway area located near the central section of the Proposed Wind Farm which is in the process of infilling with vegetation corresponds to this habitat. The area is within a strip of cutaway bog surrounded by wet heath, raised bog, bog woodland, scrub and conifer woodland. This habitat forms part of the habitat complex referred to as the 'Bog Pool Area'.

Species in wetter parts include bulrush bulbous rush *Juncus bulbosus*, Bulrush *Typha latifolia*, marsh pennywort *Hydrocotyle vulgaris* and branched bur-reed *Sparganium erectum* (the latter two of which are indicative of elevated nutrient levels). Around the edge of the waterbody, purple moor-grass, soft rush and Sphagnum mosses are present. Large parts of this area contain *Sphagnum cuspidatum* and it is likely the entire waterbody will eventually be infilled due to colonisation by vegetation and return to peat forming conditions.

Branched bur-reed and bulrush are indicative of nutrient-rich water; bulrush and marsh pennywort are associated with rich fen. Marsh pennywort can also occur in bogs however, and as such is less strongly associated with rich fen. These species are in contrast with Soft rush and *S.cuspidatum* which are associated with acidic conditions.

The history of disturbance in this area contributes to this atypical plant assemblage; however, due to it's situation and the abundance of *S.cuspidatum* it is assessed to be an atypical example of a dystrophic lake. It is assessed that this habitat will succeed to fen, and potentially then succeed to raised bog over a very long time-scale.

Due to it's potential to regenerate and contribute to suitable conditions for regeneration of surrounding raised bog areas, this habitat is of **Local Importance Higher value**.

The FI response submitted in 2019 clarified the absence of links with Annex I habitat for this habitat type. The FI response noted the following:

"*As part of the habitat mapping for the EIAR the bog pool area was given the reference code FL1 (as per Fossitt, 20007) which corresponds to Dystrophic lakes. The bog pool habitat however does not correspond to the Annex I habitat of the same name. The Annex I habitat typically contains, inter alia, Utricularia spp., Rhynchospora alba, R. fusca and Hydrophorus spp. None of these species were recorded at the bog pool area. One sphagnum species was present, Sphagnum papillosum, however this species is not listed as typical for the Annex I habitat. The relevés recorded zero species listed as typical for the Annex I habitat and the previous EIAR surveys recorded just one - Juncus bulbosus. Therefore, given the species composition of the bog pool area, it can be concluded that bog pool area does not correspond with any Annex I habitat type*."

This habitat is not overlapped by any proposed infrastructure. It is located c. 20m from T8 and c. 5m from the T8 hard standing footprint.

Plate 1-21: FL1 Dystrophic lakes

1.1.1.1.22 WS1/PB1 Scrub/Raised bog Mosaic

An area of disturbed raised bog in the central part of the Proposed Wind Farm is bordered by raised bog and wet heath and Dystrophic lake to the south-east and by conifer woodland to the north-west.

There is an abundance of small to medium sized Sitka spruce and lodgepole pine invading this area. Ling is dominant in the shrub layer. Heath-plait moss is the dominant moss species. Reindeer lichen is also present. *S.capillifolium* hummocks are present in some areas but sphagnum cover is low overall.

The abundance of invading conifers, dominance of heath-plait moss over sphagnum and high, leggy growth habit of ling are indicative of desiccation caused by peat harvesting and drainage in adjacent areas.

Due to desiccation, disturbance and colonisation by non-native trees, this habitat type is **Local Importance Higher value**.

It is located c. 18m from the proposed T8 location, and c. 4m from the proposed T8 hard standing footprint. It is overlapped by the T8 bat felling buffer.

Plate 1-22: WS1/PB1 Scrub/Raised bog Mosaic

1.1.1.1.23 WD3/PB1 Conifer woodland/Raised bog Mosaic

This habitat mosaic is present to the west of the proposed access road leading south to T8. It is characterised by scattered lodgepole pine trees, with occasional downy birch interspersed with open spaces dominated by a dense growth of ling heather.

It originates from colonisation of an area of drained but intact raised bog by lodgepole pine, in addition to profuse ling growth typical of drained raised bog.

This mosaic is **Local Importance Higher value**.

It is not overlapped by any proposed infrastructure.

This area is overlapped by the Kilmurry Coillte Biodiversity area. It is broadly characteristic of the identified Coillte management goal for this area, namely creation of open woodland on the drained raised bog.

Plate 1-23: WD3/PB1 Conifer woodland/Raised bog Mosaic

1.1.1.1.24 WL1 Hedgerows

Hedgerows are present in the north and south of the Proposed Wind Farm.

Hedgerow comprised of hawthorn, hazel, ivy and grey willow is present along the existing northern Coillte access track. A section of hedgerow in this area is also comprised of invasive cherry laurel *Prunus laurocerasus*. A self-seeded hedgerow comprised of downy birch is present in the south of the site. Hawthorn is the most frequent component of hedgerows across the site.

This habitat is **Local Importance Higher value**.

Hedgerows are overlapped or intersected by proposed internal access tracks, construction access roads, T1 hard standing and grid connection. They are also present along the existing local road forming part of the proposed construction traffic access connection between the northern and southern sections of the Proposed Wind Farm.

Plate 1-24: WL1 Hedgerows

1.1.1.1.25 WL2 Treelines

A treeline comprised of mature pedunculate oak left standing after surrounding conifer plantation was felled is present near T11.

An ash and hawthorn treeline is present between the immature oak plantation and conifer plantation traversed by the proposed northern site access road.

A mature ash treeline is present along and both sides of an existing farm access track to the north of T2. Other species include field rose, guelder rose *Viburnum opulus*, hawthorn hazel, grey willow, whych elm *Ulmus glabra*, wild privet *Ligustrum vulgare* and wild plum.

This habitat is **Local Importance Higher value**.

The oak treeline is entirely within the T11 bat felling buffer, and another section of treeline in agricultural land is within the T1 felling buffer. The northern site access road intersects a treeline separating immature oak plantation and conifer woodland.

Plate 1-25: WL2 Treelines

1.1.1.1.26 WL1/WL2 Hedgerows/Treelines Mosaic

The majority of field boundaries are comprised of hedgerow/treeline mosaic. The dominant species is typically ash, with mature beech trees also present in some sections. These larger trees are interspersed with or alternate with sections of lower-growing trees including wild plum, hawthorn and holly, while other species including bramble, guelder rose and field rose form an understory thicket.

This habitat is **Local Importance Higher value**.

This mosaic is overlapped or intersected by proposed internal access tracks and T4/T5 hard standings. It is overlapped by the T4 and T5 bat felling buffers. This mosaic is also present along the existing local road forming part of the proposed construction traffic access connection between the northern and southern sections of the Proposed Wind Farm.

Plate 1-26: WL1/WL2 Hedgerows/Treelines Mosaic

1.1.1.1.27 FW2 Depositing/lowland rivers

This habitat is present in the southern part of the Proposed Wind Farm, where the Fear English River flows through agricultural land in the vicinity of T1-T3, and along the interface between agricultural land and woodland near T4 and T5. It is joined by tributaries to the south-east and north-west of T4/T5. The banks of these rivers are steep, sparsely vegetated banks, and many sections of the river are similar to agricultural drains due to historical canalisation.

The riverbed is heavily silted. Wet width averages c. 1-2 m, while depth ranges from c. 20-40cm.

These watercourses are bounded by hedgerows and woodland, with numerous livestock access points in agricultural areas.

Due to it's high connectivity/corridor value, this habitat is rated as **Local Importance Higher value**.

This habitat is intersected at three separate points by proposed internal access track crossings. Proposed Wind Farm infrastructure is located in catchment.

Plate 1-27: FW2 Depositing/lowland rivers

1.1.1.1.28 FW4 Drainage ditches

Numerous drains are present at the site, ranging from small forestry and bog drains to large drains associated with former peat harvesting areas and agricultural lands.

Floating sweetgrass *Glyceria fluitans* and duckweed *Lemna* Sp. were noted in one large bog drain. Colonisation of smaller bog drains by sphagnum was also noted in some locations. Historical fly tipping was also noted in one drain.

This habitat is **Local Importance Higher value**.

Drainage ditches are intersected by proposed access roads, and overlapped by the T5 hard standing and T4/T5 bat felling buffers.

Plate 1-28: FW4 Drainage ditches

1.1.1.2 Annex 1 Appraisal

As noted above, the intact raised bog south of T9/T10 (Mulgeeth Bog) corresponds to the Annex I priority habitat “active raised bog [7110]”, due to the high degree of wetness, typical species, large extent, high sphagnum cover in parts, low number and ineffectiveness of drains, this area is classified as active raised bog and as such corresponds to the Annex I priority habitat “active raised bog [7110]”. The drained intact raised bog described above is in less favourable condition but still retains a high degree of naturalness and as such has links with the Annex I habitat "Degraded raised bogs still capable of natural regeneration [7120]". This habitat is not representative of the Annex I habitat "Depressions on peat substrates of the Rhynchosporion [7150]".

A previous Annex I assessment of the raised bog south of the proposed location of turbine T9 and turbine T10 was carried out on 22/08/2014. Two relevés were undertaken to record in detail flora species and respective cover of each present. In summary this assessment found that the high bog present at the location is a remnant of a more extensive degraded/cutover raised bog which still has active raised bog (sphagnum cover >50%). The edge of the high bog is not defined by a face bank and the high bog surface has no drains; therefore, it corresponds to the Annex I priority habitat “active raised bog [7110]”. This habitat, located outside the Proposed Wind Farm boundary, is of high conservation value. The results of current surveys remain consistent with this assessment.

1.1.1.3 Turbine Delivery Route

The habitats along the TDR are Buildings and Artificial Surfaces (BL3) (roads), Amenity grassland GA2, Spoil and bare ground/Ornamental-non-native shrub Mosaic ED2/WS3, Scrub WS1, Hedgerows WL1, Treelines WL2, Hedgerow/Treeline Mosaic WL1/WL2 and Dry meadows and grassy verges (GS2).

The TDR 'points of interest' (POIs) are locations where interventions are required to accommodate the passage of turbine components. With regard to potential ecological impacts, interventions such as tree canopy trimming, tree removal, vegetation trimming and installation of load bearing surfaces on unpaved areas are the key activities of interest. The POIs are listed below along with a summary of habitats and proposed activities at each POI.

Table 1-1: TDR POI Habitat Summary

POI	Description	Habitat Notes	Notes/Potential for Ecological Impacts
1	M4 Junction 9 Slip Road	Amenity grassland GA2 on roundabout and road verges. **Local Importance (Lower Value).** Hedgerow WL1 along south-eastern edge of roundabout - roadside landscape planting. Grey alder *Alnus incana*, downy birch, pedunculate oak, hazel, cherry laurel. **Local Importance (Higher Value).**	Load bearing surface required on GA2. Vegetation trimming will affect WL1.
2	R402 / Johnstown Road Roundabout	Ornamental/non-native shrub WS3 & Spoil and bare ground ED2. Landscaped roundabout - one central cherry tree, ornamental shrub planting surrounded by gravel. Pampas grass *Cortaderia selloana*, David viburnum *Viburnum davidii*, Fortune's spindle *Euonymous fortunei*, Wilson's honeysuckle *Lonicera nitida*, *Hypericum* 'Hidcote', cherry *Prunus* Sp., ash seedlings, grey willow, cleavers *Gallium aparine*, groundsel *Senecio vulgaris*. **Local Importance (Lower Value).**	Removal of shrubs and small cherry tree required for load bearing and oversail.
3	R402 / L5025 Access Junction	Dry meadows and grassy verges GS2 along road verge. Yorkshire fog, false oat-grass, creeping thistle. **Local Importance (Lower Value).** Scrub WS1 is also present - grey willow, privet, downy birch, cherry laurel bramble. **Local Importance (Higher Value).**	GS2 potentially subject to disturbance during removal of roadside barrier. Vegetation trimming will affect WS1.

POI	Description	Habitat Notes	Notes/Potential for Ecological Impacts
4	L5025 Bend 1	Hedgerow/Treeline Mosaic WL1/WL2. Ash, hawthorn, ivy. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
5	L5025 Bend 2	Hedgerow/Treeline Mosaic WL1/WL2. Ash, sycamore, hawthorn, ivy. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
6	L5025, north of the River Kilooney Bridge	Treeline WL2. Ash, sycamore, hawthorn, ivy. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
7	L5025, south of the River Kilooney Bridge	Hedgerow WL1. Ash, hawthorn, ivy, bramble, privet. Treeline WL2. Beech, sycamore, ash, ivy, lodgepole pine, Wilson's honeysuckle. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1 & WL2.
8	Southern Site Access Junction	Hedgerow WL1. Low cut hedge. Hawthorn, wild plum, elder, guelder rose, ivy, bramble, yarrow, cocksfoot grass. **Local Importance (Higher Value).**	A section of this hedgerow will be removed to create the main (southern) site entrance.
9	R402 Raven Junction	Dry meadows and grassy verges GS2 at junction. Recently cut. Yorkshire fog, creeping buttercup, white clover, dandelion, hogweed. Hedgerow/Treeline Mosaic WL1/WL2 along L5012 after junction. Larch *Larix* Sp., ash, hawthorn. Hedgerow WL1. Low-cut hawthorn hedgerow at junction. **Local Importance (Higher Value).**	Vegetation at junction potentially affected by vegetation trimming. Minimal tree canopy trimming for load clearance will affect WL1/WL2.

POI	Description	Habitat Notes	Notes/Potential for Ecological Impacts
10	Kilshanroe Road Bend 1	Hedgerow/Treeline Mosaic WL1/WL2 along L5012 after junction. Ash, hawthorn, elder. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
11	Kilshanroe Road Bend 2	Hedgerow/Treeline Mosaic WL1/WL2 along L5012 after junction. Ash, hawthorn, elder, ivy, cleavers, cow parsley *Anthriscus sylvestris*. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
12	Kilshanroe Road Bend 3	Hedgerow WL1. Low-cut hedgerows with hawthorn, elder, hazel, bramble and ivy. Elm *Ulmus* Sp. and ash tree standing side by side in one location. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect roadside trees. Vegetation trimming will affect WL1.
13	Kilshanroe Road Bend 4	Hedgerow/Treeline Mosaic WL1/WL2 along L5012. Ash, hawthorn, pedunculate oak. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
14	Kilshanroe Road Bend 5	Hedgerow/Treeline Mosaic WL1/WL2 along L5012. Ash, hawthorn, sycamore. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance will affect WL1/WL2.
15	Northern Site Access	Hedgerow/Treeline Mosaic WL1/WL2 along L5012. Ash, hawthorn, pedunculate oak. **Local Importance (Higher Value).**	Minimal tree canopy trimming for load clearance and tree removal at site entrance will affect WL1/WL2.

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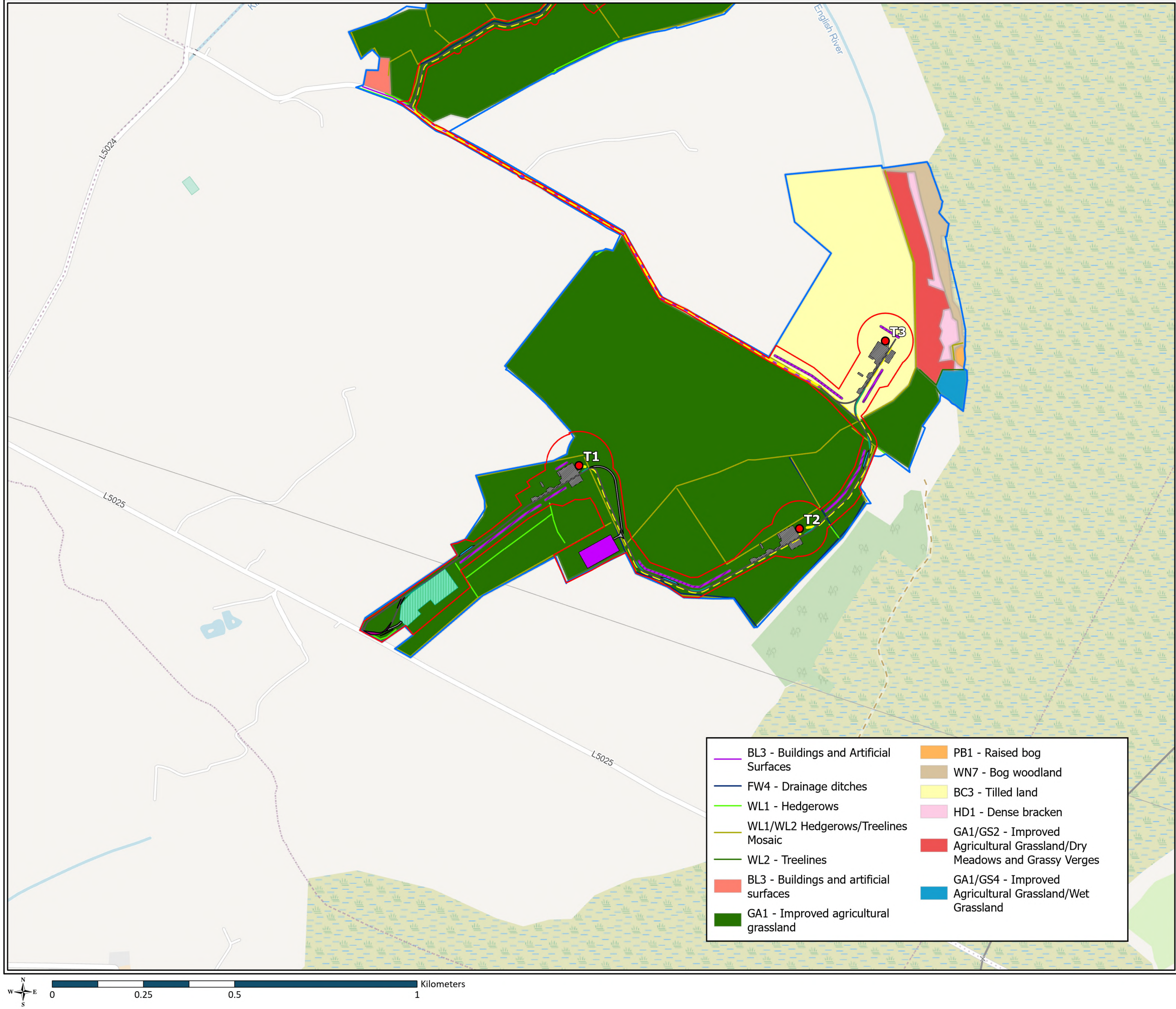

Legend

- Proposed Development Boundary
- Study Area Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Blade Transfer Area
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Berms
- Cable Route
- Turbines

- BL3 - Buildings and Artificial Surfaces
- FW4 - Drainage ditches
- WL1 - Hedgerows
- WL1/WL2 Hedgerows/Treelines Mosaic
- WL2 - Treelines
- BL3 - Buildings and artificial surfaces
- GA1 - Improved agricultural grassland
- PB1 - Raised bog
- WN7 - Bog woodland
- BC3 - Tilled land
- HD1 - Dense bracken
- GA1/GS2 - Improved Agricultural Grassland/Dry Meadows and Grassy Verges
- GA1/GS4 - Improved Agricultural Grassland/Wet Grassland

TITLE:	Habitat Map Page 1		
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FIGURE NO:	8.9		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:10,000	**REVISION:**	0
DATE:	12/05/2025	**PAGE SIZE:**	A3

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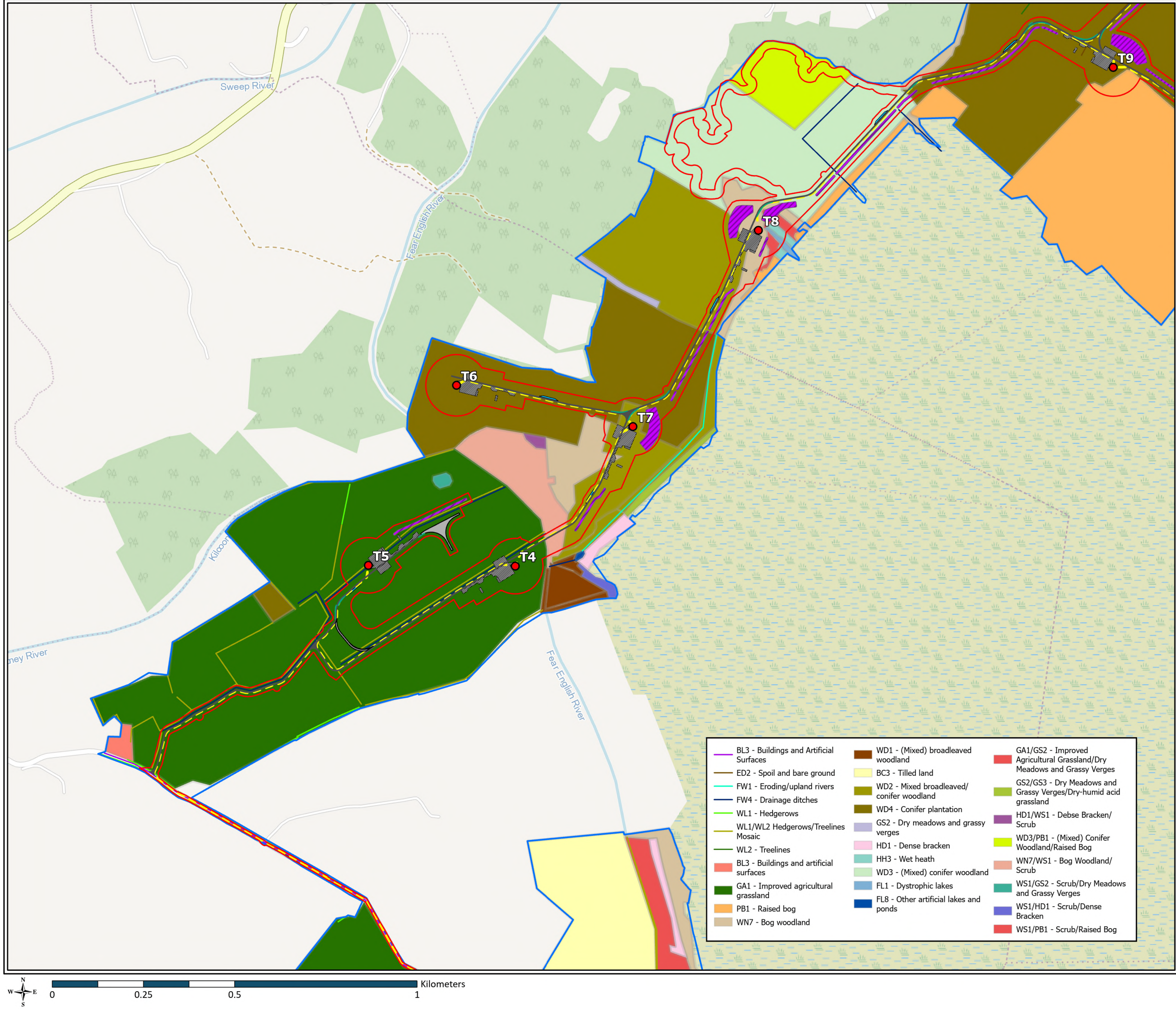

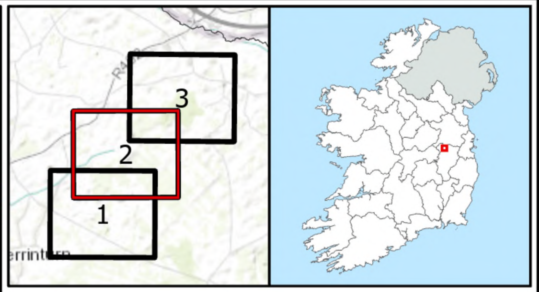

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- Proposed Development Boundary
- Study Area Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Passing Bays
- Turbine Hardstanding
- Berms
- Cable Route
- Turbines

- BL3 - Buildings and Artificial Surfaces
- ED2 - Spoil and bare ground
- FW1 - Eroding/upland rivers
- FW4 - Drainage ditches
- WL1 - Hedgerows
- WL1/WL2 Hedgerows/Treelines Mosaic
- WL2 - Treelines
- BL3 - Buildings and artificial surfaces
- GA1 - Improved agricultural grassland
- PB1 - Raised bog
- WN7 - Bog woodland
- WD1 - (Mixed) broadleaved woodland
- BC3 - Tilled land
- WD2 - Mixed broadleaved/ conifer woodland
- WD4 - Conifer plantation
- GS2 - Dry meadows and grassy verges
- HD1 - Dense bracken
- HH3 - Wet heath
- WD3 - (Mixed) conifer woodland
- FL1 - Dystrophic lakes
- FL8 - Other artificial lakes and ponds
- GA1/GS2 - Improved Agricultural Grassland/Dry Meadows and Grassy Verges
- GS2/GS3 - Dry Meadows and Grassy Verges/Dry-humid acid grassland
- HD1/WS1 - Debse Bracken/ Scrub
- WD3/PB1 - (Mixed) Conifer Woodland/Raised Bog
- WN7/WS1 - Bog Woodland/ Scrub
- WS1/GS2 - Scrub/Dry Meadows and Grassy Verges
- WS1/HD1 - Scrub/Dense Bracken
- WS1/PB1 - Scrub/Raised Bog

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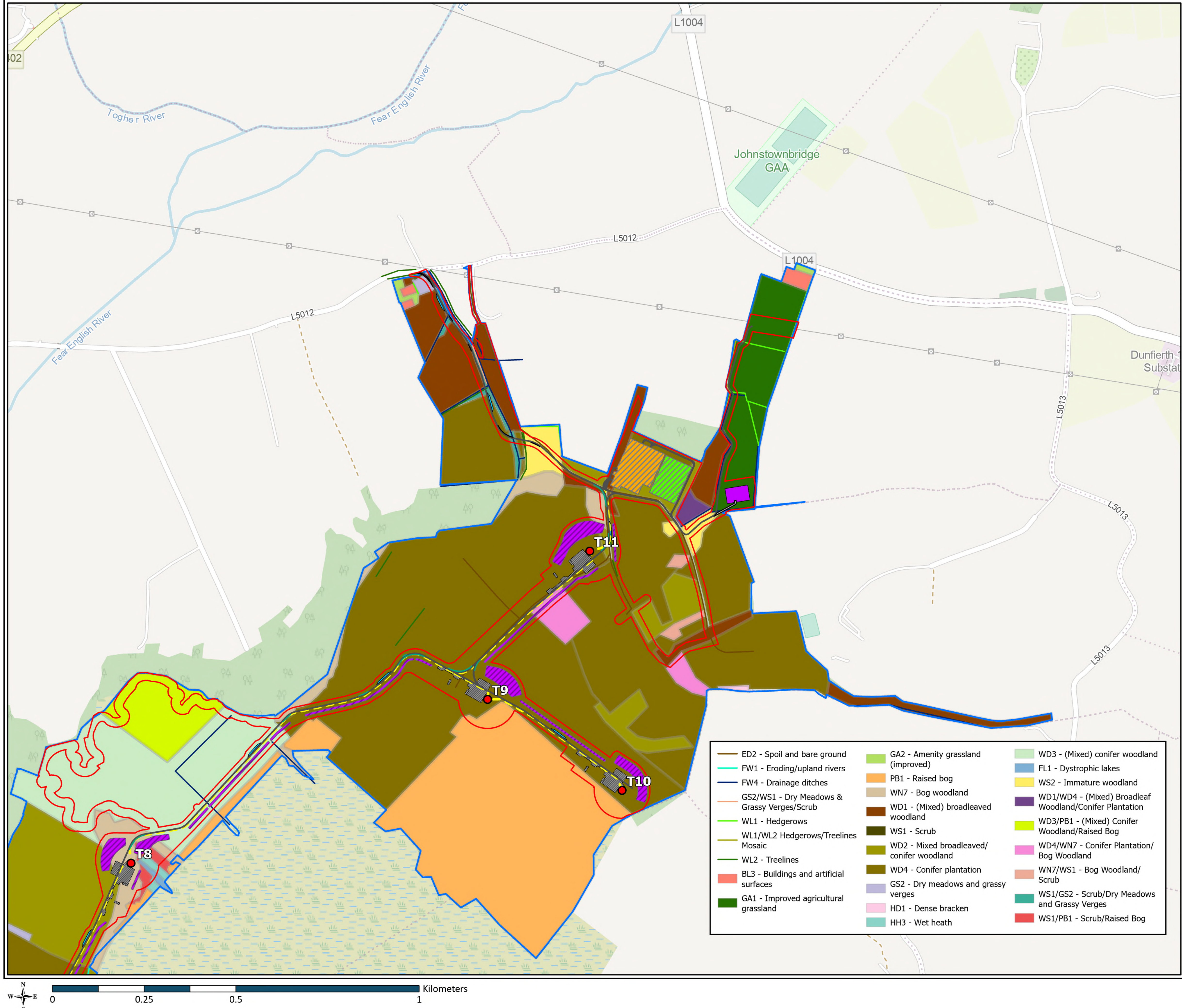

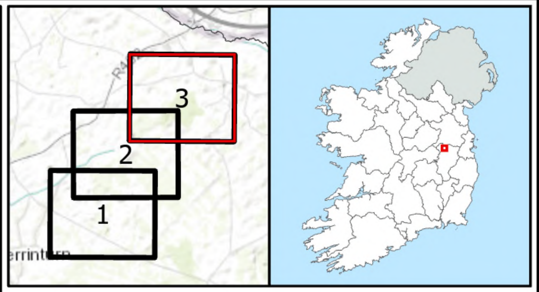

Legend

- Proposed Development Boundary
- Study Area Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Berms
- Peat Deposition Area
- Substation
- Cable Route
- Turbines

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1.1.2 Rare/Protected Botanical Species

The Proposed Wind Farm lies within Ordnance Survey National Grid 10 km Square N73. This 10 km grid square was searched for records of protected plant species, and the 2 km grid squares (tetrads) within N73 were also interrogated to provide higher resolution records for species of interest. This list was then compared to the lists of species protected under the Flora (Protection) Order of 2022 and the Ireland Red List No. 10: Vascular Plants (Wyse et al. 2016). Table 8-12 presents details of the rare and protected plant species found within the 10 km square N73. NPWS Flora Protection Order (FPO) mapping for bryophytes and vascular plants was also consulted. The NPWS National Survey of Native Woodlands (NSNW) dataset was also examined.

One record for a species designated as “Near Threatened” was returned: Corn marigold *Glebionis segetum*. This record is from a domestic property c. 600m north of the Proposed Wind Farm. Corn marigold is a common constituent of wildflower seed mixes, and due to it's location in a domestic setting and lack of other records in the area, this contemporaneous record (2019) is considered likely to have been planted at this location. Corn marigold was not recorded during botanical surveys at the Proposed Wind Farm.

One record for a 'Vulnerable' species was returned: Alder buckthorn *Frangula alnus*, located c. 2.7km east of the Proposed Wind Farm. This species was not recorded during botanical surveys at the Proposed Wind Farm. It is noted that common buckthorn *Rhamnus cathartica* was recorded in recolonising cutover bog near the Proposed Wind Farm site, and there are similarities between the habitat preferences of these two species.

The presence of one Annex V species- Large white-moss *Leucobryum glaucum* was indicated by NPWS Article 17 reporting. There are no records of this species overlapping the Proposed Wind Farm; the closest records are located in 1 km grid squares N7234 and N7432 which lie respectively c. 1 km and c. 960m west and south of the Proposed Wind Farm. Large white-moss was not recorded during botanical surveys at the Proposed Wind Farm. Large white moss is not threatened, being currently assessed as 'Favourable'. Annex V species are those of community interest whose taking in the wild and exploitation may be subject to management measures.

FPO mapping indicates the presence of a record for the FPO (2022) species Bog orchid *Hammarbya paludosa* in cutover bog/drained raised bog c. 60-80m east of the Proposed Wind Farm. However this record is not contemporaneous, dating from 1894, prior to the industrial strip mining of raised bogs initiated by Bord Na Móna in the mid 1940's. Bog orchid, a species of wet, open acidic *Sphagnum* bog, was not recorded during botanical surveys at the Proposed Wind Farm.

NPWS National Survey of Native Woodlands (NSNW) shapefiles indicate a mixed stand of non-Annex Bog woodland and Oak-ash-hazel woodland directly southwest of turbine 2. The presence of bog woodland in this area is consistent with the occurrence of this habitat in other parts of the study area where Drehid Bog transitions to agricultural land, and the presence of oak-ash-hazel woodland demonstrates the climax woodland community which develops on drier soils in this area.

Species identification was completed using; Webb’s ‘An Irish Flora’, 8th edition, 2012., F. Rose ‘The Wild Flower Key’, Revised edition, 1981, and The British Bryological society’s ‘Mosses and Liverworts of Britain and Ireland a field guide’, first edition, 2010.

No rare or protected species were recorded during site surveys. No FPO (Flora Protection Species) were noted within the Proposed Wind Farm or surrounding areas.

Table 1-2: Rare/Protected Flora: Desktop Results

Common Name	Grid Square	Location of closest Record	Year of Last Record	Survey	Conservation Status	Habitat	Result of surveys for Drehid
Alder buckthorn *Frangula alnus*	N73	N773 339 – c. 2.7km east of Proposed Wind Farm	2015	National Vegetation Database Data from NBDC - Online Atlas of Vascular Plants 2012-2020	Threatened Species: Vulnerable	Limestone pavement, hedgerow, fens and boggy places. In fen carr areas, in damp woodland, heaths on acid soils (rare on calcareous soils) (Rose, 2006)	Species not found within study area
Large white cushion moss *Leucobryum glaucum*	N73	N7234 – c. 1 km west of Proposed Wind Farm	2012	Bryophytes of Ireland	EU Habitats Directive Annex V. Overall conservation status 'Favourable' (Lockhart, N., et al, 2012).	Broad ecological range, common habitats are acidic woodland and mires, from wet heath through to valley mires, raised bogs and even fens (BBS, 2010).	Species not found within study area

Common Name	Grid Square	Location of closest Record	Year of Last Record	Survey	Conservation Status	Habitat	Result of surveys for Drehid
Bog orchid *Hammarbya paludosa*	N73	c. 60-80m east of the Proposed Wind Farm	1894	NPWS Rare/Threatened Plants Database	FPO (2022); Threatened Species: Near Threatened	Wet, open acidic Sphagnum bog	Species not found within study area
Corn marigold *Glebionis segetum*	N73	c. 600m north of Proposed Wind Farm.	2019	Vascular plants: Online Atlas of Vascular Plants 2012 Onwards	Threatened Species: Near Threatened	Disturbed/waste ground, arable weed of light sandy soils	Species not found within study area

1.1.3 Invasive Plant Species

1.1.3.1 Desktop Records

The invasive species listed in Table 8-13 have been recorded within 10 km grid square N73. Japanese knotweed (*Fallopia japonica*), sycamore (*Acer pseudoplatanus*), rhododendron ponticum, butterfly-bush and cherry laurel (*Prunus laurocerasus*) were the only invasive plant species noted in records within N73.

Table 1-3: Invasive Species within 10 km grid square N73 and 1 km grid squares overlapping TDR(Source: NBDC)

Common Name	Scientific Name	Year of Last Record	Location of Record	Legal status	Invasive Impact
Wind Farm/Substation					
Sycamore	*Acer pseudoplatanus*	2020	N765 384 – c. 380m north of Proposed Wind Farm	None	Medium Impact
Cherry Laurel	*Prunus laurocerasus*	2005	N710 345 - c. 2km west of Proposed Wind Farm	None	High Impact
Rhododendron	*Rhododendron ponticum*	2022	c. 100m east of Proposed Wind Farm/c. 170m north-east of T9 In woodland c. 25m from access track south of T8	Schedule III	High Impact
Japanese Knotweed	*Fallopia japonica*	2021	N733 393 - c. 2.8 km north-west of Proposed Wind Farm	Schedule III	High Impact
Butterfly-bush	*Buddleja davidii*	2019	N760 373 - overlapping existing access track north of T9 N766 375 & N766 374 - c. 230m south of proposed substation	None	Medium Impact

Common Name	Scientific Name	Year of Last Record	Location of Record	Legal status	Invasive Impact
TDR					
Cherry Laurel	*Prunus laurocerasus*	2005	N7134	None	High Impact
Sycamore	*Acer pseudoplatanus*	2005	N7134	None	Medium Impact

1.1.3.2 Invasive Species Recorded During Surveys

An individual *Rhododendron ponticum* bush c. 2 x 3m in extent was recorded in mixed broadleaved/conifer woodland adjacent to a section of proposed access track south of T8. This Schedule III invasive species was also recorded in conifer plantation c. 170m north-east of T9, as indicated by the desktop record above.

Sycamore was recorded within mixed broadleaved/conifer woodland within the proposed substation footprint, and was noted to be common in open parts of recently replanted conifer plantation to the south of the proposed substation. It was also recorded in hedgerows at TDR points of interest.

Butterfly bush was recorded along existing forestry tracks north of T9 and south of the proposed substation.

Cherry laurel was recorded at two TDR points of interest (POI 1 & 3).

Snowberry (Symphoricarpos albus), another invasive species, was identified during ecological survey. This record is c. 15m from the proposed T7 - T8 access track. Snowberry is a medium impact invasive species.

The presence of regenerating Lawson cypress in a block of conifer woodland was noted. This non-native species has not been assessed to date in terms of invasiveness, but has been observed to spread successfully in forestry plantations.

Table 1-4: Invasive Species recorded onsite

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
Sycamore	*Acer pseudoplatanus*	In substation footprint and replanted conifer blocks in north of site TDR POIs: 5, 6, 7 & 14	None	Medium Impact
Cherry Laurel	*Prunus laurocerasus*	Existing Coillte entrance in north (adjacent domestic property boundary) TDR POIs: 1 & 3	None	High Impact

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
Rhododendron	*Rhododendron ponticum*	c. 100m east of Proposed Wind Farm/c. 170m north-east of T9 In woodland c. 25m from access track south of T8	Schedule III	High Impact
Butterfly-bush	*Buddleja davidii*	N760 373 - overlapping existing access track north of T9 N766 375 & N766 374 - c. 230m south of proposed substation	None	Medium Impact
Snowberry	*Symphoricarpos albus*	ITM 0674913 0736546 - c. 15m from proposed T7 - T8 access track	None	Medium Impact

1.1.4 Terrestrial Mammals (excluding bats)

1.1.4.1 Desktop Study

In addition to mammal surveys, a desktop review of information available from the National Biodiversity Data Centre (NBDC) indicates that the following species have been observed within the 10 km grid square (N73) in which the Proposed Wind Farm is located: badger (*Meles meles*), pygmy shrew (*Sorex minutus*), red squirrel (*Sciurus vulgaris*), otter (*Lutra lutra*), Irish hare (*Lepus timidus* subsp. *Hibernica*), Irish stoat (*Mustela erminea* subsp. *Hibernica*), pine marten (*Martes martes*), red deer (*Cervus elaphus*), red fox (*Vulpes Vulpes*), hedgehog (*Erinaceus europaeus*) and wood mouse (*Apodemus sylvaticus*). See Table 8-15 below for more information.

Table 1-5: Desktop results of mammals within and adjacent to the Proposed Wind Farm (NBDC records within 10 km grid square N73) and 1 km grid squares overlapping TDR

Mammal Name	Legal Protection	Conservation Status (Marnell et al. 2019)	Location
Wind Farm/Substation			
Badger (*Meles meles*)	Wildlife Acts	Least Concern	N73
Hedgehog (*Erinaceus europaeus*)	Wildlife Acts	Least Concern	N73
Irish hare (*Lepus timidus* subsp. *Hibernica*)	EU Habitats Directive Annex V, Wildlife Acts	Least Concern	N73
Irish stoat (*Mustela erminea* subsp *hibernica*)	Wildlife Acts	Least Concern	N73
Otter (*Lutra lutra*)	EU Habitats Directive Annex II & Annex IV Wildlife Acts	Least Concern	N73
Pine marten (*Martes martes*)	EU Habitats Directive Annex V, Wildlife Acts	Least Concern	N73
Pygmy shrew (*Sorex minutus*)	Wildlife Acts	Least Concern	N73
Red deer (*Cervus elaphus*)	Wildlife Acts	Least Concern	N73
Red fox (*Vulpes Vulpes*)	None	Least Concern	N73
Red squirrel (*Sciurus vulgaris*)	Wildlife Acts	Least Concern	N73
Wood mouse (*Apodemus sylvaticus*)	None	Least Concern	N73
TDR			
Badger (*Meles meles*)	Wildlife Acts	Least Concern	N7135
Irish hare (*Lepus timidus* subsp. *Hibernica*)	EU Habitats Directive Annex V, Wildlife Acts	Least Concern	N7437
Red fox (*Vulpes Vulpes*)	None	Least Concern	N7437 N7640
Otter (*Lutra lutra*)	EU Habitats Directive Annex II & Annex IV Wildlife Acts	Least Concern	N7438
Hedgehog (*Erinaceus europaeus*)	Wildlife Acts	Least Concern	N7438

1.1.4.2 *Invasive Mammals*

The desktop review of information available from the National Biodiversity Data Centre (NBDC) indicate that six invasive mammal species have been observed within the 10 km grid square (N73): American mink (*Mustela vison*), brown rat (*Rattus norvegicus*), grey squirrel (*Sciurus carolinensis*), rabbit (*Oryctolagus cuniculus*), fallow deer (*Dama dama*) and house mouse (*Mus musculus*). See Table 8-16 below for more information.

Table 1-6: Desktop results of invasive mammals within and adjacent to the Proposed Wind Farm (NBDC records within 10k m grid square N73)

Mammal Name	Legislation	Conservation Status (Marnell et al. 2019)	Invasiveness (NBDC)
American mink (*Mustela vison*)	Third Schedule listed species under Regulations 49 & 50 in the European Communities (Birds and Natural Habitats) Regulations 2011. (Note: Regulation 50 not yet enacted).	None	High Impact
Brown rat (*Rattus norvegicus*)	Third Schedule listed species under Regulations 49 & 50 in the European Communities (Birds and Natural Habitats) Regulations 2011. (Note: Regulation 50 not yet enacted).	None	High Impact
Grey squirrel (*Sciurus carolinensis*)	Third Schedule listed species under Regulations 49 & 50 in the European Communities (Birds and Natural Habitats) Regulations 2011. (Note: Regulation 50 not yet enacted). Regulated invasive species of Union concern under the European Regulation on the prevention and management of the introduction and spread of invasive alien species [1143/2014].	None	High Impact
Rabbit (*Oryctolagus cuniculus*)	None	Least Concern	Medium Impact
Fallow deer (*Dama dama*)	Wildlife Acts Specified provisions of Regulations 49 & 50 in the European Communities (Birds and Natural Habitats) Regulations 2011 in Republic of Ireland apply to this species (NB Regulation 50 not yet commenced).	Least Concern	High Impact
House mouse (*Mus musculus*)	None	Least Concern	High Impact

1.1.4.3 Previous Mammal Surveys

Previous surveys noted badger activity across the Proposed Wind Farm, and also located a number of setts. Otter signs were also noted within the study area. Other species recoded during previous surveys were Irish hare, wood mouse, deer species, red fox, red squirrel, pine marten, and rabbits. Additionally, potential habitats for hedgehog, Irish stoat, pygmy shrew, and red deer were noted. Numerous field signs indicative of mammal activity such as prints, scat, and burrows, were recorded during previous surveys.

1.1.4.4 Current Mammal Surveys (2024)

During current mammal surveys the following species and/or their field signs were observed within or adjacent to the Proposed Wind Farm: badger, otter, fox, red squirrel, pine marten, wood mouse, Irish hare, red deer, Irish stoat and rabbit (an invasive species). Some deer signs including a small proportion of the trails and droppings observed were not definitively attributed to particular species. Of the 10 species identified, all are of 'Least Concern'. One (rabbit) is an invasive species. While not observed during surveys, species such as hedgehog and pygmy shrew are also likely to occur on site. See Table 8-17 and Figure 8-10 below for more information. Deer droppings were abundant across the site and as such are not mapped. Please see the confidential badger report which accompanies this application for details and photos of setts.

Table 1-7: Mammals and associated field signs observed within the study area

Species	Field Signs	Direct Observations
Badger	Snuffles Scat Latrines Trails Hair Setts	Trail Camera Footage
Otter	Spraints Prints Holts	None
Fox	Scat	None
Red Squirrel	Feeding signs	None
Pine marten	Scat	Trail Camera Footage
Wood mouse	None	Trail Camera Footage
Irish hare	None	Live sightings
Red deer	Droppings	Live sighting

Species	Field Signs	Direct Observations
	Tracks/Prints Antler Hair	
Deer species	Droppings Tracks/Prints	None
Rabbit	Burrows	None
Irish stoat	Prints	None

1.1.4.4.1 Badger

Badger activity was recorded across the Proposed Wind Farm, with signs of badger in widely distributed across the site, but absent from very wet peatland habitats. Snuffle holes were common in wooded areas, and latrines/scat were common, most often associated with sett entrances but also in several instances functioning as territorial markers. Well-defined trails were recorded in a number of locations, and badger hair was observed snagged in fencing intersecting a trail. Trail camera video footage of badgers was also recorded at a number of locations.

A total of 21 setts were recorded during current surveys, including one inactive potential outlier sett which is classified as such on a precautionary basis. A total of five main setts are present, indicative of five family groups/territories. The majority of setts observed are in woodland or scrub, with some also located in hedgerows/treelines running through agricultural land.

The locations of these setts relative to proposed infrastructure are detailed in Table 8-18. Exact locations are included in the confidential badger mitigation report which accompanies this application.

Further setts in the wider area were recorded during previous surveys. These are detailed in Table 8-19 to provide additional information on badger activity at the landscape scale. Setts A and B are likely to be in the same territory as Setts 7 and 8. Setts C and D could potentially be within the same territory as Setts 19 - 21; however, they may also be within a different territory .

The badger population and density of family group territories is notably high in this area.

Table 1-8: Badger setts including relative distances to infrastructure

Sett No.	No. of entrances	Activity	Type	Closest Infrastructure/Activities	Notes
1	1	Active	Subsidiary	Proposed access track (25m)	N/A
2	1	Active	Subsidiary	Proposed access track (20m)	N/A
3	7	Active	Main	Existing access track to form part of site access route (115m) Substation compound (250m)	N/A
4	3	Active	Annex	Access track (1m) Overlapped by access track felling buffer.	N/A
5	5	Inactive	Annex	Access track (12m) Access track felling buffer (5m)	N/A
6	11	Active	Main	Access track (158m)	N/A
7	2	Active	Annex	Hard stand (overlaps sett)	N/A
8	1	Active	Subsidiary	Hard stand (83m) Turbine felling buffer (20m)	N/A
9	2/4	Active	Subsidiary	Hard stand (590m)	2 disused entrances c. 18m from 2 active entrances - potentially same sett or separate sett.
10	4	Active	Main	Hard stand (623m)	N/A
11	3	Active	Annex	Hard stand (607m)	N/A
12	1	Active	Subsidiary	Hard stand (461m)	N/A
13	1	Inactive	Outlier	Hard stand (252m)	N/A
14	1	Inactive	Outlier (potential)	Turbine felling buffer (76m) Access track (89m)	Potential sett, included on precautionary basis
15	5	Active	Main	Access track (89m) Turbine felling buffer (147m)	N/A

Sett No.	No. of entrances	Activity	Type	Closest Infrastructure/Activities	Notes
16	1	Active	Subsidiary	Access track (137m) Hard stand (186m)	N/A
17	1	Active	Subsidiary	Access track (101m) Hard stand (126m)	N/A
18	4	Inactive	Annex	Access track (127m) Hard stand (155m)	Fresh digging by smaller mammal near sett
19	15-17	Active	Main	Access track (10m) Site compound (24m)	High number of entrances, some dug out from inside onto vertical bank not used for access.
20	2	Inactive	Subsidiary	Site compound (27m)	N/A
21	7	Active	Annex	Site compound (38m)	N/A

Table 1-9: Additional Sett Records (Historical Surveys)

Sett ID	No. of entrances	Type	Closest Infrastructure/Activities	Notes
A	3	Subsidiary	Proposed construction access track (447m)	N/A
B	2	Subsidiary or Outlier	Proposed construction access track (297m)	N/A
C	4	Annex	Proposed construction access route between northern and southern turbine clusters (existing local road) (173m)	N/A
D	2	Subsidiary	Proposed construction access route between northern and southern turbine clusters (existing local road) (240m)	N/A

1.1.4.4.2 Otter

Otter signs including prints and spraints were recorded along the Fear English River to the north of T4, and also at the bog pool near of T8. A potentially active otter holt is present along the Fear English River to the north of T4, with mixed-age spraint recorded nearby. A potential otter holt to the south of T4 was observed to be inactive, similarly to previous surveys in 2019. A lateral tree root extends across the entrance to this burrow, with continued growth of the root restricting access and severely reducing potential for use by otter. A two-entrance den/burrow with potential to be used as a maternity holt was observed along a drainage ditch upstream of the Fear English River separating conifer plantation from agricultural land to the north of T6. Trail camera surveys completed under licence 058/2024 confirmed this is not being used by otter. Similarly, a feature with potential to be used as a holt was observed along a drainage ditch/treeline north of T2, but was confirmed as not being used by otter. This is currently assessed as being a potential outlier sett (Sett 13 detailed above). All holts and potential holts detailed above are outside the Proposed Wind Farm boundary. The baseline otter report is included in Appendix 8.1-3.

An incidental record of otter using an artificial pond created by peat harvesting on Timahoe North Bog was noted during wader transect surveys in 2021. This record was located c. 2.1 km south-east of the holts recorded on the Fear English River.

1.1.4.4.3 Fox

The presence of this common mammal was indicted by observations of scat in mixed/broadleaved/conifer woodland and bog woodland. A number of dens which could potentially be used by fox were also noted.

1.1.4.4.4 Red Squirrel

Red squirrel feeding signs in the form of stripped spruce cones were recorded in wooded areas in the north of the Proposed Wind Farm, with the majority of records concentrated in conifer plantation around T6 and T7. One feeding sign was also recorded in conifer plantation north of the proposed substation. No dreys were observed during surveys.

1.1.4.4.5 Pine marten

Pine marten scat was recorded in a prominent location on an existing track running along the north-western margin of Timahoe North Bog (east of T7). Scat was also recorded in a prominent location on a log in mixed broadleaved woodland east of T4. A pine marten was filmed by a trail camera at night time moving along a log near a drainage ditch/treeline south of T5.

1.1.4.4.6 Wood mouse

This species was recorded in trail camera video footage near the Fear English River west of T6, and along a drainage ditch bank to the north of T6. Small mammal burrows which could potentially be used by this species were recorded in field boundary running parallel to the proposed grid connection.

1.1.4.4.7 Irish hare

Two live sightings of Irish hare were recorded, both occurring in agricultural grassland. One record was south of T5; the other was south-west of T1.

1.1.4.4.8 Red deer

A group of red deer were flushed in immature oak plantation woodland near the northern site access route. Deer tracks and droppings were distributed widely across the area in which the Proposed Wind Farm is located. A high proportion of these signs are readily attributable to red deer, based on the size and appearance of prints and droppings. A red deer antler, and red deer hairs snagged on fencing were further signs observed confirming the presence of this species.

1.1.4.4.9 Deer species

Not all deer signs could be definitively attributed to a particular species. This includes droppings, trails/tracks, and bark stripping. The height at which bark stripping was observed could indicate either red or fallow deer, but is unlikely to indicate Sika. It is noted that fallow deer were identified onsite during previous surveys.

1.1.4.4.10 Irish stoat

An Irish stoat print was observed in mud bordering a drainage ditch in a densely vegetated field boundary to the south-west of T5.

1.1.4.4.11 Rabbit

Rabbit burrows were observed in agricultural field boundaries and woodland margins. European rabbit is classified as a non-native invasive species.

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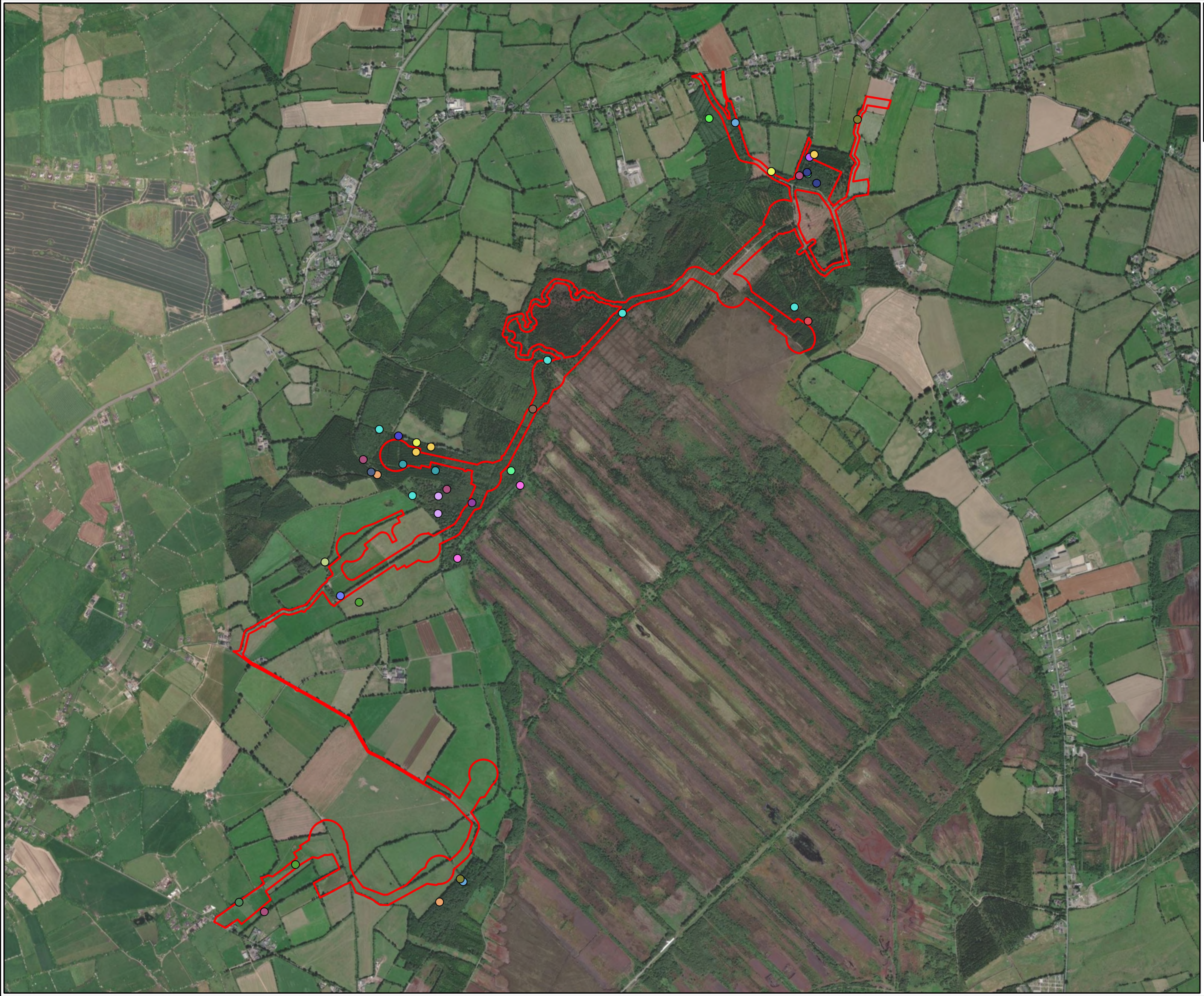

Legend

- Proposed Development Boundary
- Badger, Latrine
- Badger, Print
- Badger, Scat
- Badger, Snuffle
- Badger, Snuffles
- Badger, Trail, Hairs
- Badger, Trail, Snuffles
- Deer, Bark Stripping
- Deer, Browsing Signs
- Deer, Track
- Deer, Wallow
- Fox, Scat
- Irish Hare, Live Sighting
- Irish Stoat, Prints
- Pine Marten, Scat
- Pine Marten, Trail Cam Footage
- Rabbit, Burrow
- Red Deer, Antler
- Red Deer, Live Sighting
- Red Squirrel, Abundant Feeding Signs
- Red Squirrel, Feeding Sign
- Red Squirrel, Feeding Signs
- Wood Mouse, Trail Cam Footage

N W E S

0 0.5 1 2 Kilometers

TITLE: Mammal Field Signs			
PROJECT: Drehid Wind Farm and Substation			
FIGURE NO:	8.10		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:20,000	**REVISION:**	0
DATE:	12/05/2025	**PAGE SIZE:**	A3

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1.1.5 Bats

The results of the bat desktop study and onsite bat surveys are presented below. The bat report is included in Appendix 8.1-4.

1.1.5.1 Desktop Study

The UBSS Cave Database for the Republic of Ireland, Ordnance Survey Ireland Karst Landscapes, National Monuments Service, and National Inventory of Architectural Heritage GIS layers did not indicate that there were underground caves or monuments with bat roost potential within or near the site.

There are eight 2km grid squares which encompass the site: N73G , N73H, N73L, N73M, N73N, N73P, N73T and N73U. These held previous bat records as detailed in Table 8-20 below (NBDC maps, most recent data search 04/03/2025).

Additionally, there are desktop records of soprano pipistrelle from 1 km grid square N7234 (2019) (overlapping TDR), common pipistrelles from 1 km grid squares N7333 and N7437 (overlapping TDR) (2019)

Table 1-10: Bat records in 10km Grid square N73 and 2km Grid squares N73G, N73H, N73L, N73M, N73N, N73P, N73T, N73U.

Species	N73	N73G	N73H	N73L	N73M	N73N	N73P	N73T	N73U
Brown long-eared bat	4	0	0	0	0	1	0	2	0
Common pipistrelle	61	1	14	2	5	8	0	6	0
Soprano pipistrelle	48	0	0	0	3	15	0	17	1
Pipistrellus sp. *sensu lato*	1	0	0	0	0	0	0	0	0
Leisler's bat	27	0	1	0	3	8	0	11	0
Daubenton's bat	2	0	0	0	0	0	0	1	0
Natterer's bat	3	0	0	0	1	0	0	2	0
Whiskered bat	2	0	0	0	0	0	0	2	0

During 2018 EIAR bat surveys, a single soprano pipistrelle was observed emerging from the stand of trees where trees 14-21 are located (see Figure 3-3 in Appendix 8.1-4) (exact tree not observed). These trees are outside the Proposed Wind Farm and Substation footprint.

1.1.5.2 Bat Landscapes

Bat landscapes are plotted in 5 km grid squares, of which two overlap the Proposed Wind Farm.

For the southern turbines (T1 - T3), the bat landscape association model (Lundy et al., 2011) suggests that the development is part of a landscape that is of low-moderate suitability for all bats. These southern turbines and their environs are of moderate suitability for common pipistrelle, and low-moderate suitability for brown long-eared bat, soprano pipistrelle, Leisler's bat, whiskered bat, Daubenton's bat, whiskered bat and Natterer's bat. This area (landscape encompassing T1-T3) is of low suitability for Nathusius' pipistrelle and lesser horseshoe bat.

For the northern turbines (T4 - T11), the bat landscape characterisation is moderate for all bats. The landscape in this area is of moderate-high suitability for common pipistrelle, moderate suitability for brown long-eared bat, soprano pipistrelle, Leisler's bat, Daubenton's bat and Natterer's bat, and of low-moderate suitability for whiskered bat. The landscape encompassing T4-T11 is of low suitability for lesser horseshoe bat and for Nathusius' pipistrelle.

1.1.5.3 Bat Activity Surveys 2023

Overall, five species of bat were noted during these surveys: common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat and Daubenton's bat, as well as genus-level records of *Myotis* and *Pipistrellus*. Survey results are presented in Table 8-21 and individual records are mapped in Appendix 8.1-4.

Table 1-11: Bat Activity Survey Results 2023 (bat passes)

	30/05/2023			08/08/2023		20/09/2023		
	TR1	TR2	TR3	TR3a	TR1	TR2a	TR3	TR1
Common pipistrelle	28	25	5	0	70	1	5	24
Soprano pipistrelle	3	3	1	9	11	0	14	21
Leisler's bat	0	32	2	2	6	26	5	0
Nathusius' pipistrelle	0	1	0	0	0	0	0	0
Daubenton's bat	0	1	0	0	0	0	0	0
Pipistrellus Sp.	0	0	0	0	0	1	12	6
Myotis sp.	0	0	0	0	0	4	0	1
Total	31	62	8	11	87	32	36	52

1.1.5.4 Bat Activity Surveys 2022

Overall, five species of bat were noted during these surveys: common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and a bat in the genus *Myotis*. Survey results are presented in Table 8-22, and individual records are mapped in Appendix 8.1-4.

Table 1-12: Bat Activity Survey Results 2022 (bat passes)

Date	28/07/2022			29/08/2022		
Transect	B	C	D	D	C	A
Common pipistrelle	2	2	12	5	0	47
Soprano pipistrelle	10	1	1	4	1	12
Leisler's bat	0	4	1	3	11	2
Brown long-eared bat	0	1	0	0	0	0
Myotis Sp.	0	0	1	0	0	0
Total	12	8	15	12	12	61

1.1.5.5 2023 Static Detector Surveys

Table 8-23 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2023, based on occurrence across the entire survey season. The occurrence of each species per survey period (i.e. spring/summer/autumn) at each detector location is detailed in Appendix 8.1-4 A total of 11 static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat). Genus-level records of *Pipistrellus* and *Myotis* were also made.

Table 1-13: Summary of 2023 static detector results

Species	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
Pipistrellus pipistrellus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pipistrellus pygmaeus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pipistrellus nathusii	✓	✓	✓	✓	✓	✓	✓	X	X	X	✓
Pipistrellus Sp.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Myotis daubentonii	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Myotis mystacinus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Myotis nattereri	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Myotis Sp.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Species	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
Nyctalus leisleri	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plecotus auritus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Common Pipistrelle

The total number of recordings for common pipistrelle at the Proposed Wind Farm was 58,082 no. recordings; 52.39% of total recordings. These were recorded over 86 no. nights which gives an average of 675.37 no. recordings per night.

Soprano Pipistrelle

The total number of recordings of soprano pipistrelle recorded at the Proposed Wind Farm was 26,959 no. recordings; 24.31% of total recordings. These were recorded over 86 no. nights. This gives an average of 313.48 no. recordings per night.

Leisler's Bat

The total number of recordings for Leisler's bat at the Proposed Wind Farm was 22,685 no. recordings; 20.46% of total recordings. These were recorded over 86 no. nights which gives an average of 263.78 no. recordings per night.

Brown Long-Eared Bat

The total number of recordings for brown long-eared bat at the Proposed Wind Farm was 486 no. recordings; 0.44% of total recordings. These were recorded over 86 no. nights which gives an average of 5.65 no. recordings per night.

Daubenton's Bat

The total number of recordings for Daubenton's bat at the Proposed Wind Farm was 484 no. recordings; 0.44% of total recordings. These were recorded over 86 no. nights which gives an average of 5.63 no. recordings per night.

Whiskered Bat

The total number of recordings for whiskered bat at the Proposed Wind Farm was 461 no. recordings; 0.42% of total recordings. These were recorded over 86 no. nights which gives an average of 5.36 no. recordings per night.

Natterer's Bat

The total number of recordings for Natterer's bat at the Proposed Wind Farm was 226 no. recordings; 0.20% of total recordings. These were recorded over 86 no. nights which gives an average of 2.63 no. recordings per night.

Nathusius' Pipistrelle

The total number of recordings for Nathusius' pipistrelle at the Proposed Wind Farm was 11 no. recordings; 0.01% of total recordings. These were recorded over 86 no. nights which gives an average of 0.13 no. recordings per night.

Genus level Bats

The total number of recordings for bats identified to Myotis level only (could not be identified to species level) at the Proposed Wind Farm was 755 no. recordings; 0.68% of total recordings. These are likely a combination of whiskered bat, Daubenton's bat and Natterer's bat.

The total number of recordings for bats identified to Pipistrelle level only (could not be identified to species level) at the Proposed Wind Farm was 726 no. recordings; 0.65% of total recordings. These are likely a combination of common, soprano and Nathusius' pipistrelle.

The graphs within Plate 8-29 to Plate 8-39 below show the number of bat passes (per species) recorded at each static detector location over the three surveillance periods.

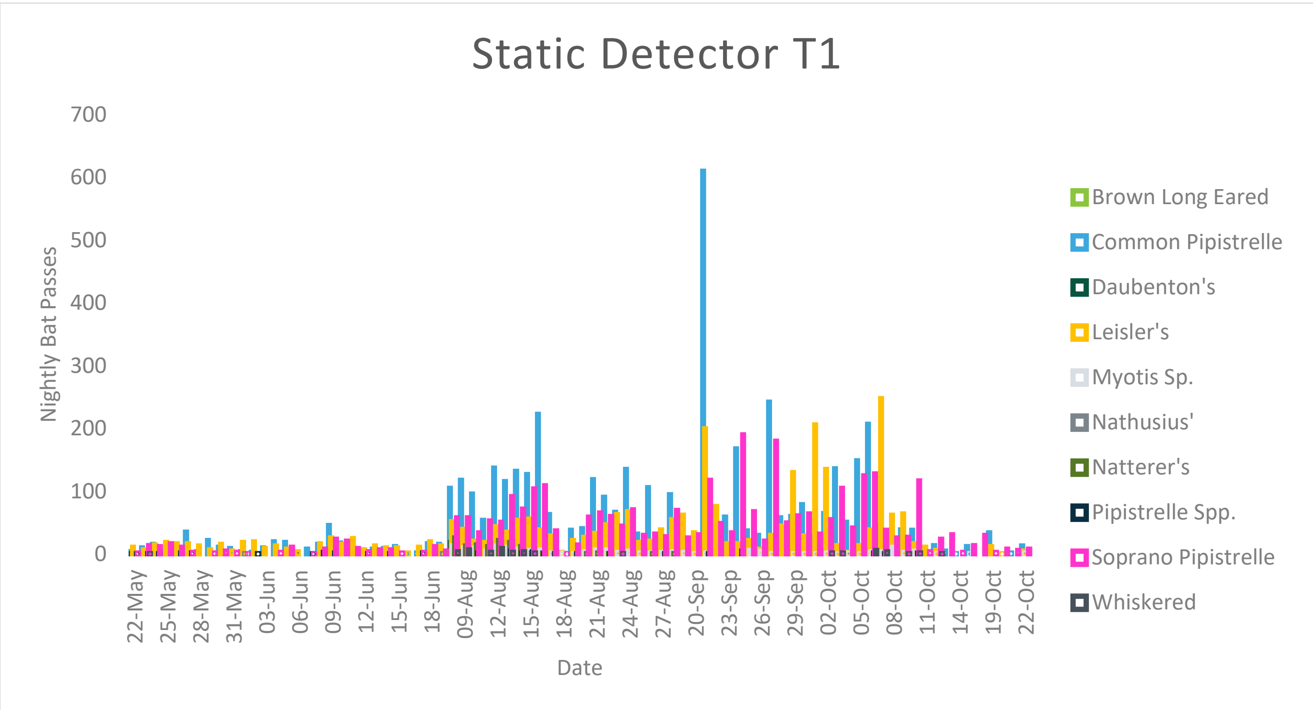

Plate 1-29: Total number of nightly passes recorded at static location T1 (2023)

The static unit T1 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. Higher levels of activity were recorded in periods 2 and 3 (08/08 - 30/08/2023 and 19/09 - 24/10/2023). Common pipistrelle spiked in activity on night 3 of round 3 (21/09/2023) with 610 passes. Leisler's bat and Soprano pipistrelle had more pronounced spikes in activity during period 3 vs periods 1 and 2.

All other species/groups had lower activity levels.

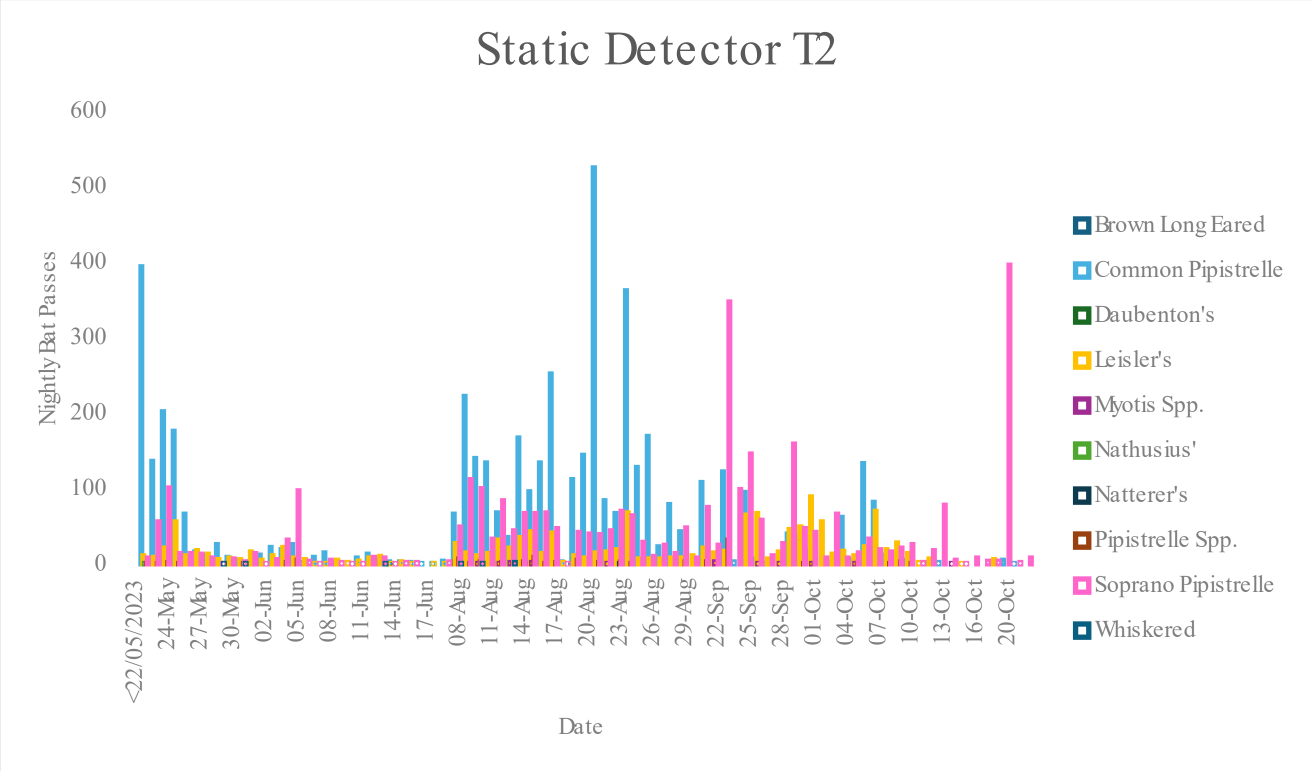

Plate 1-30: Total number of nightly passes recorded at static location T2 (2023)

The static unit T2 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. The majority of activity was recorded in periods 2 and 3 (08/08 - 30/08/2023 and 19/09 - 24/10/2023). There was a spike in activity around the beginning of period 1 (22/05/23 - 20/06/23). Common pipistrelle spiked in activity on night 14 of round 2 (21/08/2023) with 525 passes. Activity for this species was highest during period 2. Soprano pipistrelle had more pronounced spikes in activity during period 3 vs periods 1 and 2.

All other species/groups had lower activity levels.

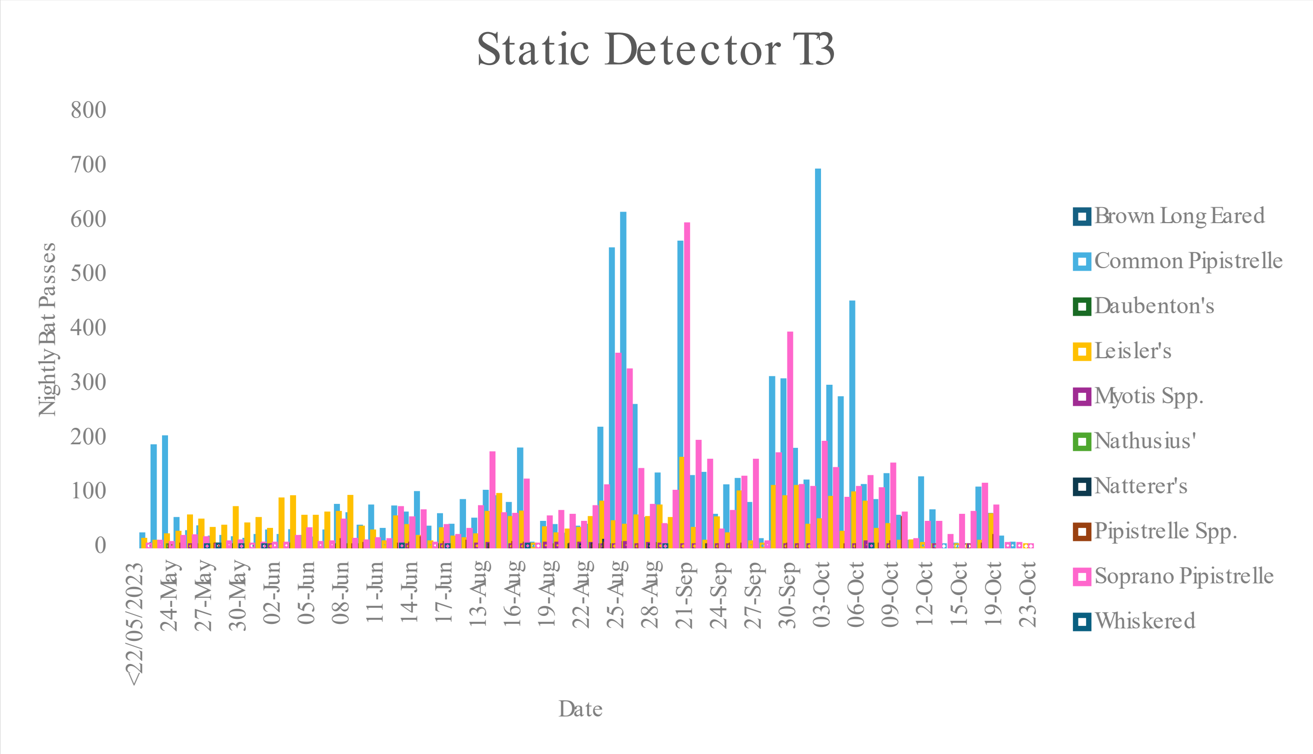

Plate 1-31: Total number of nightly passes recorded at static location T3 (2023)

The static unit T3 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. The majority of activity was recorded in periods 2 and 3 (08/08 - 30/08/2023 and 19/09 - 24/10/2023). The highest amount of activity occurred during survey period 3 (19/09 - 24/10/2023). Both common and soprano pipistrelle had higher levels of activity than other species, and common pipistrelle had the highest number of pronounced spikes in activity during all survey periods. Leisler's bat activity occurred across all survey periods, but no pronounced spikes in activity occurred for this species.

All other species/groups had lower activity levels.

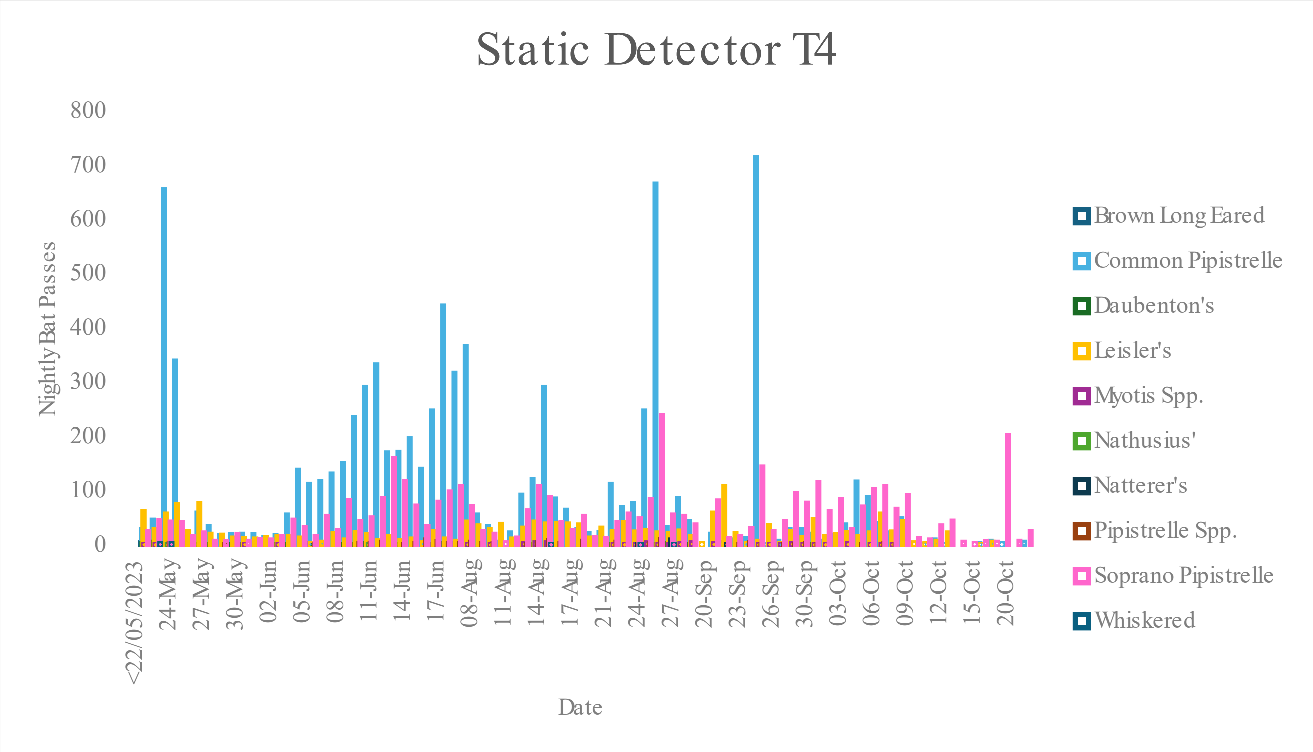

Plate 1-32: Total number of nightly passes recorded at static location T4 (2023)

The static unit T4 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. The majority of activity was recorded in period 1 (22/05/23 - 20/06/23), due to higher levels of common pipistrelle activity. The most consistent occurrence of common pipistrelle activity is within survey period 1, although larger but more isolated activity spikes for this species occur in periods 2 and 3 (the highest recorded number of passes 714 for common pipistrelle, was on 25/09/2023 during period 3). Soprano pipistrelle were active across all survey periods; this species had lower levels of activity than common pipistrelle but similar frequency of occurrence and activity spike patterns during periods 1 and 2. Soprano pipistrelle was more frequently active during period 3. Leisler's bat activity occurred across all survey periods, but spikes in activity for this species were not as pronounced as common and soprano pipistrelle.

All other species/groups had lower activity levels.

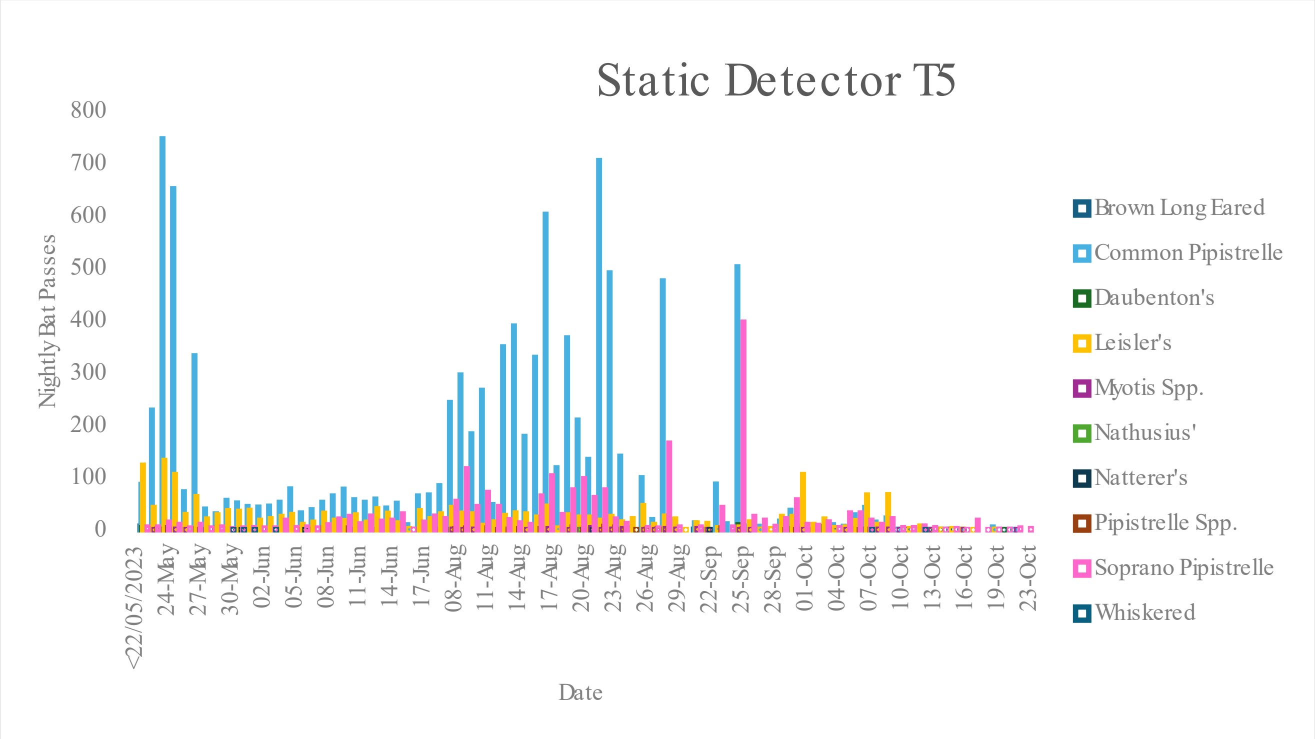

Plate 1-33: Total number of nightly passes recorded at static location T5 (2023)

The static unit T5 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. The highest activity levels at this location were recorded during survey period 2 (08/08/23 - 30/08/23), due to large spikes in common pipistrelle activity. There were also notable spikes in activity for this species at the start of period 1, but these dropped off for the remainder of period 1. Higher activity nights for soprano pipistrelle were focused in survey period 2; however the highest activity spike for this species was an outlier during survey period 3 (397 passes on 25/09/2023). Leisler's bat were more active at this location during period 1, but occurred at this location throughout surveys and had three spikes in activity late in the season (October 2023).

All other species/groups had lower activity levels.

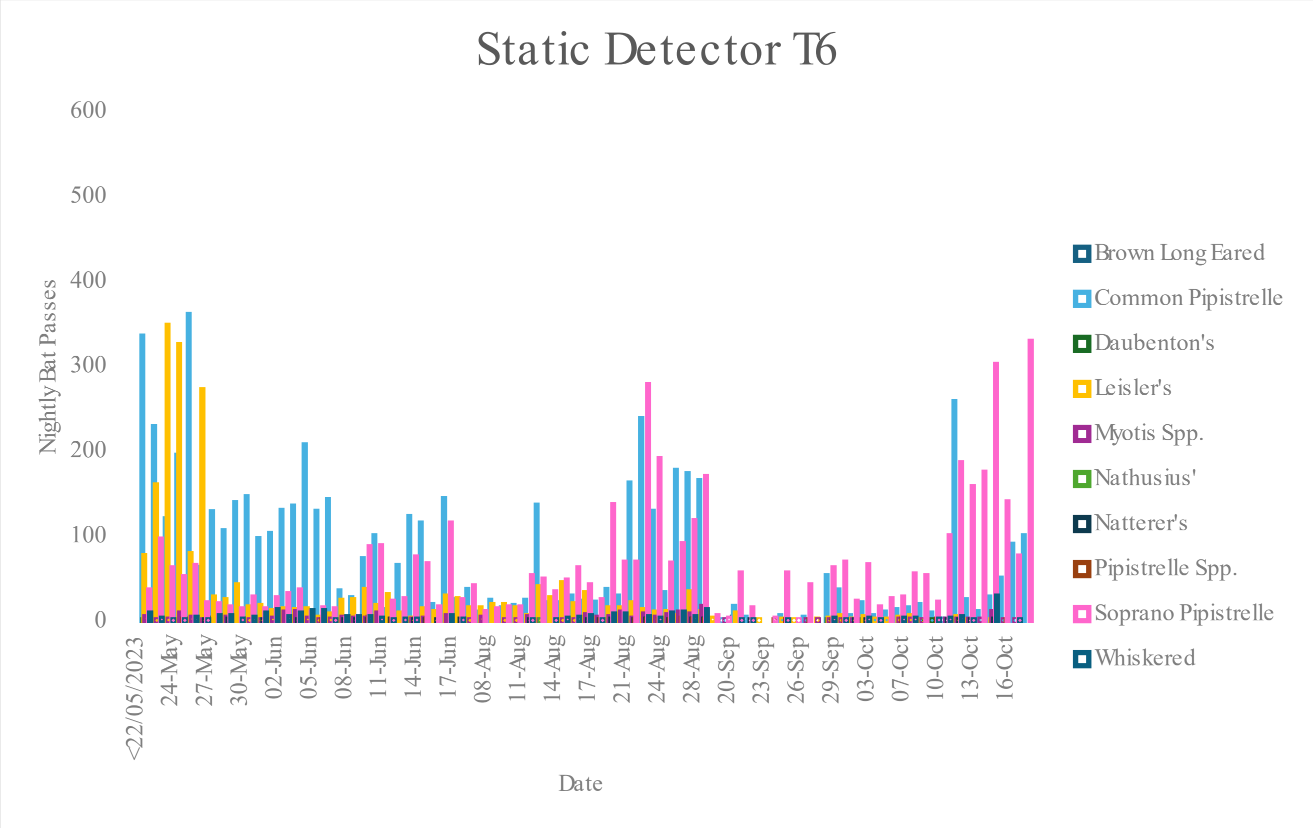

Plate 1-34: Total number of nightly passes recorded at static location T6 (2023)

The static unit T6 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. There were periods of high activity recorded across all survey periods; however, higher activity was recorded more consistently during survey period 1. The highest periods of common pipistrelle activity were during survey periods 1 and 2, while the highest periods of soprano pipistrelle were later in the season during periods 2 and 3. Leisler's bat activity during the beginning of survey period 1 was far higher than the remainder of period 1 and all of periods 2 and 3.

All other species/groups had lower activity levels.

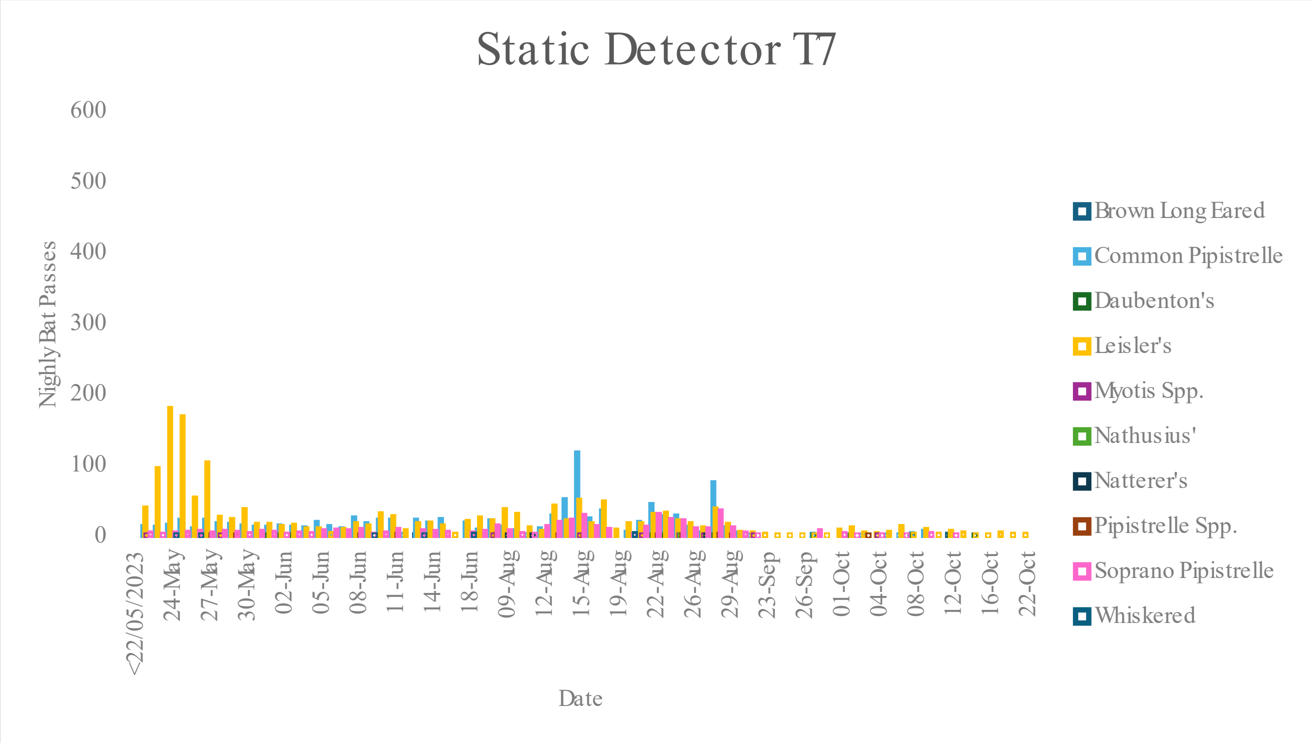

Plate 1-35: Total number of nightly passes recorded at static location T7 (2023)

The static unit T7 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. This location is notable in that it generally did not record activity spikes as high as other locations, although there were spikes in Leisler's activity around the start of period 1, with a peak of 180 Leisler's bat passes on 24/05/2023. Isolated spikes in common pipistrelle activity were recorded during survey period 2; however, these remained relatively lower (peak activity was 117 passes on 15/08/2023) than the activity spikes for this species observed at other locations.

All other species/groups had lower activity levels.

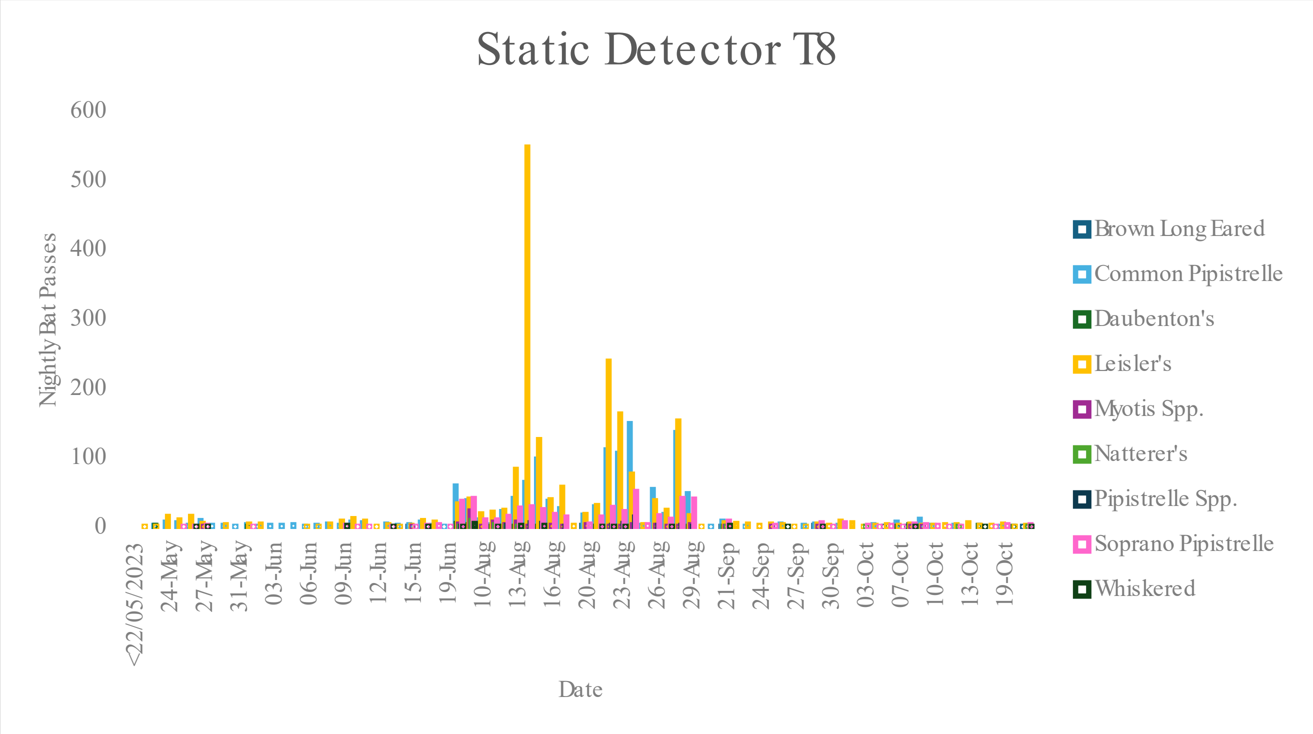

Plate 1-36: Total number of nightly passes recorded at static location T8 (2023)

The static unit T8 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. Activity at this location was focused on survey period 2, with relatively low levels recorded during the periods 1 and 3. Activity was dominated by Leisler's bat, with a number of activity spikes for this species during survey period 2 (peak activity was 548 bat passes on 14/08/2023; this was also the highest number of Leisler's bat passes recorded across all locations and survey periods). Common ad soprano pipistrelle were also more active at this location during period 2, although at relatively lower levels versus Leisler's bat.

All other species/groups had lower activity levels.

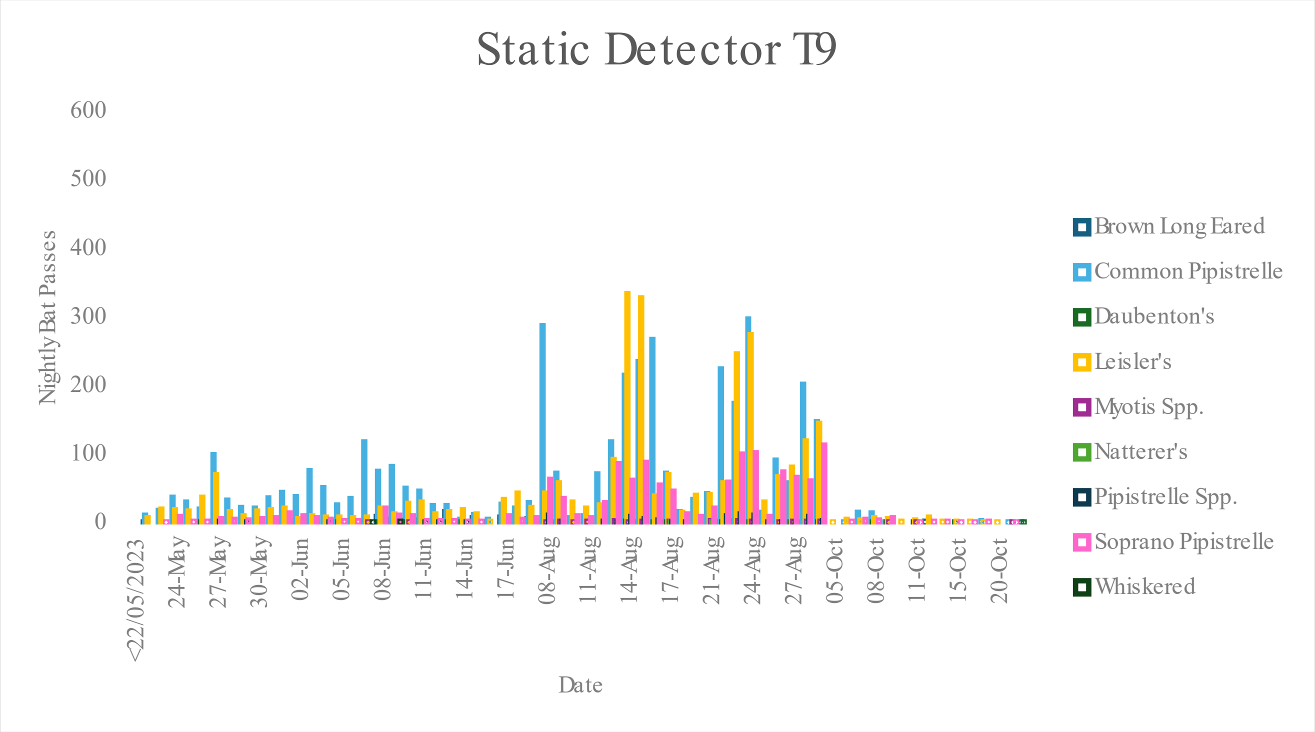

Plate 1-37: Total number of nightly passes recorded at static location T9 (2023)

The static unit T9 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. Activity at this location was highest during survey period 2, followed by period 1. Survey period 3 had relatively lower activity levels. Most of the bat activity was comprised of Leisler's bat and common pipistrelle passes, while soprano pipistrelle also comprised a relatively higher proportion of overall activity versus all other species.

All other species/groups had lower activity levels.

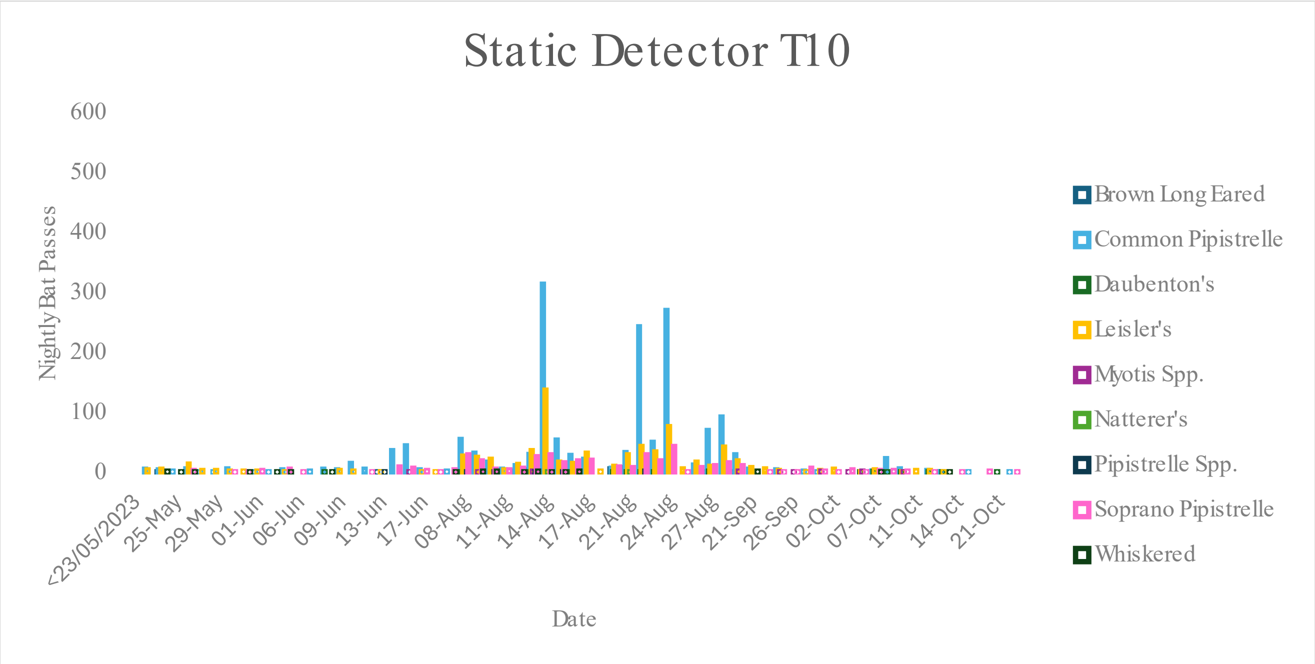

Plate 1-38: Total number of nightly passes recorded at static location T10 (2023)

The static unit T10 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. Activity across all species at this location followed a similar pattern to T8, with most activity focused in period 2; however, at T10 common pipistrelle rather than Leisler's bat accounted for the bulk of activity. Leisler's bat and soprano pipistrelle were also active at relatively higher levels during period 2 vs. periods 1 and 3.

All other species/groups had lower activity levels.

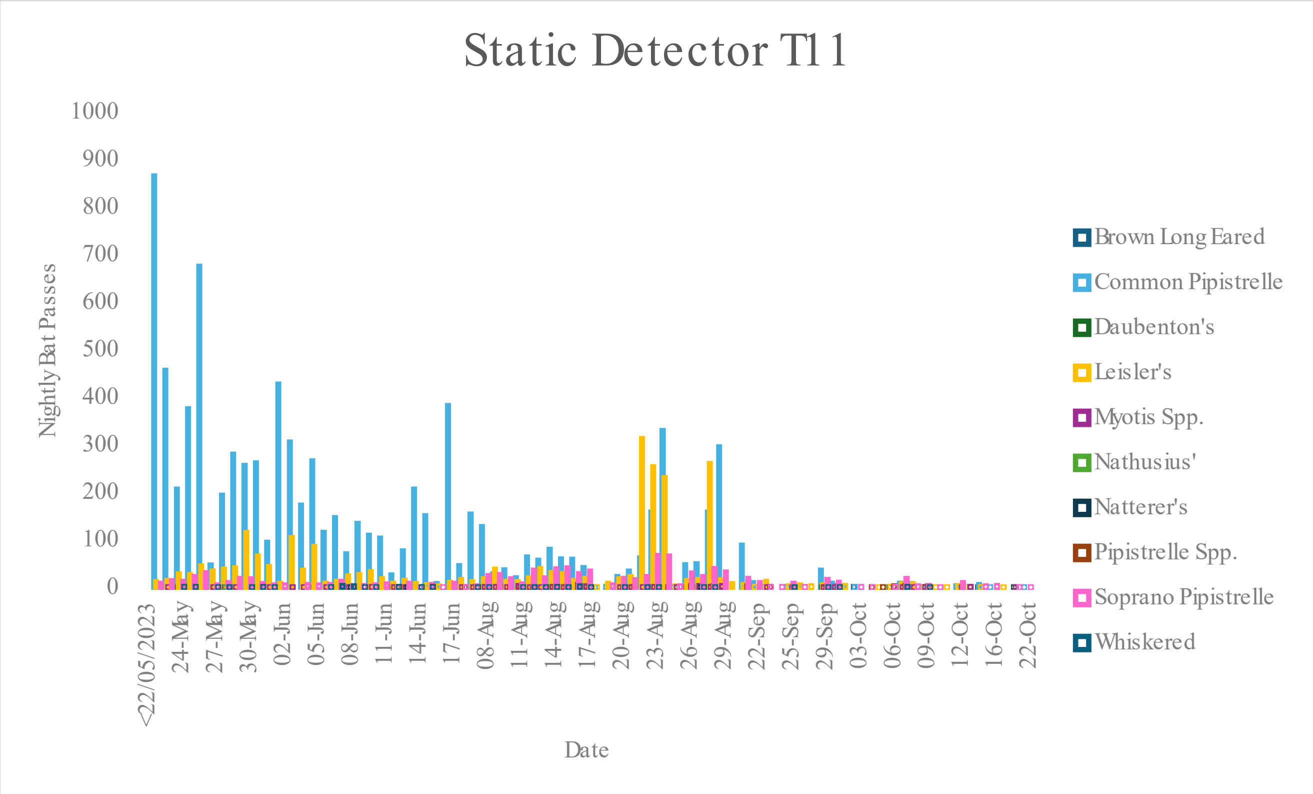

Plate 1-39: Total number of nightly passes recorded at static location T11 (2023)

The static unit T11 recorded eight species of bat, in addition to *Myotis* Spp. and *Pipistrellus* Spp. The highest activity at this location was recorded during survey period 1, and this was largely due to high common pipistrelle activity with regular spikes. The highest number of common pipistrelle passes (866) across all locations and periods was recorded here on 22/05/2023 (survey period 1). There were also common pipistrelle activity spikes during period 2. Leisler's bat activity spikes also occurred in period 1 and period 2, with higher spikes in period 2 (highest number of passes for Leisler's bat at this location was 313 on 22/08/2023). The next most active species at this location was soprano pipistrelle, although activity for this species was relatively lower than Leiser's bat and common pipistrelle.

All other species/groups had lower activity levels.

Activity at Turbine Locations

The number of passes for individual species (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Daubenton's bat, Natterer's bat and whiskered bat) at each static detector location for the full survey period of 2023 is detailed in Appendix 8.1-4. During the 2023 survey season, location T5 had the highest number of passes for common pipistrelle (9,850 passes). T3 had the highest number of passes for soprano pipistrelle (5,861) . T1 had the highest number of passes of Nathusius' pipistrelle (3 passes). T3 had the highest number of passes for Leisler's bat (3,171). Location T1 had the highest numbers of Daubenton's (188 passes) and Natterers' bat (129) passes. T6 had the highest number of whiskered bat passes (264). T9 had the highest number of brown long-eared bat passes (91).

1.1.5.6 2022 Static Detector Surveys

During 2022 surveys, a total of 11 static units were deployed during each survey period (DR01-02, DR04-012). Across all survey periods, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat) were recorded at each detector location. The occurrence of each species per survey period (i.e. spring/summer/autumn) at each detector location is detailed in Appendix 8.1-4. All summer 2022 records were identified to species level.

Common Pipistrelle

The total number of recordings for common pipistrelle at the Proposed Wind Farm was 51,398 no. recordings; 50.15% of total recordings. These were recorded over 92 no. nights, which gives an average of 558.67 no. recordings per night.

Soprano Pipistrelle

The total number of recordings of soprano pipistrelle recorded at the Proposed Wind Farm was 31,178 no. recordings; 30.42% of total recordings. These were recorded over 92 no. nights, which gives an average of 338.89 no. recordings per night.

Nathusius' Pipistrelle

The total number of recordings for Nathusius Pipistrelle at the Proposed Wind Farm was 232 no. recordings; 0.23% of total recordings. These were recorded over 92 nights, which gives an average of 2.52 no. recordings per night.

Leisler's Bat

The total number of recordings for Leisler's bat at the Proposed Wind Farm was 16,775 no. recordings; 16.37% of total recordings. These were recorded over 92 no. nights, which gives an average of 182.34 no. recordings per night.

Brown Long-Eared Bat

The total number of recordings for Brown Long-Eared Bat at the Proposed Wind Farm was 983 no. recordings; 0.96% of total recordings. These were recorded over 92 no. nights, which gives an average of 10.68 no. recordings per night.

Daubenton's Bat

The total number of recordings for Daubenton's Bat at the Proposed Wind Farm was 1,559 no. recordings; 1.52% of total recordings. These were recorded over 92no. nights, which gives an average of 16.95 no. recordings per night.

Whiskered Bat

The total number of recordings for Whiskered Bat at the Proposed Wind Farm was 211 no. recordings; 0.20% of total recordings. These were recorded over 92 no. nights, which gives an average of 2.28 no. recordings per night.

Natterer's Bat

The total number of recordings for Natterers Bat at the Proposed Wind Farm was 157 no. recordings; 0.15% of total recordings. These were recorded over 92 nights, which gives an average of 1.71 no. recordings per night.

Activity at Turbine Locations

The number of passes for individual species (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Daubenton's bat, Natterer's bat and whiskered bat) at each static detector location for the full survey period of 2022 is detailed in Appendix 8.1-4 .

During the 2022 survey season, location Dr08 had the highest number of passes for common pipistrelle (11,554). Dr08 also had the highest number of passes for soprano pipistrelle (7,860), closely followed by Dr04 (7,626). Dr02 had the highest number of passes of Nathusius' pipistrelle (60); as noted in Section 8.5.3.9 the number of passes for this species is likely to be an overestimate due to the use of Kaleidoscope auto-ID. Dr04 had the highest number of for Leisler's bat passes (2,584); Dr05, Dr07 and Dr08 also had similar numbers of Leisler's bat passes (all above 2000). Dr08 and Dr11 had the highest numbers of brown long-eared bat passes (148 and 141 respectively). Dr12 had the highest number of Daubenton's bat passes (1,062). All other locations had <129 passes for this species. Dr06 and Dr08 both had the highest numbers of Natterers' bat passes (27 at both). Dr08 had the highest number of whiskered bat passes (98).

1.1.5.7 Roost Surveys

Roost surveys were completed across two years (2022-2024).

1.1.5.7.1 Preliminary Roost Assessment 2022

A total of five bat boxes in the northern section of the site were identified in the desk study (BCI data) and these were inspected by Tom O'Donnell under his bat survey license. Four of the five bat boxes were surveyed in 2022, the fifth having fallen to the ground at that time. One adult male Soprano Pipistrelle was found in bat box No. 5. No bats were present in remaining boxes but all showed signs of previous use by bats.

A total of seven historically mapped building locations (mapped in 1st edition ordnance survey maps completed in 1846 but absent in the 2nd edition completed in 1915) near the Proposed Wind Farm were investigated; these were confirmed as absent, as indicated in 2nd edition OS mapping. A stonework crypt at Dunfierth Chapel located 1.4 km north-east of the T11 was investigated. Internal access was not possible; abundant stonework crevices were present along the walls. A possible void between the brick ceiling and slate roof was observed. A possible underground portion was noted. No evidence of occupation by bats was noted.

1.1.5.7.2 Re-checks of Potential Roost Features identified in 2018

These features first recorded in 2018 were re-checked in 2024. The majority of tree PRFs recorded in 2018 are still present in the same condition. The exceptions are a new knothole identified on tree No.3, and tree No.11 which has fallen, lowering the PRF to an un-useable height for bats. The results of this survey are detailed in Table 3-10 of Appendix 8.1-4, and locations are shown in Figure 3-1 of Appendix 8.1-4.

A number of bat boxes which were present in 2018 are no longer attached to trees: bat boxes 2, 3, 7, 8 and 9. No signs of box 7 were found. Remnants of the other boxes were present at the bases of trees.

Harvesting of conifers has recently occurred in a number of areas adjacent to trees with bat boxes, removing connectivity and shelter and thereby reducing suitability for bats. This has occurred at boxes 6 and 10. Bird droppings were also noted on the landing strips of these boxes, indicating more recent use by birds rather than bats.

Inspections of the bat boxes in 2022 noted evidence of use by bats, and an adult male soprano pipistrelle was observed roosting in box 5. It is noted that the inspection panels are now missing from boxes 4 and 5, reducing their suitability for roosting bats. Taking into account the bat boxes which have fallen down, those which have sub-optimal landscape conditions due to tree felling and those with missing inspection panels, bat box 1 is the only box of the original ten boxes which remains in good condition with suitable surrounding landscape features. As such, this box has potential to be used by roosting bats. Boxes 4 and 5 have negligible suitability due to missing inspection panels, and boxes 6 and 10 have low potential due to declines in shelter and/or connectivity conditions but cannot be ruled out as potentially being of occasional use on a precautionary basis. It is noted that future planting in these areas may improve connectivity over the lifetime of the wind farm; however, based on observed longevity of other bat boxes currently installed, none of the current bat boxes are likely to persist long term.

1.1.5.7.3 Potential Roosting Features identified in 2024 (Proposed wind farm & Substation)

A total of 17 trees (additional to the trees identified during 2018 surveys) with potential for bat roosting were identified during surveys of the Proposed Wind Farm and Substation in March-April 2024. Within these, a total of nine low potential trees are within turbine felling buffers, and one low-moderate and one moderate potential trees are also within turbine felling buffers. The moderate potential tree is a mature ash with rot within the T5 felling buffer, featuring a knothole c.3 m up the trunk, potentially with room for several bats. No signs of use by bats were observed from ground level. These are detailed in Table 3-8 in Appendix 8.4-4 and shown on Figure 3-2 in Appendix 8.4-4.

1.1.5.7.4 Potential Roosting Features (TDR)

A total of 12 trees with potential for occasional use by individual or low numbers of bats (negligible to low potential) were identified along the TDR in areas where tree trimming is likely to be required to permit the passage of turbine components. Details of these features and location coordinates are included in Table 3-10 in Appendix 8.4-4.

1.1.5.7.5 Derelict Building (northern turbine delivery site access route)

A small derelict brick-built shed is present within the footprint of the northern internal access track. Part of the corrugated roof is missing. A chimney is present. There are no PRFs in the roof, and no gaps are present in the brickwork of the shed including the chimney. The shed is surrounded by plantation woodland.

No PRFs or signs of use by bats were observed.

A disused swallow's nest was present in a corner covered by remnants of the roof.

1.1.6 Other Species

1.1.6.1 Desktop Study

The following protected/threatened species from other groups are present within NBDC records for 10 km grid square N73.

The closest record of smooth newt is from Dunfierth, c. 1.1 km north-east of the proposed grid connection high voltage loop-in.

Table 1-14: Other species - desktop records

Species name	Date of last record	Title of dataset	Designation	Closest Desktop Record
Common Frog (*Rana temporaria*)	18/03/2023	Amphibians and reptiles of Ireland	EU Habitats Directive Annex V; Wildlife Acts	0m (100m records overlap proposed access track northwest of T9)
Smooth Newt (*Lissotriton vulgaris*)	04/06/2020	Amphibians and reptiles of Ireland	Wildlife Acts	1.1 km
Dark Green Fritillary (*Argynnis aglaja*)	31/07/2018	Butterflies of Ireland pre-2022	Vulnerable	600m
Dingy Skipper (*Erynnis tages*)	13/06/2021	Butterflies of Ireland pre-2022	Near threatened	1.2 km
Large Heath (*Coenonympha tullia*)	12/08/2021	Butterflies of Ireland pre-2022	Vulnerable	780m
Marsh Fritillary (*Euphydryas aurinia*)	20/09/2022	Butterflies of Ireland post 2021	EU Habitats Directive Annex II; Vulnerable	99m
Small Heath (*Coenonympha pamphilus*)	06/06/2022	Butterflies of Ireland post 2021	Near threatened	372m
Barbut's Cuckoo Bee (*Bombus Psithyrus barbutellus*)	13/07/2014	Bees of Ireland	Endangered	1.1 km

Species name	Date of last record	Title of dataset	Designation	Closest Desktop Record
Gipsy Cuckoo Bee (*Bombus Psithyrus bohemicus*)	05/04/2020	Bees of Ireland	Near threatened	288m
Gooden's Nomad Bee (*Nomada goodeniana*)	19/04/2022	Bees of Ireland	Endangered	2.8 km
Large Red Tailed Bumble Bee (*Bombus Melanobombus lapidarius*)	05/03/2024	Bees of Ireland	Near threatened	1.2 km
Patchwork leafcutter bee *Megachile (Megachile) centuncularis*	18/07/2022	Bees of Ireland	Near threatened	4.2 km
Moss Carder-bee (*Bombus Thoracombus muscorum*)	04/05/2020	Bees of Ireland	Near threatened	1.2 km
Common Lizard (*Zootoca vivipara*)	30/06/2018	Amphibians and reptiles of Ireland	Wildlife Acts	2.9 km

1.1.6.2 Previous Surveys (Other Species)

Common lizard and common frog were recorded during the 2018 EIAR surveys.

1.1.6.2.1 2018 EIAR Surveys: Lepidoptera and Odonata

During 2018 EIAR surveys, the following butterfly species: small copper (*Lycaena phlaeas*), meadow brown (*Maniola jurtina*), green-veined white (*Pieris napi*) and large heath (*Coenonympha tullia*) were recorded. As per Table 8-24 above, large heath is categorised as Vulnerable.

Pre- 2018 EIAR surveys also recorded the following butterfly and dragonfly/damselfly species (all are categorised as Least Concern):

Lepidoptera

- Small tortoiseshell (*Aglais urticae*)
- Peacock (*Inachis io*)
- Speckled wood (*Pararge aegeria*)
- Meadow brown (*Maniola jurtina*)
- Ringlet (*Aphantopus hyperantus*)

Odonata

- Brown hawker (*Aeshna grandis*)
- Ruddy darter (*Sympetrum sanguineum*)
- Four-spotted chaser (*Libellula quadrimaculata*)
- Banded demoiselle (*Calopteryx splendens*)
- Large red damselfly (*Pyrrhosoma nymphula*)

1.1.6.2.2 2019 FI Surveys: Lepidoptera and Odonata

A lepidoptera survey was undertaken to inform the FI response in 2019 (survey carried out on Mulgeeth raised bog during July 31st to August 1st 2019).

During this survey, no marsh fritillary or associated larval foodplants were found in this area. A range of lepidoptera (moths and butterflies) and odonata (damselflies and dragonflies) were noted during this survey.

A notable moth species which was caught in the light trap was the Micromoth *Nemapogon koenigi*. This is the second Irish record; the first was found in Co. Antrim in August 2015. The larva is reported to feed on fungus, especially bracket fungus, as well as on decaying wood, especially on birch. No red list assessment for Irish micromoths has been published to date.

Other species recorded during this survey were:

Lepidoptera (Butterflies) (all categorised as Least Concern)

- Peacock (*Inachis io*)
- Green veined white (*Pieris napi*)
- Common blue (*Polyommatus Icarus*)
- Ringlet (*Aphantopus hyperantus*)

Lepidoptera (Moths) (all macro-moth species categorised as least concern. Red list assessments have not been completed for other groups to date).

- *Agriphila straminella*
- Bilberry Tortrix (*Aphelia viburnana*)
- *Blastobasis adustella*
- Buff Footman (*Eilema depressa*)
- *Catoptria margaritella*
- Cinnabar (*Tyria jacobaeae*)
- Common Footman (*Eilema lurideola*)
- Common Heath (*Ematurga atomaria*)
- Common Rustic (*Mesapamea secalis*)
- Common White (*Cabera exanthemata*)

- *Crambus pascuella*
- Crescent (*Helotropha leucostigma*)
- Dark Arches (*Apamea monoglyph*)
- *Dipleurina lacustrata*
- Dotted Clay (*Xestia baja*)
- Emperor (*Saturnia pavonia*)
- *Eudonia mercurella*
- *Eupoecilia angustana*
- Garden Grass Veneer (*Chrysoteuchia culmella*)
- High Highflyer (*Hydriomena furcata*)
- Large Yellow Underwing (*Noctua pronuba*)
- Lesser Common Rustic (*Mesapamea didyma*)
- Mottled Beauty (*Alcis repandata*)
- *Olethreutes schulziana*
- Pinion-streaked Snout (*Schrankia costaestrigalis*)
- Smoky Wainscot (*Mythimna impura*)
- *Stigmella lapponica*
- True-lover's Knot (*Lycophotia porphyria*)
- *Udea lutealis*
- *Udea prunalis*
- Willow Beauty (*Peribatodes rhomboidaria*)

Odonata (all categorised as Least Concern)

- Brown hawker (*Aeshna grandis*)
- Common Hawker (*Aeshna juncea*)
- Emperor dragonfly (*Anax imperator*)
- Black Darter (*Sympetrum danae*)
- Common Darter (*Sympetrum striolatum*)

1.1.6.3 Current Surveys (Other Species)

1.1.6.3.1 Marsh fritillary

Marsh fritillary surveys in 2022 recorded a total of 29 marsh fritillary larval webs in pockets of *Molinia*-dominated grassland with devil's bit scabious along the north-western edge of Timahoe North Bog. All larval web records are outside the Proposed Wind Farm, which is restricted to the wooded areas to the north-west of the marsh fritillary habitat bordering the open bog.

Repeat surveys in September 2023 did not detect any larval webs, but did confirm the extent and distribution of devil's bit scabious and associated marsh fritillary habitat remains similar to 2022. Smaller isolated patches of devil's bit scabious were also recorded in association with existing forestry tracks in the woodland habitats north-west of the open bog, including an area of devil's bit scabious immediately adjacent to the proposed T7 - T8 access track. These areas of devil's bit scabious along forestry tracks are unsuitable for marsh fritillary, due to limited extent, lower density of devil's bit scabious and their location in woodland. No larval webs were found at this location during surveys.

Marsh fritillary is an Annex II species under the Habitats Directive, and as such requires the designation of special areas of conservation. The Irish population is assessed as Vulnerable under the current Red List.

1.1.6.3.2 Common Lizard

Surveys in 2021 and 2022 confirmed the presence of common lizard, with records concentrated in the northern part of the Proposed Wind Farm, particularly in recently felled/replanted conifer plantation south of the proposed substation. The observed distribution pattern of lizards across the study area is assessed to align with the distribution of suitable habitat for this species. One lizard was also observed in the vicinity of T11. See Appendix 8.1-6 for the baseline lizard survey reports 2021-22.

This species was confirmed present during 2023 transect surveys, when a basking lizard was flushed in raised bog 220m east of T8 during lizard transect surveys.

Common lizard is protected under the Wildlife Act.

1.1.6.3.3 Common Frog

Observations of adult common frogs around the bog pool east of T8 (within Proposed wind Farm boundary) and in recolonising cutover bog south-west of T4 (outside Proposed wind Farm boundary) reconfirmed the presence of this species in the area.

Common frog is protected under the Wildlife Act and is listed on Annex V of the Habitats Directive.

1.1.6.3.4 Common Carder Bee

A common carder bee *Bombus pascuorum* was observed feeding on devil's bit scabious on the margin of Timahoe North Bog (outside Proposed Wind Farm). This species is assessed as Least Concern.

1.1.6.3.5 Raft Spider

A raft spider was observed at a bog pool in drained raised bog on Timahoe North Bog (outside Proposed Wind Farm), northwest of T8. No Irish red list assessment of arachnids has been completed to date.

2. ORNITHOLOGY

2.1 Target species recorded during VP, transects and other species-specific surveys

The following target species were recorded during vantage point (VP) surveys, transects and other species-specific surveys. The records of these species during hinterland surveys have also been included to provide context in relation to connectivity to important habitats in the surrounding area outside of the proposed wind farm site. The study area for VP surveys is called the 'flight activity survey area' and is unique to this survey type. Any target species passing within this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the proposed wind farm site under the SNH (2017) guidance. A proportion of observations of target species were outside of the flight activity survey area. However, the details of these observations were noted during the survey. The 'rotor sweep zone' is the band across which the proposed turbine blades would be rotating. It extends for the minimum tip of the blade from the ground to the maximum tip height of the blade in rotation.

For Turbine T1, based on the proposed hub height of 81.4m and a blade radius of 66.5m, the lower tip height is 14.9m and the upper tip height is 147.9m.

For Turbines T2- T11, based on the proposed hub height of 100.5m and a blade radius of 66.5m, the lower tip height is 34m and the upper tip height is 167m.

Theoretically, birds flying within this height range (14.9m-167m) would be at risk of collision without the consideration of avoidance.

2.1.1 Barn Owl

2.1.1.1 Barn Owl Surveys Summer 2021 & 2023

No barn owls or signs of nesting barn owl were observed during the barn owl surveys undertaken in summer 2021 and 2023. The presence of suitable hunting habitat in the local area was noted.

2.1.1.2 Barn Owl Nest Box Observation Summer 2023

A barn owl nest box located at the forestry track fork south-east of T11 was observed, during ecology surveys in 2023, to have fallen from the tree it had previously been attached to and destroyed by the fall. The box had deteriorated due to being constructed from wood; any such boxes made from wood are likely to have a relatively limited lifespan due to exposure to the elements.

2.1.2 Buzzard

Buzzards were observed during surveys throughout the two and a half-year survey period. Most records occurred within the 500m buffer zone, where buzzards were recorded flying at rotor-swept height. Buzzards were also recorded in the wider environment. No direct observations of breeding behaviour were detected over the course of the survey period; however, the activity levels recorded indicate buzzard are likely to breed in the local area.

2.1.2.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

A total of 111 observations of buzzard were recorded across all breeding season VP surveys. Buzzards were recorded circling, soaring, and perching in trees. The majority of flight activity observed overlapped the 500m buffer. The majority of observations were of single birds; however, pairs were noted on 22 occasions, and occasionally larger groups of up to six individuals were observed. Occasional soaring and display flights were observed, in addition to buzzards perching in trees. No hunting was observed. No breeding behaviour outside of display flights was observed (buzzard display flights can be used for both territorial defence and courtship).

2.1.2.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of 54 observations of buzzard were recorded across all winter season VP surveys. Most buzzard flights traversed the 500m buffer zone, and in winter 2021-22 flights were clustered within the southern portion of the buffer zone near turbines 1, 2 and 3. The majority of observations recorded individuals; there were three observations of pairs and two observations of groups of four across all winter VP season surveys. In addition to commuting flights, buzzards were observed calling, perching, displaying and soaring during these surveys. No hunting activity was observed across all winter VP season surveys.

2.1.2.3 Summer Walkover Surveys (2021, 2022 and 2023)

Across all three breeding seasons, buzzards were observed on eight occasions. There were two buzzard records during the 2021 breeding season, and four buzzard records each within the 2022 and 2023 breeding seasons. A total of three records were within the 0-25m distance band; two records were within the 25-100m distance band; one record was >100m from the transect, and two were observed flying over.

2.1.2.4 Winter Walkover Survey (2021/22)

During the winter walkover surveys, Buzzards were observed on two occasions. One observation recorded a pair on farmland (Transect 2), while the other recorded an individual (Transect 1), both within the 0-25m distance band.

2.1.2.5 Hinterland Surveys (including Raptor Surveys) (2021, 2022 and 2023)

Across all summer season hinterland surveys, a total of 34 records of buzzards were made. Of these, seven were noted during the 2021 breeding season, nine were noted during the 2022 breeding season, and 18 were noted during the 2023 breeding season. Records were made in April, May, June, July, August and September, throughout the hinterland survey area at HVPs 1, 2, 3, 4, 5, 6, 7, and 8. The majority of observations (20) were of single birds. A total of nine pairs were sighted across HVP 1 (0.8km S) in May and June 2022, at HVP 3 (1.8km E) in May and June 2023, at HVP 4 (3.1km E) in August 2023, and at HVP 8 (8.6km S) in May 2023. On two occasions, a group of three birds were noted at HVP 7 (9.5km S) in June 2022, and at HVP 4 (3.1km E) in May 2023. On one occasion, a group of four birds were sighted at HVP 4 (3.1km E) in July 2023. No hunting activity or breeding behaviours were recorded across these three breeding season survey periods.

Across all surveyed winter seasons, a total of seven records of buzzards were made. Six of which were noted during the 2021/22 non-breeding season, where five single birds were noted across HVP 1 (0.8km S) in December 2021 and January 2022, HVP 9 (9.8km S) in March 2022, and HVP 6 (8.7km SE) in February 2022. A group of four birds were sighted once at HVP 6 (8.7km SE) in March 2022. During the 2022/23 winter hinterland surveys, one record of Buzzard was made, where a lone bird was noted at HVP 3 (1.8km E) in February 2023. No hunting or nesting activity was noted.

Buzzard were noted four times during the 2023 merlin surveys, where single individuals were observed flying over the survey area.

During raptor surveys in Summer 2023, buzzard were recorded eleven times. Most records related to single individuals, however pairs and groups of three and four individuals were also sighted. Buzzards were recorded at HVP 3 (1.8km E), HVP 4 (3.1km E), HVP 6 (8.7km SE) and HVP 8 (8.6km S). One observation in July 2023 at HVP4 recorded an adult and a juvenile together. Buzzards were also observed hunting on two occasions, in June 2023 at HVP4 and September 2023 at HVP8.

2.1.3 Curlew

A total of seven records of curlew were noted during hinterland surveys across the three-year survey period. This species was not recorded during any other surveys and was not recorded at the proposed development site.

2.1.3.1 Hinterland Surveys (2021, 2022 and 2023)

During breeding season hinterland surveys, curlew were observed four times. Two of these occurred in the 2021 breeding season. In April 2021, a pair were sighted at HVP 7 (Lodge Bog) (9.5km south). In May 2021, another pair was sighted at HVP 7. The surveyor highlighted that this pair failed to successfully breed due to predation on their nests. During the 2022 breeding season, two records of curlew were made whereby a group of three birds were sighted at HVP 7 (9.5km south) in April 2022, and again at HVP 9 (Lullymore Wetlands) (9.8km south) in May 2022.

During the winter season hinterland surveys, curlew were noted on three occasions. Two of which were made during the 2021/22 winter season, both of which were noted at HVP 4 (Hortland) (3.1km east) in October 2021 and February 2022. The remaining record observed a pair of curlew at HVP 4 in January 2023.

Curlew were not recorded within the proposed development site or in adjacent lands during VP surveys, breeding and winter transect surveys, breeding wader surveys, or any other surveys conducted at the proposed development site. As such, surveys indicate that breeding curlew are not present at or near the proposed development site but are present on peatland habitats c. 9 km south-west. Similarly, surveys did not detect any wintering curlew at the proposed wind farm site but did note this species during winter at HVP4 (Hortland) c. 3.1 km east.

While curlew were not recorded at the proposed wind farm, there is potential curlew breeding habitat in the form of recolonising cutover bog (Timahoe North Bog) and intact raised bog adjacent to the proposed wind farm site.

2.1.4 Golden Plover

Golden plover were recorded occasionally during VP surveys. The majority of observations were during the winter season. Flight activity was also recorded during spring and autumn. The majority of flights observed overlapped the 500m turbine buffer. All golden plover activity observed consisted of flight activity; no roosting foraging or any other ground-based behaviour was observed.

2.1.4.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Golden plover were not observed during the 2022 summer or spring migration VP surveys. During the 2023 summer VP surveys, one record of golden plover was made. In September 2023, two individuals were observed flying over the study area and calling. The timing of this record indicates migratory activity. No breeding behaviours or activity were observed. During the 2023 spring migration surveys, two records of golden plover were made, where a distant flock of over 50 individuals was observed traversing the 500m buffer zone from VP 2 in April 2023. Later that day, a flock of 25 birds were observed within the 500m buffer zone near turbines 3, 4 and 7.

2.1.4.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

One record of golden plover was made during the 2021/22 winter VP surveys, where a flock of eight individuals were observed flying within the 500m buffer zone, near turbine 1. Six records of golden plover were made during the winter 2022/23 VP surveys. All six records overlapped the 500m buffer, with flocks of between three and 200 individuals recorded. Four of the six records observed birds flying at rotor-swept height. One record observed a flock of 200 individuals circling and calling over cutaway and intact raised bog, intersecting the 500m buffer near turbines 8, 9 and 10.

2.1.4.3 Summer Walkover Surveys (2021, 2022 and 2023)

There were no observations of golden plover during any of the breeding bird transect surveys.

2.1.4.4 Winter Walkover Survey (2021/22)

There were no observations of golden plover during any of the winter walkover surveys.

2.1.4.5 Hinterland Surveys (2021, 2022 and 2023)

Golden plover were observed five times across the three-year hinterland survey period. All observations occurred during the winter seasons. During the 2021/22 non-breeding season, golden plover were noted four times across HVP 1 (0.8km S) in November 2021 and January 2022, and HVP 6 (8.7km SE) in October and December 2021. During the 2022/23 non-breeding season, this species was observed once, where a flock of seven birds was observed at HVP 4 (3.1km E) in January 2023.

2.1.5 Goshawk

There was a single observation of goshawk during winter 2022-23 VP surveys. This species was not recorded during any other surveys.

2.1.5.1 Vantage Point Surveys: Winter Season (2022-23)

Goshawk was observed once during the 2022/23 winter VP surveys, in March 2023. An individual female was observed flying at rotor-swept height within the 500m buffer zone, between turbines 9 and 11. The surveyor noted this individual was recorded flying through and under a group of four soaring Buzzard, into the adjacent woodland. The surveyor noted there is potential breeding habitat in the general area for this species; however, no further observations were recorded and as such goshawk activity observed is limited to a single occurrence of a winter vagrant.

2.1.6 Great Black-backed Gull

Great black-backed gull were observed regularly during surveys, with numbers ranging from individuals up to a flock of 164 birds. A higher proportion of observations were during winter. The majority of observations were of birds flying through the study area, with only isolated records of small numbers of birds landing in fields.

2.1.6.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

This species was observed on a total of 19 occasions across all breeding season surveys. During the 2022 spring migration surveys, six records were made. In April 2022, a flock of 19 individuals were observed circling near turbine 2 before heading in an easterly direction. The remaining spring migration 2022 records observed individuals or pairs. All five records from summer 2022 overlapped the southern portion of the 500m buffer zone, near turbines 1, 2 and 3. Lone individuals, pairs and groups of eight birds were observed during summer 2022 surveys. During the 2023 summer VP surveys, eight records of great black-backed gull were made. All observed individuals within the 500m buffer zone, with most records occurring in the southern portion of the study area near turbines 1, 2 and 3. One individual was noted landing in an agricultural field on May 9th 2023.

2.1.6.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

Great black-backed gull were noted on 45 occasions during the 2021/22 non-breeding season. All records overlapped the 500m buffer zone. Records of lone individuals and flocks of up to 164 birds were noted, most of which were seen flying at rotor-swept height. During the 2022/23 non-breeding season, seven records of great black-backed gull were made. Five of these observed between two and 13 birds flying at rotor-swept height within the 500m buffer zone. The remaining two records involved two birds landing in a nearby agricultural field in December 2022 and a lone first-year observed in March 2023.

2.1.6.3 Summer Walkover Surveys (2021, 2022 and 2023)

Great black-backed gull was not recorded during any of the breeding transect surveys.

2.1.6.4 Winter Walkover Survey (2021/22)

During the winter walkover surveys, a group of five great black-backed gulls was observed along Transect 2.

2.1.6.5 Hinterland Surveys (2021, 2022 and 2023)

Great black-backed gull was not recorded during hinterland surveys.

2.1.7 Grey Heron

Grey heron was observed occasionally during surveys. This species was observed flying through the study area; no static records were made, and no breeding forging activity was observed.

2.1.7.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Individual grey herons were observed on a total of three occasions across all breeding season surveys. All three observations recorded flights within the 500m buffer. Grey heron were not recorded during the 2022 spring migration or summer 2023 VP surveys.

2.1.7.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

One record of grey heron was noted during the 2021/22 non-breeding season, which observed a lone adult traversing the 500m buffer zone. One record of grey heron was noted during the 2022/23 non-breeding season, which also observed a lone adult within the 500m buffer zone. .

2.1.7.3 Summer Walkover Surveys (2021, 2022 and 2023)

Individual grey herons were observed once during summer 2022 breeding bird transects and once during summer 2023 breeding bird transects.

2.1.7.4 Winter Walkover Survey (2021/22)

Grey heron was not recorded during any of the winter transect surveys.

2.1.7.5 Hinterland Surveys (2021, 2022 and 2023)

Seven records of grey heron were made during the three-year hinterland survey period. Two of which occurred during the 2021 breeding season, and the remaining five occurred during the 2023 breeding season. During the 2021 summer hinterland surveys, single birds were noted twice at HVP 6 (8.7km SE) in May 2021.

During the 2023 summer hinterland surveys, two records of individual birds were made at HVP 6 (8.7km SE) during May and September 2023. A single grey heron was also recorded at HVP 2 (0.2km NE) in July 2023. An additional two records were made during this season, where pairs were noted at HVP 6 in June and July 2023.

2.1.8 Hen Harrier

A total of two observations of hen harrier were recorded across all surveys; both were observations of a flying bird which occurred during the same transect survey in December 2021 and the surveyor noted both observations potentially involved the same individual.

2.1.8.1 Winter Walkover Survey (2021/22)

On 16th December 2021, there were two records of hen harrier flying over along Transect 1 (recorded between 10:30 - 14:30). Both observations recorded a juvenile hen harrier; the first was seen flying over raised bog and the second was seen flying over forestry at Coolree. The surveyor noted both observations may have been of the same bird.

2.1.9 Herring Gull

Herring gull were observed regularly during surveys, with individuals and flocks recorded. A higher proportion of observations were during winter. The majority of observations were of birds flying through the study area, with only limited records of small numbers of birds landing in fields

2.1.9.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Herring gull was observed on a total of 10 occasions across all breeding season surveys. During the 2022 spring migration surveys, two records of herring gull were made, comprising an individual in the northern part of the 500m buffer and a flock of 20 circling the southern portion of the 500m buffer zone before heading east. During the 2022 breeding season, four records of herring gull were made, three of which traversed the northern portion of the 500m buffer zone. Two records were lone individuals, and one observed a group of six birds. A group of four birds was seen flying Outside of the 500m buffer zone.

Three records of herring gull were made during the summer 2023 VP surveys. All overlapped the 500m buffer zone. In May 2023, a flock of seven was observed soaring near T8-T11 in the north of the site. In July 2023, a flock of three was seen flying in the same area, made up of two first-year and one second-year birds. In June 2023, a flock of 42 birds was observed in the south of the Site, flying near turbines 1, 2, 3 and 4.

2.1.9.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of 86 records of herring gull were made during the 2021/22 winter VP surveys. All of these overlapped the 500m buffer zone. Records were noted across the study area, with most clustered within the southern portion of the buffer zone near turbines 1, 2 and 3. Observations noted lone individuals, and flocks of up to 290 birds. The majority of records were of smaller flocks of less than 50 individuals. Flocks of 75, 120, 129 and 290 birds were observed flying through the southern portion of the 500m buffer, near turbines 1 and 2 in January 2022.

Herring gull were noted on 32 occasions during the 2022/23 winter VP surveys, all of which overlapped the 500m buffer zone. Lone individuals and flocks of up to 18 birds were noted across the study area. Two records noted flocks of three and four birds landing in agricultural fields. In March 2023, a flock of six birds made up of adults and first-years were recorded in the north of the Site near turbines 9, 10 and 11.

2.1.9.3 Summer Walkover Surveys (2021, 2022 and 2023)

Herring gull was not recorded during any of the breeding transect surveys.

2.1.9.4 Winter Walkover Survey (2021/22)

Herring gull was recorded once during winter transect surveys, whereby a group of five was seen along Transect 2 in association with flooded fields on 3rd January 2022.

2.1.9.5 Hinterland Surveys (2021, 2022 and 2023)

Herring gull were observed nine times during hinterland surveys across the three-year period. Two of which occurred during the 2023 breeding season, whereby two individuals were sighted at HVP 4 (3.1km E) and three individuals were sighted at HVP 8 (8.6km S) on 16th July 2023.

The remaining eight records were observed during the winter period. One of which was noted during the 2021/22 winter season, where an individual was observed at HVP 4 (3.1km E) in February 2022. Seven records were made during the 2022/23 winter season. Of which, six recorded observations of birds in groups of two to 13 individuals were made at HVP 3 (1.8km E). One record occurred at HVP 4, whereby seven individuals were noted in January 2023.

2.1.10 Kestrel

Kestrels were observed during surveys of the proposed wind farm site flight activity study area and also in the surrounding hinterland. Hunting behaviour was observed. No breeding activity or nest sites were observed. The record of one juvenile indicates the presence of a breeding population in the surrounding region, but no evidence of breeding at or near the proposed wind farm or proposed substation was recorded.

2.1.10.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Kestrel were observed a total of 22 times across all breeding season surveys.

One kestrel was noted during spring migration surveys 2022; a single individual was seen flying within the northern portion of the study area near turbine 10. Kestrel were noted on 11 occasions during the 2022 summer VP surveys. All 12 records observed lone individuals flying at rotor-swept height within the northern section of the 500m buffer near turbines 9, 10 and 11. No breeding behaviours or hunting activities were observed.

During 2023 spring migration VP surveys, two records of kestrel were made. Both noted lone individuals flying at rotor-swept height within the northern section of the 500m buffer zone near turbines 9, 10 and 11 on April 6th 2023. One observation recorded a single female, and the other recorded an individual hunting and feeding. During the 2023 summer VP surveys, eight records of kestrel were made. All noted lone individuals flying at rotor-swept height within the northern section of the 500m buffer zone near T8-T11. One of these records noted a juvenile kestrel in September 2023, and another observed a moulting male in August 2023. Hunting was observed on two occasions, in July and September 2023.

No breeding activity or nest sites were observed. The record of a juvenile indicates the presence of a breeding population in the surrounding region, but no evidence of breeding at or near the proposed wind farm or proposed substation was recorded.

2.1.10.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of 12 records of kestrel were noted during the 2021/22 winter VP surveys. All 12 records overlapped the 500m buffer zone. All 12 of these observations recorded lone individuals flying at rotor-swept height within the northern section of the 500m buffer zone near turbines 9, 10 and 11. The remaining record occurred outside the 500m buffer zone north-west of T3.

A total of five records of kestrel were made during the 2022/23 winter VP surveys, all of which observed lone individuals flying at rotor-swept height within the northern section of the 500m buffer zone near turbines 9, 10 and 11. Hunting was observed on two occasions (single female hunting on March 22nd 2023; single individual hunting on March 20th 2023).

2.1.10.3 Summer Walkover Surveys (2021, 2022 and 2023)

Kestrel was not recorded during any of the breeding transect surveys.

2.1.10.4 Winter Walkover Survey (2021/22)

Kestrel was recorded twice during winter transect surveys. One kestrel was recorded within 25m of Transect 1 on 16th December 2021. Another was recorded within 25-100m of Transect 1 on 3rd January 2022.

2.1.10.5 Hinterland Surveys (including Raptor Surveys) (2021, 2022 and 2023)

Seven observations of kestrel were made across the three-year hinterland survey period. Most of which (six) occurred during the breeding seasons. During the 2021 breeding season, Kestrel were noted twice. Both of which observed lone individuals at HVP 1 (0.8km S). During the 2022 breeding season, one observation of kestrel was made, whereby a male and a female in flight was noted at HVP 1 (0.8km S). During the 2023 breeding season, two records of kestrel were observed. Both observations were at HVP 8 (8.6km S), and one of these noted a pair in September 2023. The remaining record occurred during the 2021/22 non-breeding season, whereby a single individual was noted at HVP 6 (8.7km SE).

Kestrel were recorded twice during targeted raptor surveys. In July 2023, one record of two juveniles and a single female was made at HVP 4 (3.1km E). In September 2023, a pair of kestrel were observed soaring and hunting at HVP 8 (8.6km S).

One record of kestrel was made during merlin surveys in May 2023, where a single individual was noted flying over the survey area.

The observations of pairs and juveniles during these surveys further confirm the presence of a breeding kestrel population in the region.

2.1.10.6 Nest Boxes

The presence of three kestrel nest boxes was noted during ecological walkover surveys in 2023; locations are detailed below in Table 8-21. These boxes appeared to be relatively new and none showed signs of occupancy during surveys.

Table 2-1: Kestrel Nest Boxes

ID	Description	Relative Distance/Infrastructure
1	Kestrel nest box in mature tree along existing Coillte access track leading into northern part of site. No signs of use when surveyed.	58m from proposed northern entrance access track.
2	Kestrel nest box in mature tree corridor along existing informal access route from north (Coolree Nature Reserve). No signs of use when surveyed.	7m from proposed substation felling buffer.
3	Kestrel nest box in mature beech treeline in eastern part of Coillte woodland.	258m from proposed grid connection.

2.1.11 Kingfisher

Targeted surveys for kingfisher comprised of riverine VP and bank transect surveys were carried out in summer 2022 (distinct from the main body of ornithological surveys). These confirmed the presence of foraging kingfisher in the local river network, but did not observe any breeding sites and observations indicated the banks of the Fear English river are unsuitable for nesting kingfisher.

2.1.11.1 Kingfisher Vantage Point Surveys: Summer 2022

A total of 2 no. kingfisher observations were recorded during vantage point (VP) surveys on the Fear English River throughout the monitoring period and are summarised in Table 3.1 and Figure 3.1 in Appendix 8.2-3. Kingfisher VP surveys resulted in single observations on the 25th April (flying & perching) and 19th May 2022 visits (flying), at Kingfisher VP2 and VP4, respectively (Table 3.1 in Appendix 8.2-3). Birds were also recorded at these locations in October and May 2019, respectively (Triturus, 2019; Figure 3.2 in Appendix 8.2-3). No kingfishers were observed during the VP surveys in mid-April or mid-June.

2.1.11.2 Bank transect surveys

Bank transect surveys undertaken in August 2022 along approximately 6.9km length of riverine channel resulted in a total of 1 no. additional kingfisher observation (Table 3.2, Figure 3.1 in Appendix 8.2-3). An adult bird was recorded in flight along the Fear English River channel near the confluence of the Kilcooney River (aka Clonkeeran Stream) on the 15th August 2022.

No kingfisher nesting sites (active or inactive) were located during bank transect surveys in 2022 (current survey) or the 2019 surveys (Triturus, 2019).

No kingfisher nesting sites were identified within the study area during vantage point surveys or bank walkover surveys along 6.9km of riverine channel. The banks of the lower reaches of the Kilcooney and Sweep Rivers were typically steep (historically deepened) and heavily scrubbed-over. Some localised, largely-unvegetated areas of bank were recorded along the Fear English River, particularly along a straightened section near site VP2. However, no nests (active or inactive) were observed, despite kingfisher activity in the area.

Kingfishers usually require soft, loamy banks into which to dig their burrows (Heneberg, 2013; Cummins et al., 2010; Crowe et al., 2008; Boag, 1982) and typically choose fine-particulate banks of at least 1-2 metres high with near-vertical banks for nesting, with a slight preference for some emergent and or fringing vegetation (Heneberg, 2004, 2009). Soil compaction and particle composition are key drivers of kingfisher nest locations (Heneberg, 2004), in addition to bank slope angle (Ward et al., 1994). In general, although superficially suitable areas were present along the middle survey reaches of the Fear English channel, the soils of the historically excavated, sloping banks would appear to be too compacted for kingfisher. Indeed, no active kingfisher nests (breeding areas) have been identified in the vicinity of the proposed development to date (this survey; Triturus, 2019; FTCO, 2018). In support of previous findings, the survey area is largely unsuitable for kingfisher nesting. Although kingfishers can adapt their nest site choice if other suitable conditions (i.e. prey availability, perching sites) are prevalent (Hopkins, 2001; Morgan & Glue, 1977), the watercourses within the vicinity of the proposed development can be best considered as foraging habitat rather than a breeding area for kingfisher.

2.1.12 Lapwing

Lapwing were recorded very infrequently, with a single winter record during flight activity surveys and the remaining 10 observations occurring along Transect 3 outside the proposed development c. 1.1km south-east of T2.

2.1.12.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

There were no records of lapwing during breeding season VP surveys.

2.1.12.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

One record of lapwing was made during the 2021/22 winter VP surveys. In February 2022, a group of four individuals were noted flying at rotor-swept height within the 500m buffer zone between turbines 1 and 2. There were no records of lapwing during the winter 2022-23 VP surveys.

2.1.12.3 Summer Walkover Surveys (2021, 2022 and 2023)

Lapwing was not recorded during any of the breeding transect surveys.

2.1.12.4 Winter Walkover Survey (2021/22)

Lapwing was not recorded during any of the winter transect surveys.

2.1.12.5 Breeding Wader Surveys (2021, 2022 and 2023)

Lapwing were noted on ten occasions (all during summer 2021). All noted adults along pools, pool margins and wetland habitats along Transect 3, and observed Lapwing displaying. Six of the ten observations noted that Lapwing were seen on suitable breeding habitat, however successful breeding was not determined. It is noted that Transect 3 is located to the south-west of the study area on Timahoe North Bog, and that no lapwing habitat or breeding activity was observed within or adjacent to the Proposed Development. It is further noted that a solar array has been installed on Timahoe North Bog to the north-west of Transect 3 since surveys were completed there in 2021.

2.1.12.6 Hinterland Surveys (2021, 2022 and 2023)

Lapwing were noted six times across all hinterland surveys. Five of these observations were noted during the 2021 breeding season, where lone individuals and groups of two, six and twelve birds were observed. At HVP 1 (0.8km S), a flock of six lapwing were noted in April 2021. At HVP 7 (9.5km S), a flock of six were noted in April 2021, and a flock of twelve birds were noted at the same location in May 2021 where an attempt at breeding failed due to nest predation. At HVP 6 (8.7km SE), two records were made in May 2021 where a lone individual and a pair were noted. The remaining record occurred during the 2022 breeding season, where a pair were sighted at HVP 1 (0.8km S) in May 2022.

2.1.13 Lesser Black-backed Gull

Lesser black backed gull were recorded during surveys at the proposed wind farm site and surrounding hinterland.

2.1.13.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

A total of 12 records of lesser black-backed gull were made during the 2023 summer VP surveys. Lone individuals and flocks of up to 43 birds were noted across the study area, most of which were observed at rotor-swept height. Lesser Black-backed Gull were noted landing in fields on four occasions, and soaring on two occasions. During the 2023 spring migration VP surveys, six records of this species were made, with three records occurring in the southern portion of the study area and two occurring in the northern portion of the study area. Records of lone individuals and flocks of up to 34 birds were observed flying, soaring and landing in fields.

There were no observations of lesser black-backed gull during spring migration VP and summer VP surveys in 2022.

2.1.13.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

Two records of lesser black-backed gull were made during the winter 2021-22 VP surveys. One involved a group of four individuals flying with a mixed flock of herring gull and great black-backed gull in January 2022. This observation overlapped the southern portion of the 500m buffer zone. In March 2023, a lone individual was sighted traversing the northern portion of the 500m buffer. During the 2022-23 winter VP surveys, a total of nine records of lesser black-backed gull were made. Most of these records occurred in the north of the study area near turbines 9, 10 and 11. Observations were predominantly of lone individuals, however groups of two and five birds were also noted.

2.1.13.3 Summer Walkover Surveys (2021, 2022 and 2023)

Lesser black-backed gull was recorded once during breeding transect surveys. An individual was recorded on 01st July 2022 along Transect 1 within the 25-100m distance band.

2.1.13.4 Winter Walkover Survey (2021/22)

Lesser black-backed gull was not recorded during any of the winter transect surveys.

2.1.13.5 Other Surveys (Raptor survey 2023)

Lesser black-backed gulls were observed on seven occasions during raptor surveys, alone or in flocks of up to 26 individuals. Four of these records were made at HVP 3 (1.8km E), and the remaining three occurred at HVP 4 (3.1km E).

2.1.13.6 Hinterland Surveys (2021, 2022 and 2023)

Five records of lesser black-backed gull were made during the three-year survey period. All occurred during the 2023 breeding season. At HVP 3 (1.8km E), two records of groups of three individuals were made. At HVP 4 (3.1km E), two records were made. One of which noted a flock of three gulls, and the other noted a flock of six. At HVP 6 (8.7km SE), a single individual was observed in July 2023.

2.1.14 Little Egret

There was a single observation of little egret during summer 2022 VP surveys. This species was not recorded during any other surveys.

2.1.14.1 Vantage Point Surveys: Summer Season (summer 2022)

One record of little egret was made during summer 2022 VP surveys. On September 10th 2022, a single little Egret was observed flying at rotor-swept height in the southern portion of the 500m buffer zone, near turbine 2.

2.1.15 Merlin

There were two observations of merlin during winter 2021-22 VP surveys, and a single observation during winter transects in 2021. This species was not recorded during any other surveys.

2.1.15.1 Vantage Point Surveys: Winter Season (2021-22)

Merlin were noted on two occasions during the 2021-22 winter VP surveys. Both records observed single individuals flying at rotor-swept height within the northern portion of the 500m buffer zone on November 30th 2021 near turbine 10. One of these observations recorded a single female being briefly chased by a male sparrowhawk.

2.1.15.2 Winter Walkover Survey (2021/22)

One record of merlin was made on 16th December 2021 where a single individual was observed in the 25-100m distance band along transect 2.

2.1.15.3 Merlin Surveys (2023)

No merlin or field signs indicating the presence of breeding merlin were found during summer 2023 merlin surveys undertaken in 1 km grid squares N7935 and N7536.

2.1.16 Peregrine

There was one observation of peregrine falcon during winter 2022-23 VP surveys, three observations during hinterland surveys, and one observation during breeding bird transect surveys. This species was not recorded during any other surveys.

2.1.16.1 Vantage Point Surveys: Winter Season (2022-23)

One record of peregrine was made during the 2022/23 winter VP surveys, where a lone individual was noted flying at rotor-swept height in the vicinity of turbines 1, 4 and 5, traversing the 500m buffer.

2.1.16.2 Summer Walkover Surveys (2021, 2022 and 2023)

This Annex I species was noted on one occasion across the three-year survey period. In May 2022, a single individual was observed flying over in the 25-100m buffer along Transect 1.

2.1.16.3 Hinterland Surveys (including Raptor Surveys) (2021, 2022 and 2023)

Peregrine were recorded on three occasions during the hinterland surveys. All of which observed lone individuals. Individual birds were noted at HVP 1 (0.8km S) in April 2023 and November 2022, and one bird was noted at HVP 8 (8.6km S) in May 2023.

There were no records of peregrine during targeted breeding raptor surveys.

2.1.17 Red Kite

There was a single observation of red kite during summer 2023 VP surveys. This species was not recorded during any other surveys and rarely occurs in Kildare.

2.1.17.1 Vantage Point Surveys: Summer Season (summer 2022)

One record of red kite was made during the 2023 summer VP surveys. On June 7th 2023, a single individual flew over the 500m buffer zone above the rotor swept height band (>170m altitude), between turbine 7 and 8. This red-listed species was re-introduced to Co. Wicklow relatively recently (2007) and is rare in Co. Kildare. Red kites have also been re-introduced in Co. Down. The reintroduced population is slowly expanding from its core range in Counties Wicklow, Dublin and Down (Birdwatch Ireland, 2025b).

2.1.18 Snipe

Snipe were observed across a number of surveys during both the breeding and non-breeding seasons. A number of observations are indictive of breeding activity in the area surrounding the proposed wind farm.

2.1.18.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Snipe were observed on five occasions during the 2022 spring migration VP surveys. Two of these were call-only records. The remaining three records were of lone individuals, traversing the 500m buffer zone. All records were clustered within the intact raised bog habitat located to the south of T9 and T10 (outside proposed development boundary). Five records of snipe were made during the 2022 summer VP surveys, three of these records occurred in May, one in April, and one in June. Three of the five observations were call only records, with one call originating from the intact bog south-west of T10 and two from semi-intact bog habitats (one north-west of T7 and one north-west of T8). The remaining two records traversed the 500m buffer zone, and were clustered within the intact bog south of T9-T10. Records were all of lone individuals, concentrated in bog habitats in the north of the study area. Chipping was noted.

A single record of snipe was made during the 2023 spring migration VP surveys, where on April 6th 2022, a single individual was observed in a display flight within the 500m buffer zone near turbines 9 and 10. Snipe were observed twice during the 2023 summer VP surveys. Both records were observed from VP 2 in in June 2023.Records were of lone individuals traversing the 500m buffer zone, near turbines 9 and 10. One flew overhead at VP2, and the other was observed performing a display flight and calling.

2.1.18.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

During the 2021/22 winter VP surveys, four records of snipe were made. All traversed the northern portion of the 500m buffer zone, occurring near turbines 9, 10 and 11. Three of these records noted lone individuals, and one record noted a pair (December 20th 2021).

2.1.18.3 Summer Walkover Surveys (2021, 2022 and 2023)

Snipe was not recorded during breeding transect surveys.

2.1.18.4 Winter Walkover Survey (2021/22)

Snipe was noted once during winter transect surveys, where a single individual was found along Transect 1 (0-25m distance band) in December 2021.

2.1.18.5 Breeding Wader Surveys (2021, 2022 and 2023)

This species was observed eleven times during the three-year survey period. No records of Snipe were made during the latest breeding wader surveys in 2023.

Seven observations were made during the 2021 breeding season (all recorded along Transect 3 located 1.1 km south-east of T2), where six records recorded chipping and/or drumming, and a single pair was observed flying together. Snipe were heard chipping and drumming on pool margins, bog margins and wetland habitats along Transect 3. Six of the seven records during this survey period noted snipe on suitable breeding habitats, however successful breeding was not confirmed.

Four observations of snipe were made during the 2022 breeding season. One record indicated snipe were heard drumming and occupying territory along transect B in May 2022 within intact raised bog habitat south of T9-T10. The remaining three records also occurred along transect B in bog habitats, where three individuals were heard drumming and occupying territory in July 2022.

2.1.18.6 Hinterland Surveys (2021, 2022 and 2023)

Twelve records of snipe were made during the three-year hinterland survey period. Most of which (eight) were noted during the breeding seasons. During the 2021 breeding season, snipe were observed on six occasions. Five of which occurred at HVP 1 (0.8km S), and one of which occurred at HVP 6 (8.7km SE). Three records noted lone individuals, and three records noted pairs. During the 2022 breeding season, two records of snipe were made whereby a pair was sighted at HVP 1 (0.8km S) in May 2022, and a pair were sighted at HVP 6 (8.7km SE) in April 2022.

During the winter 2021/22 non-breeding season, four records of snipe were noted. Two of which occurred at HVP 9 (9.8km S), where a lone individual was sighted in December 2021, and a group of eight were sighted in March 2022. The remaining two records observed lone individuals at HVP 1 (0.8km S) and HVP 6 (8.7km SE) in December 2021.

2.1.19 Sparrowhawk

Sparrowhawk was observed across a number of surveys encompassing the proposed development and surrounding hinterland.

2.1.19.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Sparrowhawk was observed a total of 14 times across all breeding season VP surveys.

During the 2022 spring migration VP surveys, three records of sparrowhawk were made in April 2022. All records noted lone individuals traversing the 500m buffer. Records were made across the study area, with one record occurring in the north of the Site near turbine 9, another occurring in the centre of the Site near turbines 7 and 8, and another occurring in the southern portion of the study area**.** A total of ten records of sparrowhawk were made during the 2022 summer VP surveys. All ten records observed lone individuals flying at rotor-swept height and all ten flight lines overlapped the 500m buffer zone. Four of these records overlapped the southern portion of the study area near turbines 1 and 3, and the remaining six records occurred in the northern portion of the study area, near turbines 7, 8, 9, 10 and 11.

During the 2023 summer VP surveys, four records of sparrowhawk were made. In June 2023, a single sparrowhawk was observed near turbines 8 and 9 in the northern portion of the buffer zone. In September 2023, a single female individual was mobbed by house martin within the southern portion of the buffer zone near T1. The remaining two records occurred in the southern part of the study area. On one of these occasions (June 7th 2023), a pair of sparrowhawk were observed flying to the south of the proposed development.

2.1.19.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of 14 records of sparrowhawk were noted during the 2021/22 winter VP surveys. All 14 records overlapped the 500m buffer zone. Three of these observations were noted in the southern portion of the 500m buffer zone: a group of three sparrowhawks was observed there on November 29th 2021; a lone individual was noted on February 14th 2022, and a pair was observed on February 25th 2022. The remaining eleven records overlapped the northern portion of the 500m buffer zone near turbines 8, 9, 10, and 11, where ten records were of lone individuals and one record was of a pair.

During the 2022/23 winter VP surveys, twelve records of sparrowhawk were made.. The majority of records were observed within the northern portion of the buffer zone, near turbines 8, 9, 10 and 11. Ten of these records noted lone individuals, and two noted pairs. In March 2023, a single adult was noted with prey, flying low within the buffer zone.

2.1.19.3 Summer Walkover Surveys (2021, 2022 and 2023)

There were no observations of sparrowhawk during breeding bird transect surveys.

2.1.19.4 Winter Walkover Survey (2021/22)

Two records of sparrowhawk were noted within the 0-25m distance band along Transect 1 during the winter transect survey period. In December 2021, a single sparrowhawk was observed and in January 2022 a single individual was observed.

2.1.19.5 Hinterland Surveys (2021, 2022 and 2023)

Sparrowhawk were observed on two occasions during the hinterland surveys. In June 2022, a lone individual was sighted at HVP 7 (9.5km S). In January 2023, a single bird was observed at HVP 4 (3.1km E).

2.1.20 Stock Dove

Stock dove was observed during summer 2022 VP surveys and breeding bird transect surveys. This species was not recorded during any other surveys.

2.1.20.1 Vantage Point Surveys: Summer Season (summer 2022)

A total of two records of stock dove were made during the 2022 summer VP surveys. Both were noted on May 4th 2022, and were located in the south of the study area. One was observed within the 500m buffer zone, where a single individual was noted near turbine 1 and was observed landing in a tree. The other record was of a single individual flying inside the buffer zone.

2.1.20.2 Summer Walkover Surveys (2021, 2022 and 2023)

Stock Dove was noted once during the three-year breeding bird transect survey period. One individual was observed in the 25-100m distance band along Transect 2 in July 2022.

2.1.21 Swift

Swift were observed across a number of surveys encompassing the proposed development and surrounding hinterland. There is no potential breeding habitat for this species within the proposed development.

2.1.21.1 Vantage Point Surveys: Summer Season (2022 spring migration and summer, 2023 spring migration and summer)

Two records of swift were made during the 2022 summer VP surveys. Both of which occurred on June 6th 2022, and noted birds within the 500m buffer zone, in the north of the Site near turbines 8, 9, 10 and 11. One record observed five individuals flying together, and the other noted two individuals flying together. Swift were observed on three occasions during the 2023 summer VP surveys. All three records occurred in the northern portion of the 500m buffer zone, near turbines T7-T11 and observed swift hawking. Two of these records identified two individuals, and the other noted four individuals.

2.1.21.2 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

There were no records of swift during winter VP surveys.

2.1.21.3 Summer Walkover Surveys (2021, 2022 and 2023)

Swift were observed flying across the study area on three occasions during the three-year survey period. All three records were along Transect 1 during July 2022 breeding bird transect surveys. Two records observed single individuals, and one noted a pair.

2.1.21.4 Winter Walkover Survey (2021/22)

There were no records of swift during winter transect surveys.

2.1.21.5 Merlin Surveys (2023)

One record of swift was made in May 2023, where a pair of swift were sighted flying over the merlin survey area (1 km grid square N7935).

2.1.21.6 Hinterland Surveys (2021, 2022 and 2023)

One record of swift was made during the hinterland surveys. This occurred at HVP4 on 16th July 2023; seven birds were recorded.

2.1.22 Whooper Swan

Whooper swan were observed during winter VP surveys and hinterland surveys. Observations confirmed the regular occurrence of grazing flocks in the fields near T3, in addition to other fields further west of the proposed development. The patterns of occurrence of grazing birds observed indicate that that while fields closer to the proposed development are used, wintering whooper swan are not restricted to these fields and also utilise a number of other fields in the locality for grazing. No roosting was recorded.

2.1.22.1 Vantage Point Surveys: Winter Season (2021-22 and 2022-23)

A total of four records of Whooper Swan were made during the 2021/22 winter VP surveys. Three of these overlapped the 500m buffer zone. On December 21st 2022, a flock of seven adults and three juveniles were observed feeding in an agricultural field within the buffer zone near turbine 3. No flight activity occurred during this observation. Later that day, a flock of ten individuals was observed flying away from this the same area in a southeasterly direction. This is likely to be the same group noted feeding in the same area earlier. On January 22nd 2022, two individuals were sighted flying at rotor-swept height in the northern portion of the Site.

The remaining record occurred outside of the 500m buffer zone, near the south of the Site. This record noted a flock of 18 - 19 Whooper Swan feeding in an agricultural field immediately west of the buffer zone near turbines 1, 2 and 3.

During the 2022/23 winter VP surveys, three records of Whooper Swan were made. One of these records involved a flock of 13 whooper swans flying within the 500m buffer near turbine 1 before landing in a field to the south of VP1 and feeding on January 24th 2023.

The remaining two records were located outside of the 500m buffer zone, to the south-west of the Site, where flocks of 13 individuals were sighted landing and feeding in agricultural fields near VP1 on December 21st 2022 and February 13th 2022.

2.1.22.2 Hinterland Surveys (2021, 2022 and 2023)

Whooper swan were observed twice during hinterland surveys. Both of which occurred at HVP 3 (1.8km E) during the 2022/23 non-breeding season. In January 2023, a flock of 13 individuals, six of which were first-winters was observed. In February 2023, a flock of twelve individuals was sighted.

2.1.22.3 Incidental Observations (Winter 2023-24)

Whooper swan flocks were observed grazing in fields north of T1/west of T2-T3 during ecological surveys in March 2024. A flock of 27 adults was observed grazing in improved agricultural grassland c. 430m from T1 and T2 on 06th March 2024; a flock of 23 adults was observed grazing in the same habitat (in different field) c. 590m north-west of T3 on 20th March 2024.

2.1.22.4 Summary of Whooper Swan Grazing

Table 8-21 details the occurrence of grazing whooper swans relative to proposed turbine locations. The location of these records are shown in Table 8-21, alongside whooper swan flight activity across all survey seasons.

Table 2-2: Whooper swan: occurrence in fields near proposed wind farm

Record ID	Number of Swans	Description	Date	Distance to closest turbine
A	10	7 adults and 3 juveniles feeding in field. Flew off east after.	21/12/2021	183m (T3)
B	18-19	Swans feeding in field.	14/02/2022	600m (T3)
C	13	Flew in from south-west, turned north-west to land in field.	21/12/2022	1,115m (T1)
D	13	Flew in from south-east, landed in field, then feeding in field.	24/01/2023	577m (T1)
E	13	Flew in from west/north, feeding in field after landing.	13/02/2023	917m (T5)
F	27	Adults grazing in GA1 field.	06/03/2024	432m (T2)
G	23	Adults grazing in GA1 field.	20/03/2024	593m (T3)

2.1.23 Woodcock

This cryptic wader species was recorded during targeted woodcock surveys across all survey years, and was also detected during the course of wader surveys in summer 2022.

2.1.23.1 Woodcock Surveys (2021, 2022 and 2023)

A total of 32 records of woodcock were made across the 2021, 2022 and 2023 targeted woodcock surveys.

During the 2021 breeding season, 17 sightings of woodcock were made, including four observations of breeding pairs flying together and calling. All records observed woodcock roding and occupying territory along Transect 3. Six of which occurred within birch woodland habitat along the track, and the remaining eleven records occurred within a clearing between woodland habitats.

During the 2022 breeding season, a total of ten records of woodcock were made. In May 2022, five records of woodcock were made along transect A, and a further five records were made in June 2022 along transect B. All of which were observed roding, and occupying territory. In July 2022, a third round of surveys was undertaken. During which, no woodcock were observed.

During the 2023 woodcock surveys, five records of Woodcock were made in June 2023. Three of these observations noted roding males occupying territory in mixed woodland habitat (W-1), while two observations noted roding males occupying territory from W-2 (located in drained raised bog facing mixed woodland).

2.1.23.2 Breeding Wader Surveys (2022)

Woodcock were observed twice during the breeding wader surveys. Both records were noted in July 2022, and noted individual woodcock roding over bog (adjacent to conifer plantation), along transect B. Breeding status was assessed as 'Occupied Territory'.

2.1.23.3 Hinterland Surveys (2021, 2022 and 2023)

Woodcock was sighted on one occasion during the three-year hinterland survey period, where a single individual was observed at HVP 1 (0.8km S) in December 2021.

2.1.23.4 Ecological Walkover Surveys (2023)

Woodcock were flushed from woodland around T8, T10 and T11 during non-avian ecology surveys in winter 2023-24.

2.2 Migratory SCI Species Flight Activity Maps

2.2.1 Golden Plover

Please see overleaf.

2.2.2 Lapwing

Please see overleaf.

2.2.3 Whooper Swan

Please see overleaf.

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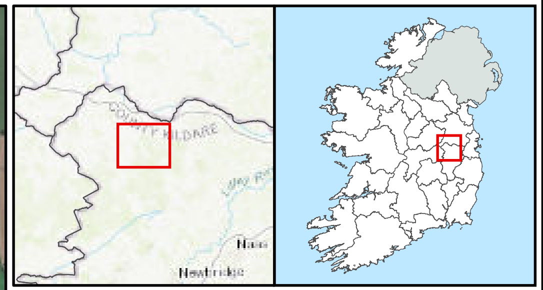


Legend

Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

8, 06/04/2023, 09:47

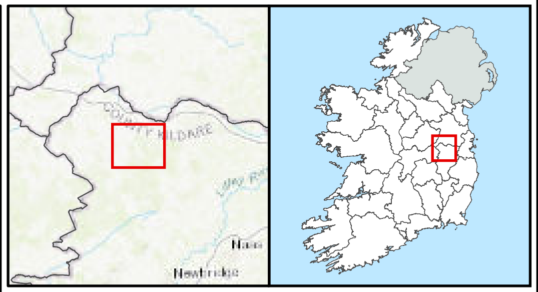
9, 06/04/2023, 18:23

TITLE:	Golden Plover Spring Migration 2023
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	REVISION: 0
DATE: 20/05/2025	PAGE SIZE: A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Kilometers
0 0.5 1

Path: R:\Map Production\2020\P20-326\Workspaces\P20_326_Flightlines\P20_326_Flightlines.aprx



Legend

Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

10, 12/09/2023, 11:58

TITLE:	Golden Plover Summer 2023
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	REVISION: 0
DATE: 20/05/2025	PAGE SIZE: A3

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

0 0.5 1 Kilometers

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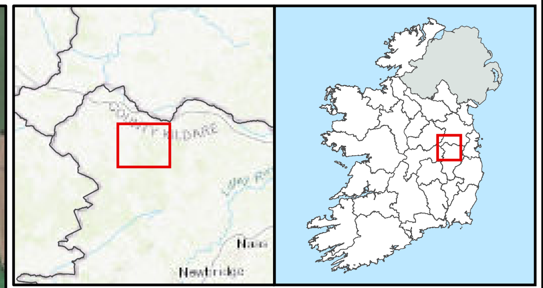

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Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

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PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	REVISION: 0
DATE: 20/05/2025	PAGE SIZE: A3

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0 0.5 1 Kilometers

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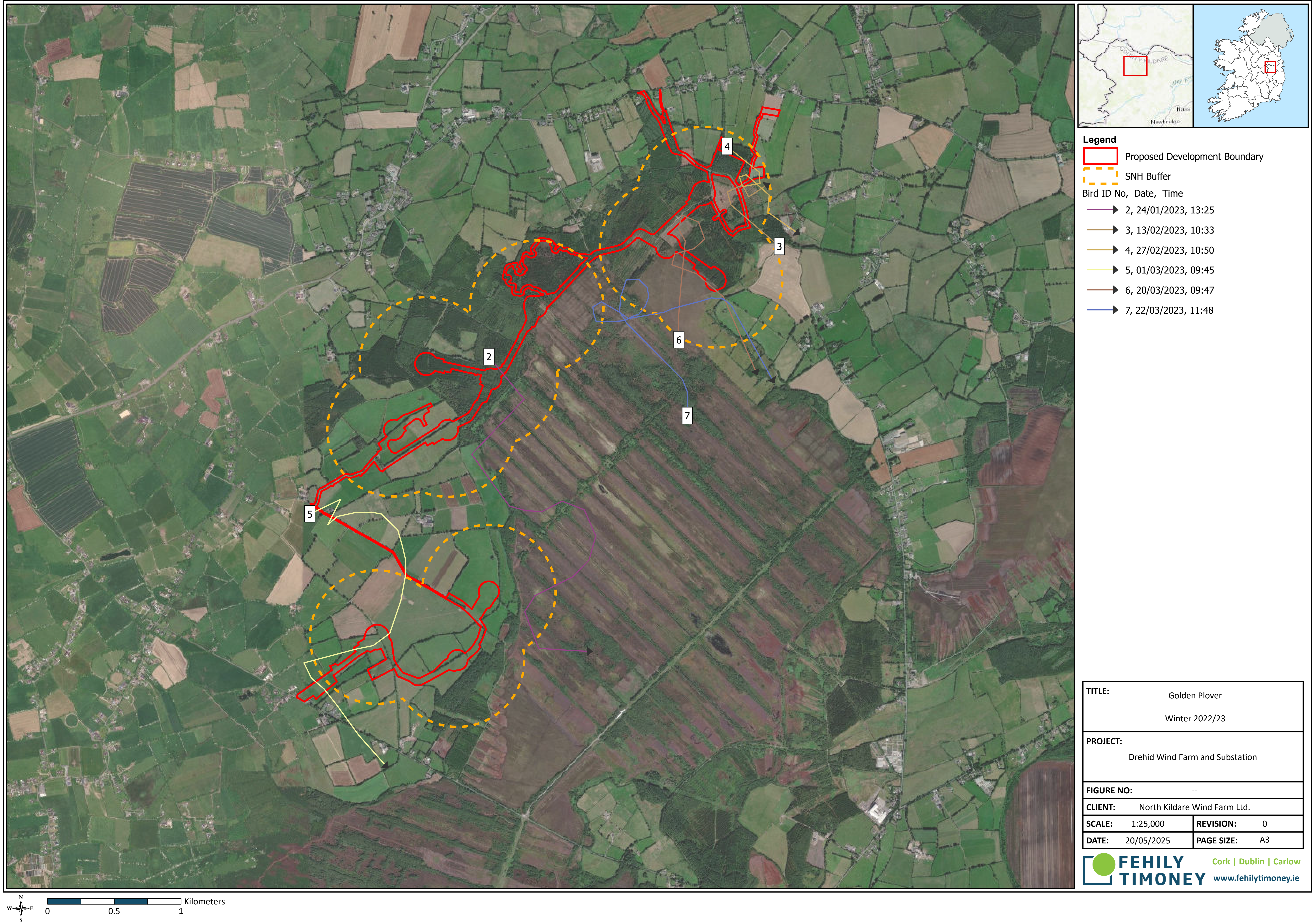

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Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

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3, 13/02/2023, 10:33

4, 27/02/2023, 10:50

5, 01/03/2023, 09:45

6, 20/03/2023, 09:47

7, 22/03/2023, 11:48

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PROJECT:	Drehid Wind Farm and Substation		
FIGURE NO:	--		
CLIENT:	North Kildare Wind Farm Ltd.		
SCALE:	1:25,000	REVISION:	0
DATE:	20/05/2025	PAGE SIZE:	A3

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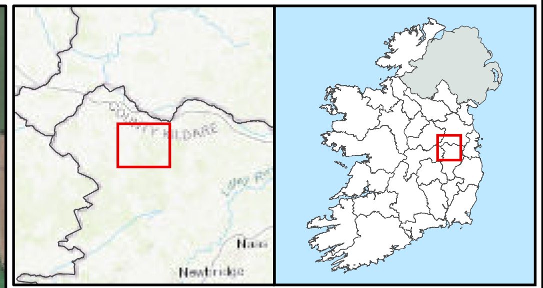

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Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

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PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	**REVISION:** 0
DATE: 20/05/2025	**PAGE SIZE:** A3

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Legend

Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

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3, 22/01/2022, 08:48

1, 21/12/2021, 11:16

4, 14/02/2022, 09:35

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PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	REVISION: 0
DATE: 20/05/2025	PAGE SIZE: A3

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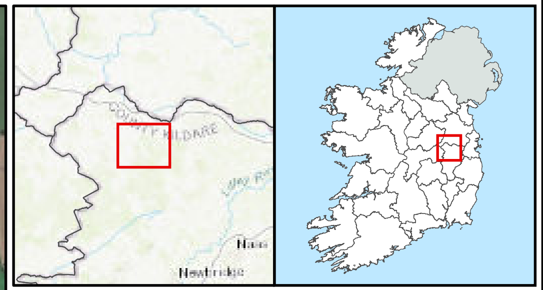

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Proposed Development Boundary

SNH Buffer

Bird ID No, Date, Time

5, 21/12/2022, 13:10

6, 24/01/2023, 11:27

7, 13/02/2023, 09:00

TITLE:	Whooper Swan Winter 2022/23
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	--
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:25,000	REVISION: 0
DATE: 20/05/2025	PAGE SIZE: A3

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APPENDIX 2

Drain Crossings

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P22-242 DREHID WIND FARM AND SUBSTATION SID

Preliminary Technical Report for Proposed Bridges and Culverts

Prepared for:
North Kildare Wind Farm Ltd

Date: May 2025

Document No:
P22-242-FT-EWE-XX-RP-DE-0018

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PRELIMINARY TECHNICAL REPORT FOR PROPOSED CULVERTS AND BRIDGES

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
P02	Draft	PA/SH/KB	PD	JH	19/05/2025

Client: North Kildare Wind Farm Ltd

Keywords: Culvert, Bridge, Watercourse, Land Drain, Arterial Drainage Scheme, OPW.

Abstract: Fehily Timoney and Company is pleased to submit this Preliminary Technical Report for the Proposed Bridges and Culverts for Drehid Wind Farm SID.

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1. INTRODUCTION

1.1 Proposed Development

This Preliminary Technical Report has been prepared by Fehily Timoney and Company (FT) on behalf of North Kildare Wind Farm Ltd. The report outlines the preliminary design and location of proposed culverts and structures to minimize the impacts of the Proposed Development access tracks and hardstanding areas on the hydrology of the local environment.

The Proposed Development Site includes lands in the townlands of Ballynamullagh, Kilmurry, Killyon, Coolree, Mulgeeth, Drehid, and Dunfierth, covering a footprint of 79 ha. The site is 3.7 km southwest from the town of Enfield and 12.4 km southwest from the town of Kilcock. Access to the site is via the M4 motorway until Enfield, then along the R402 for approximately 7.7 km and finally along the local road (L5025) to the entrance of the site. The site lies approximately 2.8 km south of the motorway M4 at Enfield and 1.2km southeast of the regional road R402 linking the M4 to the R420 east of Tullamore in County Offaly.

The Proposed Development access tracks and hardstanding areas will intersect several watercourses and land drains. These include:

- Three watercourse crossings over the Fear English River (EPA Name: Ballynamullagh), which are part of the Arterial Drainage Scheme.
- Four additional crossings over channels that are part of the Arterial Drainage Scheme.
- Several land drain crossings.

These crossings are proposed with culverts and structures, such as bridges, to ensure uninterrupted river flow. They are designed to maintain natural hydrological conditions while supporting the development infrastructure.

The location of the Proposed Development site is shown in Figure 1.1

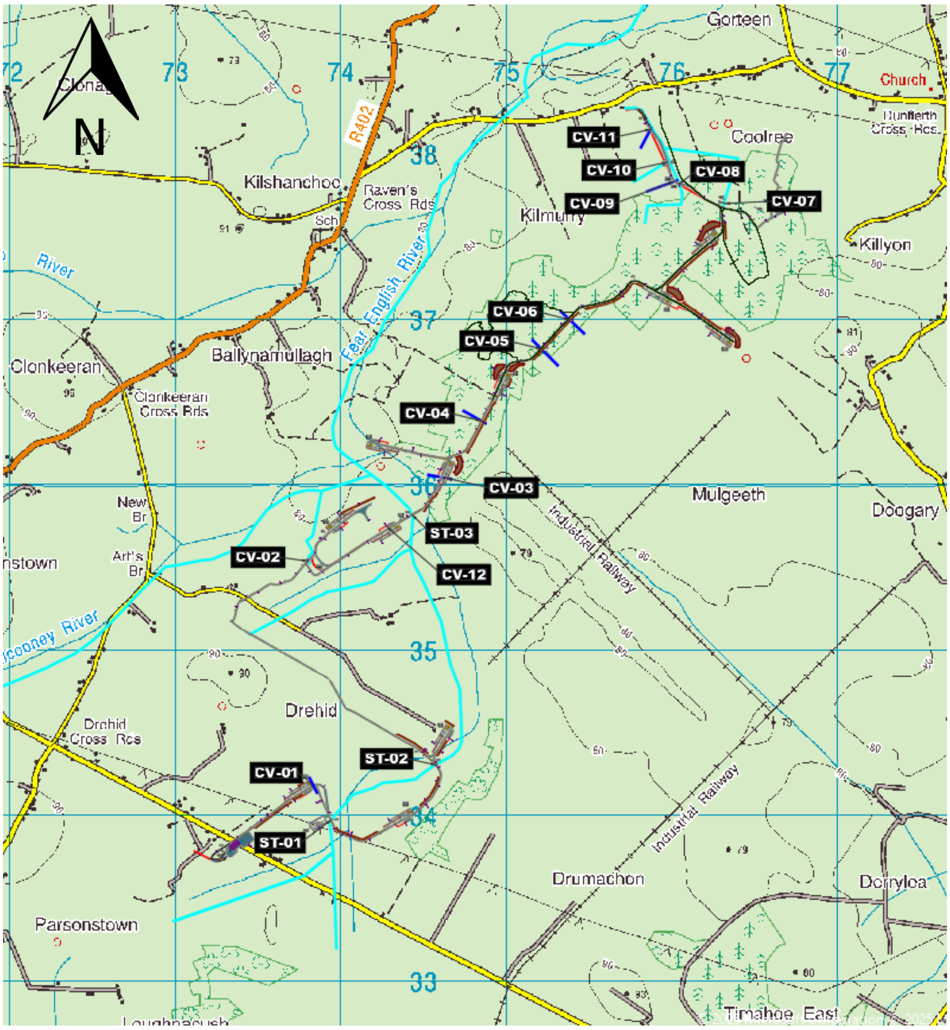

Figure 1-1: Proposed Scheme

1.2 Existing Streams and Proposed Culverts and Structures

The Fear English River flows through the site, also referred to by the EPA as Ballynamullagh (River waterbody code - IE_EA_07B020100). This waterbody is a tributary of the River Blackwater, which in turn is a tributary of the River Boyne. The river originates approximately northeast of Parsonstown and flows further north through, Drehid, Ballynamullagh, Kilmurry, Gorteen and joins the River Blackwater.

The Kilcooney River, referred to by the EPA as Coolree 07 (River waterbody code - IE_EA_07B020100) is a tributary of the Fear English River and it flows in a northeastern direction. A small tributary of this river intersects with the site.

The proposed structures in the scheme include 3 bridges (ST-01, ST-02, ST-03) and 12 culverts/temporary crossing structures to accommodate the river crossings, arterial drainage scheme and land drain crossings. CV-08 and CV-10 will be temporary crossing structures which will be installed only during the construction phase and removed when the construction activity is completed.

1.2.1 Crossing - ST-01

The crossing is located approximately 200 m southeast of proposed Turbine 1. The catchment size of the river at the location of the proposed bridge is 2.25 km2, obtained using the Ordnance Survey 1:50,000 scale Discovery Series Maps and LIDAR

Figure 1-2 below shows the existing conditions of the river at the crossing point.

The proposed structure layout is shown on drawing No. P22-242-0300-0021.

Table 1-1: Proposed Bridge ST- 01

Bridge Name	Bridge Width (m)	Bridge Span (m)	Bridge Height (m)	Bridge Coordinates	
				Easting (ITM)	Northing (ITM)
ST -01	5	8.50	0.60*	673974.665	734133.343

*From top of riverbank and flood plain to bridge soffit

Figure 1-2: Existing Stream looking upstream

1.2.2 Crossing - ST-02

The crossing is located downstream of ST-01, approximately 700 m away. It crosses the same river, the Fear English River, and it is next to Turbine 3. The catchment size of the river at the location of the proposed structure is 3.46 km2, obtained using the Ordnance Survey 1:50,000 scale Discovery Series Maps and LIDAR.

Figure 1-3 below shows the existing conditions of the river at the crossing point. Currently, there is a culvert for the existing access track that intersects the river. ST-02 will provide a new clear span bridge immediately adjacent to this existing culvert.

The proposed structure layout is shown on drawing No. P22-242-0300-0022.

Table 1-2: Proposed Bridge ST-02

Bridge Name	Bridge Width (m)	Bridge Span (m)	Bridge Height (m)	Bridge Coordinates	
				Easting (ITM)	Northing (ITM)
ST-02	4.50	8.50	0.55*	674610.717	734467.701

* From top of riverbank and flood plain to bridge soffit

Figure 1-3: Existing Stream Culvert looking upstream

1.2.3 Crossing - ST-03

The crossing is located downstream of ST-01 and ST-02 and approximately 100 m northeast of proposed Turbine 4. The catchment size of the river at the location of the proposed structure is 5.016 km2, obtained using the Ordnance Survey 1:50,000 scale Discovery Series Maps and LIDAR.

Figure 1-4 below shows the existing conditions of the river at the crossing point.

The proposed structure layout is shown on drawing No. P22-242-0300-0023.

Table 1-3: Proposed Bridge ST - 03

Bridge Name	Bridge Width (m)	Bridge Span (m)	Bridge Height (m)	Bridge Coordinates	
				Easting (ITM)	Northing (ITM)
ST-03	4.50	8.70	0.85*	674467.038	735976.277

* From top of riverbank and flood plain to bridge soffit

Figure 1-4: Existing Stream looking upstream

1.2.4 Proposed Culverts/Temporary Crossings

Access tracks and hardstanding areas pass through multiple land drains and Arterial Drainage Scheme Channels that connect or discharge to the Fear English River (River waterbody code - IE_EA_07B020100). The following table shows the list of proposed culverts, their sizes, and the associated catchments.

Table 1-4: Proposed Culverts

Culvert/ Structure Name	Culvert Type	Catchment Area (km2)	Culvert Length (m)	Culvert Diameter (mm)	Culvert Coordinates	
					Easting (ITM)	Northing (ITM)
CV-01	Circular	0.140	10.50	1050	673870.087	734342.270
CV-02	Circular	0.050	10.50	900	673844.294	735701.550
CV-03	Circular	0.060	54.13	1050	674670.598	736201.296
CV-04	Circular	0.012	10.50	900	674892.787	736543.629
CV-05	Circular	0.265	10.50	1200	675250.928	736980.500
CV-06	Circular	0.428	10.50	1500	675417.454	737158.857
CV-07	Circular	0.047	58.00	1350	676347.116	737844.516
CV-08*	Temp.	0.138	12.70	1200	676084.970	737970.987
CV-09	Circular	0.028	10.80	1050	676049.766	737993.457
CV-10*	Temp.	0.059	10.50	1050	675993.515	738103.549
CV-11	Circular	0.026	13.00	900	675904.469	738301.134
CV-12	Circular	0.176	36.00	1200	674336.666	735914.252

*Temporary Crossings

2. HYDROLOGYCAL ANALYSIS

2.1 Contribute Catchment

The hydrology of a catchment is significantly influenced by its physical characteristics, such as the size of the catchment, length of the stream, steepness of the terrain and average annual rainfall. The following table lists the parameters used for the hydrological calculations. The parameters were obtained from different sources including UK SuDS web portal, discovery mapping and site survey LIDAR; specifically calculated for the subject catchments.

Table 2-1: Catchment Characteristics

Catchment Reference	Standard Average Annual Rainfall	Soil index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres
	SAAR	SOIL	Area	W	Z
	(mm)	-	Km2	m	m
	Source: https://www.uksuds.com/		Source: Catchment Analysis - Discovery mapping and Lidar Survey		
CAT-A	822	0.47	2.250	2448.00	6.50
CAT-B	822	0.47	3.460	3085.71	5.50
CAT-C	822	0.47	5.016	3494.00	11.77
CAT-D	822	0.47	0.140	821.00	5.50
CAT-E	822	0.47	0.050	799.00	9.50
CAT-F	822	0.47	0.060	340.72	1.00
CAT-G	822	0.47	0.012	139.05	1.19
CAT-H	822	0.47	0.265	1164.21	4.31
CAT-I	822	0.47	0.428	1169.86	5.02
CAT-J	822	0.47	0.025	167.40	3.00
CAT-K	822	0.47	0.138	457.85	2.97
CAT-L	822	0.47	0.028	323.71	1.10
CAT-M	822	0.47	0.059	339.94	4.00
CAT-N	822	0.47	0.026	245.00	1.87
CAT-O	822	0.47	0.176	1305.00	10.00

2.2 Estimated Peak Flow

In accordance with the OPW guidelines on hydrology, several methods were considered for estimating the peak flow of the various watercourses at the locations of the proposed bridges and culverts for the annual exceedance probability (AEP) of 1%.

The following methods have been selected for the catchments presented in order to estimate the peak flow of the streams:

- ADAS Method.
- Institute of Hydrology Report 124 Method (IoH124).
- FSSR 6, 3 Variable Method.

The ADAS method equation is designed to yield a design flow for a return period of 75 years, while the other two methods provide the mean annual flood (a return period of approximately 1:2.3 years). Therefore, different growth factors have been applied to estimate the design flow for a return period of 100 years. These are 1.05 for the ADAS Method and 1.96 for the other two methods.

The flow estimates are all subject to a 20% climate change allowance. To account for potential errors in the flow estimates, different factors have been applied to each method, such as the FSE (Factorial Standard Error). Where there are no properties with the potential to be at flood risk, this FSE has been applied with a 65 % CI.

The different methods have been applied, but the selection of the final design flow takes into account the adequacy of each method for the size of the catchment. The ADAS method is more appropriate for very small catchments (<0.4 km2) and yields very conservative results while the IoH 124 and the FSSR 6, 3 Variable Method are more adequate for catchments larger than 0.4 km2.

The following table provides the different methods and factors used, as well as the final design flow chosen for the 100-years return period.

For Bridge crossings ST-01, ST-02, ST-03, and culvert CV-06, the catchment is >0.4 km2, therefore, IoH 124 and FSSR 6, 3 Variable Method would be more appropriate.

Table 2-2: Comparison of estimated design flows for Catchments >0.4 km2

Catchment Reference	Method	Qbar (m3/s)	Factorial Standard Error (FSE)	Q100 (100 Years)	Q100 with 20% of climate change (m3/s)
CAT-A	IoH 124	1.833	1.65	3.593	4.311
	FSSR 6, 3 Variable Method	1.748	1.58	3.426	4.111
CAT-B	IoH 124	2.688	1.65	5.269	6.322
	FSSR 6, 3 Variable Method	2.597	1.58	5.090	6.108
CAT-C	IoH 124	3.741	1.65	7.333	8.796
	FSSR 6, 3 Variable Method	3.655	1.58	7.163	8.595

Catchment Reference	Method	Qbar (m3/s)	Factorial Standard Error (FSE)	Q100 (100 Years)	Q100 with 20% of climate change (m3/s)
CAT-I	IoH 124	0.419	1.65	0.821	0.985
	FSSR 6, 3 Variable Method	0.380	1.43	0.745	0.894

When comparing the results, the IoH 124 method provides the highest flow; therefore, this method has been selected for the design flow.

For the remaining culvert crossings, the catchments are <0.4 km2, so the ADAS method would be more appropriate.

Table 2-3: Estimated design flows for Catchments <0.4 km2

Catchment Reference	Method	Catchment Area (km2)	Q75 (m3/s)	Q100 (m3/s)	Q100 with 20% of climate change (m3/s)
CAT-D	ADAS	0.140	0.193	0.202	0.243
CAT-E	ADAS	0.050	0.081	0.085	0.102
CAT-F	ADAS	0.060	0.084	0.089	0.106
CAT-G	ADAS	0.012	0.029	0.031	0.037
CAT-H	ADAS	0.265	0.280	0.294	0.352
CAT-J	ADAS	0.047	0.071	0.074	0.117
CAT-K	ADAS	0.138	0.222	0.233	0.280
CAT-L	ADAS	0.028	0.041	0.043	0.051
CAT-M	ADAS	0.059	0.121	0.128	0.153
CAT-N	ADAS	0.026	0.051	0.054	0.064
CAT-O	ADAS	0.176	0.220	0.232	0.278

3. HYDRAULIC ANALYSIS

3.1 Hydraulic Design

The hydraulic design of the proposed bridges was conducted using Manning's equation for open channels. For the culverts, the hydraulic design was carried out using Culvert Master software. These designs followed the main requirements and parameters established in the OPW Guidelines, though they are at a preliminary design stage and based on the available information.

The proposed culverts and bridges have been designed to provide a freeboard of at least 300mm, both upstream and downstream, for the design peak flow. This design accounts for a 100-year return period and 20% climate change impact.

The Manning's equation and Culvert Master software have been used for preliminary sizing of proposed bridges and culverts, which will need to be re-analysed at detailed design stage with a detailed topographical survey.

The hydraulic capacity of the channel and a section of the floodplain were used to estimate the approximate span and soffit of the proposed bridges ST-01, ST-02, and ST-03, ensuring they can convey the design flow with a minimum freeboard of 300mm. This estimation also considered that the abutments would be set back at least 2.5 meters from the banks for environmental purposes.

The proposed culverts were designed as circular culverts with an embedment of 300 mm, ensuring that they can convey the design flow with a minimum freeboard of 300 mm.

The design parameters used such as the Manning's values for the river channel were estimated based on the site visit and on the proposed manning's values from the Hec-Ras Reference Manual.

Table 3-1: Design Parameters used in the hydraulic design

Structure	Manning's Value (n)	Source
Bridges for streams	Stream bed = 0.045	HEC-RAS Manual -Table 3-1 Manning's Values
Culverts for land drains	Culvert bed = Stream bed= 0.045 Culvert walls = 0.013 Average = 0.029	HEC-RAS Manual -Table 3-1 Manning's Values

The hydraulic design of the proposed bridges and culverts was based on the topographic survey (LIDAR) provided by Bluesky International Ltd and a site visit conducted by FT on 14/10/2024 and 15/10/2024.

4. RESULTS AND CONCLUSION

A hydraulic analysis was carried out for the design of 3 bridges, 2 temporary crossings and 10 permanent culverts for the construction of Drehid Wind Farm access tracks and hardstanding areas to cross the existing watercourses and land drains.

Three calculation methods were applied to determine the design flow for the 100 years return period with an allowance of 20 % for climate change. The most adequate method was selected in accordance with the catchment characteristics.

The proposed bridges ST-01, ST-02, and ST-03 were sized using Manning's Equation to determine the minimum span and height. Additionally, a minimum setback of 2.5 meters for the abutments from the riverbanks was established for environmental and ecological considerations. These structures were designed to convey a design flow for a 100-years return period with a minimum freeboard of 300 mm.

The proposed culverts were designed in Culvert Master as circular pipe culverts following the estimated bed levels of the streams and land drains, with a minimum 300 mm of embedment and 300 mm freeboard. The temporary crossings (CV-08 and CV-10) will be removed following the completion of Drehid Wind Farm construction.

In conclusion, the design of the proposed bridges and culverts provides an estimation or preliminary sizing for the required watercourse and land drain crossings. However, detailed design analysis, including a detailed topographical survey of the waterbodies, will be required to optimize the structural dimensions and assess potential impacts on water levels and flooding.

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APPENDIX 1

HYDROLOGIC ANALYSIS

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-A	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		FSSR 6, 3-Variable Method	Climate Change
						Growth Factor	FSE	FSE	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	FSE	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	FSU WP 2.3	OPW Guidelines
Inputs	822	0.47	2.250	2448	6.5	1.96	1.65	1.58	20%

Description	Outputs				
	IH124 Method		FSSR 6, 3-Variable Method		Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	FSSR Annual Flow	FSSR 100Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	Q_a	$Q100_{FSSR}$	Q
Units	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17} * FSE$	$Q = F\,Q_a$	$Q = 0.00066 * AREA^{0.92} * SAAR^{1.22} * SOIL^{2.0} * FSE$	$Q = F\,Q_a$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106			Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	1.833	3.593	1.748	**3.426**	**4.312**

Notes

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-B	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		FSSR 6, 3-Variable Method	Climate Change
						Growth Factor	FSE	FSE	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	FSE	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis-Drawings	Catchment Analysis- Drawings	Catchment Analysis-Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	FSU WP 2.3	OPW Guidelines
Inputs	822	0.47	3.460	3085.71	5.5	1.96	1.65	1.58	20%

Description	Outputs				
	IH124 Method		FSSR 6, 3-Variable Method		Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	FSSR Annual Flow	FSSR 100Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	Q_a	$Q100_{FSSR}$	Q
Units	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$* FSE	$Q = F\,Q_a$	Q = 0.00066 * $AREA^{0.92}$ * $SAAR^{1.22}$ * $SOIL^{2.0}$* FSE	$Q = F\,Q_a$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106			Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	2.688	5.269	2.597	**5.090**	**6.323**

Notes

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-C	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		FSSR 6, 3-Variable Method	Climate Change
						Growth Factor	FSE	FSE	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	FSE	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	FSU WP 2.3	OPW Guidelines
Inputs	822	0.47	5.016	3494	11.77	1.96	1.65	1.58	20%

Description	Outputs				
	IH124 Method		FSSR 6, 3-Variable Method		Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	FSSR Annual Flow	FSSR 100Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	Q_a	$Q100_{FSSR}$	Q
Units	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17} * FSE$	$Q = F\,Q_a$	$Q = 0.00066 * AREA^{0.92} * SAAR^{1.22} * SOIL^{2.0} * FSE$	$Q = F\,Q_a$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106			Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	3.741	7.333	3.655	**7.163**	**8.800**

Notes

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-I	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		FSSR 6, 3-Variable Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	FSE	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	FSE	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	FSU WP 2.3	OPW Guidelines
Inputs	822	0.47	0.428	1169.86	5.02	1.96	1.65	1.58	20%

Description	Outputs				
	IH124 Method		FSSR 6, 3-Variable Method		Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	FSSR Annual Flow	FSSR 100Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	Q_a	$Q100_{FSSR}$	Q
Units	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17} * FSE$	$Q = F\,Q_a$	$Q = 0.00066 * AREA^{0.92} * SAAR^{1.22} * SOIL^{2.0} * FSE$	$Q = F\,Q_a$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106			Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.419	0.821	0.380	**0.745**	**0.985**

Notes

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-D	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		ADAS Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis-Drawings	Catchment Analysis- Drawings	Catchment Analysis-Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.140	821	5.5	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q = F_1 * Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.155	0.303	16.18	0.1927	0.202	**0.243**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

(yellow)	Cells to fill
(white)	Calculation
(green)	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-E	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.050	799	9.5	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1 * Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.062	0.121	12.80	0.0813	0.085	**0.102**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-F	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Avergae Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.060	340.72	1	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28}-1}{10T}\right]$	$Q = F_1 * Q_{75\ ADAS}$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.073	0.144	15.84	0.0845	0.089	**0.106**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

(yellow)	Cells to fill
(white)	Calculation
(green)	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-G	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Avergae Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	DBS	DBS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.012	139.05	1.19	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677\dfrac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\dfrac{18.79T^{0.28} - 1}{10T}\right]$	$Q = F_1 * Q_{75\ ADAS}$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.018	0.035	7.36	0.0295	0.031	**0.037**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

(yellow)	Cells to fill
(white)	Calculation
(green)	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-H	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		ADAS Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.265	1164.21	4.31	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1 * Q_{75\ ADAS}$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.273	0.535	23.37	0.2803	0.294	**0.353**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-J	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		ADAS Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis-Drawings	Catchment Analysis- Drawings	Catchment Analysis-Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.047	287.82	2.5	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1*Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.059	0.115	9.72	0.0930	0.098	**0.117**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-K	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.138	457.85	2.97	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1*Q_{75\ ADAS}$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.153	0.300	13.05	0.2221	0.233	**0.280**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-L	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		ADAS Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.028	323.71	1.1	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1*Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.037	0.072	14.67	0.0413	0.043	**0.052**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

(yellow)	Cells to fill
(white)	Calculation
(green)	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-M	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.059	339.94	4	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1 * Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.072	0.141	9.21	0.1218	0.128	**0.153**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-N	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
						IH124 Method		ADAS Method	Climate Change
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.026	245	1.87	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	Q = 0.00108 * $AREA^{0.89}$ * $SAAR^{1.17}$ * $SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677 \frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28}-1}{10T}\right]$	$Q=F_1*Q_{75\ ADAS}$	Q_{75} * 1.2
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.034	0.067	9.60	0.0514	0.054	**0.065**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

(yellow)	Cells to fill
(white)	Calculation
(green)	Result

Catchment Flow Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-O	N/A	N/A	N/A

Author	Checked	Approved
PW	SH	PD

Description	Inputs Parameters								
	Rainfall	Soil Index	Catchment Area	Max. Catchment Width	Average Height of Catchment Divide in metres	IH124 Method		ADAS Method	Climate Change
						Growth Factor	FSE	Growth Factor	Climate Change (%)
Parameters	SAAR	SOIL	AREA	W	Z	F	FSE	F_1	CC
Units	(mm)	-	km2	m	m	-	-	-	(%)
Info Source	UK SUDS	UK SUDS	Catchment Analysis- Drawings	Catchment Analysis- Drawings	Catchment Analysis- Drawings	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	DN-DNG-03064 (HD 106)	OPW Guidelines
Inputs	822	0.47	0.176	1305	10	1.96	1.65	1.050	20%

Description	Outputs					
	IH124 Method		ADAS Method			Design Peak Flow + CC for permeable areas
	IH124 Annual Flow	IH124 100Yr Flow	Time of Concentration	ADAS 75 Yr Flow	ADAS 100 Yr Flow	
Parameter	Q_a	$Q100_{IH124}$	T	$Q_{75\ ADAS}$	$Q100_{ADAS}$	Q
Units	(m3/s)	(m3/s)	Hours	(m3/s)	(m3/s)100 s)	(m3/s)
Formula	$Q = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$	$Q = F\,Q_a$	$T = 0.1677\frac{W^{0.78}}{Z^{0.39}}$	$Q = AREA\,(0.0443\,SAAR - 11.19)\,SOIL^{2.0} * \left[\frac{18.79T^{0.28} - 1}{10T}\right]$	$Q=F_1*Q_{75\ ADAS}$	$Q_{75} * 1.2$
Info Source	Formula 1 of HA 106	Formula 3 of HA 106	Formula 6 of HA 106	Formula 4 of HA 106	-	Vol 3 of 5 Pt 2, 4.2.5.5 (vii)
Outputs	0.190	0.372	18.40	0.2207	0.232	**0.278**

Notes

1. As per paragraph 5.6 of Ha 106, Design Flow, Q, is calculated using IH124 for catchments > 0.4 km2 and ADAS method for catchments < 0.4km2
2. If catchments are larger than 0.4 km2, input parameters W and Z are not required.
3. Template has been tested against Worked Examples in Chapters 7 of HA 106

	Cells to fill
	Calculation
	Result

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A SUSTAINABLE FUTURE

APPENDIX 2

HYDRAULIC ANALYSIS

Composite Stream Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-A	N/A	N/A	N/A

Author	Checked	Approved
SH	PD	PD

Description	Inputs Parameters										Design flow	Design flow Depth
	Channel/Stream Parameters					Floodplain Parameter						
	Base Width of Channel	Channel Side Slopes (1V:?H)	Channel Depth	Channel Long Gradient	Channel/Stream Manning's Roughness	Right Hand Side Floodplain Width	Left Hand Side Floodplain Width	Floodplain Side Slopes (1V:?H)	Floodplain Long Gradient	Floodplain Manning's Roughness		
Parameters	b1	Z1	y1	J1	n1	RHSfpw	LHSfpw	Z2	J2	n2	Qd	Yd
Units	m	-	m	m/m	-	m	m	-	m/m	-	m3/s	m
Info Source	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD	Appendix C of HA 106	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD 116	Appendix C of HA 106	Manual Input	Iterations
Inputs	2.2	0.27	1.700	0.002	0.045	2.50	2.50	0.00	0.002	0.045	4.310	1.890

Description	Calculations											Checker
	Channel outputs				Floodplain outputs						Total Flow	
	Channel Area	Wet Perimeter	Hydraulic Radius	Channel Flow	Base Width of the Floodplain	Floodplain Depth	Floodplain Area	Wet Perimeter	Hydraulic Radius	Channel Flow		
Parameter	A1	W1	Rh1	Q1	b2	Y2	A2	W2	Rh2	Q2	Qt	
Units	m2	m	m	m3/s	Manning	m	m2	m	m	m3/s	m3/s	
Formula	A1 = (b1+Z1*Y1)*Y1	W1 = b1+2*y1*(1+Z1^2)^1/2	RH1 = A1/W1	Manning	b2 = b1+2*Z1*Y1+ RHSfpw + LHSfpw	Y2 = Yd-Y1	A2 = (b2+Z2*Y2)*Y2	W2 = b2+2*y2*(1+Z2^2)^1/2	RH2 = A2/W2	Manning	Qt = Q1 + Q2	
Info Source												
Outputs	4.52	5.72	0.790020517	3.839	8.118	0.19	1.54	8.50	0.18	0.491	4.3305	OK

Notes

1. Cells highlighted in yellow vary with each length of ditch. Minimum longitudinal gradient should only be changed to check against actual gradient prior to upsizing ditch.
2. Minimum Streamgradient is 1 in 500 (0.2%) as per Paragraph 6.7 of HA 106
3. Template has been tested against Worked Examples in Chatpers 7 of HA 106

Floodplain Water depth	Freeboard	Soffit Depth
FPwd	FB	SD
m	m	m
FPwd = Yd - Y1		
0.190	0.3	2.190

	Cells to fill
	Calculations
	Results

Composite Stream Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-B	N/A	N/A	N/A

Author	Checked	Approved
SH	PD	PD

Description	Inputs Parameters										Design flow	Design flow Depth
	Channel/Stream Parameters					Floodplain Parameter						
	Base Width of Channel	Channel Side Slopes (1V:?H)	Channel Depth	Channel Long Gradient	Channel/Stream Manning's Roughness	Right Hand Side Floodplain Width	Left Hand Side Floodplain Width	Floodplain Side Slopes (1V:?H)	Floodplain Long Gradient	Floodplain Manning's Roughness		
Parameters	b1	Z1	y1	J1	n1	RHSfpw	LHSfpw	Z2	J2	n2	Qd	Yd
Units	m	-	m	m/m	-	m	m	-	m/m	-	m3/s	m
Info Source	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD 116	Appendix C of HA 106	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD 116	Appendix C of HA 106	Manual Input	Iterations
Inputs	2	0.27	2.300	0.002	0.045	2.50	2.50	0.00	0.002	0.045	6.323	2.550

Description	Calculations											
	Channel outputs				Floodplain outputs						Total Flow	Checker
	Channel Area	Wet Perimeter	Hydraulic Radius	Channel Flow	Base Width of the Floodplain	Floodplain Depth	Floodplain Area	Wet Perimeter	Hydraulic Radius	Channel Flow		
Parameter	A1	W1	Rh1	Q1	b2	Y2	A2	W2	Rh2	Q2	Qt	
Units	m2	m	m	m3/s	Manning	m	m2	m	m	m3/s	m3/s	
Formula	A1 = (b1+Z1*Y1)*Y1	W1 = b1+2*y1*(1+Z1^2)^1/2	RH1 = A1/W1	Manning	b2 = b1+2*Z1*Y1+ RHSfpw + LHSfpw	Y2 = Yd-Y1	A2 = (b2+Z2*Y2)*Y2	W2 = b2+2*y2*(1+Z2^2)^1/2	RH2 = A2/W2	Manning	Qt = Q1 + Q2	
Info Source												
Outputs	6.03	6.76	0.891138039	5.548	8.242	0.25	2.06	8.74	0.24	0.781	6.3292	OK

Notes

1. Cells highlighted in yellow vary with each length of ditch. Minimum longitudinal gradient should only be changed to check against actual gradient prior to upsizing ditch.
2. Minimum Streamgradient is 1 in 500 (0.2%) as per Paragraph 6.7 of HA 106
3. Template has been tested against Worked Examples in Chatpers 7 of HA 106

Floodplain Water depth	Freeboard	Soffit Depth
FPwd	FB	SD
m	m	m
FPwd = Yd - Y1		
0.250	0.3	2.850

	Cells to fill
	Calculations
	Results

Composite Stream Calculator

Stream Reference	Chainage Range	Road/String Name	Road Side
CAT-C	N/A	N/A	N/A

Author	Checked	Approved
SH	PD	PD

Description	Inputs Parameters										Design flow	Design flow Depth
	Channel/Stream Parameters					Floodplain Parameter						
	Base Width of Channel	Channel Side Slopes (1V:?H)	Channel Depth	Channel Long Gradient	Channel/Stream Manning's Roughness	Right Hand Side Floodplain Width	Left Hand Side Floodplain Width	Floodplain Side Slopes (1V:?H)	Floodplain Long Gradient	Floodplain Manning's Roughness		
Parameters	b1	Z1	y1	J1	n1	RHSfpw	LHSfpw	Z2	J2	n2	Qd	Yd
Units	m	-	m	m/m	-	m	m	-	m/m	-	m3/s	m
Info Source	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD 116	Appendix C of HA 106	Manual Input	Manual Input	Manual Input	Minimum design gradient = 1/500 Paragraph 6.6, page 11, HD 116	Appendix C of HA 106	Manual Input	Iterations
Inputs	2.84	0.27	1.550	0.003	0.045	2.50	2.50	0.00	0.003	0.045	8.800	2.100

Description	Calculations											Checker
	Channel outputs				Floodplain outputs						Total Flow	
	Channel Area	Wet Perimeter	Hydraulic Radius	Channel Flow	Base Width of the Floodplain	Floodplain Depth	Floodplain Area	Wet Perimeter	Hydraulic Radius	Channel Flow		
Parameter	A1	W1	Rh1	Q1	b2	Y2	A2	W2	Rh2	Q2	Qt	
Units	m2	m	m	m3/s	Manning	m	m2	m	m	m3/s	m3/s	
Formula	A1 = (b1+Z1*Y1)*Y1	W1 = b1+2*y1*(1+Z1^2)^ 1/2	RH1 = A1/W1	Manning	b2 = b1+2*Z1*Y1+ RHSfpw + LHSfpw	Y2 = Yd-Y1	A2 = (b2+Z2*Y2)*Y2	W2 = b2+2*y2*(1+Z2^2)^1/2	RH2 = A2/W2	Manning	Qt = Q1 + Q2	
Info Source												
Outputs	5.05	6.05	0.834683319	5.450	8.677	0.55	4.77	9.78	0.49	3.601	9.0508	OK

Notes

1. Cells highlighted in yellow vary with each length of ditch. Minimum longitudinal gradient should only be changed to check against actual gradient prior to upsizing ditch.
2. Minimum Streamgradient is 1 in 500 (0.2%) as per Paragraph 6.7 of HA 106
3. Template has been tested against Worked Examples in Chatpers 7 of HA 106

Floodplain Water depth	Freeboard	Soffit Depth
FPwd	FB	SD
m	m	m
FPwd = Yd - Y1		
0.550	0.3	2.400

	Cells to fill
	Calculations
	Results

Culvert Designer/Analyzer Report
CV-01

Peak Discharge Method: User-Specified					
Design Discharge	0.2430	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	83.69	m	Invert Downstream	83.65	m
Length	10.50	m	Slope	0.003810	m/m
Drop	0.04	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.2430	m³/s	Bottom Elevation	83.65	m
Depth	0.22	m	Velocity	0.49	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1050 mm Circular	0.2430 m³/s	84.12 m	1.37 m/s

Culvert Designer/Analyzer Report
CV-01

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	84.12	m	Discharge	0.2430	m^3/s
Headwater Depth/Height	0.40		Tailwater Elevation	83.87	m
Inlet Control HW Elev.	84.06	m	Control Type	Outlet Control	
Outlet Control HW Elev.	84.12	m			

Grades

Upstream Invert	83.69	m	Downstream Invert	83.65	m
Length	10.50	m	Constructed Slope	0.003810	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.27	m
Slope Type	Mild		Normal Depth	0.41	m
Flow Regime	Subcritical		Critical Depth	0.27	m
Velocity Downstream	1.37	m/s	Critical Slope	0.018507	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.07	m
Section Size	1050 mm		Rise	1.07	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	84.12	m	Upstream Velocity Head	0.04	m
Ke	0.50		Entrance Loss	0.02	m

Inlet Control Properties

Inlet Control HW Elev.	84.06	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.9	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-02

Peak Discharge Method: User-Specified					
Design Discharge	0.1020	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	78.64	m	Invert Downstream	78.60	m
Length	10.50	m	Slope	0.003810	m/m
Drop	0.04	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.1020	m³/s	Bottom Elevation	78.60	m
Depth	0.20	m	Velocity	0.36	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.1020 m³/s	78.93 m	0.94 m/s

Culvert Designer/Analyzer Report
CV-02

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elev	78.93	m	Discharge	0.1020	m³/s
Headwater Depth/Height	0.32		Tailwater Elevation	78.80	m
Inlet Control HW Elev.	78.88	m	Control Type	Outlet Control	
Outlet Control HW Elev.	78.93	m			

Grades

Upstream Invert	78.64	m	Downstream Invert	78.60	m
Length	10.50	m	Constructed Slope	0.003810	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.20	m
Slope Type	Mild		Normal Depth	0.27	m
Flow Regime	Subcritical		Critical Depth	0.18	m
Velocity Downstream	0.94	m/s	Critical Slope	0.019969	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	78.93	m	Upstream Velocity Head	0.02	m
Ke	0.50		Entrance Loss	0.01	m

Inlet Control Properties

Inlet Control HW Elev.	78.88	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.7	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-03

Peak Discharge Method: User-Specified					
Design Discharge	0.1060	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	79.50	m	Invert Downstream	79.35	m
Length	54.13	m	Slope	0.002845	m/m
Drop	0.15	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.1060	m³/s	Bottom Elevation	79.35	m
Depth	0.15	m	Velocity	0.36	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-3	1-1050 mm Circular	0.1060 m³/s	79.81 m	1.09 m/s

Culvert Designer/Analyzer Report
CV-03

Design:Trial-3

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	79.81	m	Discharge	0.1060	m³/s
Headwater Depth/Height	0.29		Tailwater Elevation	79.50	m
Inlet Control HW Elev.	79.74	m	Control Type	Outlet Control	
Outlet Control HW Elev.	79.81	m			

Grades

Upstream Invert	79.50	m	Downstream Invert	79.35	m
Length	54.13	m	Constructed Slope	0.002845	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.18	m
Slope Type	Mild		Normal Depth	0.28	m
Flow Regime	Subcritical		Critical Depth	0.18	m
Velocity Downstream	1.09	m/s	Critical Slope	0.019497	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.07	m
Section Size	1050 mm		Rise	1.07	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	79.81	m	Upstream Velocity Head	0.02	m
Ke	0.50		Entrance Loss	0.01	m

Inlet Control Properties

Inlet Control HW Elev.	79.74	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.9	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-04

Peak Discharge Method: User-Specified					
Design Discharge	0.0370	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	79.55	m	Invert Downstream	79.51	m
Length	10.50	m	Slope	0.003810	m/m
Drop	0.04	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.0370	m³/s	Bottom Elevation	79.50	m
Depth	0.08	m	Velocity	0.21	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.0370 m³/s	79.73 m	0.85 m/s

Culvert Designer/Analyzer Report
CV-04

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	79.73	m	Discharge	0.0370	m^3/s
Headwater Depth/Height	0.19		Tailwater Elevation	79.58	m
Inlet Control HW Elev.	79.69	m	Control Type	Outlet Control	
Outlet Control HW Elev.	79.73	m			

Grades

Upstream Invert	79.55	m	Downstream Invert	79.51	m
Length	10.50	m	Constructed Slope	0.003810	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.11	m
Slope Type	Mild		Normal Depth	0.16	m
Flow Regime	Subcritical		Critical Depth	0.11	m
Velocity Downstream	0.85	m/s	Critical Slope	0.021922	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	79.73	m	Upstream Velocity Head	0.01	m
Ke	0.50		Entrance Loss	0.01	m

Inlet Control Properties

Inlet Control HW Elev.	79.69	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.7	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-05

Peak Discharge Method: User-Specified					
Design Discharge	0.3530	m^3/s	Check Discharge	0.0000	m^3/s

Grades Model: Inverts					
Invert Upstream	80.69	m	Invert Downstream	80.63	m
Length	10.50	m	Slope	0.005714	m/m
Drop	0.06	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.3530	m^3/s	Bottom Elevation	80.63	m
Depth	0.18	m	Velocity	0.39	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-3	1-1200 mm Circular	0.3530 m^3/s	81.18 m	1.48 m/s

Culvert Designer/Analyzer Report
CV-05

Design:Trial-3

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	81.18	m	Discharge	0.3530	m^3/s
Headwater Depth/Height	0.40		Tailwater Elevation	80.81	m
Inlet Control HW Elev.	81.12	m	Control Type	Outlet Control	
Outlet Control HW Elev.	81.18	m			

Grades

Upstream Invert	80.69	m	Downstream Invert	80.63	m
Length	10.50	m	Constructed Slope	0.005714	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.31	m
Slope Type	Mild		Normal Depth	0.42	m
Flow Regime	Subcritical		Critical Depth	0.31	m
Velocity Downstream	1.48	m/s	Critical Slope	0.017683	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	81.18	m	Upstream Velocity Head	0.06	m
Ke	0.50		Entrance Loss	0.03	m

Inlet Control Properties

Inlet Control HW Elev.	81.12	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m^2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-06

Peak Discharge Method: User-Specified					
Design Discharge	0.9850	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	80.00	m	Invert Downstream	79.97	m
Length	10.50	m	Slope	0.002857	m/m
Drop	0.03	m			

Headwater Model: Unspecified

Tailwater properties: Rectangular Channel

Tailwater conditions for Design Storm.					
Discharge	0.9850	m³/s	Bottom Elevation	79.97	m
Depth	0.21	m	Velocity	0.68	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1500 mm Circular	0.9850 m³/s	80.79 m	1.89 m/s

Culvert Designer/Analyzer Report
CV-06

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	80.79	m	Discharge	0.9850	m³/s
Headwater Depth/Height	0.52		Tailwater Elevation	80.18	m
Inlet Control HW Elev.	80.69	m	Control Type	Outlet Control	
Outlet Control HW Elev.	80.79	m			

Grades

Upstream Invert	80.00	m	Downstream Invert	79.97	m
Length	10.50	m	Constructed Slope	0.002857	m/m

Hydraulic Profile

Profile	M2		Depth, Downstream	0.50	m
Slope Type	Mild		Normal Depth	0.81	m
Flow Regime	Subcritical		Critical Depth	0.50	m
Velocity Downstream	1.89	m/s	Critical Slope	0.016376	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.52	m
Section Size	1500 mm		Rise	1.52	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	80.79	m	Upstream Velocity Head	0.09	m
Ke	0.50		Entrance Loss	0.04	m

Inlet Control Properties

Inlet Control HW Elev.	80.69	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.8	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-07

Peak Discharge Method: User-Specified					
Design Discharge	0.1170	m^3/s	Check Discharge	0.0000	m^3/s

Grades Model: Inverts					
Invert Upstream	79.50	m	Invert Downstream	79.30	m
Length	58.00	m	Slope	0.003448	m/m
Drop	0.20	m			

Headwater Model: Unspecified

Tailwater properties: Triangular Channel

Tailwater conditions for Design Storm.					
Discharge	0.1170	m^3/s	Bottom Elevation	79.30	m
Depth	0.71	m	Velocity	0.40	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-2	1-1350 mm Circular	0.1170 m^3/s	80.02 m	0.15 m/s

Culvert Designer/Analyzer Report
CV-07

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	80.02	m	Discharge	0.1170	m³/s
Headwater Depth/Height	0.38		Tailwater Elevation	80.01	m
Inlet Control HW Elev.	80.01	m	Control Type	Outlet Control	
Outlet Control HW Elev.	80.02	m			

Grades

Upstream Invert	79.50	m	Downstream Invert	79.30	m
Length	58.00	m	Constructed Slope	0.003448	m/m

Hydraulic Profile

Profile	M1		Depth, Downstream	0.71	m
Slope Type	Mild		Normal Depth	0.26	m
Flow Regime	Subcritical		Critical Depth	0.17	m
Velocity Downstream	0.15	m/s	Critical Slope	0.018906	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.37	m
Section Size	1350 mm		Rise	1.37	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	80.02	m	Upstream Velocity Head	0.00	m
Ke	0.50		Entrance Loss	0.00	m

Inlet Control Properties

Inlet Control HW Elev.	80.01	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.5	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-08

Peak Discharge Method: User-Specified					
Design Discharge	0.2800	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	79.00	m	Invert Downstream	78.95	m
Length	12.70	m	Slope	0.003937	m/m
Drop	0.05	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.2800	m³/s	Bottom Elevation	78.95	m
Depth	0.36	m	Velocity	0.49	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1200 mm Circular	0.2800 m³/s	79.45 m	0.98 m/s

Culvert Designer/Analyzer Report
CV-08

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	79.45	m	Discharge	0.2800	m³/s
Headwater Depth/Height	0.37		Tailwater Elevation	79.31	m
Inlet Control HW Elev.	79.38	m	Control Type	Outlet Control	
Outlet Control HW Elev.	79.45	m			

Grades					
Upstream Invert	79.00	m	Downstream Invert	78.95	m
Length	12.70	m	Constructed Slope	0.003937	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.41	m
Flow Regime	Subcritical		Critical Depth	0.28	m
Velocity Downstream	0.98	m/s	Critical Slope	0.017833	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	79.45	m	Upstream Velocity Head	0.04	m
Ke	0.50		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	79.38	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-09

Peak Discharge Method: User-Specified					
Design Discharge	0.0520	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	79.22	m	Invert Downstream	78.99	m
Length	10.80	m	Slope	0.021296	m/m
Drop	0.23	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.0520	m³/s	Bottom Elevation	78.99	m
Depth	0.07	m	Velocity	0.67	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1050 mm Circular	0.0520 m³/s	79.41 m	0.91 m/s

Culvert Designer/Analyzer Report
CV-09

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	79.41	m	Discharge	0.0520	m³/s
Headwater Depth/Height	0.17		Tailwater Elevation	79.06	m
Inlet Control HW Elev.	79.37	m	Control Type	Entrance Control	
Outlet Control HW Elev.	79.41	m			

Grades

Upstream Invert	79.22	m	Downstream Invert	78.99	m
Length	10.80	m	Constructed Slope	0.021296	m/m

Hydraulic Profile

Profile	S2		Depth, Downstream	0.12	m
Slope Type	Steep		Normal Depth	0.12	m
Flow Regime	Supercritical		Critical Depth	0.12	m
Velocity Downstream	0.91	m/s	Critical Slope	0.021023	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.07	m
Section Size	1050 mm		Rise	1.07	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	79.41	m	Upstream Velocity Head	0.04	m
Ke	0.50		Entrance Loss	0.02	m

Inlet Control Properties

Inlet Control HW Elev.	79.37	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.9	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-10

Peak Discharge Method: User-Specified					
Design Discharge	0.1530	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	80.10	m	Invert Downstream	79.90	m
Length	10.50	m	Slope	0.019048	m/m
Drop	0.20	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.1530	m³/s	Bottom Elevation	79.90	m
Depth	0.08	m	Velocity	0.92	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1050 mm Circular	0.1530 m³/s	80.42 m	1.21 m/s

Culvert Designer/Analyzer Report
CV-10

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	80.42	m	Discharge	0.1530	m³/s
Headwater Depth/Height	0.30		Tailwater Elevation	79.98	m
Inlet Control HW Elev.	80.38	m	Control Type	Entrance Control	
Outlet Control HW Elev.	80.42	m			

Grades

Upstream Invert	80.10	m	Downstream Invert	79.90	m
Length	10.50	m	Constructed Slope	0.019048	m/m

Hydraulic Profile

Profile	S2		Depth, Downstream	0.21	m
Slope Type	Steep		Normal Depth	0.21	m
Flow Regime	Supercritical		Critical Depth	0.21	m
Velocity Downstream	1.21	m/s	Critical Slope	0.018943	m/m

Section

Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.07	m
Section Size	1050 mm		Rise	1.07	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	80.42	m	Upstream Velocity Head	0.07	m
Ke	0.50		Entrance Loss	0.04	m

Inlet Control Properties

Inlet Control HW Elev.	80.38	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.9	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-11

Peak Discharge Method: User-Specified					
Design Discharge	0.0650	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	80.00	m	Invert Downstream	79.89	m
Length	13.00	m	Slope	0.008462	m/m
Drop	0.11	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.0650	m³/s	Bottom Elevation	79.89	m
Depth	0.05	m	Velocity	0.87	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.0650 m³/s	80.22 m	0.99 m/s

Culvert Designer/Analyzer Report
CV-11

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	80.22	m	Discharge	0.0650	m³/s
Headwater Depth/Height	0.24		Tailwater Elevation	79.94	m
Inlet Control HW Elev.	80.19	m	Control Type	Outlet Control	
Outlet Control HW Elev.	80.22	m			

Grades					
Upstream Invert	80.00	m	Downstream Invert	79.89	m
Length	13.00	m	Constructed Slope	0.008462	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.14	m
Slope Type	Mild		Normal Depth	0.18	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.99	m/s	Critical Slope	0.020716	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	80.22	m	Upstream Velocity Head	0.03	m
Ke	0.50		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	80.19	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	0.7	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-12

Peak Discharge Method: User-Specified					
Design Discharge	0.2780	m³/s	Check Discharge	0.0000	m³/s

Grades Model: Inverts					
Invert Upstream	80.00	m	Invert Downstream	79.79	m
Length	36.00	m	Slope	0.005833	m/m
Drop	0.21	m			

Headwater Model: Unspecified

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.					
Discharge	0.2780	m³/s	Bottom Elevation	79.79	m
Depth	0.27	m	Velocity	0.55	m/s

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.2780 m³/s	84.27 m	1.47 m/s
	Trial-2	1-1200 mm Circular	0.2780 m³/s	80.44 m	1.39 m/s

Culvert Designer/Analyzer Report
CV-12

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	84.27	m	Discharge	0.2780	m³/s
Headwater Depth/Height	4.67		Tailwater Elevation	80.06	m
Inlet Control HW Elev.	80.42	m	Control Type	Outlet Control	
Outlet Control HW Elev.	84.27	m			

Grades					
Upstream Invert	80.00	m	Downstream Invert	79.79	m
Length	36.00	m	Constructed Slope	0.005833	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.30	m
Velocity Downstream	1.47	m/s	Critical Slope	1.942215	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.290	
Section Material	Concrete		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	84.27	m	Upstream Velocity Head	0.01	m
Ke	0.50		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	80.42	m	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	0.7	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
CV-12

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	80.44	m	Discharge	0.2780	m³/s
Headwater Depth/Height	0.36		Tailwater Elevation	80.06	m
Inlet Control HW Elev.	80.37	m	Control Type	Outlet Control	
Outlet Control HW Elev.	80.44	m			

Grades					
Upstream Invert	80.00	m	Downstream Invert	79.79	m
Length	36.00	m	Constructed Slope	0.005833	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.28	m
Slope Type	Mild		Normal Depth	0.37	m
Flow Regime	Subcritical		Critical Depth	0.28	m
Velocity Downstream	1.39	m/s	Critical Slope	0.017839	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.029	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	80.44	m	Upstream Velocity Head	0.04	m
Ke	0.50		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	80.37	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

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APPENDIX 3

SITE PHOTOS


53°21'58", -6°53'26", 141,3m, 46°
14/10/2024 10:56:09


53°22'6", -6°52'55", 137,4m, 225°
14/10/2024 11:51:36


53°22'8", -6°52'52", 140,3m, 78°
14/10/2024 11:53:27


53°21'18", -6°52'45", 139,2m, 4°
14/10/2024 13:12:13


53°23'18", -6°51'24", 148,6m, 288°
14/10/2024 16:35:30


53°23'18", -6°51'24", 148,6m, 288°
14/10/2024 16:35:30


53°23'18", -6°51'24", 140,9m, 148°
14/10/2024 16:36:04


53°23'6", -6°51'9", 141,0m, 310°
14/10/2024 16:50:46


53°22'47", -6°51'58", 141,8m, 322°
15/10/2024 12:22:16


53°22'50", -6°51'30", 137,1m, 326°
14/10/2024 17:14:51


53°23'18", -6°51'24", 140.9m, 148°
14/10/2024 16:36:04


53°22'53", -6°52'1", 135.4m, 338°
15/10/2024 12:55:32


53°22'46", -6°52'1", 146,4m, 161°
15/10/2024 12:31:41

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APPENDIX 3

TDR Report

Pell Frischmann

Drehid Wind Farm

Route Survey Report

December 2024

10109576

Report Ref.	**241218 Drehid Rsr**
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Prepared for

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Pell Frischmann

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1 Introduction

1.1 Purpose of the Report

Pell Frischmann (PF) has been commissioned by North Kildare Wind Farm Limited to undertake an route access review of the potential delivery route for wind turbine Abnormal Indivisible Loads (AIL) associated with the construction and development of Drehid Wind Farm, located southeast of Kilshanroe, Co. Kildare.

The Route Survey Report (RSR) has been prepared to help inform the developer on the likely issues associated with the development of the site with regards to off-site transport and access for AIL traffic. The report identifies the key issues associated with AIL deliveries and notes that remedial works, either in the form of physical works or as traffic management interventions will be required to accommodate the predicted loads.

The detailed assessment and subsequent designs of any remedial works are beyond the agreed scope of works between PF and North Kildare Wind Farm Limited at this point in time.

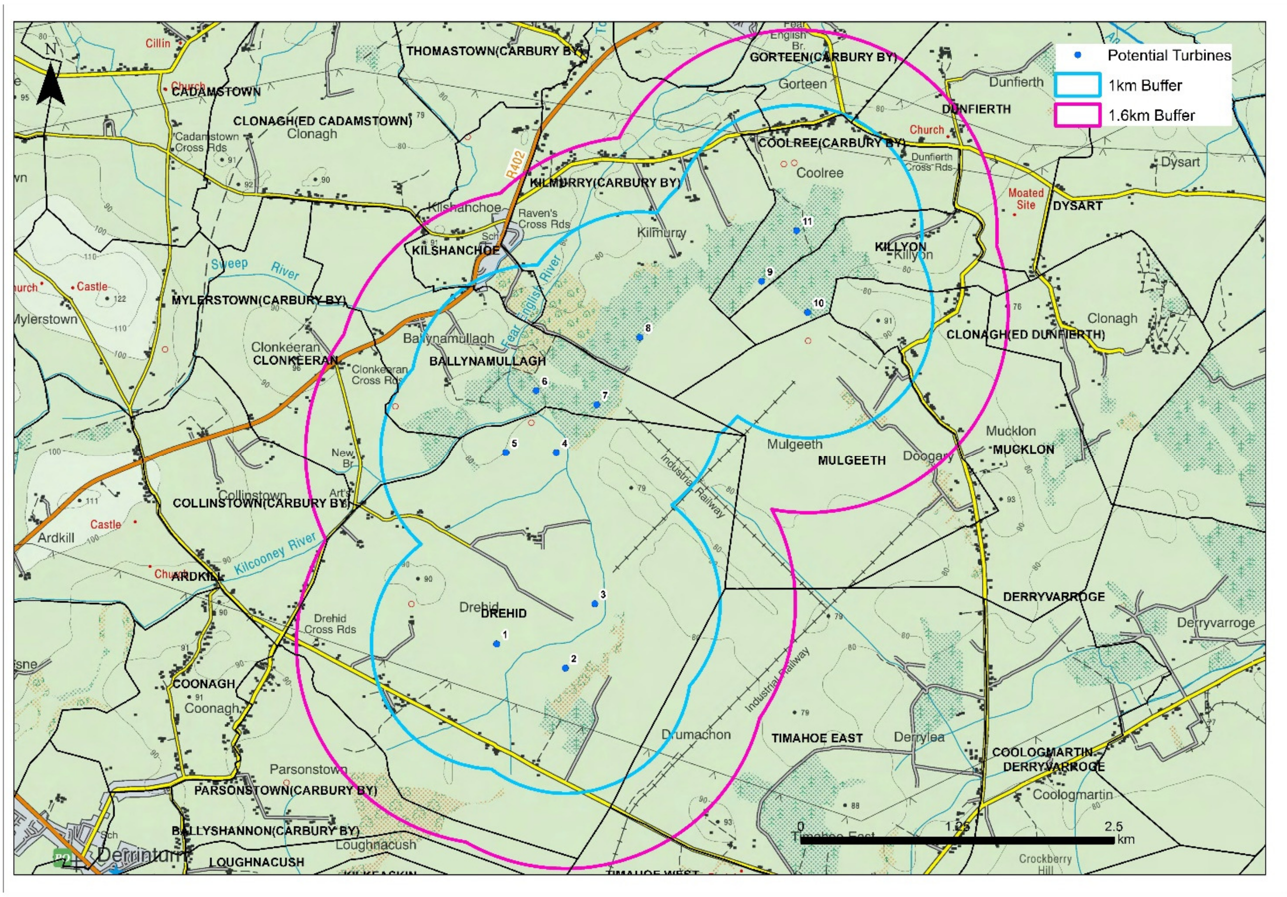
It is the responsibility of the wind turbine supplier to ensure that the entirety of the proposed access route is suitable and meets with their satisfaction. The turbine supplier will be responsible for ensuring that the finalised proposals meet with the appropriate levels of health and safety consideration for all road users has been made in accordance with the relevant legislation at the time of delivery.

2 Site Background

2.1 Sites Location

The development site is located to the southeast of Kilshanroe, Co. Kildare. Figure 1 illustrates the general site location.

Figure 1: Site Location Plan



2.2 Candidate Turbine

North Kildare Wind Farm Limited have indicated that they wish to consider the use of a Nordex N133 on a TS 100 tower. This assessment has considered the N133 blade (total length of 65.5m) and a worst-case tower section (26.9m in length x 4.3m in diameter) to consider access for all components.

2.3 Proposed Delivery Equipment

To provide a robust assessment scenario based upon the known issues along the access route, it has been assumed that all blades would be carried on a Super Wing Carrier trailer to reduce the need for mitigation in constrained sections of the route.

Towers would be carried in a 4+7 clamp adaptor style trailer, whereas loads such as the hub, nacelle housing and top towers would be carried on a six-axle step frame trailer.

Figure 2: Super Wing Carrier Trailer

Figure 3: Tower Trailer

Where access constraints are extreme, it is proposed that the blade would be transferred from the Super Wing trailer to a blade lifting trailer. This trailer can lift blades up to a maximum angle of 60 degrees to clear potential constraints and shortening the length plan view. An example trailer is illustrated in Figure 4.

Figure 4: Example Blade Lifting Trailer

To undertake the transfer between trailers, a blade transfer area will need to be constructed. The area of land required will need to be circa 175m x 60m and will need to include two crane pads. Storage for up to six blades should also be available, with all infrastructure designed in accordance with turbine supplier standards.

The proposed location for the transfer station is the southern development area of the proposed wind farm and as such, no additional third party land areas are required.

3 Access Route Review

3.1 Proposed Access Route

As requested by North Kildare Wind Farm Limited, access has been considered from the M4 motorway. Access from the port to the M4 will be undertaken once the turbine haulier has been engaged by the developer, post planning determination.

Access to the site will be taken from the south for all loads. Access from the south to the northern turbine locations is not possible using internal access tracks, so all northern turbine components will need to access the southern junction where blades will be transferred to a blade lifting trailer (required to overcome physical constraints) at a blade transfer area. Tower and all other loads will undertake a U turn in the southern area, and will then backtrack until the R402 Raven Junction, where they will turn right for the northern access junction.

The proposed access route is as follows:

- Loads will depart the M4 at Junction 9 and will join the R402, southbound;
- Loads will pass through Johnstown Bridge and Kilshancoe;
- All loads will turn off the R402 onto the L5025, turning left at The Sweep Crossroads junction;
- Loads will continue on the L5025 heading southeast to the site access junction. At the site access junction, loads will turn left into a purpose designed junction;
- Blade loads for the northern turbines will be transferred onto a blade lifting trailer. All other northern turbine loads will undertake a U-turn and will rejoin the L5025, proceed northwest;
- Northern turbine loads will turn right onto the R402 and will proceed northbound;
- At the Raven Junction, loads will turn right onto Kilshanroe Road and will continue eastbound to the northern access junction.

The proposed access route from the M4 to the development site access junctions is shown in Figure 5 for the southern access. Figure 6 illustrates the route from the blade transfer area to the northern access junction.

Figure 5: Proposed Access Route from M4 to Southern Access Junction

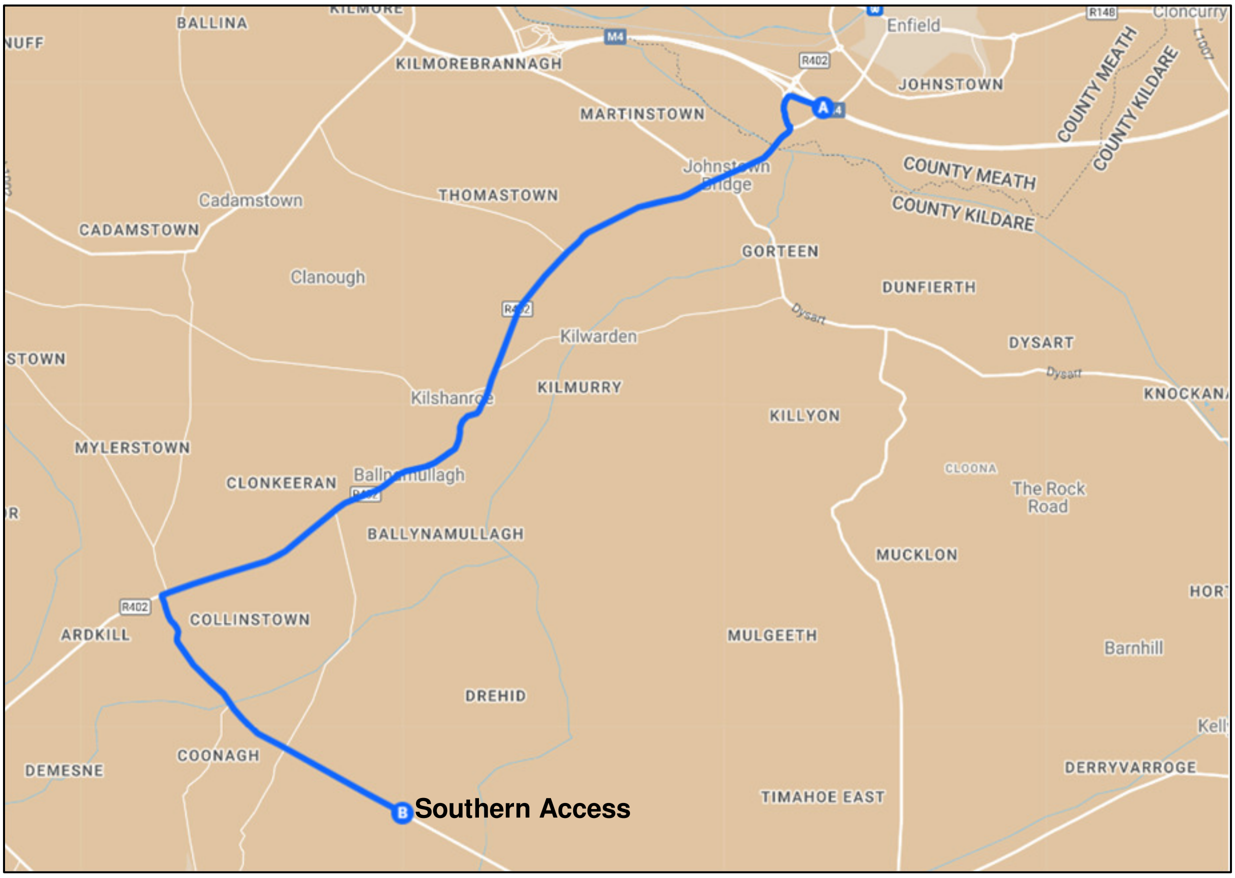
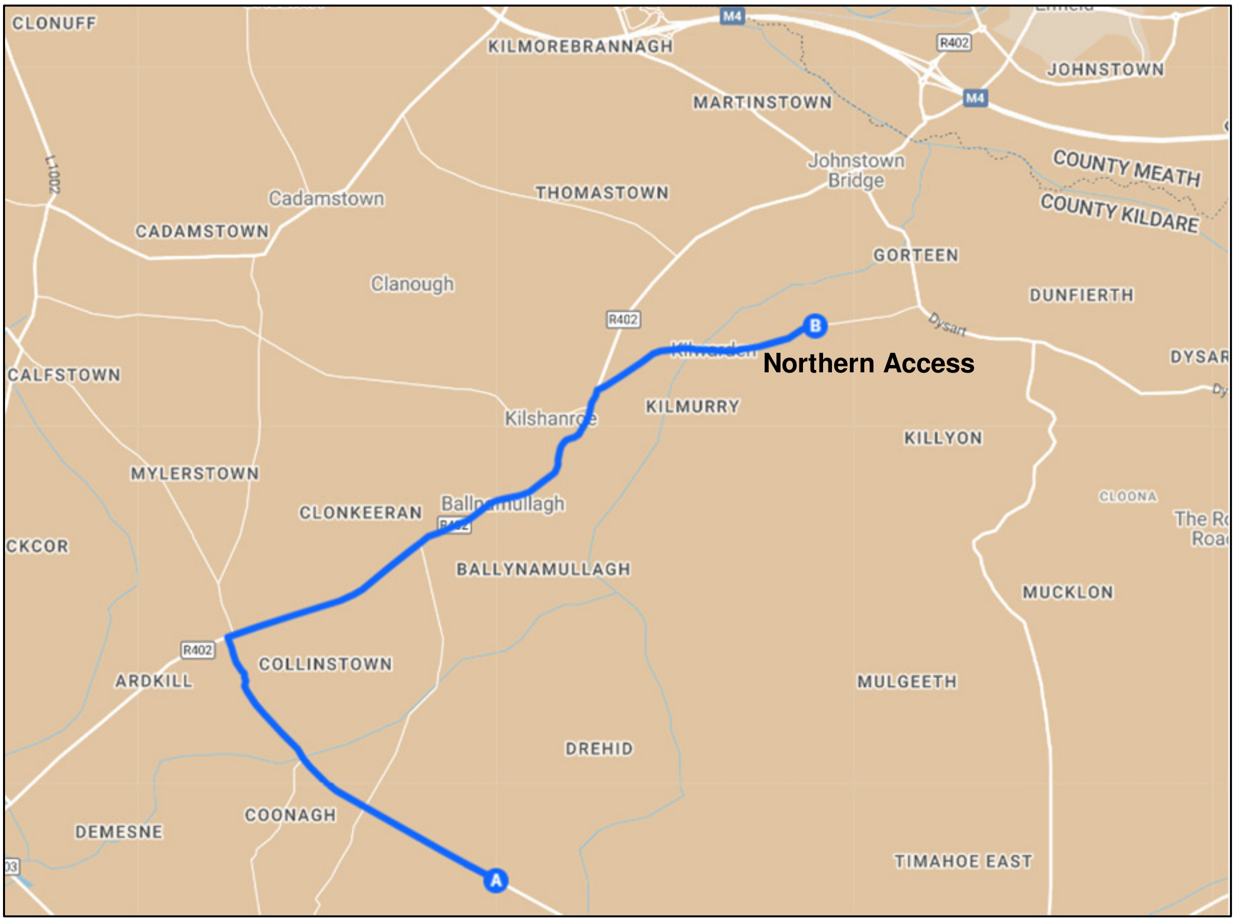


Figure 6: Proposed Access Route from Blade Transfer Area to Northern Access



3.2 Route Constraints

The constraints noted during the access route review are provided in the tables below. These cover all constraints from the M4 through to the proposed site entrance. No consideration of the transport issues within the port or development site have been undertaken and this includes the design of the site access junction.

Plans illustrating the location of the constraints are provided in Appendix A.

Table 3-1: Constraint Points and Details

<table>
<tr><th>POI</th><th>Key Constraint</th><th>Details</th></tr>
<tr><td>1</td><td>M4 Junction 9 Slip Road
</td><td>Loads will depart the M4 at Junction 9 and will take the first exit at the roundabout with the R402 (southbound).

A swept path assessment has been undertaken and indicates that loads will oversail the entry verge where two road signs should be removed.

Loads will require an over-run surface on the central island of the roundabout where one chevron sign should be removed.

On exiting the junction, loads will over-run the splitter island where three road signs should be removed. Verge vegetation trimming is required on the exist.</td></tr>
<tr><td>2</td><td>R402 / Johnstown Road Roundabout
</td><td>Loads will continue southbound on the R402. At the roundabout with Johnstown Road, loads will take the second exit and will continue southbound on the R402.

A swept path assessment has been undertaken and indicates that loads will over-run the entry splitter island, central island and exit splitter island of the roundabout. Load bearing surfaces are required.

Two road signs on the entry splitter island, two chevron signs on the central island and two signs on the exit splitter island should be removed.

Following the roundabout, loads will continue southbound, heading through Johnstown Bridge and Kilshanroe. Loads will need to exercise care passing through both villages and oncoming traffic should be held back to allow loads access to both lanes in sinuous sections. Care should be exercised when passing over traffic calming measures noted on the road.</td></tr>
<tr><td>3</td><td>R402 / L5025 Access Junction
</td><td>Southern Access Route

Loads will turn left onto the L5025 and will continue eastbound to reach the southern access junction.

A swept path assessment has been undertaken and indicates that loads will oversail the inside of the junction where two road signs and a barrier should be removed.

It is recommended that the load suspension settings are increased to account for any changes in vertical clearance on the L5025.

Northern Access Route

Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads will turn right at this junction. The swept path assessment also covers this movement.

All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.</td></tr>
</table>

POI	Key Constraint	Details
4	**L5025 Bend 1** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
5	**L5025 Bend 2**  	**Southern Access Route** Loads will proceed ahead on the L5025, passing through the two bends. A swept path assessment has been undertaken at this location and indicates that loads will oversail both sides of the road. Hedge trimming works will be required in the western verge along with an area of load bearing surfacing. Tree canopy trimming is required. A minor area of load bearing surface is required in the eastern verge along with the removal of a utility pole stay wire. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
6	**L5025, north of the River Kilooney Bridge** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
7	**L5025, south of the River Kilooney Bridge** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
8	**Southern Site Access Junction** 	**Southern Access Route** Loads will turn left into a new site access junction. A swept path assessment has been undertaken at this location and indicates that loads will require the removal of a section of fence, access gate and hedge to enable the construction of the access junction. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads will turn right out of the site. The swept path assessment also covers this movement. All overhead utilities on the L5025 and inside the access site should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
9	**R402 Raven Junction** 	**Northern Access Route** Loads for the northern access junction will turn right at the junction. A swept path assessment has been undertaken at this location and indicates that loads will oversail the inside of the junction where verge vegetation trimming is required. It is recommended that the load suspension settings are increased to account for any changes in vertical clearance on the Kilshanroe Road.
10	**Kilshanroe Road Bend 1** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
11	**Kilshanroe Road Bend 2** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
12	**Kilshanroe Road Bend 3** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. A section of verge hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
13	**Kilshanroe Road Bend 4** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. Two lengths of hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
14	**Kilshanroe Road Bend 5** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. A minor area of load bearing surface is required in the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
15	**Northern Site Access** 	**Northern Access Route** Loads will turn right into a new site access junction. A swept path assessment has been undertaken at this location and indicates that trees should be removed to enable the construction of the site access junction. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road. Engagement on with the power line operator is recommended.

3.3 Swept Path Assessment Results and Summary

The detailed swept path drawings for the locations assessed are provided in Appendix B for review. The drawings in Appendix B illustrate tracking undertaken for the worst-case loads at each location.

The colours illustrated on the swept paths are:

- Grey / Black – OS / Topographical Base Mapping;
- Green – Vehicle body outline (body swept path);
- Red – Tracked pathway of the wheels (wheel swept path); and
- Purple – The over-sail tracked path of the load where it encroaches outwith the trailer (load swept path).

Where mitigation works are required, the extents of over-run and over-sail areas are illustrated on the swept path drawings.

3.4 Overhead Constraints

Overhead utilities will foul the raised blade when this is carried in the upright position. Where the blade is raised, these will need to be relocated, lowered or removed. It is assumed in this assessment that the blade tip is raised from the southern access junction, through to the northern access junction. As such, all overhead utilities would need to be removed.

A detailed overhead utility review is required prior to loads being transported and engagement with utility providers will be required.

Overhead utilities on the R402 should also be removed. It may be possible, depending upon the views of the Garda and haulier to lower the blade on straight sections of the R402 and early engagement with both is recommended.

3.5 Summary Issues

It is strongly suggested that following a review of the RSR, North Kildare Wind Farm Limited should undertake the following prior to the delivery of the first abnormal loads, to ensure load and road user safety:

- A review of clear heights with utility providers and the transport agencies along the route to ensure that there is sufficient space to allow for loads plus sufficient flashover protection (to electrical installations);
- That any verge vegetation and tree canopies which may foul loads is trimmed prior to loads moving;
- That a review of potential roadworks and or closures is undertaken once the delivery schedule is established in draft form;

- That a test run is completed to confirm the route and review any vertical clearance issues; and
- That a condition survey is undertaken to ascertain the extents of road defects prior to loads commencing to protect the developer from spurious damage claims.

4 Summary

4.1 Summary of Access Review

PF has been commissioned by North Kildare Wind Farm Limited to prepare a Route Survey Report to examine the issues associated with the transport of AIL turbine components to Drehid Wind Farm.

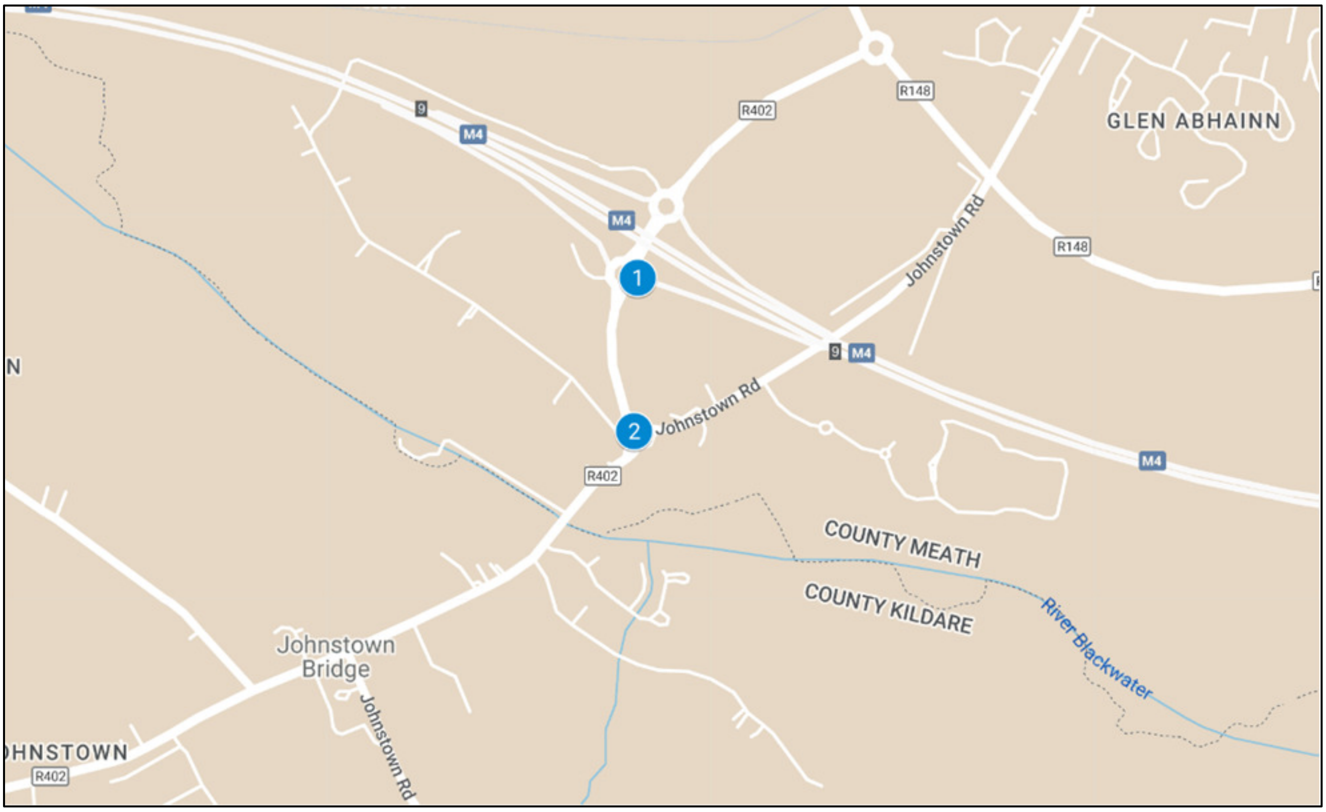
This report identifies the key points and issues associated with the proposed routes and outlines the issues that will need to be considered for successful delivery of components.

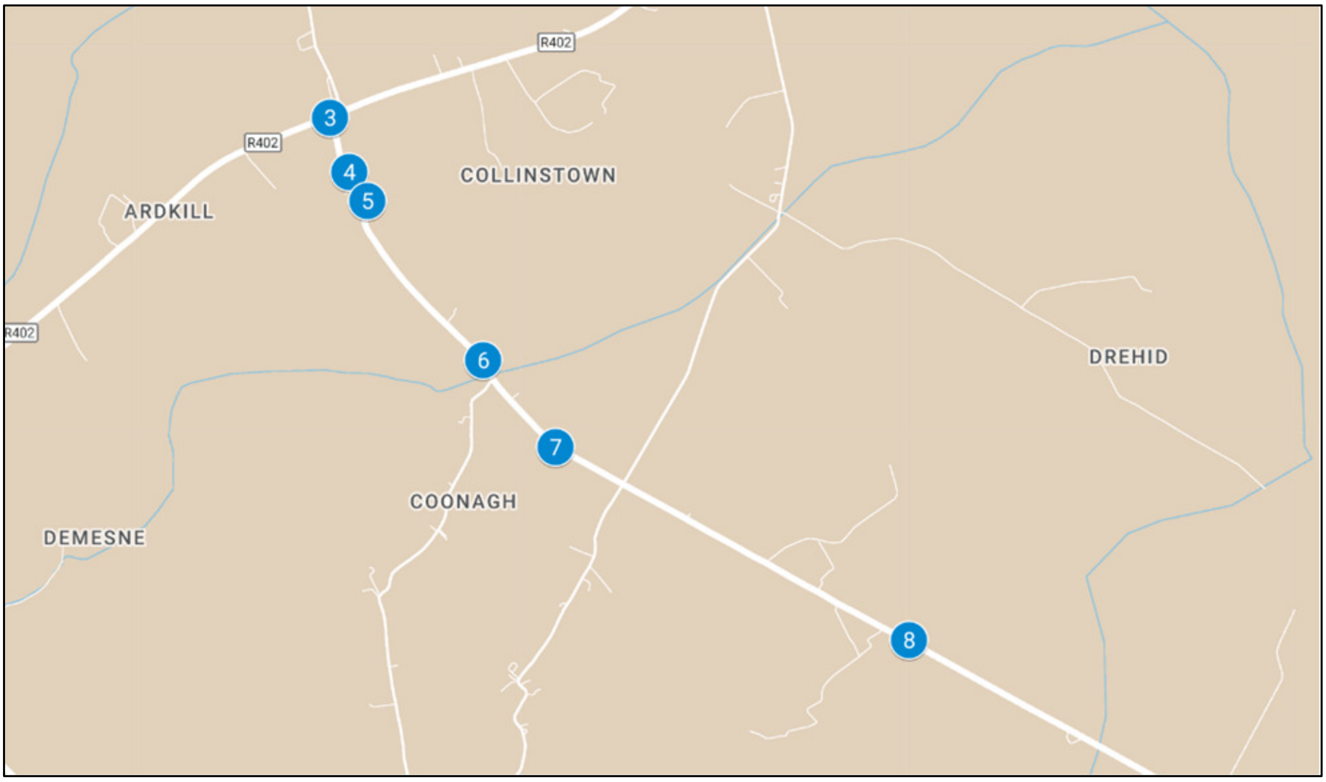
This report has been based upon a worst case of Nordex N133 turbine sections and has been undertaken on the basis of a Superwing Carrier blade trailer, transferring to a blade lifting trailer for access to the northern development area.

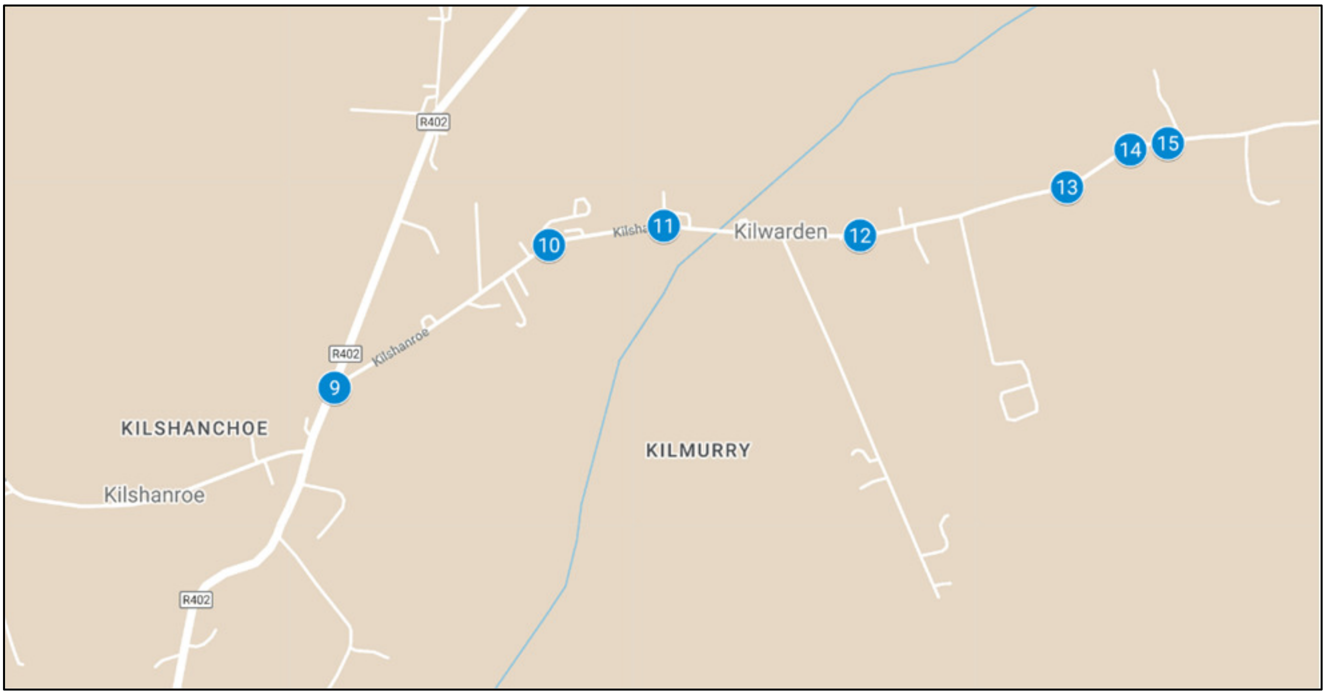
The report is presented for consideration to North Kildare Wind Farm Limited. Various road modifications and interventions are required to successfully access the site.

Appendix A Points of Interest

An electronic version of the POI plan can be found here:
https://www.google.com/maps/d/edit?mid=1Vm6M6mS4QLn5zg9k91_iL_p2v2ojopw&usp=sharing






R402
R402
R402
Kilshanroe
Kilsha
Kilwarden
KILSHANCHOE
Kilshanroe
KILMURRY
9
10
11
12
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Appendix B Swept Path Assessment Drawings

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Project	DREHID WIND FARM		Name	Date	Scale: 1:500 @ A3
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		Checked	TL	18/12/2024	Drawing Status: Draft
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Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER	Drawing No.	SK01		Revision: 00
SPA Location	M4 Junction 9 Slip Road				

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: M4 Junction 9 Slip Road

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Scale: 1:1000 @ A3

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Drawing Status: Draft

Drawing No. SK01A

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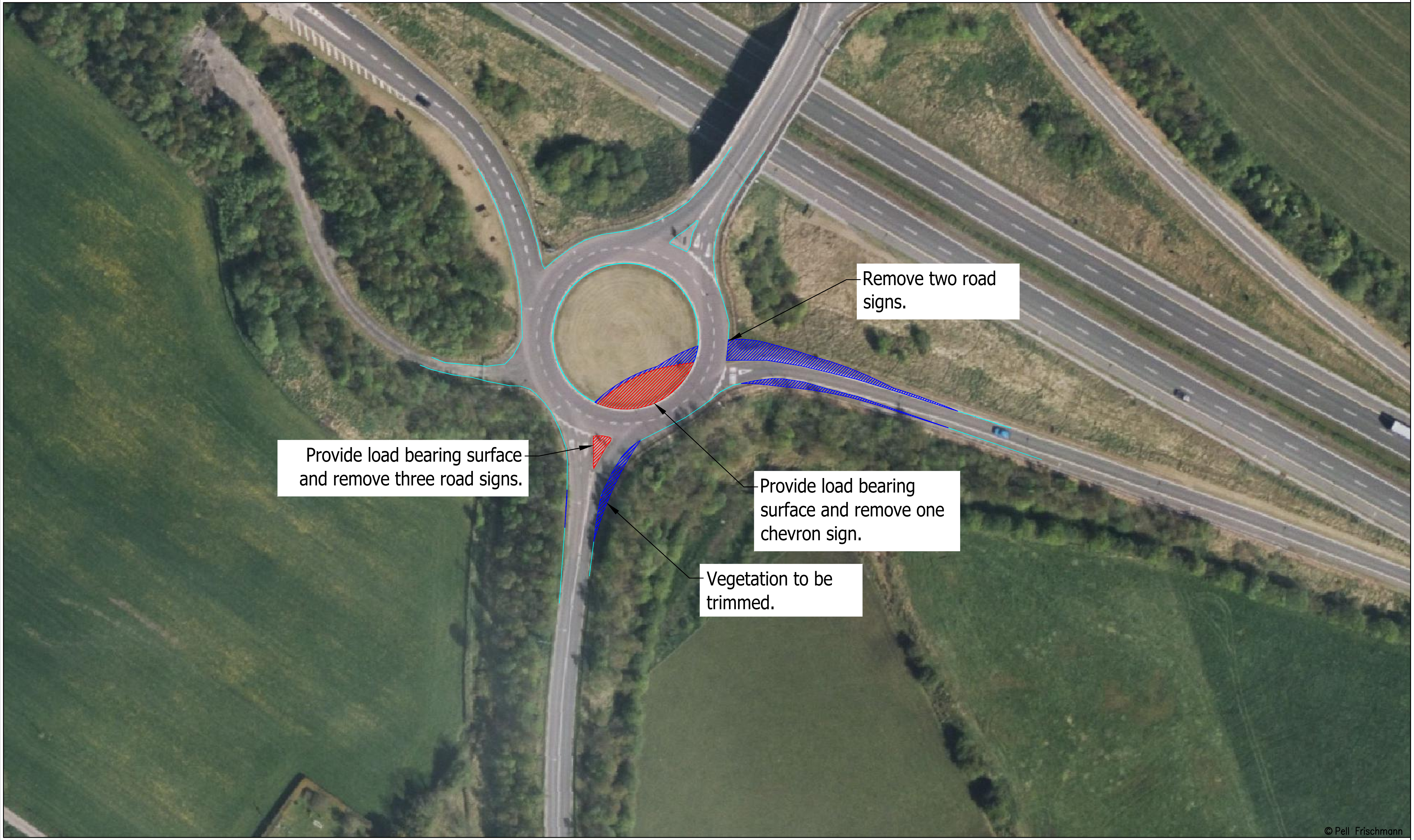

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Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: M4 Junction 9 Slip Road

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Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		1

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK01B

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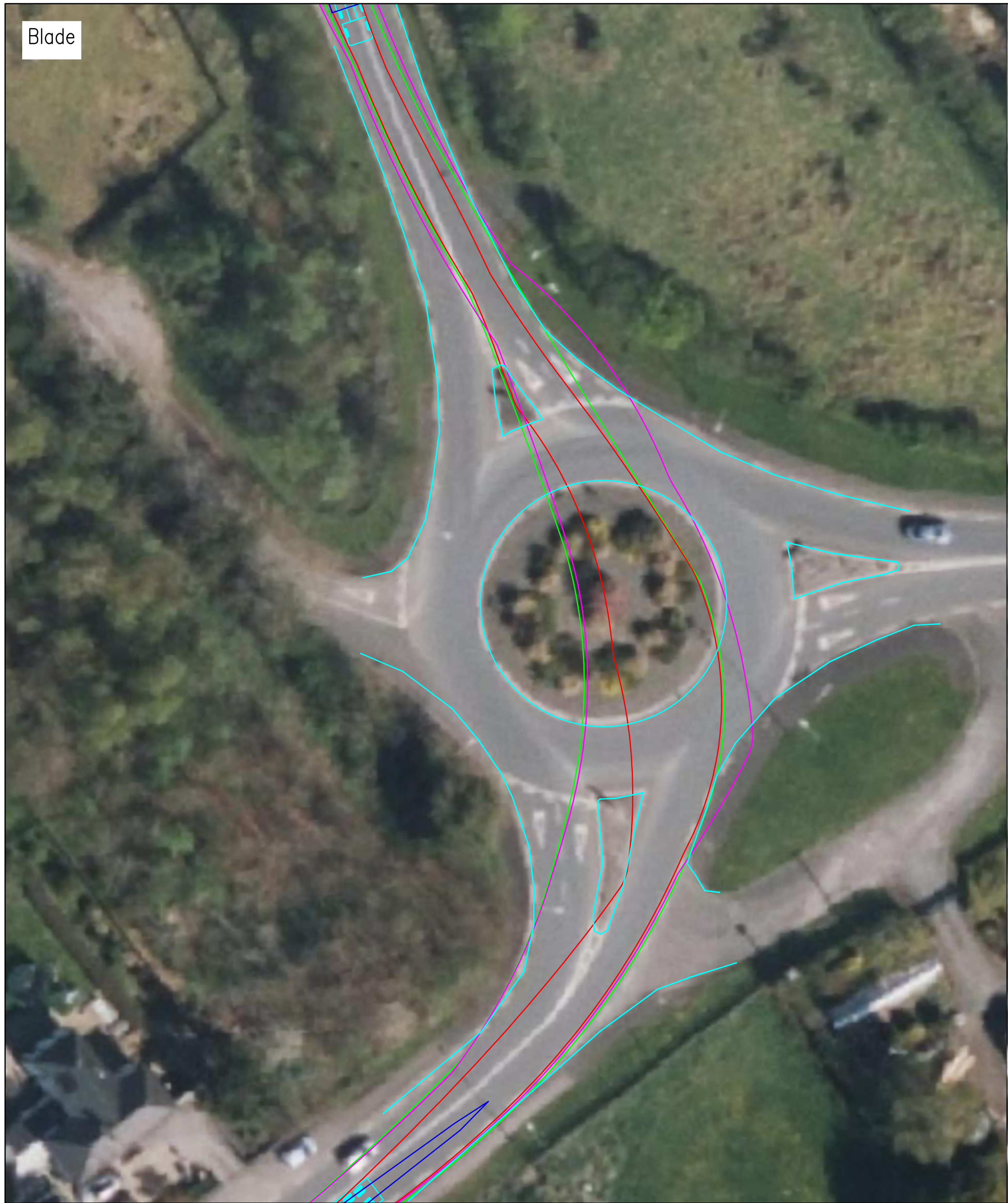

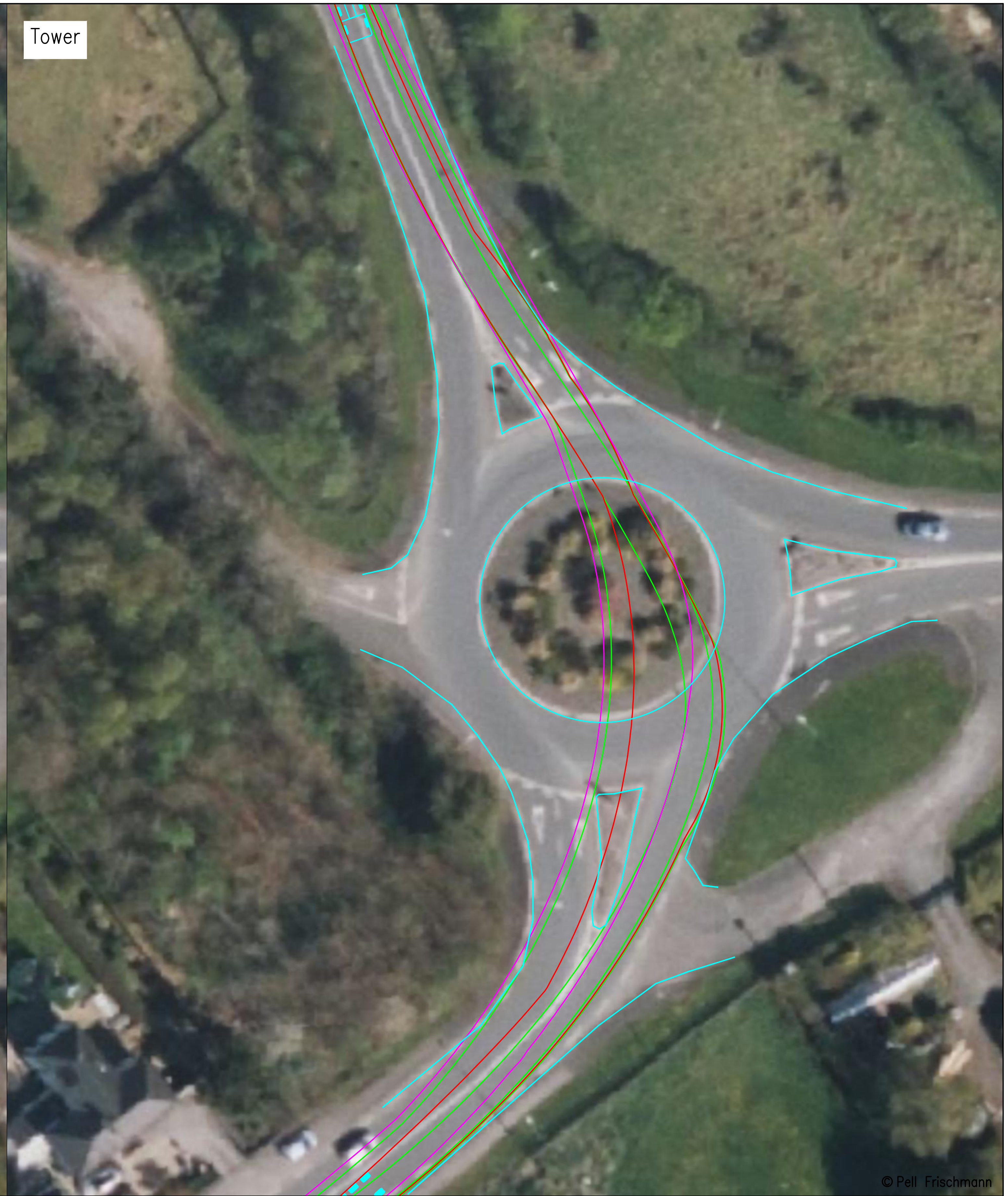

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / Johnstown Road Roundabout

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

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Designed	GB	18/12/2024
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Drawing No. SK02

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Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / Johnstown Road Roundabout

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
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Scale: 1:1000 @ A3

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Drawing Status: Draft

Drawing No.: SK02A

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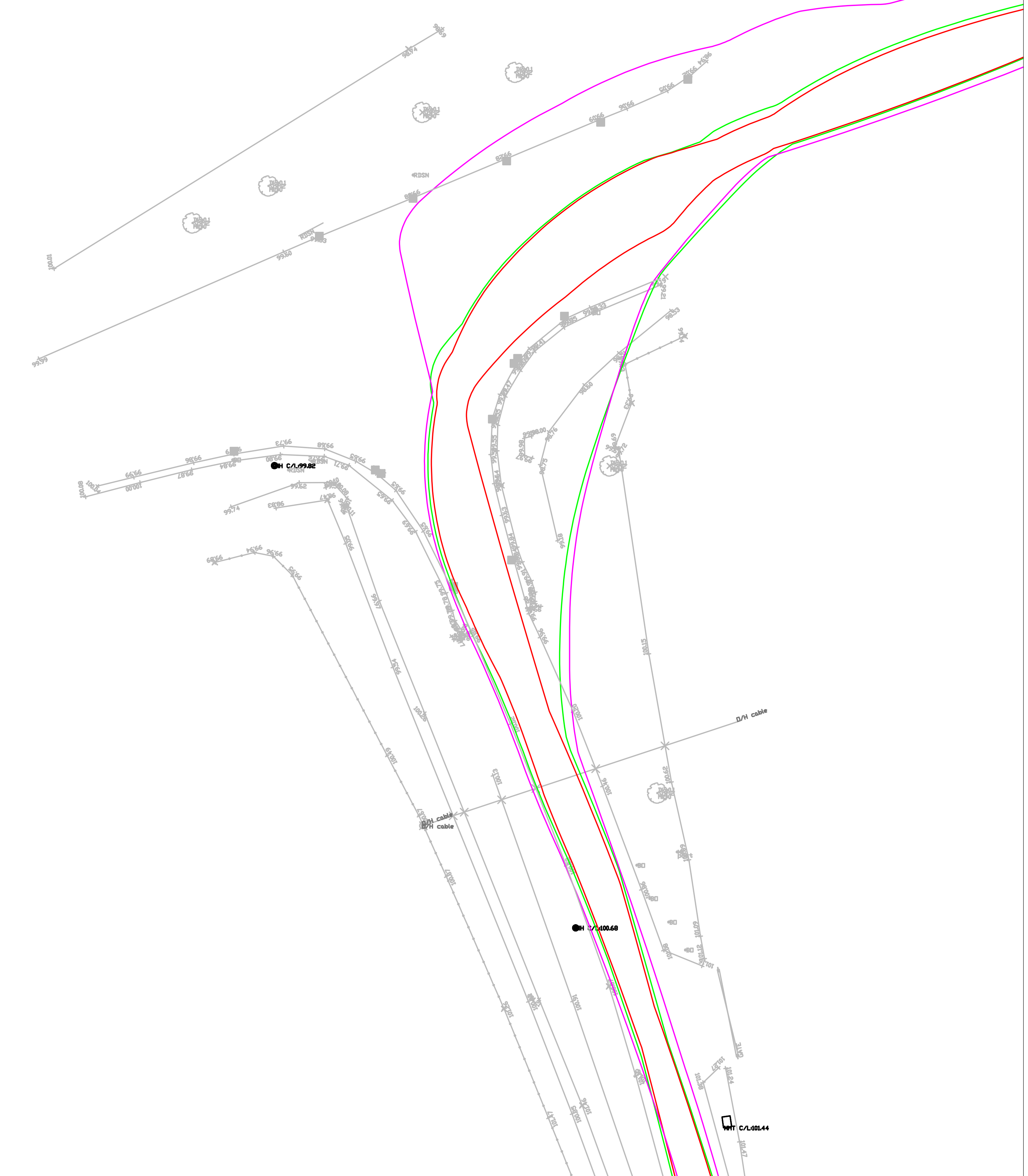

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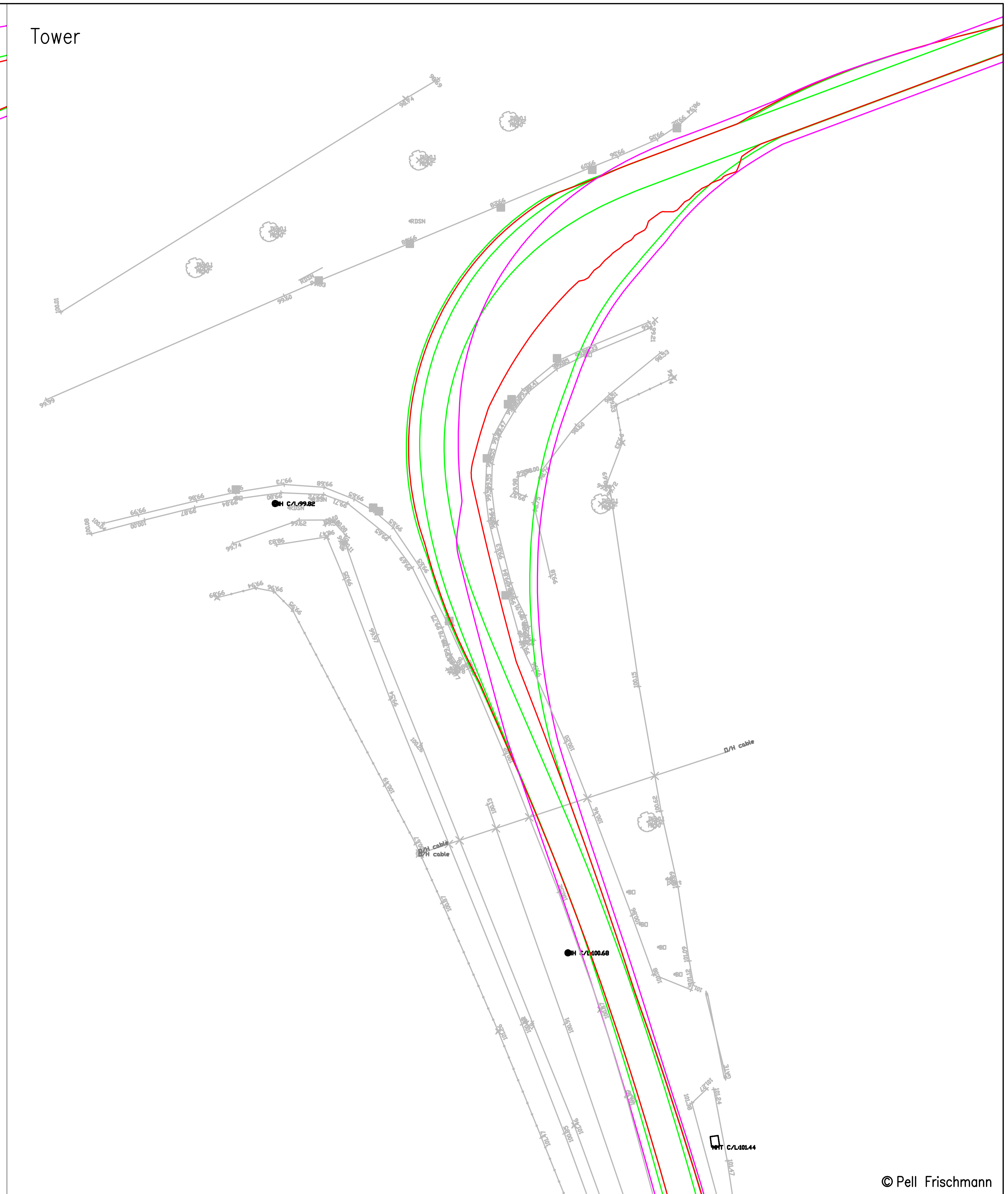

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / L5025 Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Designed	GB	18/12/2024
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Point of Interest		3

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Drawing No. SK03

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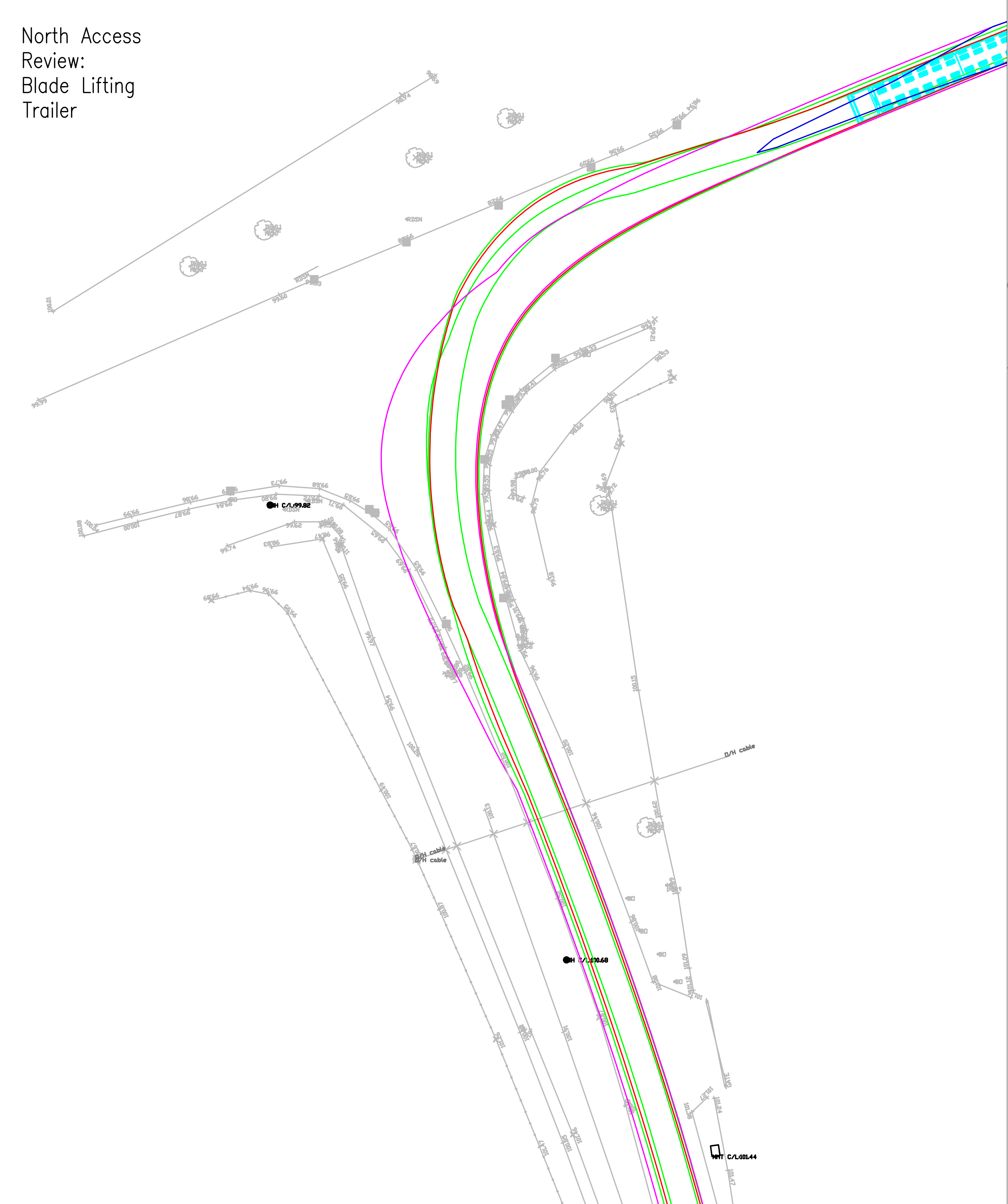

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / L5025 Junction

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
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Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		3

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File No.: 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No.: SK03A

Notes:
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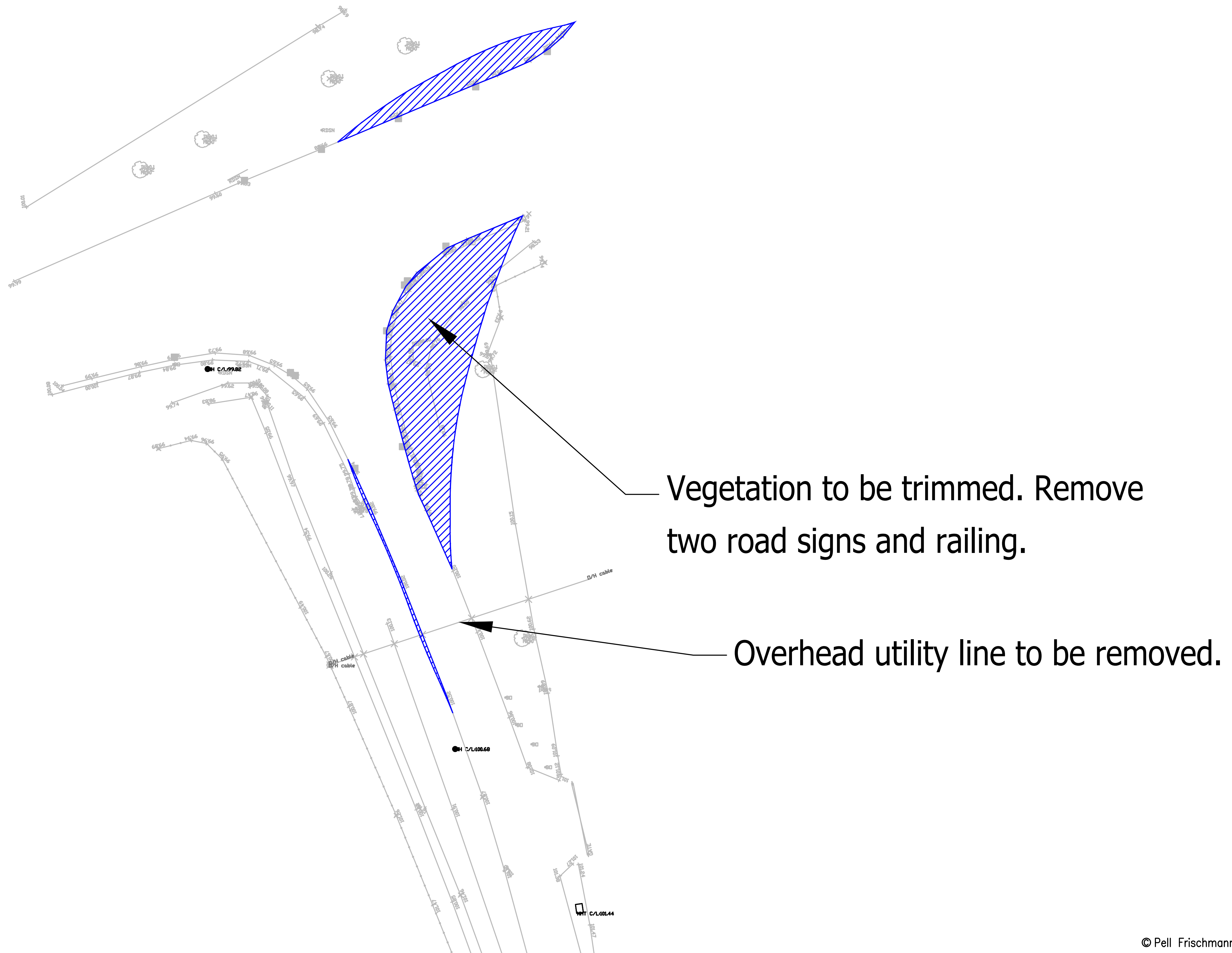
Revision: 00



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Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / L5025 Junction

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		3

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

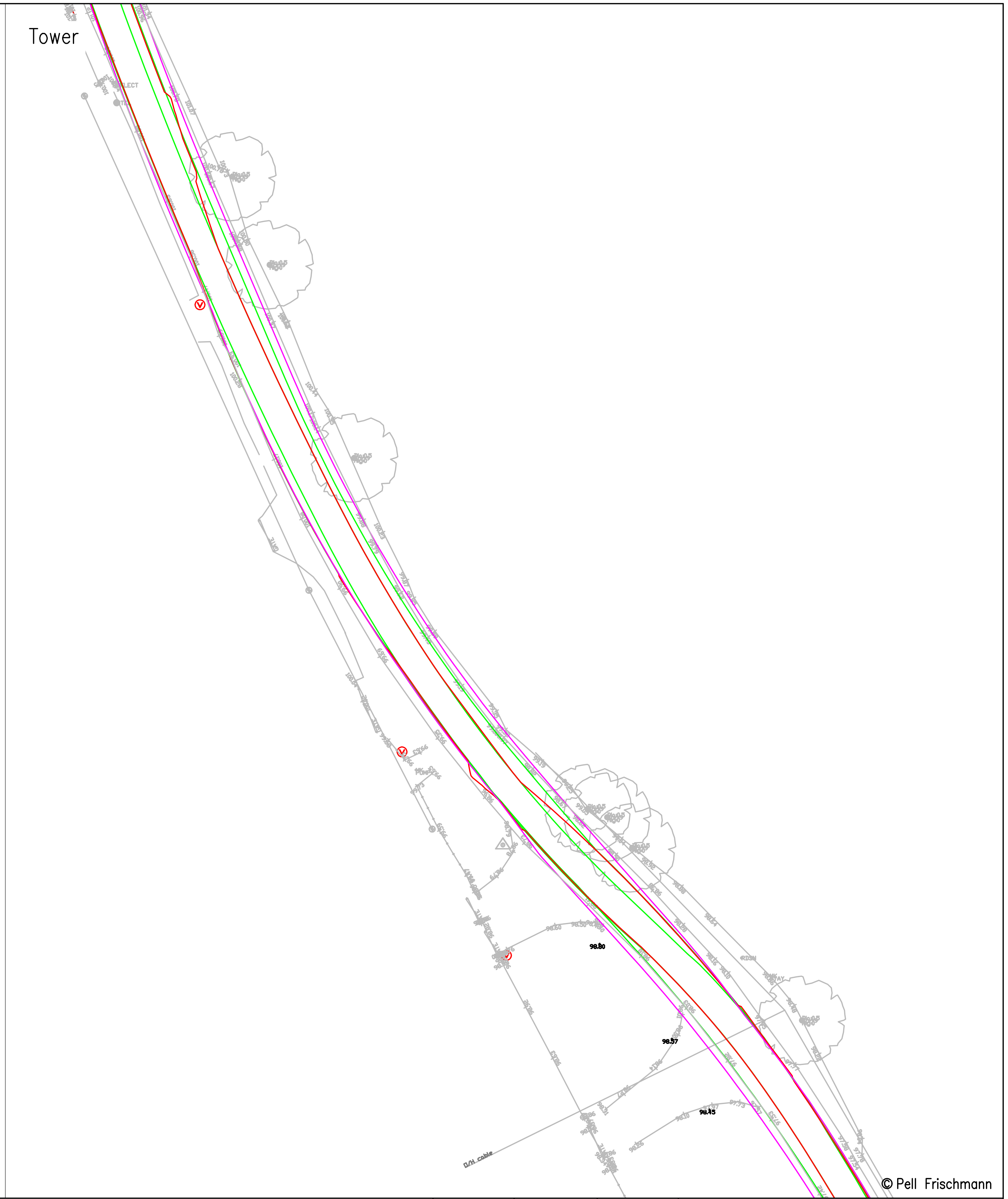
Drawing No. SK03B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

Blade

Tower



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Project	DREHID WIND FARM		Name	Date
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SPA Location	L5025 Bend 1			

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File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Revision: 00

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Notes:
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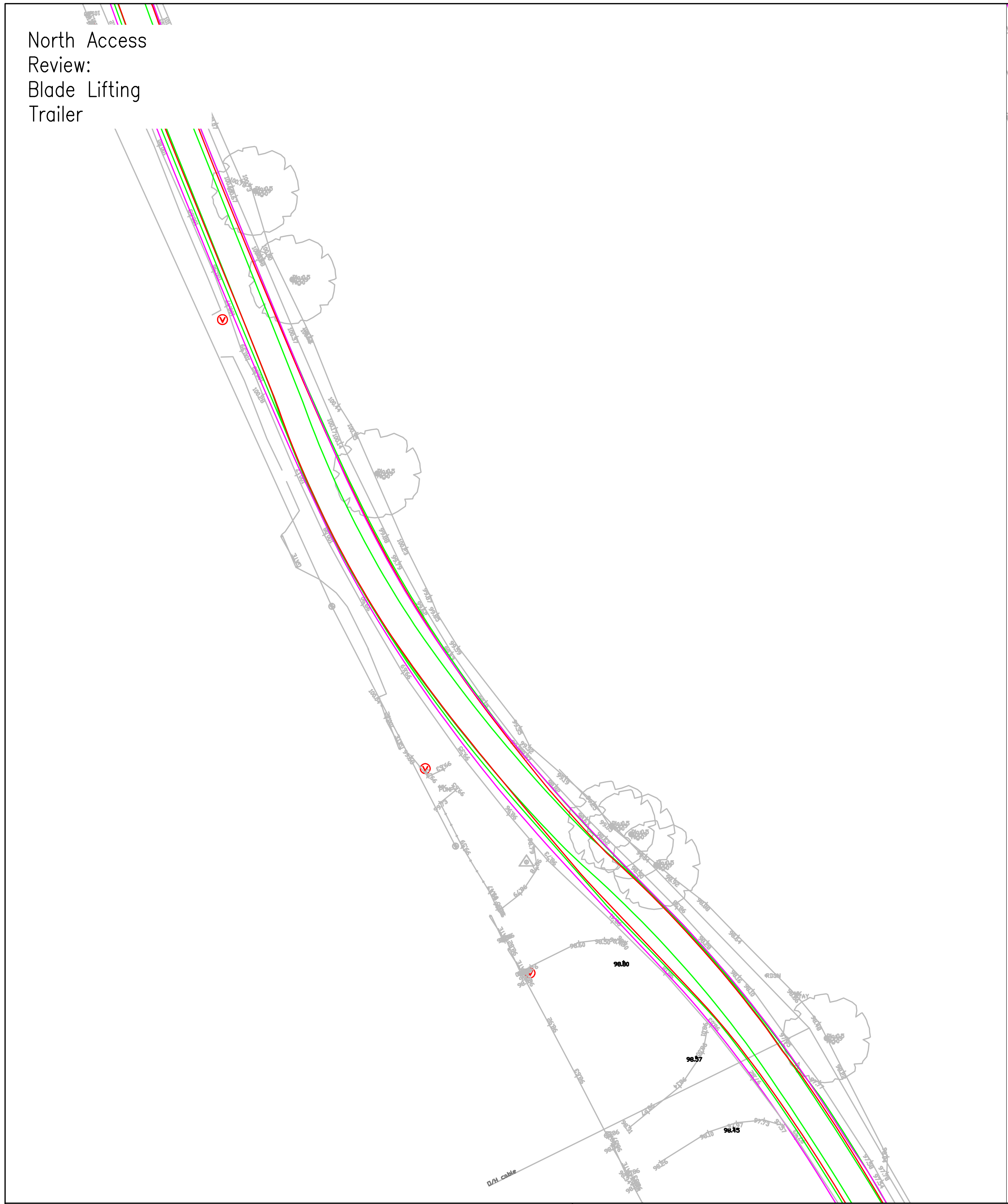

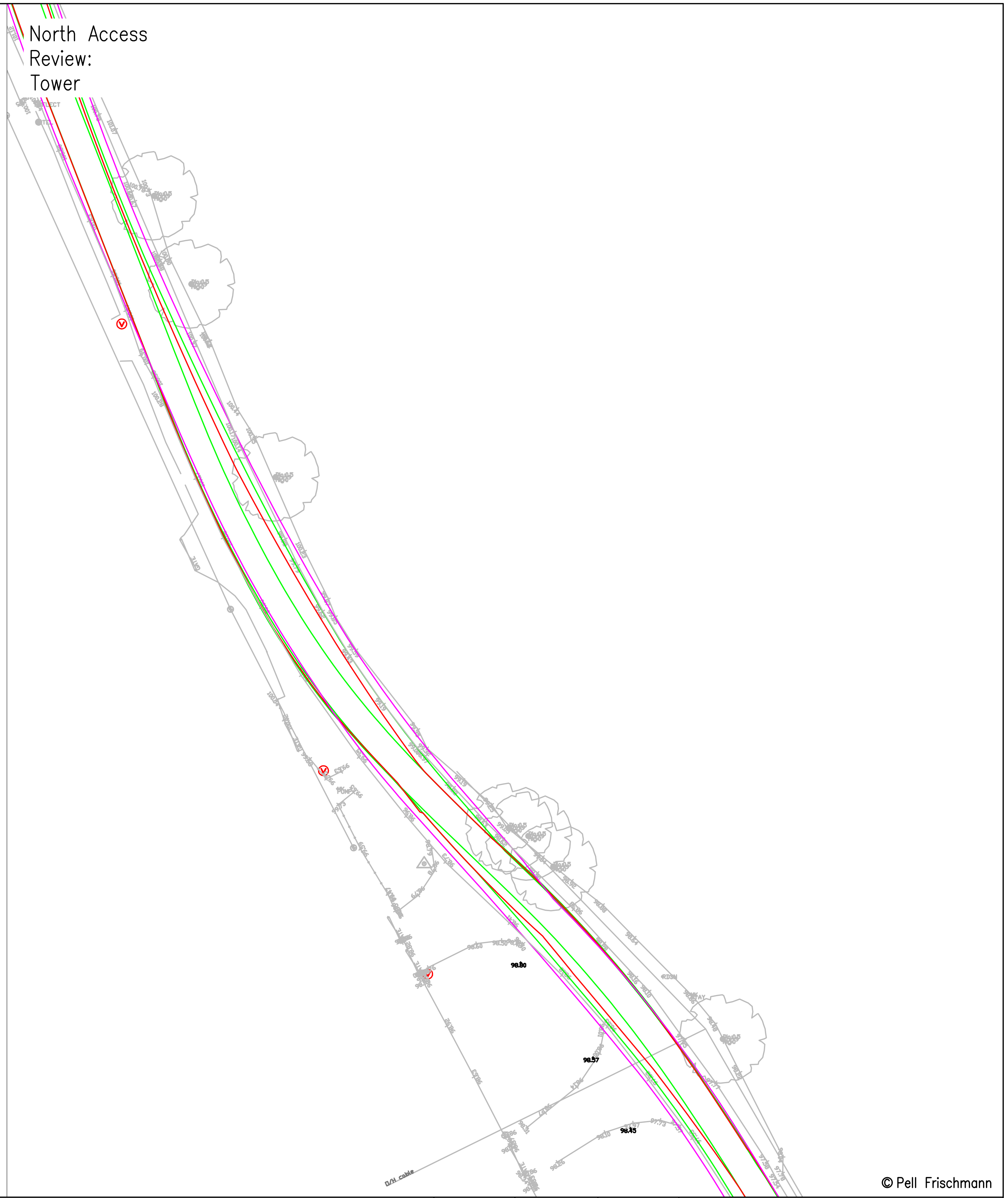

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 1

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		4

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File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK04A

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2. This is not a construction drawing and is intended for illustration purposes only.

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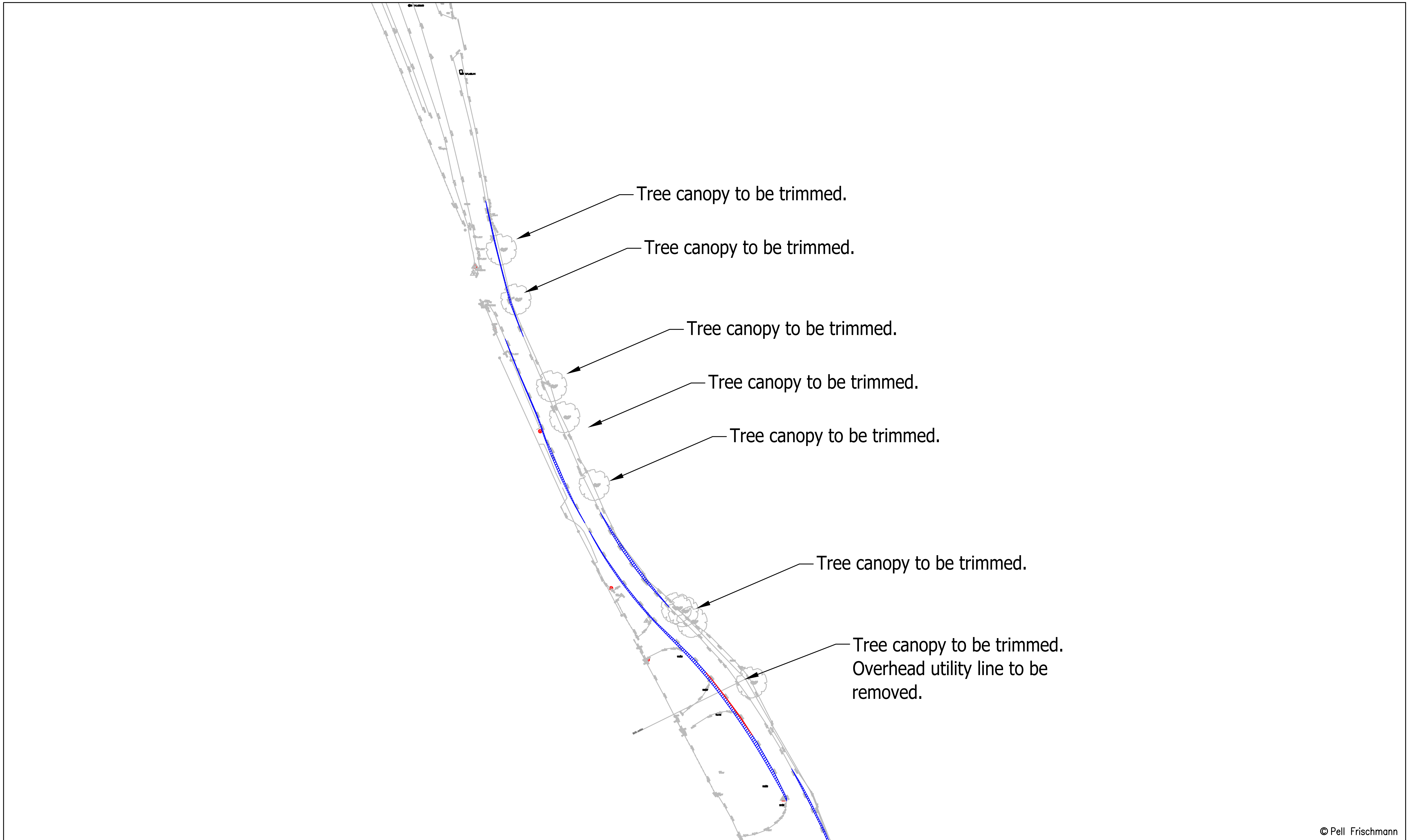

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 1

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		4

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK04B

Notes:
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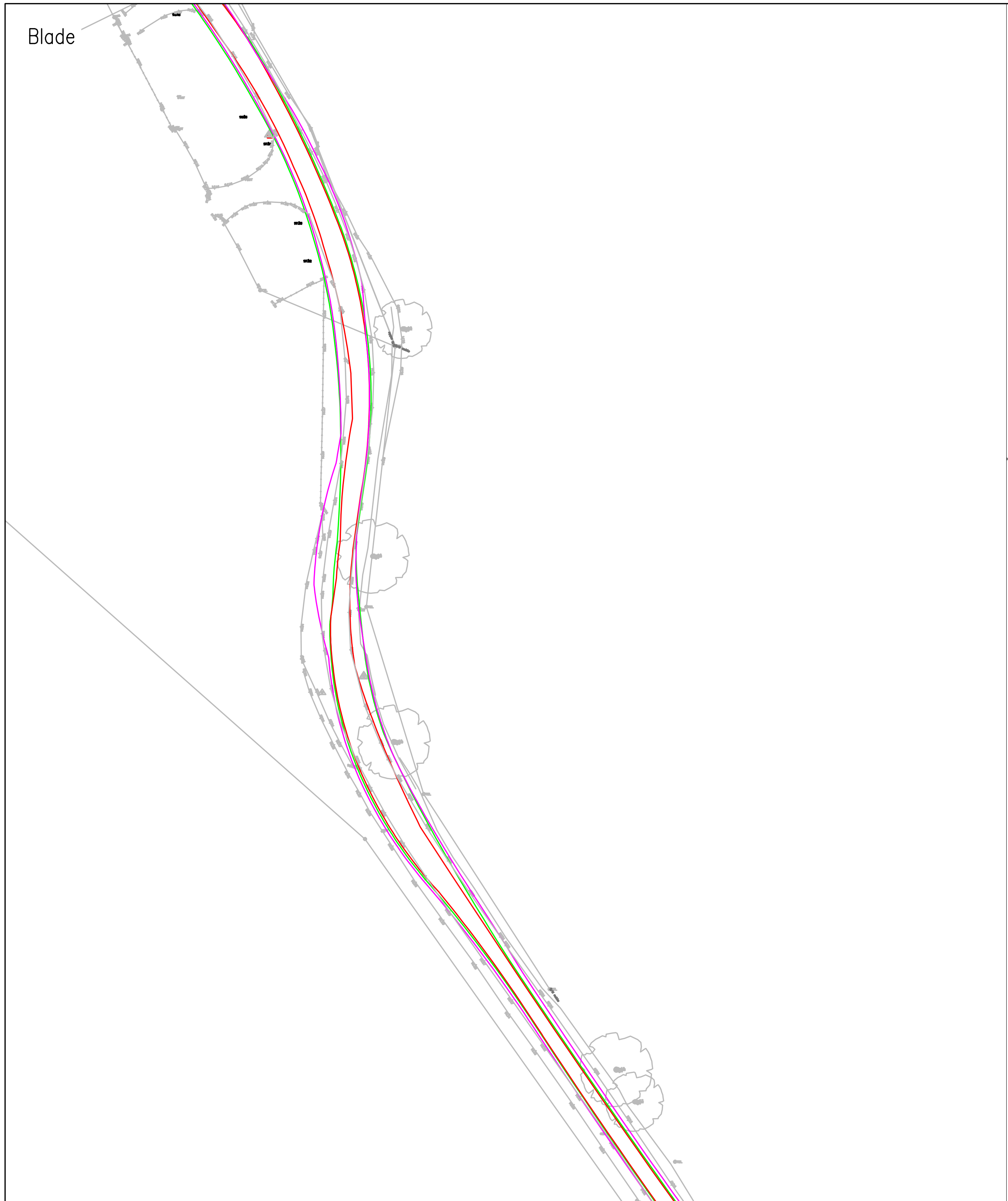

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Email: pfedinburgh@pellfrischmann.com
www.pellfrischmann.com

Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	5	

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK05

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		5

Scale: 1:1000 @ A3

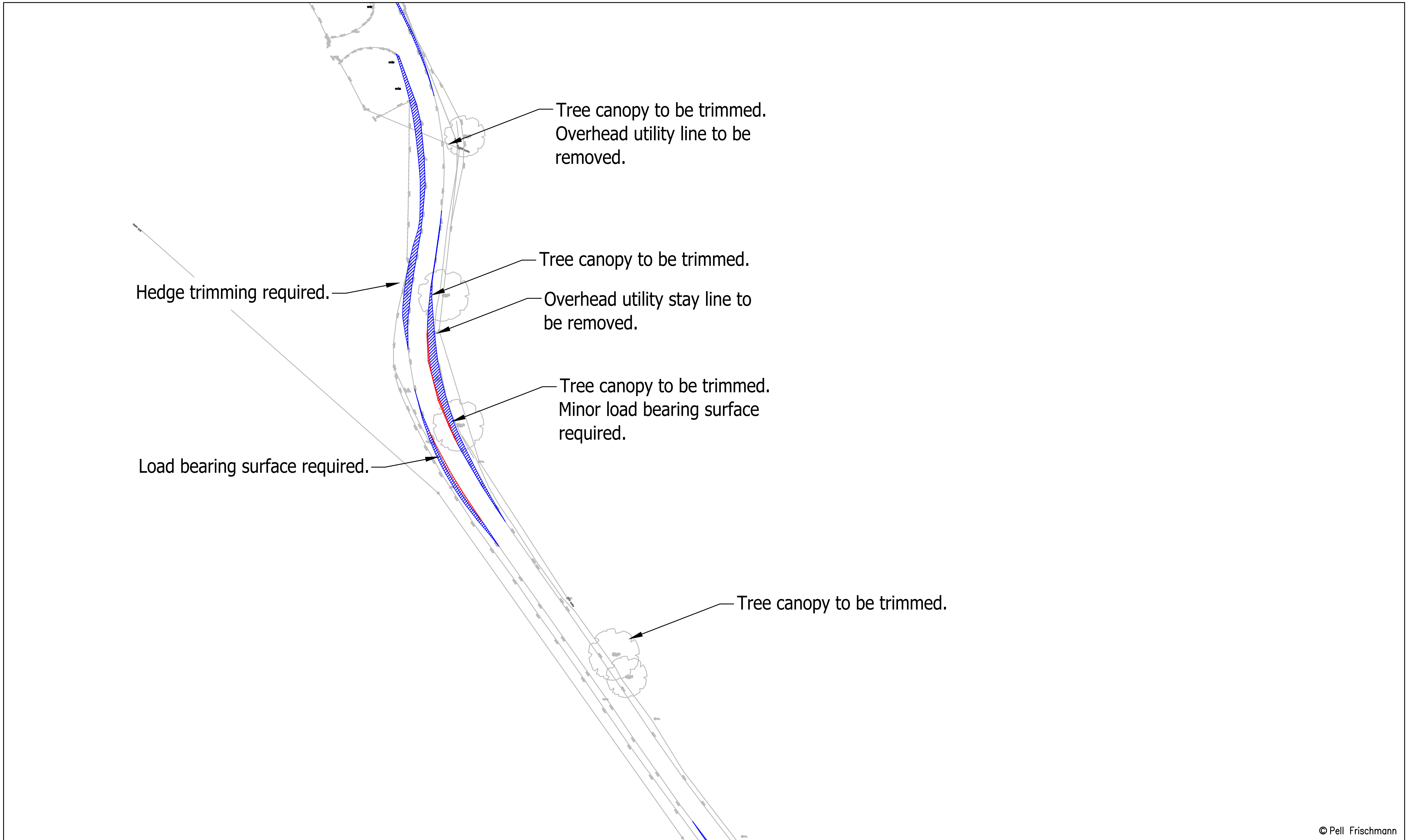
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK05A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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www.pellfrischmann.com

Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		5

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK05B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01

Blade

Tower

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 North of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	6	

Scale: 1:1000 @ A3

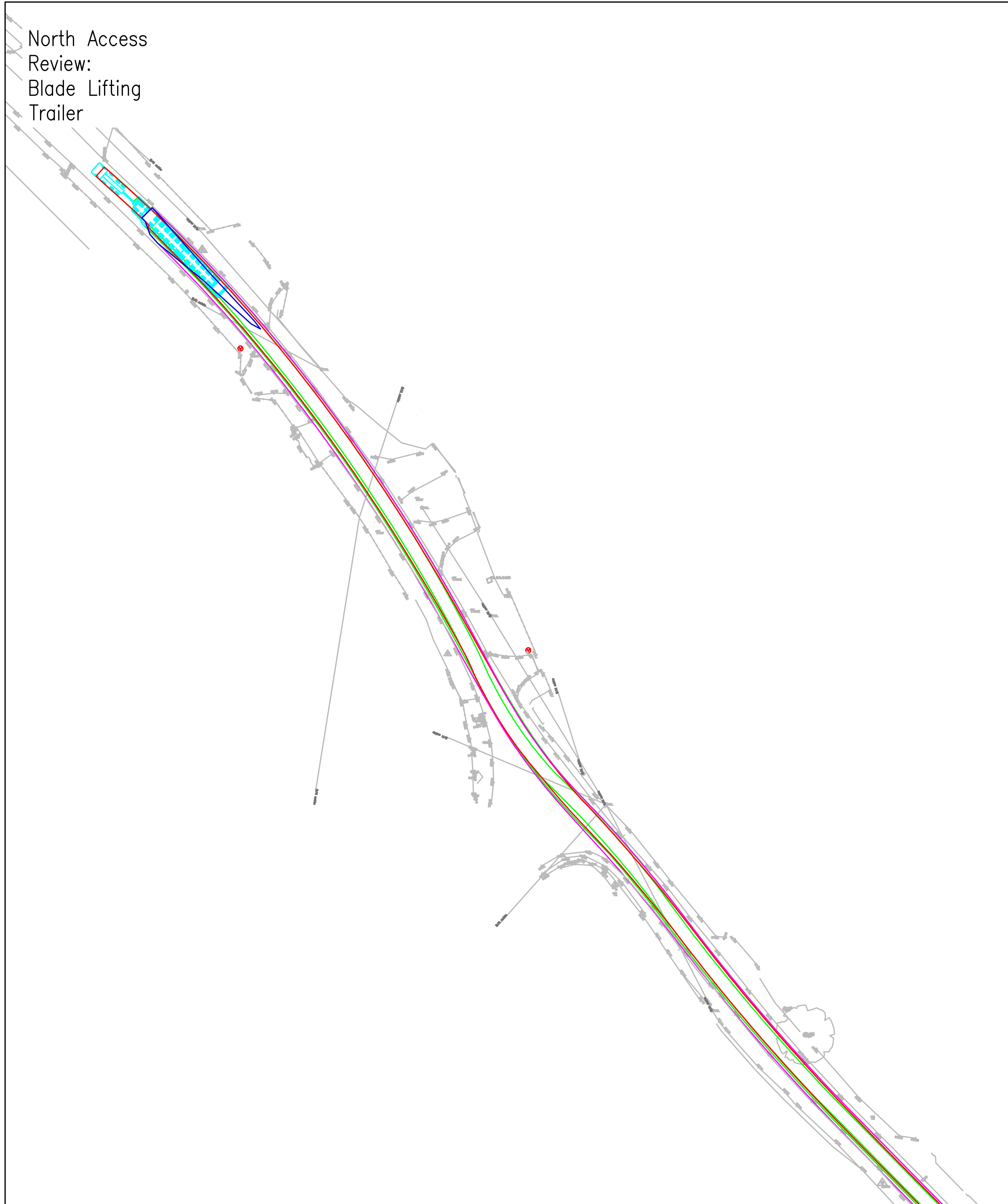
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK06

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 North of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	6	

Scale: 1:1000 @ A3

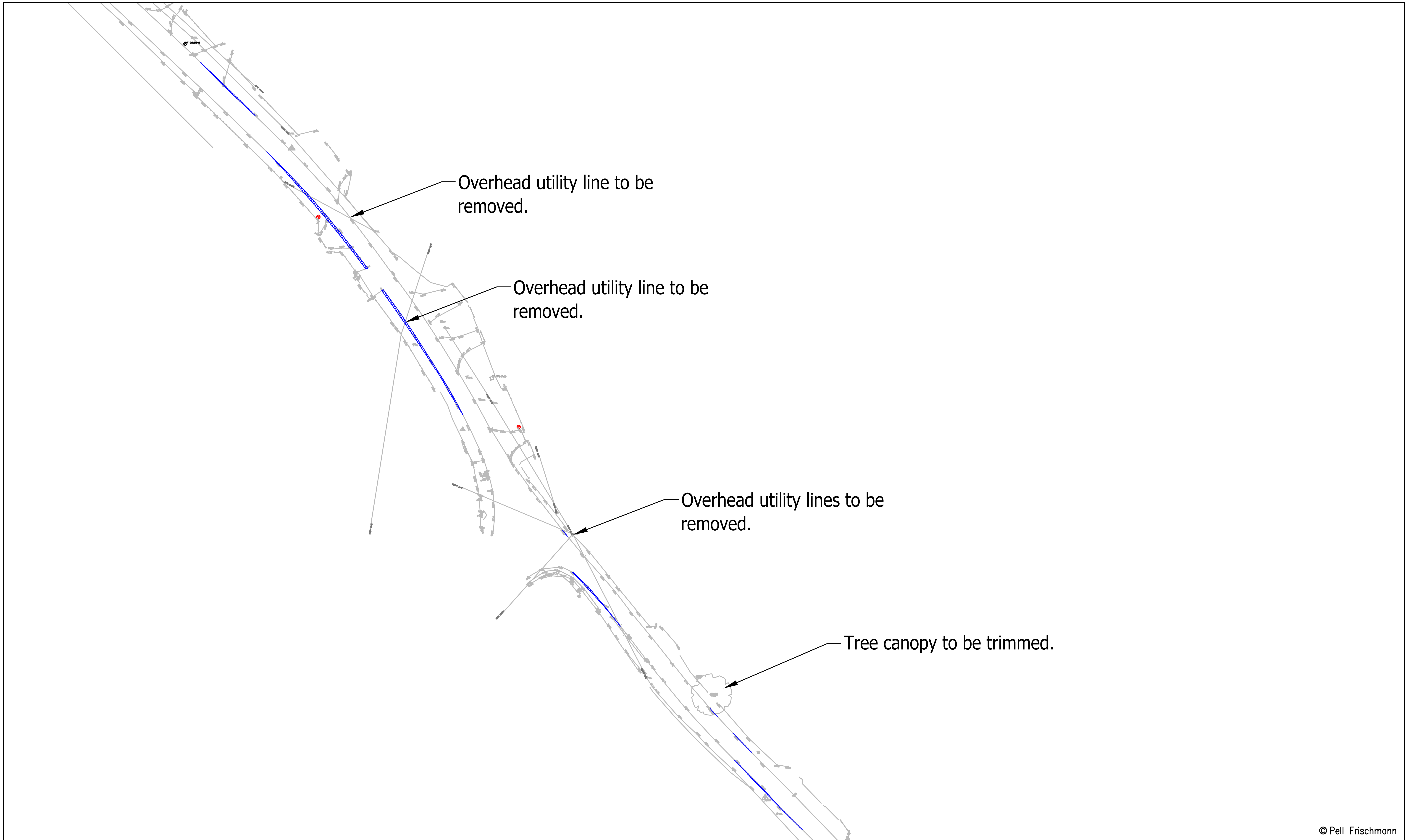
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK06A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 North of River Kilooney Bridge

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		6

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

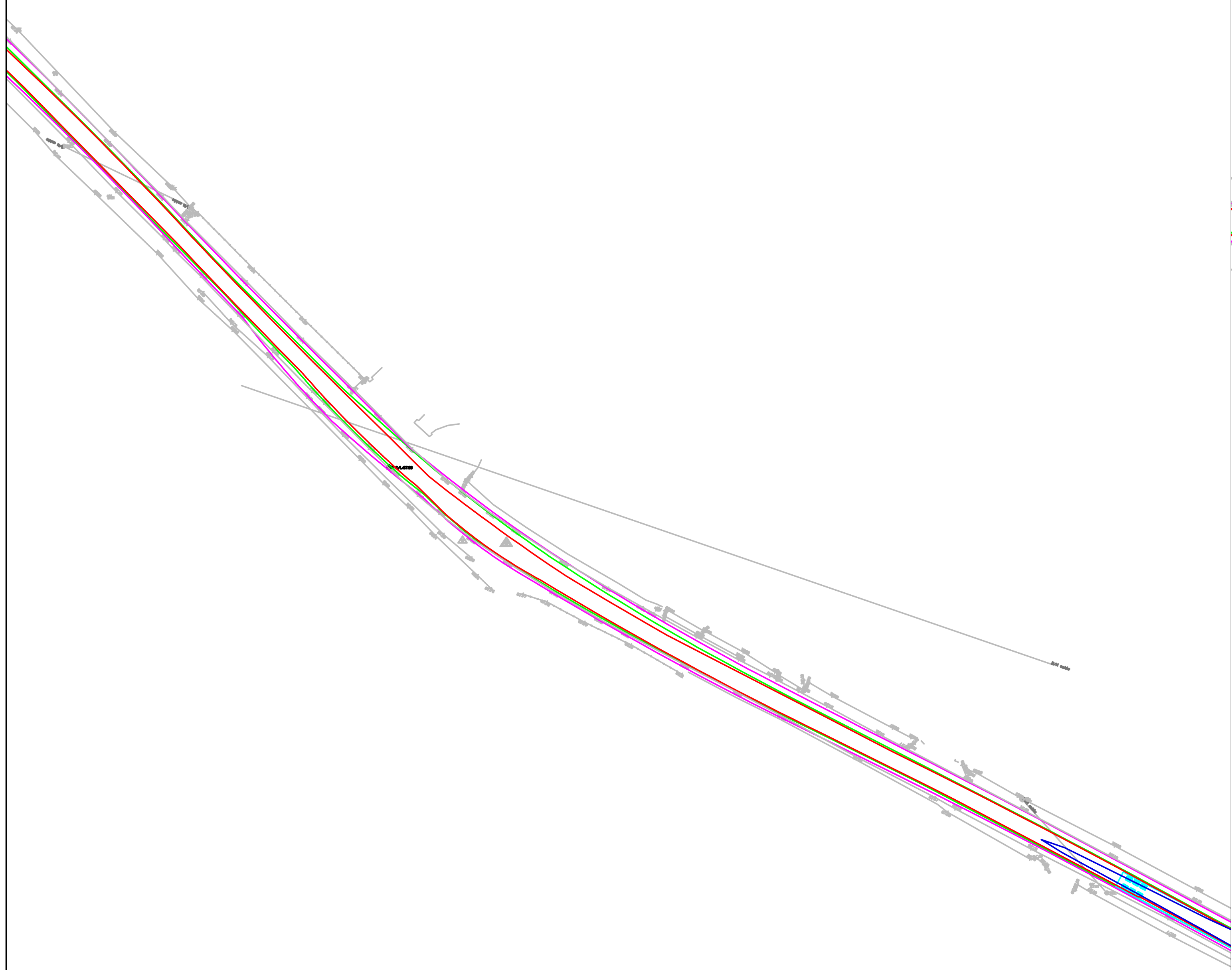
Drawing Status: Draft

Drawing No. SK06B

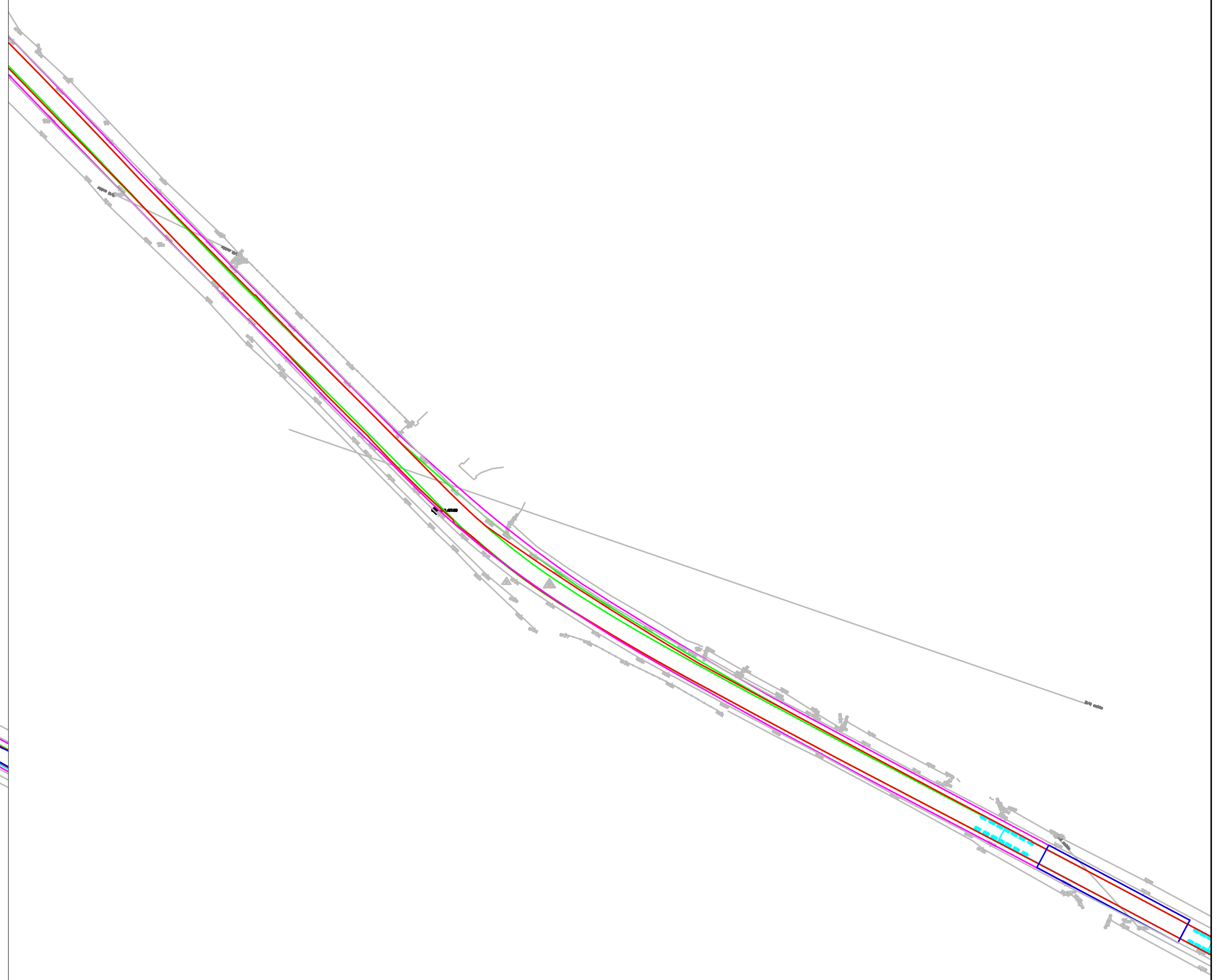
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

Blade



Tower



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 South of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

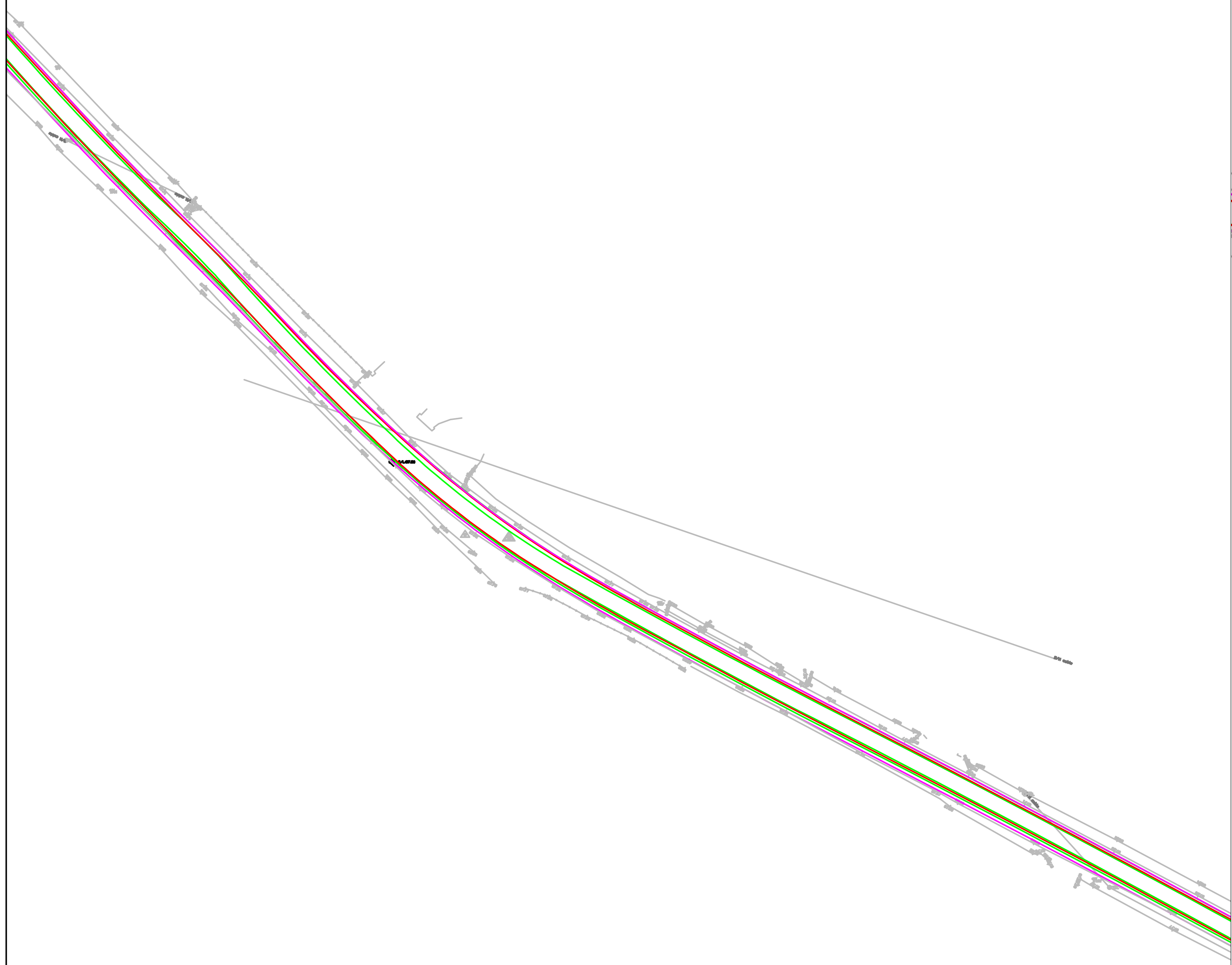
Drawing Status: Draft

Drawing No. SK07

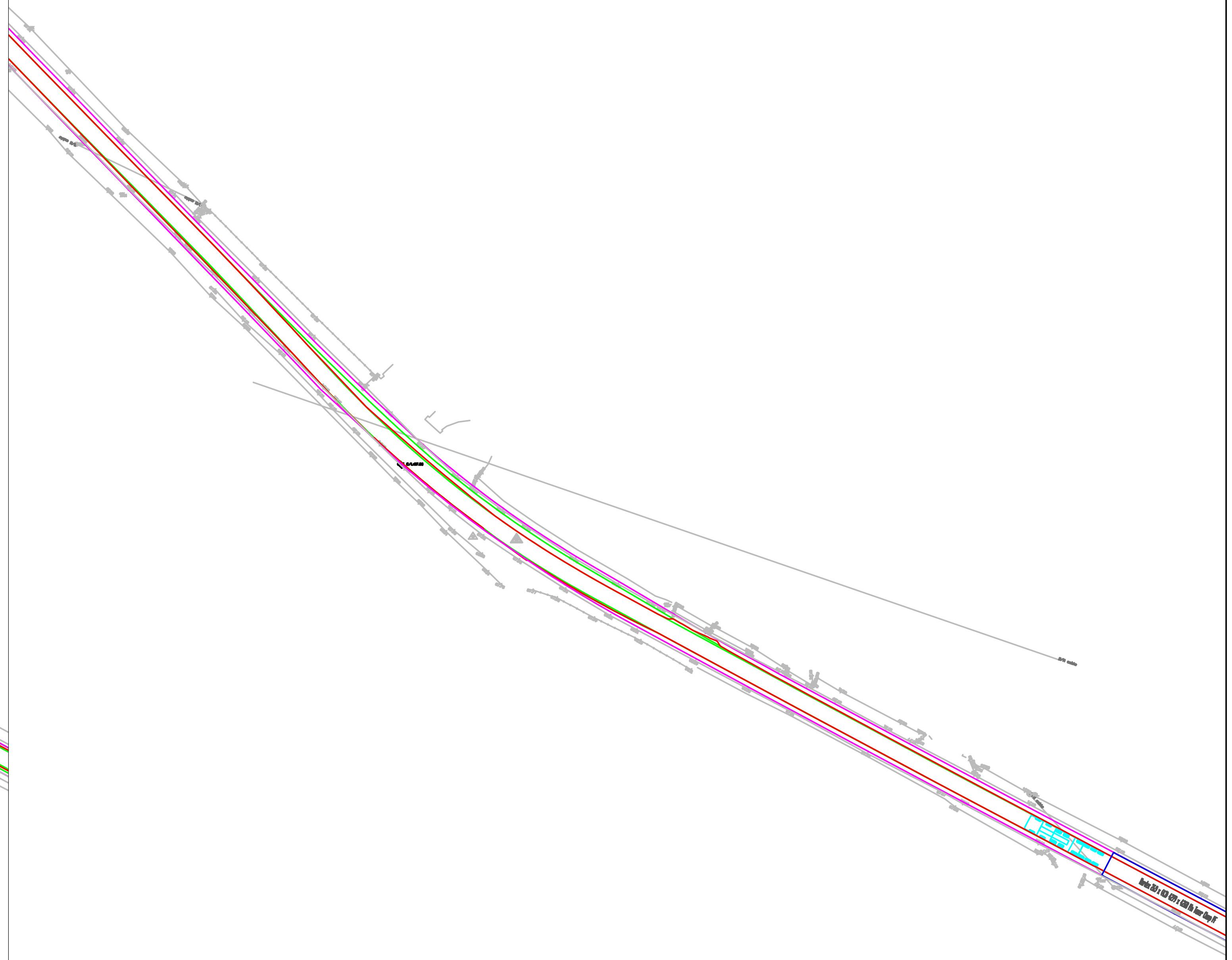
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

North Access Review: Blade Lifting Trailer



North Access Review: Tower



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 South of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

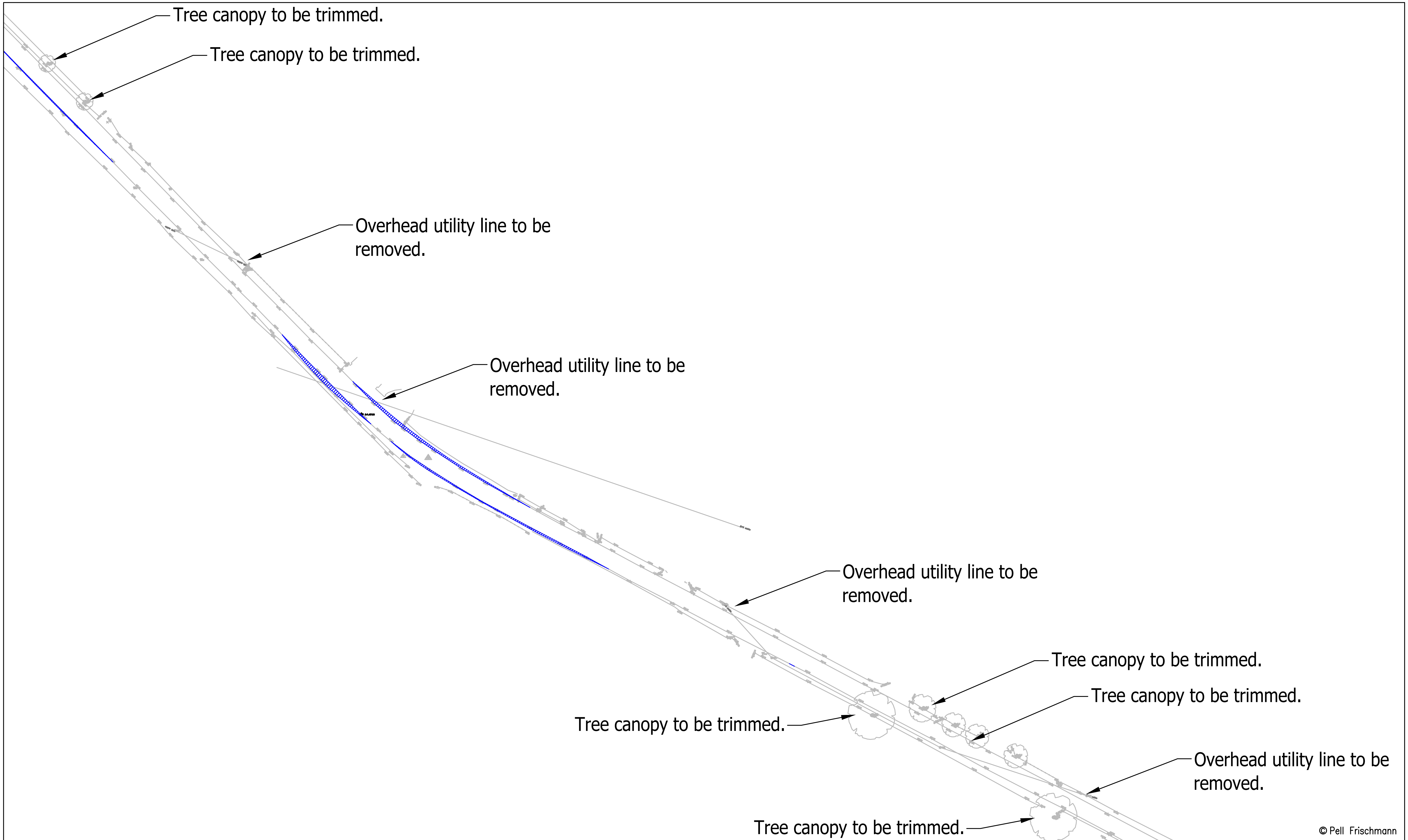
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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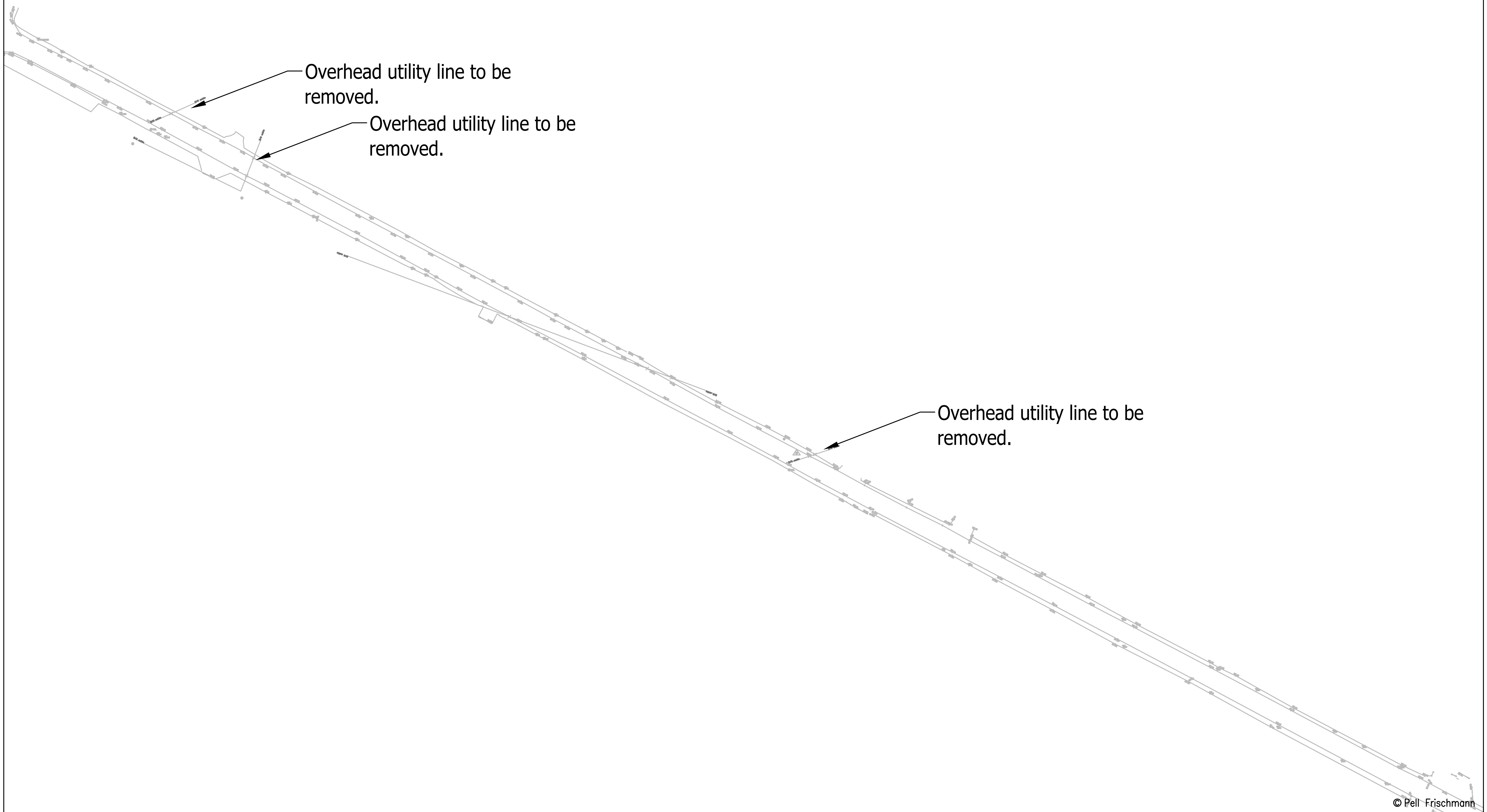
Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	L5025 South of River Kilooney Bridge

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale	1:1000 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK07B
Revision	00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 East of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

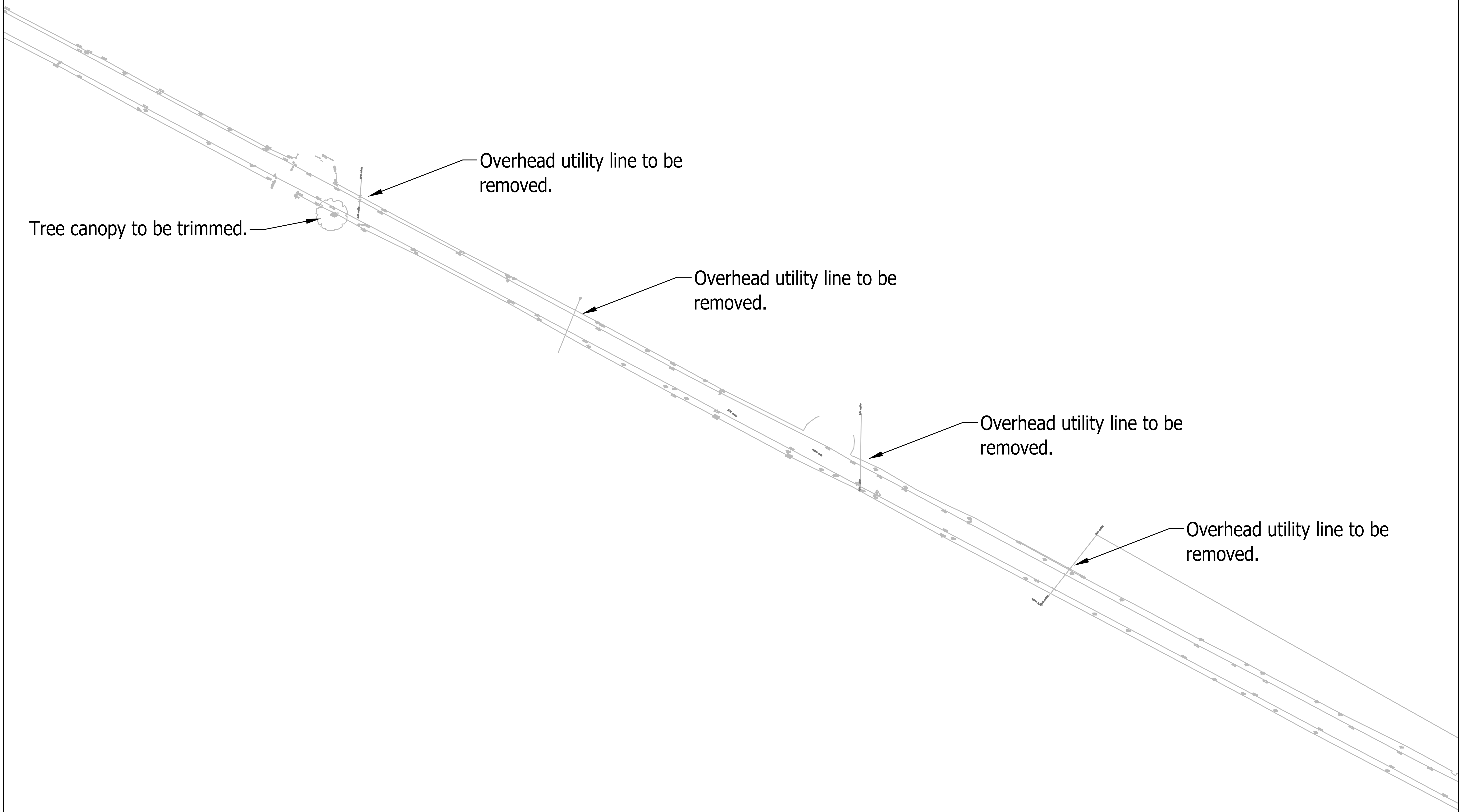
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07C

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 East of River Kilooney Bridge

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07D

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Southern Site Access Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK08

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Southern Site Access Junction

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK08A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Southern Site Access Junction

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK08B

Notes:
1. All mitigation is subject to confirmation through a test run.
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Revision: 00

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 Raven Junction

Key: Wheel SPA — Body SPA — Load SPA — Indicative — Overrun — Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		9

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK09

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	R402 Raven Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		9

Scale	1:1000 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK09A
Revision	00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client	NORTH KILDARE WIND FARM LTD.
Key	Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail
Project	DREHID WIND FARM
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bends 1 & 2

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		10&11

Scale	1:1000 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK10
Revision	00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 1&2

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		10&11

Scale	1:1000 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK10A
Revision	00

Notes:
1. All mitigation is subject to confirmation through a test run.
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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 3

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		12

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK11

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision 00

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Project	DREHID WIND FARM		
Client	NORTH KILDARE WIND FARM LTD.	Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
Key	Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail	SPA Location	Kilshanroe Road Bend 3

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		12

Scale: 1:1000 @ A3

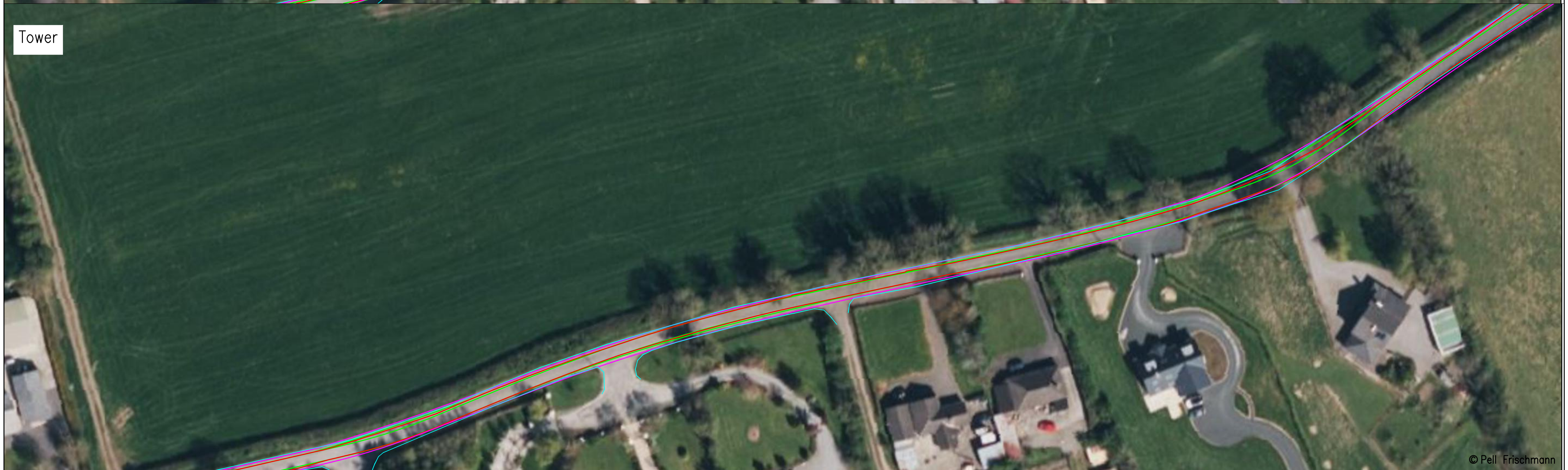
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK11A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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www.pellfrischmann.com

Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Kilshanroe Road Bend 4

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		13

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK12

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Email: pfedinburgh@pellfrischmann.com
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Project	DREHID WIND FARM		Name	Date
		Drawn	GB	18/12/2024
		Designed	GB	18/12/2024
		Checked	TL	18/12/2024
Client	NORTH KILDARE WIND FARM LTD.	Point of Interest		13
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER	Drawing No.	SK12A	
SPA Location	Kilshanroe Road Bend 4			

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

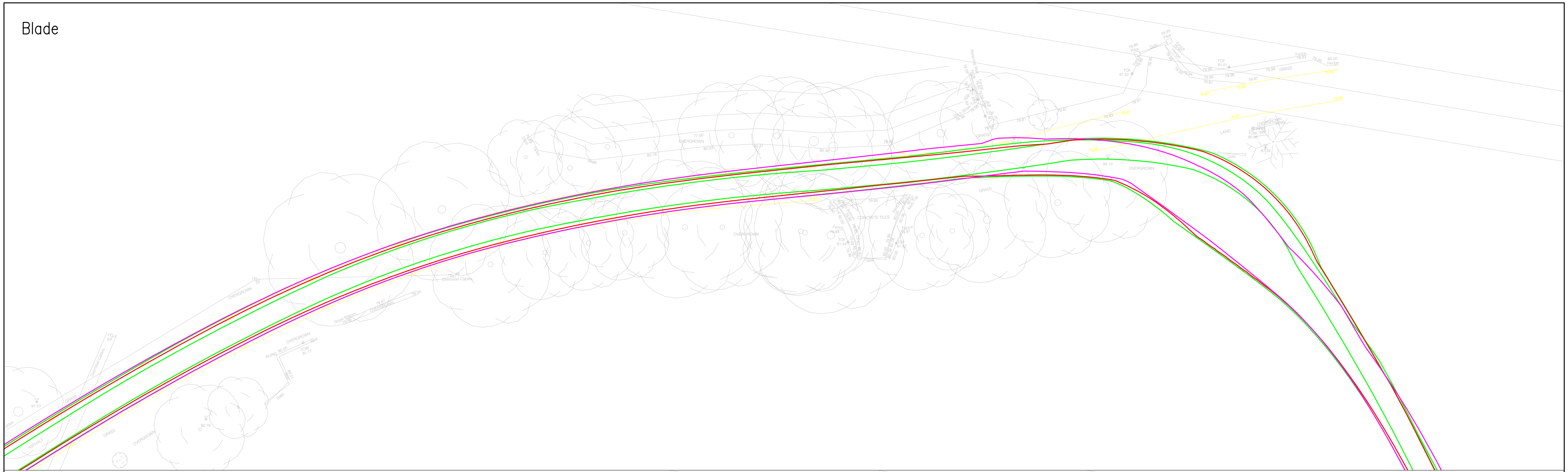
Drawing Status: Draft

Revision: 01

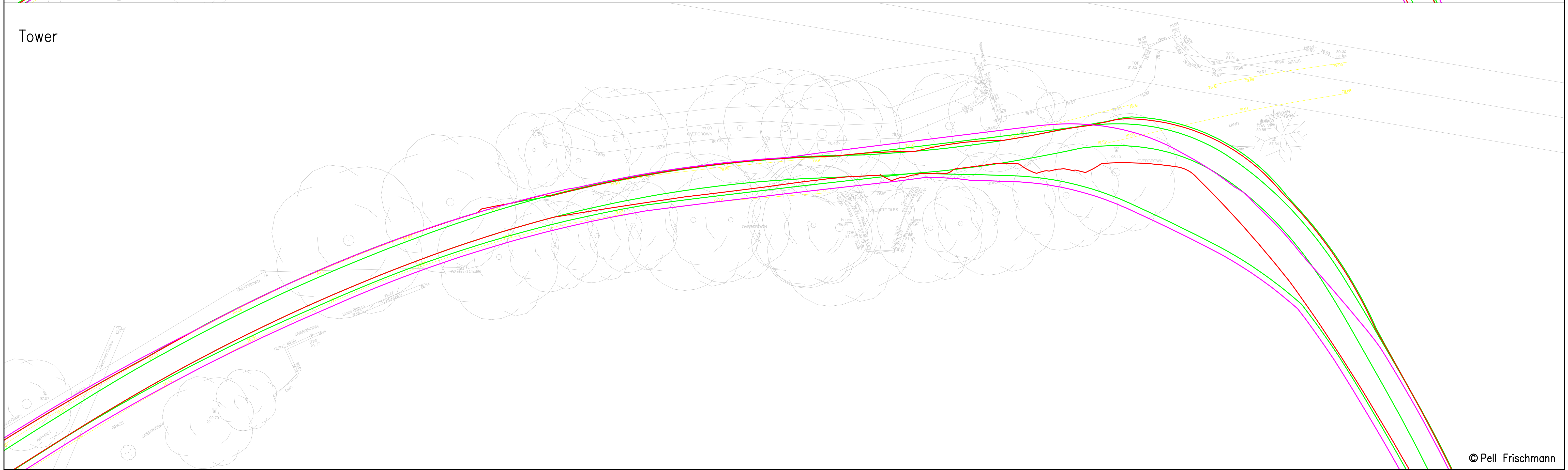
Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Blade



Tower



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www.pellfrischmann.com

Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 5 and North Site Access

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		14&15

Scale: 1:500 @ A3

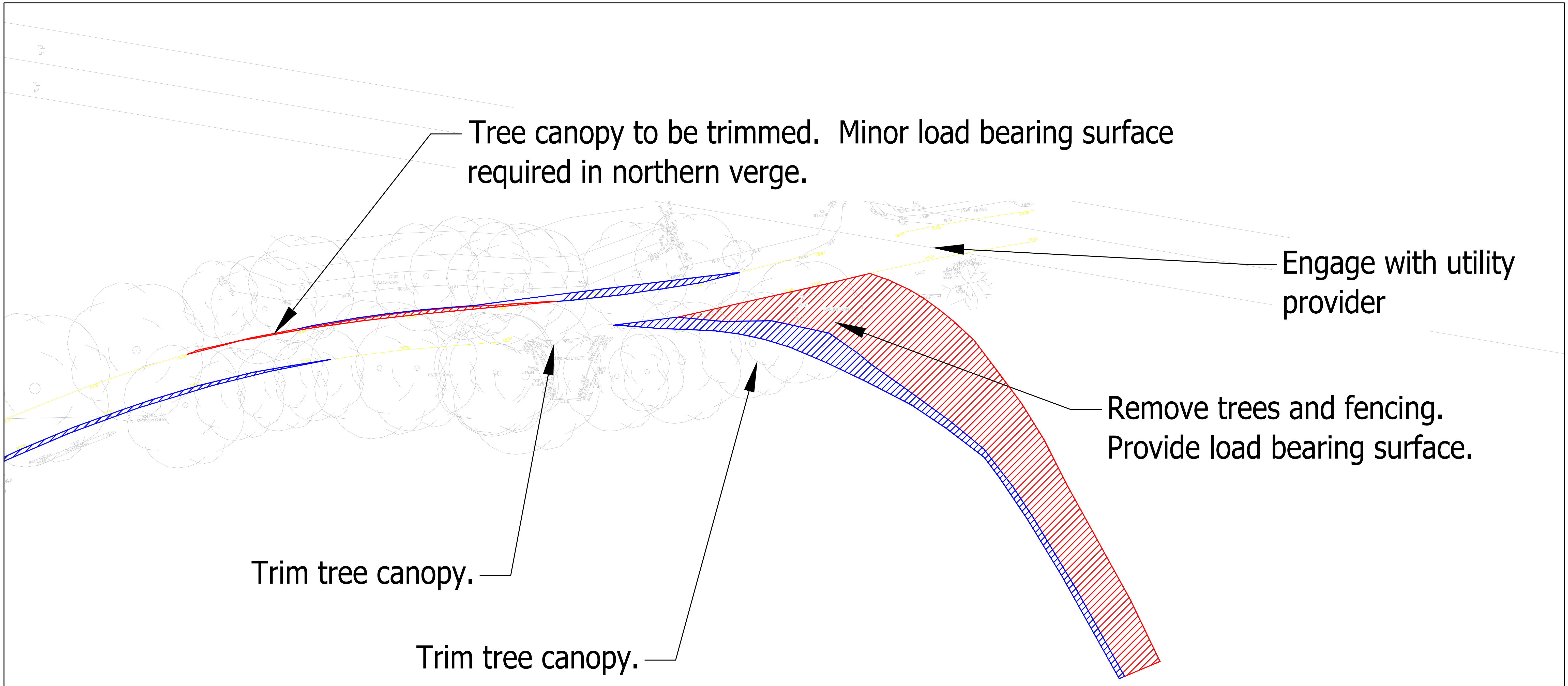
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK13

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01



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Client	NORTH KILDARE WIND FARM LTD.	Project	DREHID WIND FARM
		Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
		SPA Location	Kilshanroe Road Bend 5 and North Site Access

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		14&15

Scale: 1:500 @ A3
File No. 241218 Drehid RSR Tracking.dwg
Drawing Status: Draft
Drawing No. SK13A
Revision: 01

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

FEHILY TIMONEY

DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

APPENDIX 4

Eirgrid Cable Requirements

Document No:DTIS-230908-BUV

Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

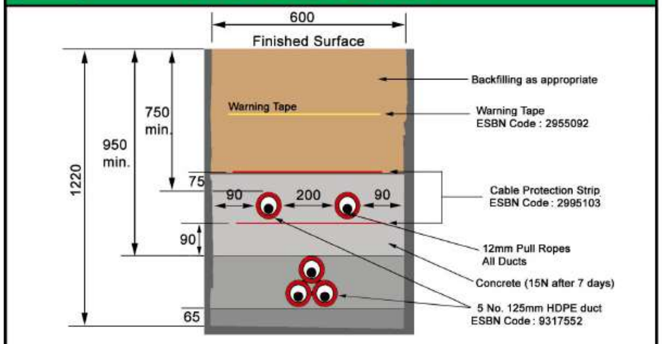
ESB Networks

Rev 0: Date 09-10

Approved:

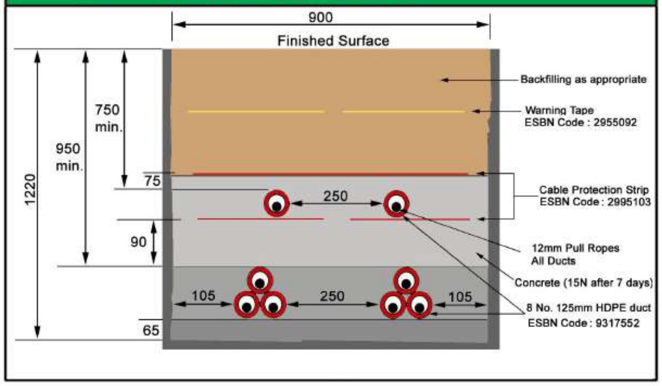
Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/38kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

1A 110kV Single Circuit Standard Trench Cross-Section



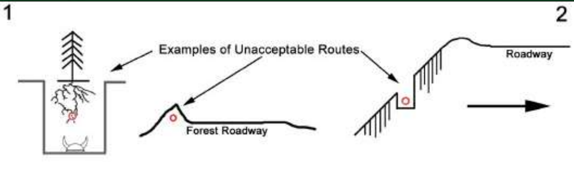
Note : Only 1ESBN comms duct maybe required if ESBN specify
Note : Maximum duct depth ≤ 1.5m to top of trefoil group

1B 110kV Double Circuit Standard Trench Cross-Section



1C Trench Installation Sequence

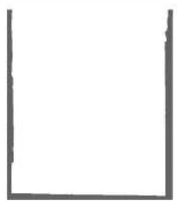
1



WARNING:
Always agree trench route with ESBN before excavation commences.
Unstable, insecure & poor access routes will not be accepted by ESB.

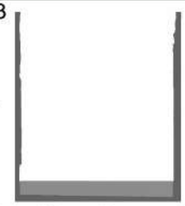
NB Semi-dry concrete to be used always

2



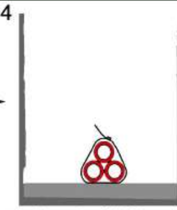
Excavate trench to required dimensions.

3



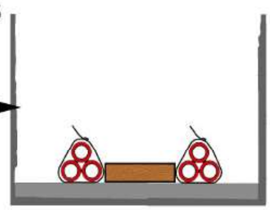
Lay in, level & thoroughly compact 65mm bedding layer of CBM4 (15N after 7 days) concrete.

4



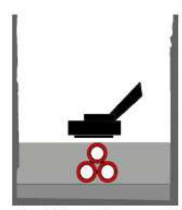
Lay in, joint and trefoil 125mm HDPE power ducts using cable ties. (Code 1131071) at 3m intervals.

5



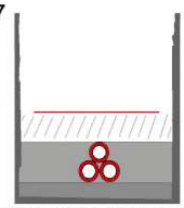
For double circuits it is vital to space power ducts 250mm apart using timber or other suitable spacers.

6



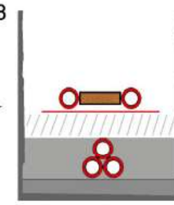
Lay in and thoroughly compact 300mm layer of CBM4 (15N after 7 days) concrete around and above ducts

7



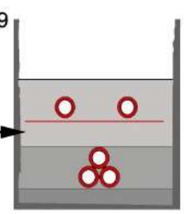
-Lay in 1st 90mm of CBM4 (15N after 7 days) concrete
-Install 400mm wide red marker strip, code 2995103.
(1 strip for sigle circuit, two for double circuit)

8



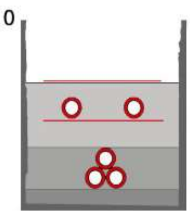
Install two 125mm HDPE comms cable ducts, spaced as per drawings above equidistant from both trench edges. Use timber or other suitable spacers to maintain the required spacing.

9



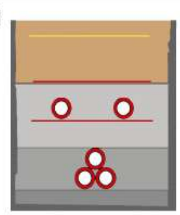
Install further 185mm layer of CBM4 (15N after 7 days) concrete and compact thoroughly.

10



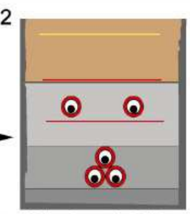
Lay in another 400mm wide marker strip as outlined in fig. 6

11



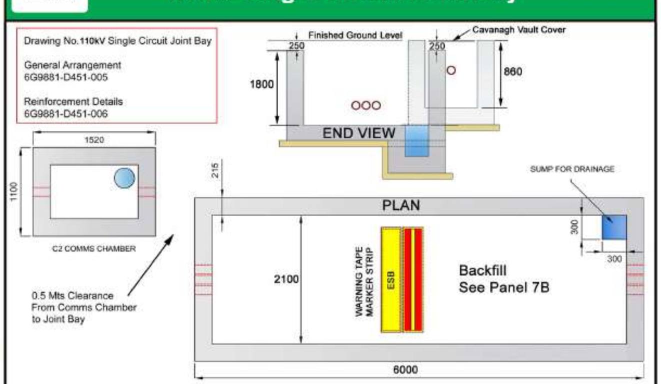
- Lay in 500mm wide yellow warning tape (1 width for single circuit, 2 for double circuits)
- Backfill the top 300mm of trench per appropriate local authority or other specification agreed with ESB

12

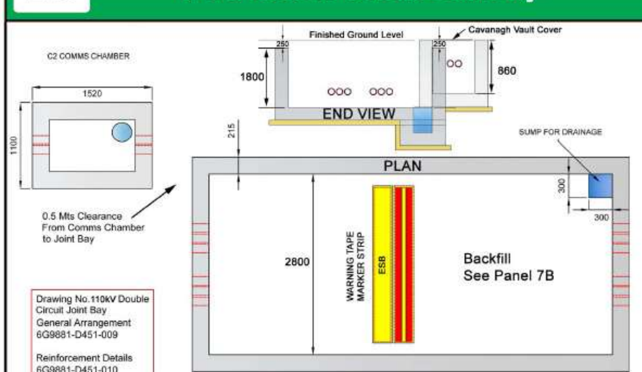


Thoroughly brush, mandrel all ducts & install 12mm polyproplene draw rope, then seal all ducts with screw type end plug - Jack Moon type

2A 110kV Single Circuit Joint Bay



2B 110kV Double Circuit Joint Bay



Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

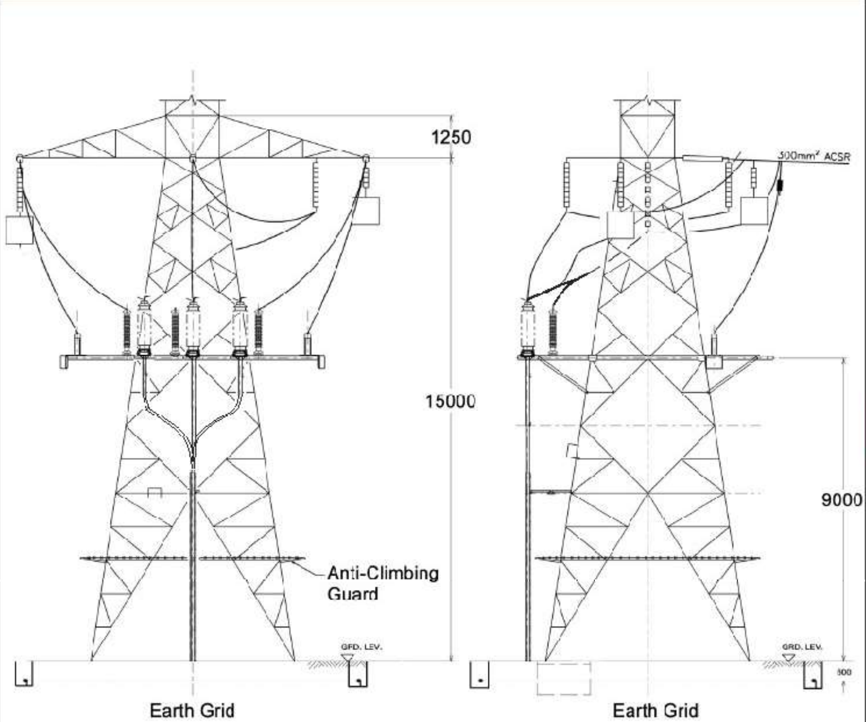
ESB Networks

Rev 0: Date 09-10

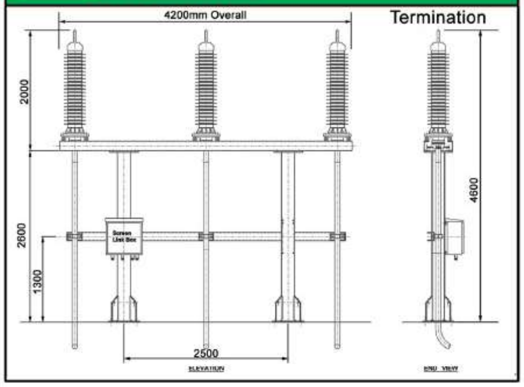
Approved:

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/38kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

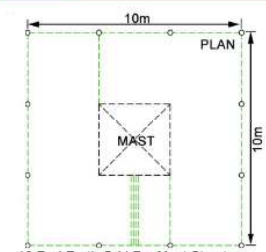
3A 110kV Cable End Mast Termination



3B Typical 110kV Termiantion Arrangement for Substations



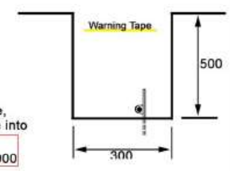
3C Earth Grids



12 Rod Earth Grid For Mast Structure

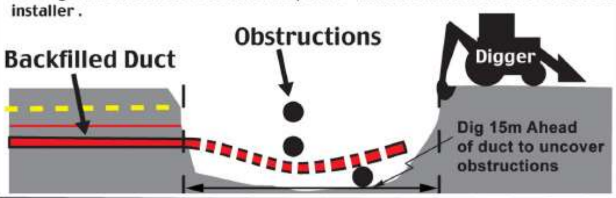
Earth Grid resistances <10 Ohms.
If ground is known to be high resistance, plan ahead and put additional earthwire into cable trench.

Drg. No.
PE424-D901-911-001-000



4A Obligation of Duct Installer to Minimise the Number and Severity of Duct Bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 15m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions. Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer.



4B Standard for Brushing, Mandrelling, Roping and End-Capping of 110kV Ducts

All Ducts must be:
- Thoroughly brushed and mandrelled to prove ducts against debris /excessive deflection
- Roped using 12mm polyproplene rope with certified safe breaking load of 1.5 tons -- all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bunclana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/coil handling
- Sealed using endcaps against grit and water getting into them
  NB: Replace mandrels once mandrel wear indicators or grooves are worn down
  Replace brushes once brush diameter falls 5mm below dimensions in table below
- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESBN ducting
- Approved ESBN Mandrel and brush suppliers :

Brandon Agencies, Rathnew, Co Wicklow: Phone 0404 20500 (Brushes & Mandrels)
IS Varian, Greenhills industrial Estate, Walkinstown, Dublin 12 Phone: 01-4501150 (Brushes Only)
Clydesdale UK Phone 0044 1234 855 855 (Brushes & Mandrels)
Tynagh Network Systems, Loughrea, Co Galway. Phone: 091 842206 (Brushes & Mandrels)

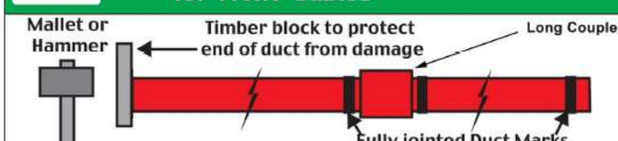
125mm HDPE Duct Size

4C Approved ESBN ducting for 110kV cables

- Use only solid wall high impact resistance ESBN approved HDPE red ducting to IS 370colour standard and ESBN specification 16113 (7.1mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESBN irrespective of manufacturer

- Current approved HDPE Duct and duct bend manufacturers are:
  Lynplast (bend fittings only), Uponor-Radius Systems, Wavin, Quality Plastics, Emtelle

4D Specification for Duct Jointing for 110kV Cables

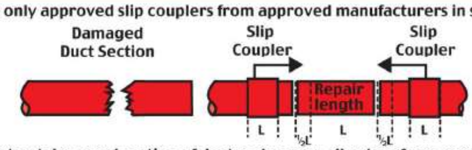


All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached

Always smear duct lubricant on coupler rubber ring

4E Repair of Existing Ducts

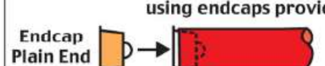
Use only approved slip couplers from approved manufacturers in section 4C



- **Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges**
- **Slide, position and centre the repair couplers on the centering marks**

4F Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale



ESBN Code 125mm: 9317583

Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

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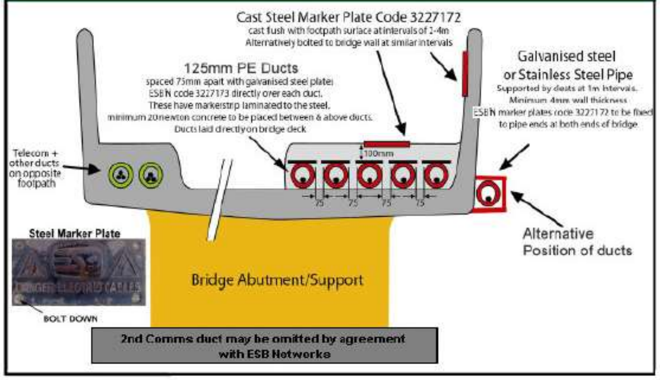
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks

Rev 0: Date 09-10
Approved:

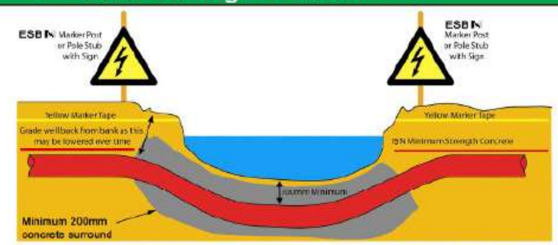
5A Bridge Crossings: Restricted Footpath Designs



5B Bridge Crossings: Restricted Footpath Designs

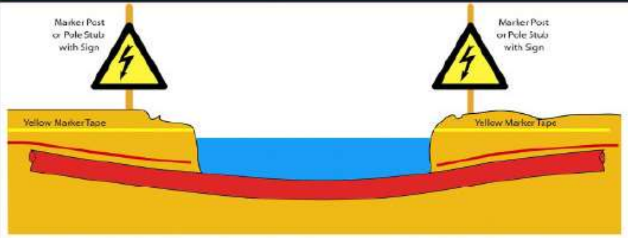
1. The design must be agreed with the bridge authority. Position in footpath is preferred.
2. Minimum cover over ducts on footpath 100mm.
3. **Where duct cover is >600mm, marker strip 75mm above ducts and marker tape (300mm below surface) + steel surface markers suffice**
4. Red ducting is not suitable for cable run external to bridges.
5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.

6A River/Stream Crossings: Standard Where Burial/Drilling IS Possible



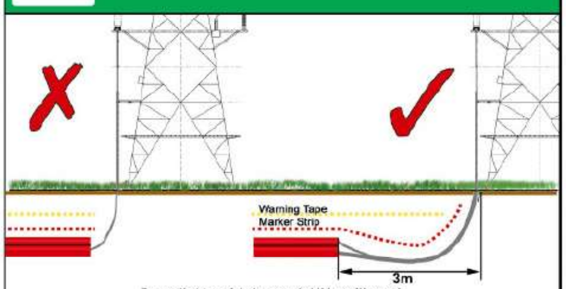
1. Depth of burial below bottom of river or stream to be agreed with relevant authority (if applicable)
2. If normal red ducting is installed by trenching, it must be encased in CBM4 (15N after 7 days) conrete to prevent uplift and to provide mechanical protection. Seal any joints to prevent concrete entering duct.
3. If drilled crossing is practical, use heavy red wall coiled HDPE duct **(sections 2.2 & 2.9 in MV/LV manual)**
4. Install an ESBN marker post on both sides of the crossing - ESBN code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
5. Where circumstances require it a large steel pipe can be installed, into which a number of standard ESBN duct sizes are pulled in **(see section 2.9.4 of MV/LV manual for guidance)**
6. If crossing a tidal section of a river or stream a foreshore licence will be required

6B River/Stream Crossings: Standard Where Burial/Drilling IS NOT Possible



1. Installation on base of river or stream to be agreed with relevant authority (if applicable)
2. Heavy wall steel pipe to be used free of weld beads/swarf. Minimum 8mm steel wall thickness to be used. Encase in CBM4 (15N after 7 days) concrete for corrosion protection, minimum 100mm surround
3. Install an ESBN marker post on both sides of the crossing - ESBNcode 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
4. Ensure a smooth connection using rubber coupler between crossing pipe size and ESBN standard duct as the steel pipe size will usualy differ from the standard ESBN ducting. Alternatively run ESBN ducting right through the steel pipe
5. If crossing a tidal section of a river or stream a foreshore licence will be required

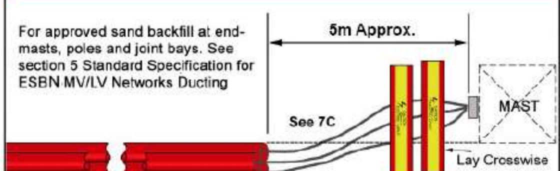
7A Cable End Mast Position



Ensure that trench is deepened at this position and cable is supported all round so that it does not tighten further during Backfilling

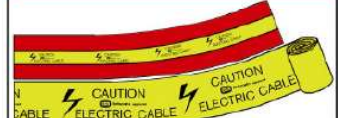
7B Cable End Mast Position

For approved sand backfill at end-masts, poles and joint bays. See section 5 Standard Specification for ESBN MV/LV Networks Ducting

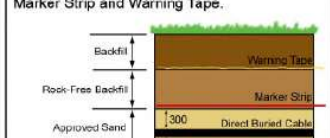


Offset trefoil to line up with edge of mast for ease of cable pulling.
Never install ducting right up to mast with long radius bend attached.
Both marker strip and warning tape to be used
between duct and mast (laying the marker strip crosswise as shown above).

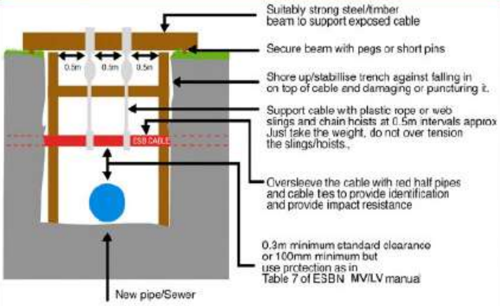
7C Cable End Mast - Marker Strip/Tape



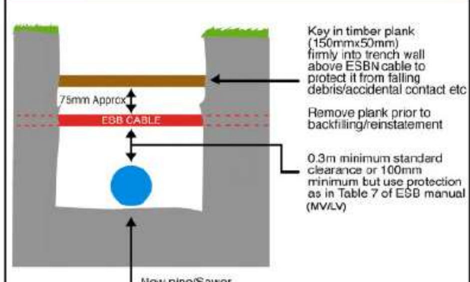
Cover cable between duct and mast with both Marker Strip and Warning Tape.



8A Supporting ESBN Cables/Ducts During Trenching Works



8B Supporting ESBN Cables/Ducts During Trenching Works



9 Avoidance of Cable Damage Due to Improper Backfilling at Cable Crossings

Trench AFTER improper backfilling and Ramming

Excessive deflection resulting in a shearing action at the trench walls and risk of cable or duct failure later.

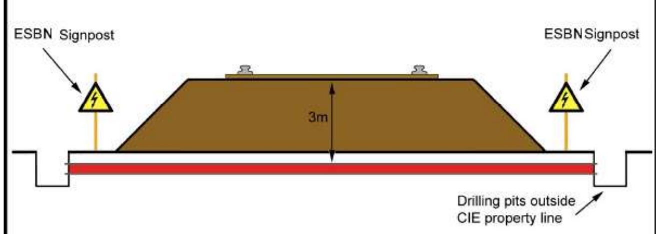
Trench AFTER carefull backfilling and Ramming

Layers all round the cable to be hand tamped. Cable to be well supported by firm bed of sand beneath the cable. No compaction machinery directly over cable/duct for 300mm minimum distance

Result : Very little cable deflection and shearing at edges of trench

Standard Specification for ESB 110kV Networks Ducting/Cabling

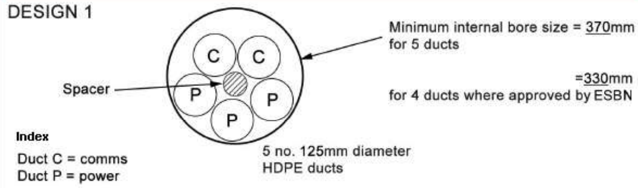
10A 110kV Railway Crossing Details



Formal licence for crossing and approval required from Iarnrod Eireann
Accurately record crossing location & erect marker posts.

10B TypicalDirectional Drill/Thrust Bore Duct Bore Details

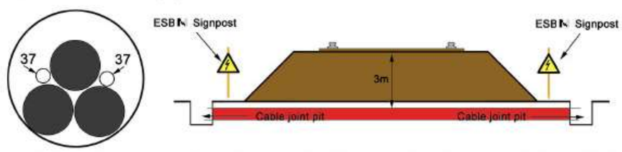
DESIGN 1



Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)
All interstitial space to be bentonited thoroughly to maintain cable rating.
Accurately record crossing location & erect marker posts.

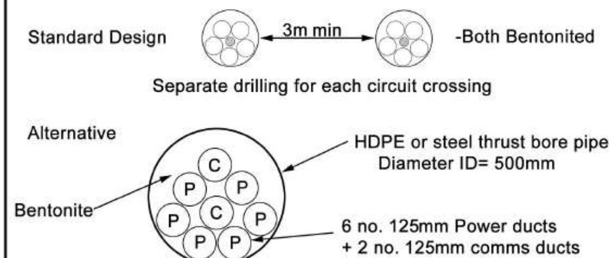
10C Typical Directional Drill/Thrust Bore Duct Bore Details

ALTERNATIVE DESIGN



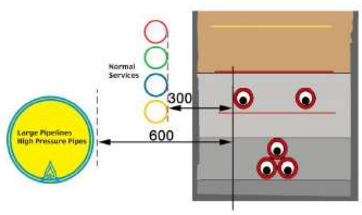
Install 1 no. 300mm ID SDR 17.6 duct with 3 no. short length cables pulled into this pipe along with 2 x 37mm comms ducts.
Full cable joint bays are required on either side of crossing along with C2 chambers for this design .
This method is used where it is not not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions.
All interstitial space to be thoroughly bentonited to maintain cable rating.
Accurately record crossing location & erect marker posts.

10D Typical Double Circuit Bore Crossing



All crossings to be accurately recorded and signposts erected given impracticality of marker tape.

11 Minimum Standard Clearances to Other Services

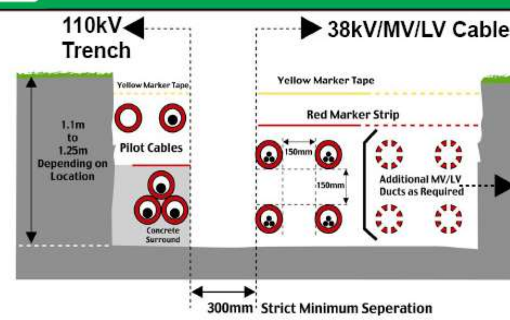


Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESBN

ESBN ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESBN

Other services must never be laid directly over ESBN ducts on parallel runs

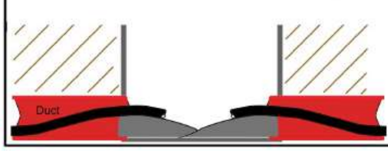
12 Combined 110kV & 38kV Cable Runs



NB. Where it is necessary to employ this formation, the seperation distance of 300mm should be strictly controlled and monitored to minimise derating (see MV/LV manual page 180)
Detailed calculations and design to be agreed between ESBN / ESBI

13 Sealing and Protection of 110kV Cables Once they Exit Ducts

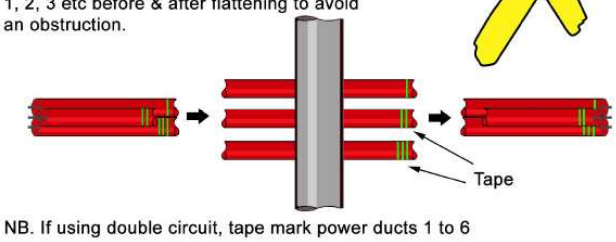
Ducts to be thoroughly sealed using ESBN tyco approved water sealant and 4hr fire rating approved for firestop.
NB - All joint bay entries to be thoroughly sealed to prevent sand washout and subsidence.



Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

14 Duct Crossovers Are Not Allowed

Be especially careful when going from flat to trefoil formation in vicinity of services
Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.



NB. If using double circuit, tape mark power ducts 1 to 6

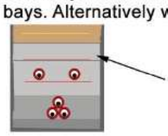
15 Crossing Dumps/Contaminated Ground

Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness.
Gasketed couplers alone are inadequate.

Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks.
Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur)
NB. Waste oils and chemicals can seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.



Concrete is continued up to 300mm of final surface to offset derating (CBM4 - 15N after 7 days)

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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 5

Construction Environmental Management Plan (CEMP)

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DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DREHID WIND FARM AND SUBSTATION,CO. KILDARE

Construction and Environmental Management Plan (CEMP)

Prepared for:

North Kildare Wind Farm Ltd

Date: June 2025

Unit 3/4, Northwood House, Northwood Crescent,
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1. INTRODUCTION

1.1 General Introduction and Purpose

This document is the Construction and Environmental Management Plan (CEMP) for the Proposed Development and has been prepared by Fehily Timoney & Company (FT) on behalf of North Kildare Wind Farm Limited.

The CEMP will be a key construction contract document, and the appointed contractor will be obliged to implement it in full. It will be updated by the Contractor prior to construction to take account of any relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the Proposed Development. The CEMP also includes measures for the operational and decommissioning phase of the Proposed Development. Decommissioning of the Proposed Wind Farm is intended to take place following its 35-year operational life; while the Proposed Substation is expected to remain in situ in perpetuity, and will be taken charge of by EirGrid. General guidance for the decommissioning of the Proposed Wind Farm is contained in Section 4.3.10 of this CEMP.

The CEMP will be a live document and will be subject to ongoing review through regular environmental auditing and site inspections. The measures in the CEMP will be implemented in full and further measures may be added as may be identified from the auditing and site inspections.

The CEMP sets out the key construction and environmental management issues associated with the Proposed Development , to ensure that the environment is protected and impacts on the environment are minimised.

The CEMP should be read in conjunction with the Environmental Impact Assessment Report (EIAR) and the Natura Impact Statement (NIS).

The document is divided into six sections:

Section 1: Introduction provides details on the existing site and the Proposed Development

Section 2: Existing Site Environmental Conditions provides details of the main existing geotechnical, hydrological, ecological and archaeological conditions onsite. These conditions will be considered by the contractor in the construction, operation and decommissioning of this Proposed Development.

Section 3: Overview of Construction Works, this section provides an overview of the construction works proposed, including drainage and sediment controls to be installed.

Section 4: Environmental Management Plan (EMP), this section outlines the main requirements of the EMP and outlines operational controls for the protection of the environment including soil management, habitat and species, site drainage control, archaeology, construction traffic, site reinstatement and decommissioning, waste management.

Section 5: Safety & Health Management Plan, this section defines the work practices, procedures and management responsibilities relating to the management of safety and health during the design, construction and operation of the Proposed Development.

Section 6: Emergency Response Plan contains predetermined requirements and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the Proposed Development.

1.2 Statement of Authority

This CEMP has been prepared by Brian Cronin of Fehily Timoney and Company.

Brian Cronin is a Senior Environmental Scientist with a BSc in Environmental Science from University College Cork and an MSc in Environmental Engineering from Trinity College Dublin. He is member of the Institution of Engineers of Ireland (MIEI). Brian has ten years of post-graduate experience including three years working in forestry and biomass research; four years working on contaminated land and land remediation projects, and EIARs; and three years working on renewable energy projects, project managing the preparation of EIAR for wind farms as well as writing the EIAR chapters himself.

This report was reviewed by Jim Hughes (BA, EIA/SEA Dip, MSc), Director Energy and Planning with Fehily Timoney and Company. Jim is a professional Town Planner with almost 20 years' experience in managing large complex infrastructure projects. Jim has extensive Strategic Infrastructure Development experience having being Project Director / Project Manager for the submission of numerous SID Wind Farm Projects and the submission of multiple no. SID applications for onshore electrical infrastructure under Section 182 of the P&D Act.

1.3 The Applicant

The applicant for the Proposed Development is North Kildare Wind Farm Ltd., which is a subsidiary of Statkraft Ireland Ltd.

1.4 The Site

The Proposed Development is located approximately 1.2km from Kilshanchoe, 2km from Johnstown Bridge and 5km from Carbury. The location of the Proposed Development is shown in Figure 1.1.

A site layout plan of the Proposed Development is shown in Figure 1.2. The Project

The Proposed Development consists of the Proposed Wind Farm, the Proposed Substation and the Turbine Delivery Route (TDR), as described in Chapter 3 of the EIAR.

The Proposed Wind Farm and all associated works are within the townlands of Ballynamullagh; Kilmurry, Killyon, Coolree, Mulgeeth and Drehid, Co. Kildare. The Proposed Substation and all associated works are within the townland of Coolree, Co. Kildare.

The Proposed Wind Farm consists of the erection of up to 11 no. wind turbines with a tip height of 147.9 to 167 m, access tracks including trackside drainage, development of site entrances, temporary compounds, internal collector circuit cabling, and a recreational amenity trail. Permission is sought for a period of 10 years and an operational life of 35 years from the date of commissioning of the entire wind farm.

The Proposed Substation consists of a new 110 kV substation which will connect into the existing Kinnegad-Rinawade 110 kV overhead line by way of a loop-in/loop out connection.

The TDR will require temporary minor alterations to the public road for the delivery of turbines to the site.

A detailed description of the Proposed Development is outlined in Section 3.1, and further detail is provided in chapter 3 of the EIAR.

The site is accessed from M4 motorway until Enfield, then along the R402 for ca. 7.7km and finally local road(L5025) to the entrance of the site. The nearest turbine lies c. 2.8km south of the motorway M4 at Enfield and 0.95km southeast of the regional road R402.

World Imagery: Earthstar Geographics
World Topographic Map: Esri, HERE, Garmin, FAO, USGS, NGA

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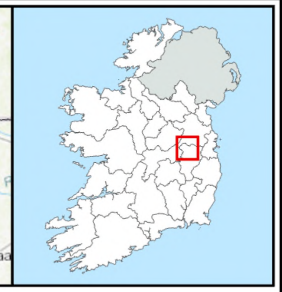

Legend

Proposed Development Boundary

TITLE: Site Location	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 1.1	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:22,500	**REVISION:** 0
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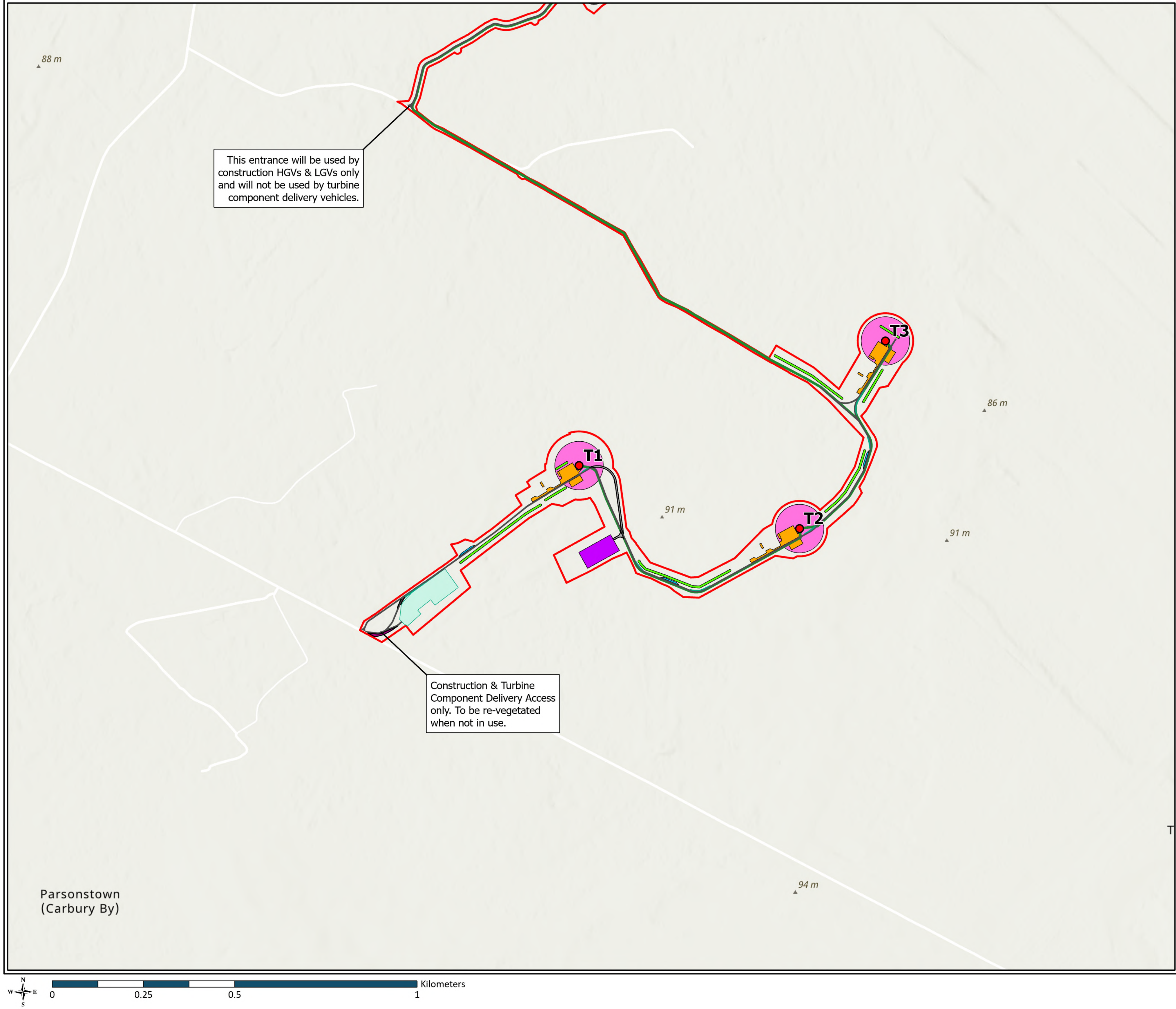

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Blade Transfer Area
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Berms
- Turbine Swept Path
- Cable Route
- Turbines

TITLE: Layout of the Proposed Development - Page 1	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 1.2	
CLIENT: North Kildare Wind Farm Ltd	
SCALE: 1:10,000	**REVISION:** 0
DATE: 11/06/2025	**PAGE SIZE:** A3

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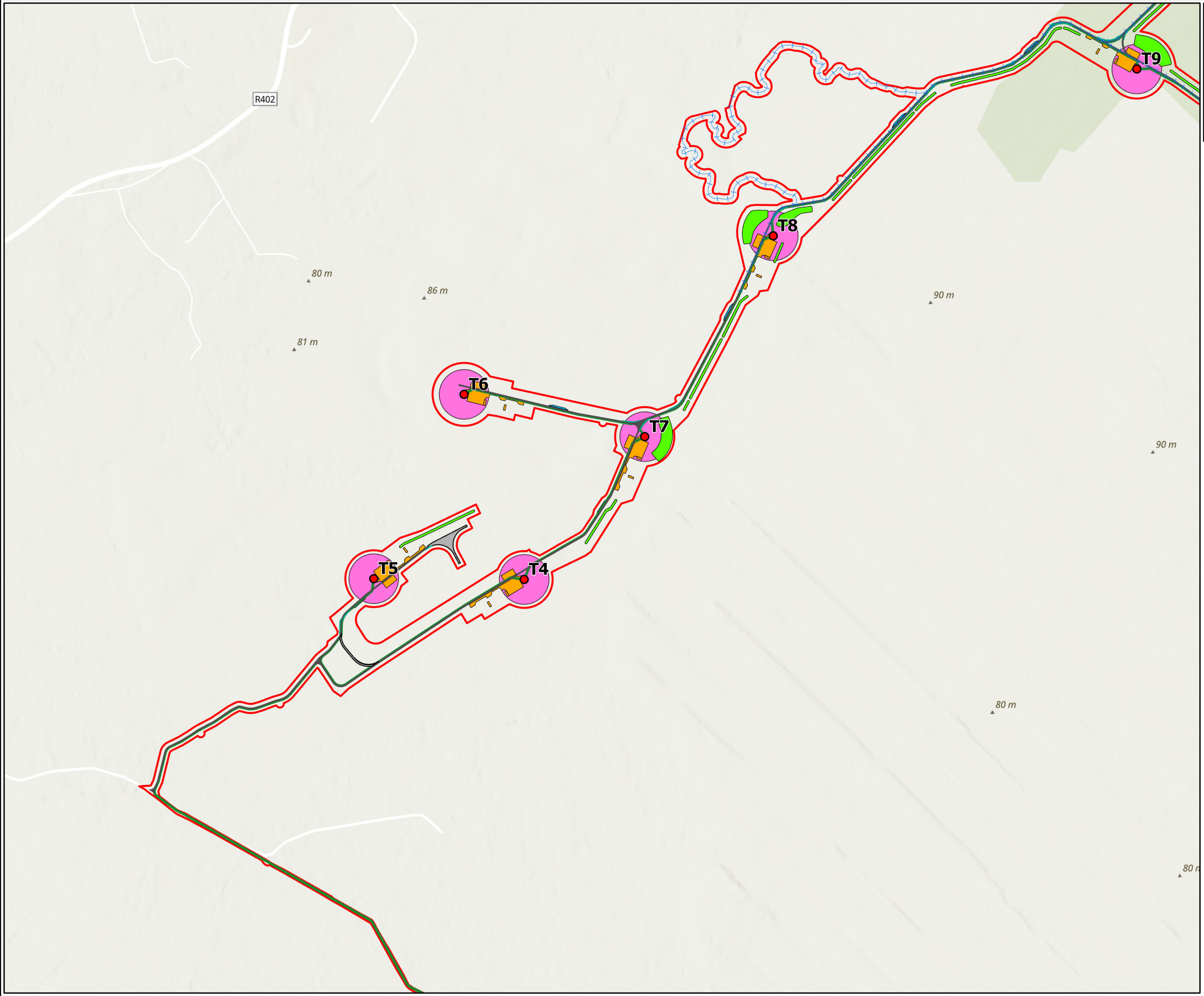

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Passing Bays
- Turbine Hardstanding
- Berms
- Turbine Swept Path
- Cable Route
- Recreation and Amenity Trail
- Turbines

TITLE: Layout of the Proposed Development - Page 2	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 1.2	
CLIENT: North Kildare Wind Farm Ltd	
SCALE: 1:10,000	**REVISION:** 0
DATE: 11/06/2025	**PAGE SIZE:** A3

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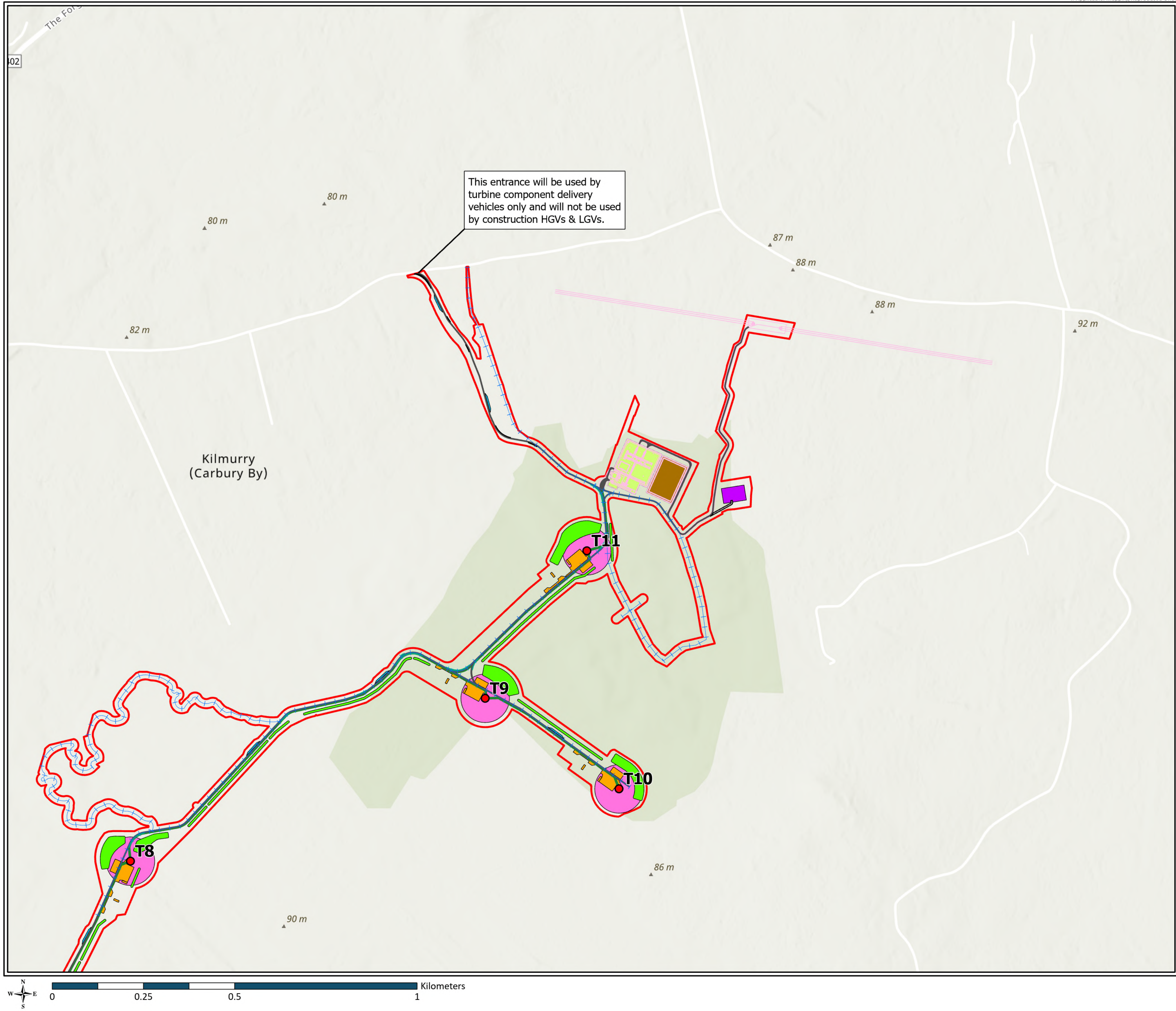

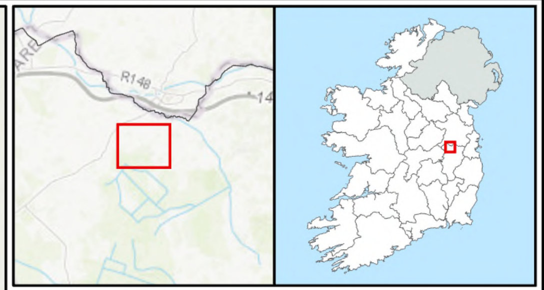

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Peat Deposition Area
- Substation
- Berms
- Turbine Swept Path
- Cable Route
- Recreation and Amenity Trail
- Substation Detail
- Turbines

TITLE:	Layout of the Proposed Development - Page 3		
PROJECT:	Drehid Wind Farm and Substation		
FIGURE NO:	1.2		
CLIENT:	North Kildare Wind Farm Ltd		
SCALE:	1:10,000	REVISION:	0
DATE:	11/06/2025	PAGE SIZE:	A3

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2. EXISTING SITE ENVIRONMENTAL CONDITIONS

2.1 Existing Site Description

2.1.1 The Site of the Proposed Development

The site of the Proposed Development is located in relatively low-lying but undulating land with the majority of proposed turbines located below the 80m contour. The landcover is classified by Tailte Eireann's National Land Cover map as improved grassland, treelines, hedgerows, transitional forest, coniferous forest, broadleaved forest and woodland, mixed forest, scrub, bare peat, bare soil and disturbed ground, and artificial surfaces (forest roads). The east of the site is adjacent to a cutover bog (Timahoe Bog). The Fear English River bisects the site, flowing south to north before it enters the Blackwater River at Johnstown Bridge. The landscape is classified as being of low sensitivity from a landscape perspective.

The Fear English River and the Kilcooney River, both of which are tributaries of the River Blackwater, flow through the site. The Kilcooney River rises near Carbury at approximately 95mOD and flows in a north-easterly direction through the site for approximately 1km before its confluence with the Fear English River. It joins the Fear English River to the south of Ballynamullagh.

The soil on the site of the Proposed Development is a diverse mix of subsoil types but predominantly comprises limestone tills, peat, and limestone sands and gravels. There are also significant deposits of lake sediment to the north of the site.

According to Eircode data 2025, within 1 km, there are only 91 no. receptors; with no receptors located within 4 times the tip height of any turbine. The closest occupied dwelling to the current proposed layout is located 642m from the nearest proposed turbine location.

2.1.2 Turbine Delivery Route (TDR)

The turbine delivery route is shown in Figure 2.1. A Delivery Route Selection and Assessment was carried out by Pell Frischmann to identify the optimum delivery route to site and is presented as Appendix 13.1 of this EIAR. It is proposed to deliver turbines to the site from the M4 motorway and then the R402 to the junction of the L402/L5025 and follow the L5025 to the main site entrance.

From the main site entrance, the components being delivered for turbines T01, T02 and T03 can be delivered directly to their respective hardstanding locations. However, an alternative delivery route is required for delivery of the components of the remaining turbines (T04 to T11).

The proposed access route is as follows:

- Loads will depart the M4 at Junction 9 and will join the R402, southbound;
- Loads will pass through Johnstown Bridge and Kilshancoe;
- All loads will turn off the R402 onto the L5025, turning left at The Sweep Crossroads junction;
- Loads will continue on the L5025 heading southeast to the site access junction. At the site access junction, loads will turn left into a purpose designed junction;
- Blade loads for the northern turbines will be transferred onto a blade lifting trailer. All other northern turbine loads (for T4 to T11) will undertake a U-turn and will rejoin the L5025, proceed northwest;
- Northern turbine loads will turn right onto the R402 and will proceed northbound;
- At the Raven Junction, loads will turn right onto Kilshanroe Road and will continue eastbound to the northern access junction.

Due to the oversized nature of the wind turbine components, some alterations will be required along the route. These points along the route are termed points of interest (POIs). There are fifteen POIs along the route which are listed below.

- POI 1: Loads will oversail the entry verge where two road signs should be removed. Loads will require an over-run surface on the central island of the roundabout where one chevron sign should be removed. On exiting the junction, loads will over-run the splitter island where three road signs should be removed. Verge vegetation trimming is required on the exit.
- POI 2: At the roundabout with Johnstown Road, loads will over-run the entry splitter island, central island and exit splitter island of the roundabout. Load bearing surfaces are required. Two road signs on the entry splitter island, two chevron signs on the central island and two signs on the exit splitter island should be removed.
- POI 3: Loads will oversail the inside of the junction where a left turn is made off the R402 onto the L5025. Two road signs and a barrier should be removed here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 4: Loads will oversail both verges on the L5025 at the first bend along this stretch. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 5: Loads will oversail both sides of the road at the next bend along the L5025. Hedge trimming will be required on the western verge along with an area of load bearing surfacing. Tree canopy trimming is required. A minor area of load bearing surface is required in the eastern verge along with the removal of a utility pole. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 6: Further along the L5025, north of the Kilooney Bridge, loads will oversail both verges. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 7: Further along the L5025, south of the Kilooney Bridge, loads will oversail both verges. Tree canopy trimming will be required here. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 8: At the main site entrance, the delivery will require the removal of a section of fence, access gate and hedge (to enable construction of the site entrance). All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 9: At Raven Junction on the R402, loads will oversail the inside of the junction where verge vegetation trimming will be required.
- POI 10: On Kilshanroe Road, loads will oversail both verges at the first bend along this road. Tree canopy trimming will be required here. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 11: Further along Kilshanroe Road, loads will oversail both verges at the second bend. Tree canopy trimming will be required here. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 12: Further along Kilshanroe Road, loads will oversail both verges at the third bend. Tree canopy trimming will be required here. A section of verge hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 13: Further along Kilshanroe Road, loads will oversail both verges at the fourth bend. Tree canopy trimming will be required here. Two lengths of hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

- POI 14: Further along Kilshanroe Road, loads will oversail both verges at the fifth bend. Tree canopy trimming will be required here. A minor area of load bearing surface is required in the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
- POI 15: Where the delivery route enters the northern, temporary site entrance, removal of a number of trees will be required to construct the temporary site entrance. The loads will oversail both verges and therefore tree canopy trimming will also be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

The Turbine Delivery Route Assessment is presented in Appendix 1. There will be mainly minor works required along the Turbine Delivery Route, including minor modifications of roundabouts, which include removing shrubs and signs and filling roundabout island to load bearing. Hedges may have to be trimmed back on both sides of the road.

The turbine delivery route was examined, and a number of stream crossings were identified along the route, as follows:

- Structure over the River Blackwater at Johnstown Bridge on the R402
- Structure over the Togher River at Thomastown on the R402
- Structure over the Sweep River at Kilshanshoe on the R402
- Structure over the Kilcooney River at Collinstown

No works are proposed at the above crossing points.

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Legend

- Proposed Development Boundary
- Turbine Delivery Route
- Site Entrances

TITLE:	Turbine Delivery Route
PROJECT:	Drehid Wind Farm and Substation
FIGURE NO:	2.1
CLIENT:	North Kildare Wind Farm Ltd.
SCALE: 1:30,000	**REVISION:** 0
DATE: 09/05/2025	**PAGE SIZE:** A3

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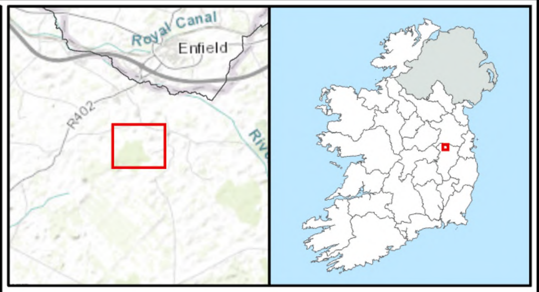

Legend

- Proposed Development Boundary
- Peat Deposition Area
- Substation
- Existing 110kV Overhead Line
- Grid Connection Route
- Substation Detail

TITLE: Proposed Substation	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 2.2	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:5,500	REVISION: 0
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3. OVERVIEW OF CONSTRUCTION WORKS

3.1 Description of the Proposed Development

North Kildare Wind Farm Ltd. is proposing to construct a wind farm and substation in County Kildare, which will comprise of 11 no. turbines with a total installed capacity (TIC) of up to 52.8MW. It is anticipated that the Proposed Wind Farm will connect to the national grid via the Proposed Substation .

The Proposed Development for which consent is being sought will consist of two planning applications as mentioned above.

The Proposed Wind Farm will consist of the following:

- Construction of 11 no. wind turbines, each with a rotor diameter of 133 m. 10 no. turbines will have a hub height of 100.5 m and a tip height of 167 m; while one turbine (T1, closest to the site entrance) will have a hub height of 81.4 m and a tip height of 147.9 m;
- Construction of permanent turbine foundations and crane pad hardstanding areas and associated drainage;
- Construction/upgrade of 1. no. main site entrance (off local road L5025), and 1 no. additional site entrance (off local road L50242);
- Construction of 1. no. site entrance (off local road L5012) to accommodate the delivery of large turbine components;
- Use of 1 no. existing Coillte entrance (off local road L5012) for pedestrian/cyclist access to an amenity trail;
- Construction of 9.67 km of new internal access tracks and associated drainage infrastructure;
- Upgrading of 951 m of existing tracks and associated drainage infrastructure;
- Establishment of 2 no. temporary construction site compounds and associated ancillary infrastructure including parking;
- Establishment of 1. No. temporary blade set down area;
- Construction of drainage and sediment control systems;
- 3 no. Watercourse Crossings;
- Upgrade and extension to an existing recreation amenity trail and installation of signage, picnic tables and bicycle stands;
- All related site works and ancillary development including signage, berms, culverts, drain crossings, landscaping, and soil excavation;
- Forestry felling (both permanent and temporary) to facilitate construction and operation
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed Substation including the laying of underground cabling along the local road L50242 which traverses the site.

The Proposed Substation will consist of the following:

- Construction of a 110 kV Substation and associated works within the townland of Coolree The Substation includes a total compound footprint of 1.32 hectares. , enclosed by palisade fencing. The Substation Compound will include :
- 1 No. single storey substation control building (450 m2);
- 1 No. single storey customer MV Building (160 m2);
- Switchgear, Arc Suppression Coil, Cable Sealing Ends, Cable Chair, Circuit Breakers, Current Transformers, Disconnects, Post Insulators, Surge Arrestors, Grid Code Compliance Equipment and Voltage Transformers; and all associated ancillary works necessary to facilitate the development;

- 9 No. lightning masts to a height of 20 m;
- 2.6m high palisade guard railing with perimeter boundary fencing will be erected around the periphery of the compound for security and protection measures;
- Lighting will be provided by 9 no. lighting columns, approximately 3m in height as well as exterior wall mounted lights on the control buildings;
- Erection of 2 no. line-cable interface masts to enable a loop-in/loop-out connection to the existing Kinnegad-Rinawade 110 kV overhead line. The steel lattice masts will extend to heights of 16m above existing ground level;
- Laying of 110 kV underground cabling between the proposed substation and the proposed loop-in/loop-out masts;
- Permanent access road (ca. 7.3 km in length) which traverses the townlands of Ballynamullagh, Kilmurry, Coolree and Mulgeeth to allow access to the substation including a short spur (ca. 0.9 km) off the main access track to access the 2 no. line-cable interface masts. The entrance to the local road (L5025) and local road (L50242) will be shared with the proposed Drehid Wind Farm;
- 3 no. stream crossings;
- Associated construction works and drainage infrastructure;
- Peat deposition area immediately adjacent to the proposed substation.

Certain temporary accommodation works associated with the Turbine Delivery and the provision of passing opportunities along the local road network are subject to this EIA but for which planning consent is not being sought within the current application. These works to facilitate the delivery of turbine components and haulage to Site are detailed further in Section 3.4.4.1 of the EIAR and include hedge or tree cutting; temporary removal of signage and street furniture and street lighting; and temporary filling of roundabout islands to load bearing. For these locations, works associated with road infrastructure have been identified and assessed in the EIAR. However, permission for these works will be sought separately with the local Planning Authority (Meath County Council and Kildare County Council) if the need arises, through consultation and agreement with ESB and also through road opening license as necessary.

3.2 Site Layout

The site layout of the Proposed Development is shown in Figure 1.2.

3.3 Construction Period

The construction period for the entire project is estimated to take approximately 18 months.

The layout of the site lends itself to clearly defined phases (civil construction, cables, turbines, on-site substation) where the various work elements can overlap without a significant increase in local traffic movements or congestion on site. There is likely to be some overlap with civil works and turbine erection, and also with turbine erection and commissioning.

It is estimated the civil and electrical works will include the following:

- Temporary site compounds;
- Site entrances;
- New stream crossings;
- New site roads & drainage;

- Upgrade to local roads;
- Turbine foundations and hardstands;
- Electrical compound and substation building;
- Cable trenching and ducting (internal cables only);
- Cable pulling (internal cables only);
- Turbine delivery and installation;
- Grid connection cable ducting;
- Grid connection cable pulling;
- Break existing 110kV overhead line, erect masts and establish new loop-in connection;
- Testing, commissioning and energisation.

The final programme will be developed post planning in consultation with the turbine manufacturer and the main construction contractor, based on projected turbine delivery dates.

A construction programme for an 18-month construction period is shown in Chapter 3 of Volume 2 of the EIAR.

3.4 Overview of the Construction Sequence

The construction of a wind farm project and a new loop-in substation is a major infrastructural project. The construction of this project will involve many inter-related, inter-dependent and overlapping elements of a complex nature.

The following section outlines the construction methodology for the Proposed Development. Upon mobilisation for the construction of the development, peat excavation (where required), upgrading of existing site tracks and the provision of new site tracks will precede all other activities. Construction stage drainage infrastructure will be constructed in parallel with the track construction, elements of which will be adopted into and will accord with the site's operational drainage as set out in the Planning Drawings . This will be followed by the construction of the turbine foundations and the provision of the hardstanding areas. In parallel with these works the on-site electrical works; substation and internal cable network will be constructed. The electrical works are anticipated to commence during month 5 in parallel with the wind farm works.

The proposed construction programme is presented below:

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Main Construction Element																		
Site Establishment																		
Site Roads																		
Hardstands 11no																		
Foundations 11no																		
Internal Collector System																		
Substation Construction and LILO connection																		
WTG Delivery 11no																		
WTG Install 11no																		
Comissioning																		
Site Reinstatment and Demob																		

Plate 3-1: Proposed construction works programme

3.4.1 Overview of the Construction Methodology

Method statements are presented below for the key elements of the construction process. The contractor for the main construction works will, following appointment, take ownership, expand upon and generally develop these method statements appropriately for the construction stage, in accordance with this CEMP.

The proposed construction methodology is summarised under the following headings:

- Site Entrances;
- Temporary Site Compounds;
- Felling;
- Concrete Washout Area and Wheel Washing;
- Upgrade of Existing Internal Access Tracks ;
- New Site Access Tracks;
- Cable Works;
- Drainage and Watercourse Crossings;
- Crane Hardstands;
- Turbine Foundations;
- Substation Compound;
- Electrical Works;
- Turbine Erection;
- TDR temporary accommodation works.

3.4.1.1 Site Entrances

During construction, the site will be accessed by the main site entrance on the L5025. There will also be a site entrance constructed off the L5012, immediately west of the existing Coillte entrance, for the purposes of turbine delivery only. However, this site entrance will be decommissioned after turbine delivery, and all other construction traffic will be via the main site entrance.

During operation, turbines T01, T02 and T03 will be accessed by the main site entrance off the L5025, while turbines T04 to T11 and the Proposed Substation will be accessed via the alternative site entrance off the L50242.

Both the main site entrance and the alternative site entrance will be of a bellmouth design, with the main site entrance achieving sight lines of 160m to the north and a sightline of 155m to the south; and the alternative site entrance achieving sight lines of 90 m. More details of the site entrances can be seen on the site entrance drawings P22-242-0300-0015 to P22-242-0300-0018.The access point has been selected with consideration for safety of public road users and construction staff and to ensure they can be constructed to comply with TII design requirements for direct accesses. Each of the access points are presented in the Planning Drawings accompanying the application and include designs and minimum visibility splays.

Site entrances will be constructed using the same methodology as the construction of the wind farm tracks as described in section 3.4.1.5.

Site entrances will be secured and locked when not in use. Where required, the entrances will be controlled by flagmen to assist traffic movements.

3.4.1.2 Temporary Site Compounds

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. There will be 2 no. temporary compounds, one located in the southern portion of the site near T1 and T2; and one located adjacent to the proposed on-site substation. These will include temporary self-contained welfare facilities (e.g. ecopod type) and offices. The location of the two temporary site compounds is shown on planning drawing P22-242-0100-0001 (copied into Appendix 2 for ease of viewing). Layout plans of each of these are shown in Planning drawings P22-242-0300-0019 and P22-242-0300-0020 which can also be found in Appendix 2.

Facilities to be provided in the temporary site compounds will include the following:

- Site offices to include meeting rooms, canteen and welfare facilities complying with latest legislation, of Portacabin type construction
- Portable container toilets
- Areas for storage of materials and fuel including bunded fuel storage
- Waste management areas
- Aggregate stores
- Storage sheds
- Footpaths
- Employee parking
- Potable water supply
- A water tanker to supply water used for other purposes
- Contractor lock-up facility
- Temporary power and lighting

The compounds will be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts.
- Drainage runs and associated settlement ponds will be installed around the perimeter.
- Temporary, modular, containerised offices welfare units will be delivered to site using articulated lorry and lifted into place using a suitable crane.
- A concrete bunded area with an associated oil interceptor will be provided within the main compound for the storage of lubricants, oils and site generators and coalescing media oil water separator will be installed to mitigate against any hydrocarbon spillages.
- The compound will be fenced all round and secured with locked gates.
- Self-contained portaloos with an integrated wastewater holding tank will be used maintained by the providing contractor and removed from site on completion of the construction works. These will be located in the temporary compounds, as well as in several areas throughout the site due to the dispersed nature of the site.
- Potable water will be delivered to site in suitable canisters on a daily basis for drinking.
- Upon completion of the projects the compounds will be decommissioned, and the material will be removed off-site for recovery or disposal by a proposed waste contractor. The hardcore stone and geo-grid will be removed from site and the area will be reinstated by backfilling with the material arising during excavation, landscaping with topsoil as required.

3.4.1.3 *Felling and Site Clearance*

Felling of approximately 28.4 ha of woodlands dominated by or mainly comprised of conifers is required in the northern portion of the site to create 'bat buffers' around turbines T6 to T11, as well as felling a corridor for the access tracks plus trackside drainage and berms. It should be noted that the clear-felling of trees in the State requires a felling licence. The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing which is governed by the Forestry Act 2014 as amended and the Forestry Regulations 2017 (S.I. No. 191 of 2017). A felling licence will include the provision of relevant replant lands (afforestation area) to be planted in consideration for the proposed tree felling on the Site. The associated afforestation of alternative lands equivalent in area to those lands being permanently clear-felled is also subject to licensing ('afforestation licensing').

The area of trees to be felled will be minimised to only that required to accommodate the Proposed Development.

The contractor will not commence tree removal on site until both felling and afforestation licences are in place

Tree felling, trimming and site clearance will not be carried out during the bird breeding season which commences on March 1st and finishes on August 31st. All site clearance / enabling works will be preceded by survey and inspection by an Ecological Clerk of Works for the presence of any species or habitats protected by Law in accordance with the TII's "Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes". The following confirmatory surveys, as specified within the Biodiversity chapter, will be undertaken by the Ecological Clerk of Works (who will be suitably qualified and competent to undertake such surveys) in accordance with the methodologies set out in the EIAR, prior to the commencement of Construction, in order for the Contractor to ensure the most relevant mitigation measures are included in the Design and Construction:

a) An otter survey 200m upstream and downstream of the footprint of all watercourse crossings to identify holt / couch locations and need for mammal passage/mitigation;
b) A bat survey of trees to be felled in accordance with the NRA Guidelines for the Treatment of Bats Prior To the Construction of National Road Schemes (a visual inspection of the tree during daylight hours followed by a night time detector survey);
c) A badger survey within 150m of all works areas;
d) A common frog surveys along all drain crossings (and spawn survey) during the breeding season of common frog (approximately January – midsummer). Spawn translocation may be required under licence where active breeding drains are within the development footprint during the construction phase.
e) An invasive plant species survey of all watercourses and lands within the footprint of the Works.

If any such species or habitats are found, as a result of such survey and inspection, the Contractor will undertake the following:

- Record and report the ecological data in accordance with the requirements of the National Biodiversity Data Centre (NBDC);
- If mitigation measures for such species or habitats have not been identified in the EIAR for that area of the Site, the Contractor will, consult with the National Parks and Wildlife Services and the Inland Fisheries Ireland as appropriate to determine and implement appropriate mitigation for the species / habitat.

3.4.1.4 Concrete Washout Area and Wheel Washing

All concrete will be delivered to site via ready-mix trucks from a local supplier.

Concrete trucks will not be washed out on Site, this will only be permitted in the designated concrete wash-out area. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m. The residual liquids and solids will be disposed of off-site at an appropriate licenced waste facility.

The concrete wash-out area will be constructed as follows:

- The topsoil and subsoil, if necessary, will be stripped out and placed adjacent to the temporary compound area
- An impermeable membrane will be installed directly onto the subsoil, and or subsoil, to form the impermeable concrete wash-out settlement lagoon
- A designated truck wash-down concrete apron shall be constructed next to this settlement lagoon
- Impermeable lined drains will direct the wash-out flow to the wash-out settlement lagoon
- The residual liquids and solids will be disposed of off-site at an appropriate licenced waste facility.

Upon completion of the projects the concrete wash-out area and settlement lagoon will be decommissioned by removing the impermeable membrane and backfilling the area with the material arising during excavation. The removed material will be recovered or disposed off-site at an appropriate facility.

A wheel wash facility will be located at the main site entrance to reduce construction traffic fouling public roads. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a proposed contractor.

3.4.1.5 New Site Access Tracks

Drainage runs, and associated settlement ponds will be installed. All site tracks will be designed taking account of the loadings required by the turbine manufacturer and will consist of a compacted stone structure.

New roads within the site will be floated on both mineral soils and on peat soils. Floating roads are constructed without excavating the existing ground. They will consist of a layer of combined geotextile and geogrid laid directly on the existing surface. Layers of stone will then be placed on top with additional geogrid reinforcement as required. A layer of compacted Cl 804 material will be placed on top to provide a suitable running surface.

The stone required for the construction of the internal access roads will be sourced from quarries in the vicinity.

The track formation will consist of a minimum 500mm hardcore on geo-textile membrane. The construction methodology for newly constructed tracks will be as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500 mm depth.
- A drainage ditch will be formed along sides of the track.

- Surplus excavated material will be placed along the side of the track where suitable and dressed to blend in with surrounding landscaping and partially obscure sight of the track.

3.4.1.6 Upgrade of Existing Internal Access Tracks

It is proposed to utilise the existing road network as much as possible within the site. It will be required to widen existing agricultural and forestry tracks on site by 1.5 m to 4.5m, with some additional local widening at bends in the tracks. This will involve the slight re-location of existing roadside swales to allow for widening.

Some of the existing piped drain crossings will need to be extended due to the widening of the tracks.

Existing agricultural and forestry drains will be retained along their existing routes and only slight diversions are anticipated to be required to provide for track widening.

Existing track upgrades shall follow the same methodology as for new access tracks.

The road construction details of new and upgrades to existing access tracks are detailed on planning application drawing P22-242-0300-0026 which can be found in Appendix 2.

3.4.1.7 Watercourse Crossings

There will be three new stream crossings required as a result of the development. The route of the access tracks will not cross existing stream crossings. The locations of the stream crossings are shown on planning application drawing P22-242-0101-0004, P22-242-0101-0007 and P22-242-0101-0018 in Appendix 2.

The sizes of the stream crossings required throughout the site to cross tributaries of the River Boyne and the River Blackwater were estimated as part of the flood risk assessment. The crossings are sized to convey a 1 in 100-year flood with a 20% allowance for climate change, while maintaining a minimum freeboard of 300 mm.

In accordance with the consultation responses received from the IFI it is proposed to provide clear spans in place of culverts.

The IFI has provided detailed specifications on the design of temporary and permanent stream crossings in fisheries sensitive streams. Bridge foundations will be designed and positioned at least 2.5 metres from the river bank so as not to impact on the riparian habitat.

A Section 50 application will be required to obtain the consent of the OPW for the design of the three new stream crossings. The IFI will also be consulted at the detailed design stage.

For the construction of the watercourse crossings, the following methodology shall apply:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in Section 4 of this CEMP.
- Bank protection will be installed as necessary to ensure that the existing stream banks are not disturbed during construction.
- The line of the access track and crossing will be marked out on site by a site engineer.
- On approach to the crossing, flow connectivity cross drains will be installed at 50m centres in accordance with the final drainage design.
- The extent of the excavation for bridge supports will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter. Bridge foundations will be designed and positioned at least 2.5m from the river bank.

- The excavated material will be stored at agreed locations within the site in accordance with the Soil Management Plan.
- A layer of concrete blinding will be laid directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface, followed by placement of the concrete blinding layer for the bridge supports.
- Steel reinforcement will be fixed in accordance with the designer's drawings & schedules and the supports will be shuttered.
- Concrete will be placed and compacted to the levels and profile indicated on the construction drawings.
- Upon completion of the concreting works the bridge supports will be covered from the elements and left to cure for a sufficient period in accordance with the design specification.
- The bridge supports will be backfilled using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material is to be approved by the project geotechnical engineer.
- Following curing, appropriate pre-cast bridge beam sections will be lifted into place by a crane or HIAB truck in accordance with an approved lifting plan.
- The bridge parapets will be steel-fixed, shuttered and poured to tie in with the pre-cast bridge deck beams and the upper section of the bridge deck will be poured and finished using ST1 concrete.
- Ductwork will be installed within the bridge deck in accordance with the design to carry the grid connection cables across the watercourse.
- A timber post and rail fence will be installed, affixed to the bridge parapets, to run the length of the bridge deck.

3.4.1.8 Drain Crossings

Access tracks and hardstanding areas pass through multiple land drains and Arterial Drainage Scheme Channels that connect or discharge to the Fear English River (River waterbody code - IE_EA_07B020100). The following table shows the list of proposed culverts, their sizes, and the associated catchments.

Table 3-1: Proposed Culverts

Culvert/ Structure Name	Culvert Type	Catchment Area (km2)	Culvert Length (m)	Culvert Diameter (mm)	Culvert Coordinates	
					Easting (ITM)	Northing (ITM)
CV-01	Circular	0.140	10.50	1050	673870.087	734342.270
CV-02	Circular	0.050	10.50	900	673844.294	735701.550
CV-03	Circular	0.060	54.13	1050	674670.598	736201.296
CV-04	Circular	0.012	10.50	900	674892.787	736543.629
CV-05	Circular	0.265	10.50	1200	675250.928	736980.500
CV-06	Circular	0.428	10.50	1500	675417.454	737158.857
CV-07	Circular	0.047	58.00	1350	676347.116	737844.516
CV-08*	Temp.	0.138	12.70	1200	676084.970	737970.987
CV-09	Circular	0.028	10.80	1050	676049.766	737993.457
CV-10*	Temp.	0.059	10.50	1050	675993.515	738103.549
CV-11	Circular	0.026	13.00	900	675904.469	738301.134

Culvert/ Structure Name	Culvert Type	Catchment Area (km2)	Culvert Length (m)	Culvert Diameter (mm)	Culvert Coordinates	
					Easting (ITM)	Northing (ITM)
CV-12	Circular	0.176	36.00	1200	674336.666	735914.252

*Temporary Culverts

Some drain clearing will be required at existing crossings, where they have become blocked, to maintain the continuity of flows. These existing pipes may need replacing if they are found to be in a collapsed state.

For a drain crossing using a piped culvert, the following methodology will be used.

- The access track construction will finish at least 10m from the nearside bank of the drain.
- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in Section 4 of this CEMP.
- Pipe culvert installation will only take place during dry periods.
- The bed of the drain will be prepared using a mechanical digger and hand tools to the required levels accordance with the design.
- A bedding layer will be laid in the base of the watercourse using Class 6 aggregate material and blinding to the desired levels in accordance with the design.
- The pipe is laid in one lift or in sections using a crane in accordance with an approved lift plan.
- Bedding material is placed and compacted around the pipe to the desired levels in accordance with the design.
- Where appropriate a 500mm of suitable bedding material in the form of clean round gravel between 10-100mm diameter, shall be laid in the base of the pipe in accordance with the recommendations set out in Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses from Inland Fisheries Ireland.
- The pipe is covered using compacted Class 6N fill material in accordance with the design up to the levels required by the access track sub formation.
- Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.
- The access track construction continues over the crossing in accordance with the methodology outlined in Section 3.4.1.5.
- For small drain crossings, pipes of suitable diameter will be laid directly into the bed of the drain.

3.4.1.9 Cable Works

The specification for cable trenches will vary slightly depending on cable voltage, location and existing land use. Cable trench construction details can be found on drawing P22-242-0300-0028 Grid Connection Trench Details, located in Appendix 2, which shows construction details for electricity cables beside internal site access tracks.

All electrical and fibre-optic cabling on site between the wind turbines and the substation building will be buried in trenches of 0.6m wide by 1m deep located directly adjacent to the internal tracks.

Internal site cables will be direct buried or ducted as per the specification outlined in Appendix 2.

The following describes the construction methodology for cable installation works inside the wind farm site.

For direct buried cables, the following methodology shall apply:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in Section 4 of this CEMP.
- The line of the cable trench will run beside the site access tracks until it exits to the public road.
- The ground will be excavated using a mechanical digger. The top layer of soil will be removed and placed to one side. It will be used for landscaping the top of the backfilled cable trench following the laying of the cables. The remaining subsoil, excavated to the required depth, will be placed separately and used as backfill.
- Safe ladder access/egress to trenches will be provided into the trench.
- The cables will be laid directly onto a bed of suitable material, free from sharp stones and debris*.
- A suitable material will be placed over the top of the cables to protect them during backfilling*.
- Warning tape and plates will be installed by hand in accordance with the trench design and ESBN/Eirgrid specifications and the engineer's design.
- On completion, the ground will be reinstated, and marker posts will be positioned at agreed centres to the side of the trench highlighting the presence of cables below.
- Trenches will vary in width depending on the number of cables in the circuit. Where there is more than one set of cables they will be separated as per cable manufacturers and ESB/ EirGrid requirements.

Where ducting is required within the Site (i.e., for areas where cables will be laid under access tracks or other loaded surfaces), suitable ducting will be required to protect the cables. In this scenario, tasks marked by an asterisk (*) in the above methodology will be replaced by the following steps:

- Ducts will be placed into the trench manually, having been delivered to road side embankment/verge by tractor and pipe trailer and then offloaded by hand.
- Approved bedding material will be used to surround the ducts. It will be delivered straight from a concrete truck or by skid steer along the route.
- Approved fill material will be compacted above and below the power cable ducting as per the engineer's design.
- Exposed duct ends will be capped.
- A 12mm Draw rope will be blown through the ducting at later date.
- Small jointing pits will be located along the route of the trench which will be left open until jointing takes place. A protective handrail/ barrier will be placed around each pit for health and safety reasons.
- Once the cables are joined and sealed the jointing container will be removed and the cables at the joint-bay locations will be back-filled in the same manner as the rest of the cable trench.
- The cables will be terminated on the switchgear terminals at each turbine location and at the substation switchboard. Ducts will be cast into each foundation to provide access for the cables into the turbine. Likewise, at the substation, ducts will be cast through the building foundation to provide access for the cables.
- There are no existing buried services expected within the site however the appointed contractor will be responsible for carrying out pre-construction survey ahead of construction. Prior to commencement of the works, records of services such as watermains, sewers, gas mains and other power cables will be obtained from the relevant service providers.

- Cable detection tools, ground penetrating radar and slit trenches will be used, as appropriate, to find the exact locations of existing services. The final locations of the cable trenches will be selected to minimise conflicts with other services.
- Trenches where ducts are laid will be back filled every evening. During excavation works signage will be erected local to the works warning of the dangers.

3.4.1.10 Turbine Hardstands

All crane pads and associated splays will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure in accordance with the detailed engineering designs and employer's requirements.

All crane pads will be formed on a suitably stiff layer and the finished crane pad surface will provide a minimum bearing capacity of 260kN/m^2. Where excavations beyond 5m below ground level are required to reach a suitable bearing, pile foundations will be required (only expected for turbines T8, T9 ad T10).

Crane pad and associated splay formation will consist of either 1 or 2 layers of suitable fill material depending on the properties of the underlying load bearing layer. Where the underlying layer is soft soil, 2 layers of suitable fill formation are used and the stone capping layer.

The crane hardstands will be constructed in one of two following ways:

- Typical excavation method;
- Piled hardstand method.

A piled construction method will be required for the hard standings of T8, T9 and T10. All other hardstandings will be constructed with the typical excavation method.

The excavation method can be summarised as follows:

Excavation Method:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in Section 4 of this CEMP.
- Establish alignment of the hardstands from the construction drawings and mark out the corners with ranging rods or timber posts.
- Drainage runs and associated settlement ponds will be installed.
- The excavated material will be stored close to the hardstand. Topsoil and subsoil stockpiles will be formed, and the side compacted to prevent silt run off during heavy rain or air bourn dust during dry periods.
- The soil will be excavated down to a suitable formation layer of either firm clay or rock.
- Suitable granular fill will be spread and compacted in layers to provide a homogeneous running surface.
- Batters to have a slope of between 1:1 and 1:5 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

Piled Hardstand Method:

This system involves:

- Construction of a temporary piling platform to facilitate the installation of the piles. This platform will comprise a geogrid reinforced platform using one or two layers of reinforcing geogrid with suitable granular fill. Piles will be installed through this reinforced platform to the required depth.
- Piles will be positioned to match the outrigger pads of the turbine crane and as agreed with the turbine supplier. Geotechnical analysis of the site investigation information will dictate the type of pile to be used. There are several methods however the most likely will either be pre-cast driven piles and auger bored piles.
- Construction of a floating hardstand across the full extent of the hardstand comprising a geogrid reinforced platform using one or two layers of reinforcing geogrid with suitable granular fill.
- A reinforced concrete pad will be constructed on top of the piles. Shuttering will be used lined with polythene and an antibleeding admixture used to prevent any concrete leachate occurring.

3.4.1.11 Turbine Foundations

The wind turbine foundations will be constructed using standard reinforced concrete construction techniques. Reinforced concrete piled foundations will be required for turbines T8, T9 and T10. The foundations for all other turbines will be standard excavated reinforced concrete base.

Turbine foundations will be designed to Eurocode Standards. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation as per the turbine manufacturer’s guidelines which will be incorporated in the civil foundation design.

The turbine foundations will be constructed as follows:

Standard Excavated Reinforced Concrete Base:

a) The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.
b) The excavated material will be stored at agreed locations close to the base. Topsoil and subsoil stockpiles will be formed, and the side compacted to prevent silt run off during heavy rain or airborne dust during dry periods. A portion of the subsoil material will be used as backfill and the topsoil will be used for landscaping around the finished turbine post construction.
c) No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.
d) Around the perimeter of the foundation formation a shallow drain will be formed to catch surface water entering the excavation. The drain will direct the water to a sump if required where it will be pumped out to a settlement pond away from the excavation.
e) A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. If required, geogrid and soil replacement will be laid according to the foundation design, followed by placement of the concrete blinding layer.
f) If soil replacement is required, the aggregate used must be tested and approved by the project geotechnical engineer.
g) High tensile steel reinforcement will be fixed in accordance with the designer’s drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools.

h) Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required.
i) The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base.
j) Concrete will be placed using a concrete pump and compacted using vibrating pokers to the levels and profile indicated on the construction drawings.
k) Upon completion of the concreting works the foundation base will be covered from the elements that could cause hydration cracking and or delay setting in any way.
l) Steel shutters will be used to pour the upper plinth section.
m) The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material is to be approved by the project geotechnical engineer.
n) A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance.

Reinforced Concrete Piled Foundations:

Piling will be required for the foundations of turbines T8, T9 and T10.

Follow Items (a) to (c) as above, then for piled foundations:

Auger bored piles will be used for piled foundations.

- A piling platform for the piling rig will be constructed. This can be done in two ways depending on the bearing capacity of the underlying soil.
- The first method is to lay geogrid on the existing surface and a stone layer will then be placed on top of the geogrid by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
- The second method is to excavate the soils to a suitable intermediate mineral subsoil and backfill to the formation level.
- The piling rig, fitted with an auger, will then bore through the soft material with casing fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.
- When the auger is removed high tensile steel cages will be lowered into the boreholes. These steel cages will extend above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.
- Reinforcing steel on the top of the pile will tie to the foundation base steel.

Base construction is then undertaken as per items (e) to (n) above.

3.4.1.12 Turbine Erection

The turbine will be supplied and installed with a blade tip height of 147.9 m for T1 and 167 m for T2 to T11. The turbines will be delivered in sections to the site as follows:

• Foundation anchors	x	1
• Towers	x	3/4
• Blades	x	3
• Hub	x	1
• Nacelle	x	1
• Switchgear Components	x	1

A lift plan will be developed for each turbine location detailing the storage positions for each component, crane size and lifting sequence. It is anticipated that each turbine will take 3 to 4 days to erect with two cranes set up at each turbine - one main crane and a tailing/ support crane. The support crane will assist in the assembly of the main crane and also in the initial lift of the tower sections and hub and blade assembly. Components will be delivered using specially adapted heavy load trailers set up specific to the turbine supplier requirements. Upon completion of the erection, all sections will be tightened to the correct torque and the internal fit out of the turbine undertaken. Finally, the turbines will be commissioned and tested.

3.4.1.13 Substation Compound

The substation will comprise an EirGrid compound and an Independent Power Producer (IPP) compound as shown in the planning drawing 23727-MWP-00-00-DR-C-0101. The EirGrid compound will measure 96.3 m x 94.8 m; and the IPP compound will measure 72.0 m x 34.1 m. The substation will provide a connection point between the wind farm and the proposed grid connection point to the existing 110kV Kinnegad-Rinawade overhead line.

The IPP building's main function is to provide housing for switchgear, control equipment and monitoring equipment necessary for the proper functioning of the substation and wind farm. The building will be constructed by the following methodology:

- The area of the control buildings and compound will be marked out using ranging rods or wooden posts and the vegetable soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.
- Drainage runs and associated settlement ponds will be installed.
- The dimensions of the Building and Compound area are set to meet the requirements of EirGrid and the necessary equipment to safely and efficiently operate the wind farm.
- The foundations will be excavated down to the level indicated by the designer and concreted.
- The blockwork walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.
- The blockwork will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation.
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane.

- The wooden roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.

The remainder of the substation compound will be brought up to the agreed formation and approved stone imported and graded to the correct level as per the detail design and constructed using the same methodology as the construction of the wind farm tracks as described in section 3.4.1.5.

Equipment plinths will be marked out, excavated and constructed using in-situ reinforced concrete or pre-cast concrete. Provision will be made in each plinth for earth connection.

Following the construction of the equipment plinths an earth mat will be installed throughout the compound. This will be connected to each plinth and the buildings as per the electrical earth protection design.

3.4.1.13.1 Electrical Works

Substation Fit Out and Switchgear Installation

The substation will have a domestic electrical system including lights, sockets, fire alarm and intruder alarm. The high voltage switchgear is installed through the following method.

- The switchboard units are delivered to site on a truck and unloaded using a forklift, front end loader or HIAB crane.
- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works.
- The switchgear will be unloaded on to a concrete plinth directly outside the substation building.
- The units will be moved inside the substation building using a hand driven forklift and positioned over the internal trench supports, prepared previously.
- The switchgear is then secured as per manufacturer's instructions, by bolting directly to steel support bars over the trench.
- The building is fitted out with small light and power and ancillary wind farm control equipment such as SCADA computer, remote telemetry units, metering etc.
- All equipment and fittings are then connected, wired tested and commissioned in accordance with the Electrical Contractor's commissioning plan.

Transformers

- The turbine transformers will be placed directly onto the turbine foundation upon delivery to site, prior to the installation of the turbine towers.
- The transformers will be of the sealed type and will be inspected for any damage prior to offloading. It is likely that the units will be installed using a small mobile all-terrain crane and will be tested, commissioned and energised by suitably trained and authorised persons.
- The accessible sections of the transformer will be protected within an enclosure which shall be locked at all times displaying appropriate warning signs.
- Transformers and ancillary plinth-mounted equipment required in the substation compound will be delivered to site and unloaded directly in place by HIAB crane or similar.

- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works and adequate hard standings will be provided prior to delivery to facilitate safe unloading.

3.5 Construction Working Hours

Heavy vehicle access and noisy construction activities will be from 07:00 hours to 19.00 hours Monday to Saturday. This restriction will apply to the delivery of the majority of materials to site. Any working outside of these hours will be agreed with Kildare County Council.

Delivery of the nacelles and blades will require the use of abnormally-sized and slow-moving vehicles. These vehicles may require a Garda Síochána escort; the timing of these deliveries will be agreed with Kildare County Council and the Garda Síochána where necessary. It is possible that, in order to minimise inconvenience to other road users, some of these deliveries will be made during the evening or at night.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 Introduction

This Environmental Management Plan (EMP) defines the work practices, environmental management procedures and management responsibilities relating to the construction of the Proposed Development.

This EMP describes how the Contractor for the main construction works will implement a site environmental management system (EMS) on this project to meet the specified contractual, regulatory and statutory requirements and environmental impact statement mitigation measures. This plan will be further developed and expanded following the grant of planning and appointment of the Contractor for the main construction works. Please note that some items in this plan can only be finalised with appropriate input from the contractor who will actually carry out the main construction works and once the planning conditions attached to any grant of planning are known. It is the contractor's responsibility to implement an effective environmental management system to ensure that the environmental requirements for the construction of this project are met.

All site personnel will be required to be familiar with the environmental management plan's requirements as related to their role on site. The plan describes the project organisation, sets out the environmental procedures that will be adopted on site and outlines the key performance indicators for the site.

- The EMP is a controlled document and will be reviewed and revised as necessary.
- A copy of the EMP will be located on the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the EMP and its contents.

This section includes the mitigation measures to be employed by the contractor and client during the construction, operation and decommissioning of the proposed development as per the Environmental Impact Assessment Report.

4.2 Project Obligations

In the construction of the Proposed Development there are a number of environmental management obligations on the developer and the contractor. As well as statutory obligations, there are a number of specific obligations set out in the Wind Farm EIAR. These obligations are set out below. The final CEMP which will be produced by the main contractor following appointment will incorporate these obligations. The contractor and all of its sub-contractors are to be fully aware of and in compliance with these environmental obligations.

4.2.1 EIA Obligations

The EIAR identified mitigation measures that will be put in place to mitigate the potential environmental impacts arising from construction of the project. These mitigation measures are set out in full in Section 4.3.

4.2.2 Planning Permission Obligations

All planning conditions associated with the project's planning permission shall be adhered to. All pre-commencement planning conditions shall be discharged fully by the project owner prior to site start.

4.2.3 Felling Licence

Any tree felling and vegetation clearance will be carried out outside of the bird nesting season (March 1st to August 31st inclusive).

Felling of coniferous forestry is required within and around the wind farm infrastructure to accommodate the construction of some turbine foundations, hard stands, crane pads, access tracks and substation. Turbines T6, T7, T8, T9, T10 and T11 are all located within forestry and consequently tree feeling will be required as part of the project.

The estimated maximum area of woodland tree felling required is ca. 28.4 ha, which will be subject to agreement with the Forest Service prior to construction.

Tree felling will be the subject of a Felling Licence from the Forest Service and will be in accordance with the conditions of such a licence. A Limited Felling Licence will be in place prior to any felling works commencing on site. The licence will include the provision of relevant replant lands to be planted in lieu of the proposed tree felling on the site.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

Before any harvesting works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The felling plan, surface water management, construction management, emergency plans and any contingency plans;
- Environmental issues relating to the site;
- The outer perimeter of all buffer and exclusion zones;
- All health & safety issues relating to the site.

4.2.4 Other Obligations

The developer and/or contractor for the main construction works will liaise directly with the County Council and An Garda Síochána in relation to securing any necessary permits to allow the works to take place including for example (non-exhaustive list):

1. Commencement notice
2. Special Permits in relation to oversized vehicles on public roads
3. Temporary Road Closures (if required)
4. Road Opening Licence (if required)

The developer will also liaise closely with the local residents, especially homeowners and landowners along the local access routes in relation to works and all reasonable steps will be taken to minimise the impact of the development on such persons.

4.3 Environmental Management Programme

This section outlines the EMP associated with the Proposed Development. The Management Plans should be read in conjunction with the EIAR. The contents of the management plans will be updated for the construction phase in line with any planning conditions that may apply.

4.3.1 Dust Management Plan

This Dust Management Plan (DMP) outlines the sources of dust during the works, identifies measures to minimise dust during the works and the complaints procedure for dust.

The principal sources of potential air emissions during the construction of the Project will be from: dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, the temporary storage of excavated materials, the construction of the proposed substation, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

The following dust control measures will be put in place during construction and decommissioning works:

Construction Stage Mitigation Measures

Construction stage mitigation measures to minimise dust and emissions are as follows:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate which compacts, preventing dust;
- A water bowser will be available to spray work areas and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable;
- The access and egress of construction vehicles will be controlled and directed to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the entrance/exit point of the proposed development site;
- The developer in association with the contractor will be required to develop and implement a dust control plan as part of this CEMP. This plan will address aspects such as excavations and haul roads, temporary stockpiling and restoration works. The plan will be prepared prior to any construction activities and will be established and maintained through the construction period. In the event the Planning Authority decides to grant permission for the Proposed Development, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Planning Authority;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and

- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

Decommissioning Stage Mitigation Measures

Mitigation measures for the removal of wind turbines and all other site works from the Proposed Development site will be the same as the construction phase with respect to dust control and minimisation. The proposed access tracks across the Proposed Wind Farm site will likely be left in situ and utilised as farm tracks and forest roads following decommissioning and no mitigation measures are proposed. In terms of the Proposed Substation, this will be left in situ and taken over by EirGrid and so no mitigation measures are proposed.

4.3.2 Noise and Vibration Management

A detailed study of noise and vibration generated as a result of project activities has been carried out as part of the EIAR.

The EIAR construction noise model appraised a number of tasks with the potential to generate noise. These tasks included: deliveries and/or removal of material to and from site, preparation of access roads and drainage, piling of foundations, concrete mixing and pouring of foundations, preparation of hardstands and drainage, installation of wind turbines and works associated with construction of the Proposed Substation and grid connection. A number of the tasks were found to potentially result in temporary elevated noise levels, prior to mitigation.

The potential for vibration at neighbouring sensitive locations during construction is typically limited to piling works, excavation works, rock-breaking operations and lorry movements on uneven road surfaces.

Noise associated with the operational wind farm turbines and associated electrical equipment has been assessed. The predicted operational noise levels were compared against the noise limits derived using the envelope based on the lowest average baseline noise levels. The operational predicted noise levels are compliant with the daytime and night-time noise limits at all receptors.

Upon decommissioning of the proposed wind farm, 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. These activities would be undertaken during daytime hours, and noise, which would be of a lesser impact than for construction, will be controlled through the relevant guidance and standards in place at the time of decommissioning.

Site access tracks could be in use for purposes other than the operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site access tracks in situ for future use. If the roads were not required in the future for any other useful purpose, they could be removed where required. This would involve removing hard core material and placement of topsoil. The impact is expected to be less than that during the construction stage.

A detailed description of the potential noise impacts associated with the Proposed Development can be found in Chapter 7 of the EIAR.

The following mitigation measures will be implemented to manage potential noise effects from the Proposed Development.

Construction Stage Mitigation Measures

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. Where turbine deliveries are required at night it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Consultation with the local community is important in minimising the likelihood of complaints and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site would be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out in the Construction Environmental Management Plan (CEMP). Proper maintenance of plant will be employed to minimise the noise produced by any 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 project. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity will be limited to avoid unsociable hours where possible. 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 fair weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

As discussed in section 7.5.1 of the EIAR, during the construction of the road for the turbine delivery route to the north of the site, there is potential for the noise limit to be exceeded at properties near the northern site entrance. Noise mitigation at this property could be provided by a combination phasing works and installation of a noise barrier between the turbine delivery route and the properties which are east and west of the access track. The noise barrier should just block the line of sight between the source and the receiver (highest window overlooking the construction works.

There is also a potential for the daytime noise limits to be exceeded during construction of the access track close to a family member of an involved landowner (R134), located east of the main southern site entrance. In addition, at this location, when the southern site entrance is used by HGV movements during all construction activities, there is potential for the daytime noise limit to be exceeded marginally (by up to 2dB). Note as a mitigation measure, access track layout has been moved eastwards to mitigate the construction noise impact at a property west of the site entrance. During the access track construction, the noise limits have the potential to be exceeded by up to 10 dB at location R134. Mitigation would be required both in terms of phasing works when close to the property and installing a noise barrier. A barrier will be installed on each side of the site entrance, and should extend from the site entrance northeastwards for approximately 80m, next to the proposed access track, in order to screen R134 and the property to the west of the site entrance. The height of the barrier should be 2.5m.

Barriers should have a minimum mass per unit surface area of greater than 7kg/m^2, with no gaps at the joints.

The predicted noise levels at other noise sensitive properties in this area are predicted to be below the construction noise limit.

With mitigation measures, the construction and decommissioning noise levels are predicted to be below the relevant noise limit of 65 dB LAeq,1hr for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. However, there is potential for temporary elevated noise levels due to the grid connection works. However, these works will be for a short duration (i.e. less than 3 days) and where the works are required over an extended period, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable.

Operational Phase Mitigation Measures

The results of the noise predictions presented in Section 7.5.2 of the EIAR and Appendix 7.4 (Volume 3 of the EIAR) show that operational noise levels meet the derived daytime and night-time noise limits at all residential properties (including mobile homes and planning applications) surrounding the wind farm. Therefore, no mitigation is required for windfarm operational noise. Appendix 7.3 (Volume 3 of the EIAR)provides full details on octave band spectra for standardized 10m wind speeds ranging from 3 m/s to cut out.

Decommissioning Stage and Mitigation Measures

The noise impact for construction works traffic would be mitigated by generally restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority. In addition any noise barrier mitigation identified during the construction phase would need to be considered, if noise sensitive locations are similar distances from the decommissioning works.

The decommissioning works, which will be at a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, typically 07:00-19:00 hours Monday to Saturday.

4.3.3 Biodiversity Management Plan

This section outlines the measures that will be put in place to protect flora and fauna species, in addition to natural and semi-natural habitats at the proposed development and describes how these areas will be managed during the lifetime of the project. This plan should be read in conjunction with the EIAR.

4.3.3.1 Objectives

The primary objectives of the management plan over the construction, operation and reinstatement phases of the project are as follows:

- Promote the conservation of habitats on site through the establishment of management and/or mitigation;
- Provide management and mitigation for aquatic habitats and water quality;
- Provide management and mitigation for avifauna;
- Provide management and mitigation for bats and terrestrial mammals;
- Monitor the usage of the wind farm site by birds post construction;
- Monitor for any collision by birds at the wind farm site post construction;
- Monitor for any collision by bats at the wind farm site post construction.

4.3.3.2 Current Site Status and Management

Existing ecological conditions are outlined in EIAR Chapter 8-1 (Biodiversity) and Chapter 8-2 (Ornithology).

4.3.3.3 Habitat and Species Mitigation and Management Requirements

The mitigation measures for ecology at the site are listed in Chapter 8-1 (Biodiversity) and Chapter 8-2 (Ornithology) of the EIAR. These include mitigation measures to prevent impacts on watercourses, to prevent disturbance to breeding birds, to limit habitat disturbance and limit impacts on terrestrial mammals and bats.

In addition, monitoring methods proposed to monitor bird and bat usage of the wind farm post construction are described, as well as fatality monitoring.

Further mitigation is also included in the NIS to prevent adverse effects on European Sites.

4.3.3.4 Mitigation by Avoidance and Design

The following measures were undertaken to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing areas of the wind farm have been kept to the minimum necessary, including all site clearance works to minimise land take of habitats and flora.
- Larger turbines have been utilised to minimise the number of turbines, reducing the total rotor envelope (less turbines) and footprint of the proposed development.
- Site design and layout deliberately avoided direct effects on designated sites and sensitive habitats such as raised bog, wet heath and mature broadleaved woodland.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers, lakes and streams. Access roads were the exception to the rule in that river crossings will have to take place; however, where possible, existing stream crossings have been utilised. Clear span bridges are to be used at the three stream crossing points on site to reduce the potential effect on stream beds and to avoid instream works (foundations will be located 2.5m from the river edge).
- Any works in or around watercourses will adhere to best practice as per NRA and IFI guidance for works potentially affecting watercourses.
- The use of floating road construction for access tracks in the vicinity of raised bog habitats will minimise potential for indirect drainage effects on these habitats.
- The use of piled foundations in areas near raised bog habitats will minimise foundation excavation volumes, thereby minimising potential indirect drainage effects on raised bog habitats.
- The hard-standing areas of the Proposed Substation has been kept to the minimum necessary including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct effects on designated sites and sensitive habitats. Specifically, the design avoided encroachment on the adjacent mature broadleaved woodland habitats to the east of the substation compound.
- All cabling with the exception of the locations of the high voltage line loop-in is to be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

4.3.3.5 Construction Stage EIAR Mitigation Measures

4.3.3.5.1 **Project Ecologist**

A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will be awarded authority to stop construction activity if there is potential for significant adverse ecological effects to occur.

This mitigation measure is applicable to the Proposed Wind Farm, Proposed Substation, Grid Connection and TDR.

4.3.3.5.2 **Proposed Mitigation Measures for Habitats**

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the Proposed Wind Farm and Proposed Substation have been kept to the minimum necessary, including the use of layout design methods to minimise excavation works.

No disturbance to habitats or flora outside the Proposed Wind Farm and Proposed Substation works areas will occur. All works and temporary storage of material will be restricted to the immediate footprint of Proposed Wind Farm and Proposed Substation works areas, which will be wholly within their respective site boundaries. Designated access points will be established within the site and all construction traffic will be restricted to these locations.

A Habitat and Species Management Plan (HSMP) is included in Chapter 8.1 of the EIAR. This details habitat restoration measures which are designed to avoid/minimise any potential conflicts between the Proposed Wind Farm and Proposed Substation and the positive effects of increasing habitat diversity in close vicinity to operational turbines. An appropriately qualified and experienced ecologist will review, implement/supervise and, where required, amend the proposed Habitat and Species Management Plan.

<u>Protection of Raised Bog (Proposed Wind Farm)</u>

In order to protect the existing raised bog and nearby groundwater wells from the effects of dewatering, groundwater cut-off techniques (such as sheet piling) will be used in preference to lowering of the water table (dewatering) during excavation and construction works in the vicinity of raised bog areas. This will avoid the possibility of significant drainage of the adjacent peat bogs. It should also be noted that the majority of excavations close to peat bogs will not extend much deeper than the existing drainage network. Any dewatering will be temporary, during construction only and will not have time to cause drainage of the peat, which due to the low permeability of the peat would result in very slow drainage. It is also proposed, following landowner agreement that drain blocking is carried out in the remnant area of raised bog to improve its condition; this would be a slight beneficial effect.

<u>Hedgerow and Treeline Reinstatement (Proposed Wind Farm)</u>

Any re-instated habitats such as Hedgerows will utilise native species suitable for the area.

Hedgerow and treeline planting will be carried out for the Proposed Wind Farm. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

New hedgerows will be planted along the outer perimeter of turbine buffers at T1, T2, T4 and T5 within the proposed wind farm site to mitigate linear wooded habitat loss and enhance and maintain connectivity in the agricultural landscape. Ash is not currently proposed to be used due to its vulnerability to ash dieback disease (ADB). However, if proven ADB resistant varieties of ash are available at the time of planting they can be used, in addition to other large-growing native species such as Alder and Oak. Smaller thicket-forming species such as elder, hazel and blackthorn will also be planted. Semi-mature specimens (heavy standard size) of native provenance will be included to accelerate establishment of new linear wooded habitats.

4.3.3.5.3 Proposed Mitigation Measures for Invasive Species

The following measures are applicable to the Proposed Wind Farm and Proposed Substation.

Prior to works, an invasive species survey will be undertaken in the area to reconfirm the findings of the EIAR.

The invasive species plan and management plan (ISMP) (EIAR Appendix 8.1-8) will be adhered to for works in any areas where invasive species are present.

Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication.

Prevention

Proposed Wind Farm

The Schedule III species *Rhododendron ponticum* was recorded in within the Proposed Wind Farm boundary in mixed broadleaved/conifer woodland adjacent to a section of proposed access track south of T8 (c. 15m from proposed T8 hard standing/20m from access track felling corridor), and also recorded in conifer plantation c. 170m north-east of T9 (outside Proposed Wind Farm boundary). Snowberry is present c. 15m from a section of proposed access track. Cherry laurel is present at two TDR POIs (1 & 3).

Where feasible, interaction with invasive species and surrounding areas potentially containing vector material will be prevented. If baseline conditions persist, prevention of the spread of invasive species by avoidance may be feasible. If this is not feasible then containment, treatment and eradication as detailed below will be required.

Proposed Substation

No invasive species are present within the Proposed Substation footprint. As such, if baseline conditions remain unchanged, interaction with proposed works is avoidable. Due to the possibility of spread of invasive species in the intervening period, a preconstruction invasive species survey is required as part of the invasive species management plan (ISMP) (EIAR Appendix 8.1-8). Containment and eradication measures are detailed in the ISMP which will be used as required in the event of changes to the invasive species baseline.

Containment, Treatment, Eradication

The presence sycamore and butterfly bush within the Proposed Wind Farm footprint, in addition to their tendency to spread reproductively means that containment measures will be required for these species. The following measures are also applicable to *Rhododendron ponticum,* cherry laurel and snowberry in the event that preconstruction surveys detect any risk of spread due to new growths becoming established within or in close proximity to the proposed works footprint.

- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infestation to ensure that seeds are not transported to other sections of the site via vehicular traffic, equipment or PPE.
- No machinery or personnel shall be allowed within this restricted area. Similarly, there shall be no storage of materials within or adjacent to this restricted area.
- There shall be no vegetation clearance or trimming within the cordoned area (except where undertaken in accordance with the invasive species management plan) as this can lead to the species recolonising other areas via the wind, water if displaced into drains, or soil and vegetation attached to machinery, vehicles or personnel.
- If Schedule III species are present, no soil or vegetation shall be removed from this area unless it is securely contained and is transported under licence to a suitably licenced facility for treatment.
- For non-schedule III species, no soil or vegetation shall be removed from this area unless it is securely contained and is to be disposed of appropriately onsite or transported to a suitably licenced facility for treatment.
- A wheel wash, draining to a secure waste receptacle will be implemented at the site entrance to prevent the possible spread of any invasive species via vehicular movements.
- All site machinery will be inspected for the presence of potential invasive plant vector material and where required will be washed down before entering the site to prevent inadvertent transport of invasive plant species vector material.

- Any site machinery intended for use in or near aquatic habitats will be washed down and sterilised before entering the site to prevent inadvertent transport of invasive species vector material.
- Site machinery working in areas with potential for invasive species to occur will be checked and washed down prior to exiting these areas and moving to other parts of the proposed site.
- Informing all site staff through toolbox talk as part of site inductions.
- Any new sightings of the species shall by relayed to construction staff and the developer via the project ecologist/ECoW. These areas shall follow the same protocol as described above.
- Reporting sighting(s) to the NPWS and NBDC and liaising with the NPWS.

Treatment and eradication options for each species are detailed in the ISMP. The eradication of the area of *Rhododendron ponticum* recorded near T8 is proposed in order to remove this reservoir which if left untreated would continue to pose an ongoing risk of site-wide infestation over the long term. Removing this source of infestation at construction stage will prevent more arduous control measures later on if this species was left unchecked and spread throughout the site. Physical removal of mature plants outside the flowering season, followed by targeted herbicide stump treatment and annual follow-up spraying of any new emergent shoots is considered to be the optimal eradication strategy.

The other area of *Rhododendron ponticum* (100m east of Proposed Wind Farm/c. 170m north-east of T9) will require monitoring during the operational phase.

4.3.3.5.4 Proposed Mitigation Measures for Terrestrial Mammals

An ecologist will supervise areas where vegetation, scrub, treeline and hedgerow removal will occur prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. badger setts) on site will be confirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Construction operations within the proposed development will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works along the cable route may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route which avoid sensitive features (e.g. mature treelines).

Where possible tree felling in forestry areas will be limited to time periods outside which pine martens may have young in dens (March and April). If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied pine marten dens are present. A necessary license under the wildlife act will be applied for should any sites have to be disturbed.

Where possible any required tree felling of trees in forestry areas will be limited to time periods outside which red squirrel may have young in dreys (peak period January to March).

If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied dreys are present. A necessary license under the Wildlife Act will be sought.

4.3.3.5.5 Proposed Mitigation Measures for Badgers

A pre-construction mammal survey including a reconfirmatory survey for any new badger setts will be undertaken within the potential zone of influence of the Proposed Wind Farm and Proposed Substation in order to reconfirm the existing environment as described in the EIAR. In the event that a new badger sett should be encountered at any point, then NPWS will be informed and *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* (NRA, 2008c) and will be followed.

A total of 21 badger setts were observed within the study area during current surveys. Mitigation proposed for these setts is detailed in Table 4-1, and additional details on specific locations are included in the confidential badger mitigation report which accompanies this application. The presence of four additional badger setts in the surrounding hinterland is also noted. All of these setts are over 150m from proposed infrastructure and construction activities and as such they do not require detailed assessment or mitigation. Their presence is noted as they are relevant when assessing the local badger population at the landscape scale.

A total of two subsidiary setts (Setts 1 & 2) are located within 30m of proposed infrastructure but are separated by a deep drainage channel, screened by vegetation and face away from works. As such, it is proposed to keep these setts open during construction (with monitoring) since they are unlikely to be damaged or disturbed, and would not be used for breeding. A total of two setts (Setts 4 & 7) are overlapped by proposed works to the degree that controlled destruction following exclusion or hard blocking is required. It is proposed to excavate within 30m of one sett (Sett 5) under ecological supervision following exclusion or hard blocking, but to retain the remainder of the sett and re-open it following construction. This course of action is proposed due to potential for the majority of the sett to remain intact, and to avoid additional tree felling which would be required to excavate the whole sett.

A total of two setts: Setts 19 (main sett) and Sett 20 (subsidiary) require hard blocking for the duration of construction, following exclusion as required. One sett (Sett 21) requires screening to provide a noise/visual barrier for the duration of construction.

The remainder of setts require monitoring or no mitigation measures. All main setts will be retained, and will be kept open in the majority of territories.

The exception to this is Sett 19. This main sett requires exclusion outside the breeding season followed by hard blocking for the duration of construction, however the presence of a nearby large Annex sett (Sett 21) located 120m from Sett 19 within the same densely vegetated field boundary provides an adequate alternative resting and breeding place while Sett 19 is hard blocked. A noise/visual barrier will be erected along the north-west and south-west edges of the site compound to screen Sett 21 from the site compound during construction.

No requirement for an artificial sett has been identified due to retention of the majority of setts, and availability of suitable alternative setts which will remain open and undisturbed near areas where setts are required to be excluded/hard blocked during construction. The option to create an artificial sett will be retained nonetheless (see confidential badger report).

The specific measures proposed for each sett are summarised in Table 4-1. Detailed procedures and requirements for implementation of mitigation for disused and inactive setts, active setts, vegetation clearance, prevention of injury to badgers and sett destruction are detailed in EIAR Chapter 8.1 Section 8.10.1.6.1.

Table 4-1: Proposed Badger Mitigation

Sett No.	Type	Closest Infrastructure/Activities	Mitigation
1	Subsidiary	Proposed northern access track (27m) Proposed northern access track felling buffer (20m)	Monitoring. This sett is separated from proposed works by a deep drain, vegetation cover and faces away from works.
2	Subsidiary	Proposed northern access track (21m) Proposed northern access track felling buffer (14m)	Monitoring. This sett is separated from proposed works by a deep drain, vegetation cover and faces away from works.
3	Main	Existing access track to form part of northern site access route (115m) Substation compound (250m)	Monitoring
4	Annex	T6-T7 access track (0m) Overlapped by access track and access track felling buffer.	If inactive - hard blocking/if active - exclusion during non-breeding season. Followed by controlled destruction prior to access track construction.
5	Annex	T6-T7 access track (12m) Access track felling buffer (5m)	If inactive - hard blocking/if active - exclusion during non-breeding season. Preconstruction check, ecological supervision and controlled excavation of road footprint within 30m of sett. Monitoring. Reopen following construction.
6	Main	T6-T7 access track (158m)	Monitoring
7	Annex	T5 hard stand (overlaps sett)	If inactive - hard blocking/if active - exclusion during non-breeding season. Followed by controlled destruction prior to hard stand construction.
8	Subsidiary	T5 hard stand (83m) T5 felling buffer (20m)	Monitoring
9	Subsidiary	T4 (590m)	None Required

Sett No.	Type	Closest Infrastructure/Activities	Mitigation
10	Main	T3 (623m)	None Required
11	Annex	T3 (607m)	None Required
12	Subsidiary	T3 (461m)	None Required
13	Outlier	T3 (252m)	None Required
14	Outlier (potential)	T2 felling buffer (76m) Access track (89m)	Monitoring
15	Main	Access track (89m) T2 felling buffer (147m)	Monitoring
16	Subsidiary	Access track (137m) T2 (186m)	Monitoring
17	Subsidiary	Access track (101m) T2 (126m)	Monitoring
18	Annex	Access track (127m) T2 (155m)	Monitoring
19	Main	Access track (10m) Site compound (24m)	If inactive - hard blocking/if active - exclusion during non-breeding season. Monitoring. Reopen following construction.
20	Subsidiary	Site compound (27m)	If inactive - hard blocking/if active - exclusion during non-breeding season. Monitoring. Reopen following construction.
21	Annex	Site compound (38m)	Erect noise/visual barrier during non-breeding season to screen sett from site compound. Monitoring.

4.3.3.5.6 Proposed Mitigation Measures for Otter

A pre-construction mammal survey will be undertaken within the footprint of the development to reconfirm the existing environment as described in the EIAR. In the event that a new otter holt should be encountered at any point, then NPWS will be informed and *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA, 2008d) will be followed.

Works will be restricted to the Proposed Wind Farm and Proposed Substation footprints, ensuring no activities are undertaken in areas which could potentially result in disturbance to otters.

Due to the distance separating Holt 1 from proposed infrastructure (over 150m), no mitigation other than trail camera monitoring is required.

In the case of the low-potential inactive Holt 2, due to unsuitability for breeding otter, no mitigation other than trail camera monitoring is required. Similarly, the burrow north of T6 which could potentially be used as a holt but currently lacks any signs of use by otter will require trail camera monitoring.

A report detailing the results of monitoring surveys will be submitted to the planning authority.

A toolbox talk shall be provided to all construction workers accessing the site to raise the awareness of the species. If otters do attempt to reoccupy the site all works shall cease within 30m of this area and the project ecologist/ECoW shall consult with NPWS. The area shall be treated as an active holt and the procedure outlined above shall apply in full.

<u>Vegetation clearance</u>

If new holts are discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works.

If a new holt is discovered all works within 30m of the holt shall be ceased including vegetation clearance. NPWS shall be contacted and a derogation licence shall be sought for the new holt.

An activity survey shall be carried out to assess the potential for the holt to be used by otters and whether or not it is a breeding female. Any measures undertaken following discovery of a new holt will be in accordance with *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA, 2008d) and licensing requirements.

<u>Measures to prevent the injury of otter during proposed mitigation measures</u>

In the event that an otter is found injured during the implementation of mitigation measures, it is important to realise that an otter is a wild animal so if injured it is highly likely to be frightened and can inflict injury. As a wild otter is not used to being handled, do no attempt to touch an injured otter, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

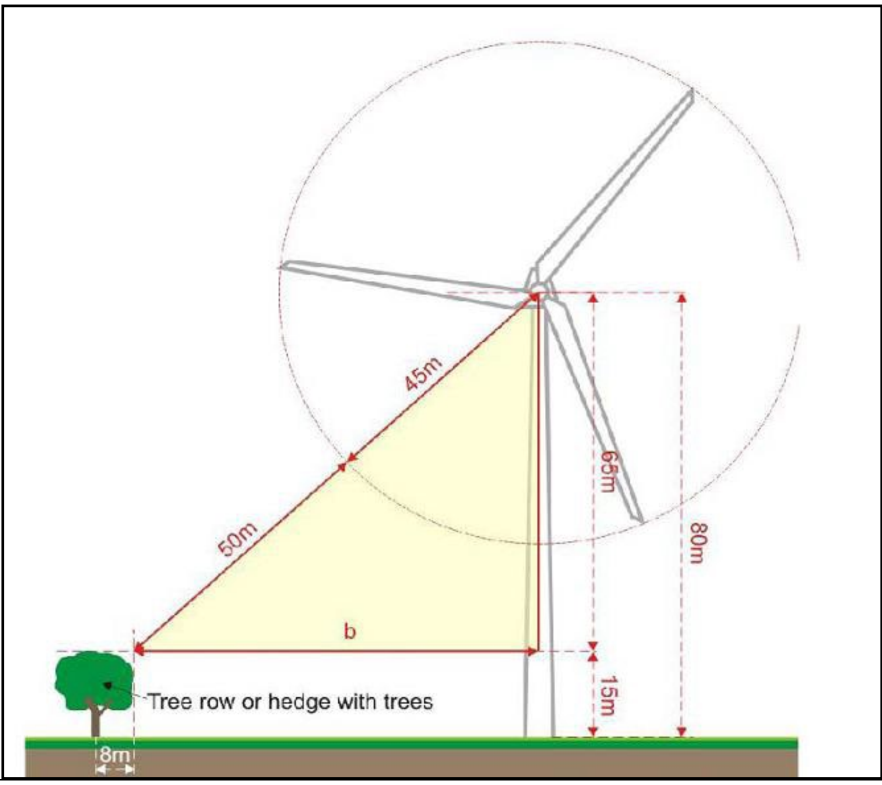
4.3.3.5.7 Proposed Mitigation Measures for Bats

Vegetation Buffer

According to SNH (2021) guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning. "*

These distances were taken into account during the design phase of the development. The following formula was used to calculate the required felling buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$b = \sqrt{(50 + \mathrm{bl})^2 - (\mathrm{hh} - \mathrm{fh})^2}$

where:

b = the distance on the ground between the edge of the canopy and the turbine (m)

bl = blade length (m)

hh = hub height (m)

fh = tree/hedgerow height

Each of the locations of the eleven turbines was surveyed and the vegetation height informed the application of the dimensions of the blade tip buffer at turbine locations, dependant on the surrounding habitat and turbine specification. The likely growth of hedgerow/treeline/forestry was taken into account for the calculation. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 4-2 below.

It should be noted that the proposed hub height for T1 is 81.4m for T1, versus 100.5 for all other turbines, resulting in a larger felling buffer for T1 compared to other turbines with the same height of surrounding vegetation.

To minimize risk to bat populations, a buffer zone is recommended around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers recommended for each turbine are presented in Table 4-2.

Table 4-2: Assessment of potential turbine/bat conflict zones [1]

Turbine number	Habitats Requiring Felling	Surrounding Tree/Hedgerow Height (fh/m)	Felling Buffer Radius (m)
T1	Hedgerow/Treeline Mosaic	12	93.5
T2	Hedgerow/Treeline Mosaic	12	75.8
T3	Hedgerow/Treeline Mosaic	12	75.8
T4	Hedgerow/Treeline Mosaic	12	75.8
T5	Hedgerow/Treeline Mosaic	12	75.8
T6	Conifer Plantation	20	84.2
T7	Conifer Plantation, Mixed Broadleaved/Conifer woodland, Bog Woodland	15	79.1
T8	Mixed Conifer Woodland, Mixed Broadleaved/Conifer woodland, Bog Woodland, Scrub	12	75.8
T9	Conifer Plantation	15	79.1
T10	Conifer Plantation	6	68.1
T11	Conifer Plantation, Mixed Broadleaved/Conifer Woodland, Bog Woodland	20	84.2

[1] Based on turbine hub-height and blade length which for T1 is 81.5 and 66.5 m respectively and 100.5m and 66.5m respectively for all other turbines.

Existing trees / scrub will be cleared around ten proposed turbines, T1, T2, T4, T5, T6, T7, T8, T9, T10 and T11 to provide a vegetation-free buffer zone around each turbine. The minimum distance has been taken into consideration for felling of conifer plantation around wind turbines. All buffers will be maintained throughout the lifetime of the wind farm. Due to sufficient existing separation from treelines, T3 does not require any felling to achieve the required 75.8m buffer.

It is noted that an enlarged buffer using a 90m distance from turbine blade tips to surrounding vegetation was recommended to be implemented in the 2019 bat assessment. This was based on high Ecobat activity levels for Leisler's bat for a number of turbines. Since the current assessment indicates none of the turbine locations are above low/moderate risk for Leisler's bat, this precautionary extension of the felling buffers is not required.

The following mitigation measures for bats are recommended:

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand).

It is recommended to complete clearance work during the autumn and spring months. Complete clearance work at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to precleared felled levels.

Diversion from turbines via Hedgerows and Treelines

Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). Vegetation buffer clearance around turbines will alter commuting and foraging routes associated with existing hedgerows and woodland edges to avoid bats entering the rotor sweep zone of turbines. Hedgerow and treeline planting will be carried out for the Proposed Wind Farm. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

Where hedgerows and treelines are affected by turbine clearance buffers, bats will be directed away from tree-free buffers along an alternative commuting route. Where bat buffers are applied, the surrounding hedgerows and treelines should act as commuting corridors, leading bats away from the turbine location, and these hedgerows should not end abruptly at the bat buffer zones. This will be achieved by planting new pollinator-friendly hedgerows, connecting existing hedgerows onsite, around the bat buffers. Willow and Alder will be included in these hedgerows due to their rapid growth. It is proposed to create double lines of hedgerow, with Willow on one side, and pollinator-friendly hedgerow species listed below on the other. Planting of these species will be staggered to prevent excessive shading and aid establishment of the hedgerows.

All hedgerow planting is required to use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. 2–3-year-old alder and willow trees are required for hedgerows to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species are to be planted along the inner edges of these hedgerows: grey willow *Salix cinerea* and alder *Alnus glutinosa*. The following native fruiting hedgerow species are to be planted along the outer edges of these hedgerows: blackthorn (*Prunus spinosa)*, elder (*Sambucus nigra)*, Holly *(Ilex aquifolium)* and rowan *(Sorbus aucuparia)*.

Tightly cut hedgerows with flat tops provide little benefit to wildlife; taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. A finger-bar cutter is recommended as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Brown Long-eared Bat and Whiskered Bat are highly averse to artificial night lighting. Artificial night lighting will be avoided throughout the site. Construction operations within the wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

It is understood that flashing red aviation lights will be provided on perimeter turbines. These will not negatively effect bats (Bennett and Hale, 2014).

Pre-construction Surveys

If three years lapse from between planning-stage surveys in 2023 and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period prior to construction. Future survey work will be completed according to best practice guidelines available (SNH, 2019/ 2021; Hundt, 2012 & Collins, 2023).

A survey of trees proposed to be felled to search for potential bat roosts prior to construction.

Based on current surveys, a total of 12 trees with potential for use by individual or small numbers of bats are present within turbine felling buffers and will require felling if the wind farm is granted permission. This will result in the loss of potential or actual bat roosting (and foraging) opportunities. Best practice in tree-felling with respect to protection of potential bat roosts should be employed, including pre-felling emergence surveys and hiring a climbing specialist with bat training and licensing to check roost features with an endoscope for bats where necessary.

The eight trees with PRFs or potential for PRFs along the TDR potentially subject to effects from vegetation trimming will require similar measures (pre-trimming works emergence surveys and where required inspection at height).

If new bat roosts are present in areas affected by proposed felling, a bat derogation license will be sought from the National Parks and Wildlife Service.

Relocation/Retention of Bat Boxes and PRFs

Bat boxes 4 and 5 adjacent to the proposed/existing access route will be replaced with new boxes (4a and 5a) located directly north along the woodland edge bordering agricultural fields (approx. location ITM 676282 737906). This will mitigate any direct effects to these bat boxes associated with upgrade works to this section of access track, in addition to providing boxes in optimal condition for use by bats.

Following confirmation that bats are absent prior to felling, the tree PRF (knothole in trunk) of tree C will be retained and relocated to the riparian zone along the Fear English River North of T4. This will be achieved by cutting out the section of trunk containing the PRF following felling, and strapping it to a suitable mature tree along the Fear English riparian zone at similar height (3m or higher). If this is not feasible, a bat box will be provided along the Fear English riparian zone.

4.3.3.5.8 Other Species

Pre-construction surveys for breeding frog will be undertaken within the development footprint to reconfirm the findings of the EIAR and account for the potential time lag between EIAR surveys and the proposed construction phase. These will consist of searching suitable areas for spawn clumps during February as per NRA guidelines. In the event that frog spawn is found within the development footprint, this will be translocated under licence to suitable receptor sites outside the Proposed Wind Farm footprint. Where breeding ponds could potentially be indirectly affected, measures to prevent effects (alternative drainage routing, control of contaminants) will be implemented where feasible. Where effects cannot be avoided, construction will not take place in these areas during frog breeding season (January to June). These restrictions shall be localised to the areas were frog spawn is found. There is potential for an indirect effect on frogs and smooth newt due to water quality changes from erosion/sediment or pollutants. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, triggering remedial measures in the event of reduced efficacy. All measures to protect aquatic ecology and prevent reductions in water quality will also protect frogs and smooth newt.

For common lizard, vegetation will be felled and removed near the proposed turbine locations outside of the peak breeding season (July-August) to displace any lizards present and reduce the risk of effects and injury to individuals. This measure will be implemented in areas of suitable habitat as per the findings of the lizard report (Appendix 8.1-6) (Triturus, 2023) (i.e. proposed grid connection and turbine T11 but also T6, T8 & T9 based on previous findings). Furthermore, targeted pre-construction surveys, and where required relocation will be conducted at the proposed works locations known to support common lizard, with trapping methodologies employed to maximise lizard capture and minimise risk to overall lizard populations.

Preconstruction surveys for marsh fritillary (habitat appraisal, and if any change to the baseline suitable habitat is detected also a follow-up larval web survey) will be undertaken to reconfirm the findings of the EIAR. If optimal habitat establishes and marsh fritillary larvae are found within the Proposed Wind Farm footprint prior to construction, translocation of turves and larval webs to suitable receptor areas outside the footprint will be undertaken. This will be achieved by marking the location of pupae/larvae, and carefully excavating the surrounding sod under ecological supervision. Translocated sods will be placed in receptor sites which have been excavated to receive the sods. Receptor sites will be located nearby in similar habitat with abundant *S. pratensis*. If required, translocation will be carried out immediately following the survey during September to ensure pupae/larvae can be relocated.

A pre-construction reconfirmatory survey for key ecological receptor bee species requiring mitigation (Barbut's cuckoo bee, Barbut's Cuckoo Bee, gipsy cuckoo bee, large red tailed bumble bee and patchwork leafcutter bee) will be carried out within the development footprint during other pre-construction surveys (mammal, amphibian and reptile surveys). In the event that a colony is found within the footprint, the structure will be left in situ until the bee's breeding cycle is complete, and then translocated prior to construction works.

4.3.3.5.9 Aquatic Ecology

IFI advice arising from consultation has been taken into account in design of watercourse crossings, and mitigation measures contained in this section.

A Surface Water Management Plan is included in the CEMP, and has regard to guidelines included in 'Guidelines for the crossing of watercourses during the construction of national road schemes' (NRA, 2008b) and 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' (IFI, 2016). This is considered to be the key mitigation measure for the protection of aquatic species located in downstream receiving waters. The Surface Water Management Plan will set out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. It will also include preparatory works on the site, including installation of silt fences and bunds.

A CEMP has been prepared and this will be distributed to all parties involved in the construction of the wind farm site (including any sub-contractors) in order to protect aquatic interests within the study area.

All access tracks have been designed to minimise excavation on the site and reduce the risk of sediment runoff. A sealed silt fence will be placed at both sides of the crossing points and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. Swales for turbine bases and hard standings will be constructed.

All infrastructure shall have a setback 50 m away from all streams within the site except for the watercourse crossings and the southern temporary compound which is within 15m of the Fear English River. Where site tracks are existing rather than a new site track, this buffer will not apply. Any access tracks crossing watercourses will be constructed as clear span bridges, where instream works are not permitted.

Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system set out in the CEMP.

Spoil heaps from the excavations for the turbine bases and trenches (where cables are to be buried) will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Berms will be compacted and planted with native species seed mixes to promote soil stabilisation and minimise sediment runoff; the berm north-east of T5 will be surrounded by silt fencing until vegetation has been established in the following growing season to minimise potential for sediment runoff into the adjacent drainage ditch. If cables will be installed in trenches, they will be located underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

An Emergency Erosion and Silt Control Response Plan is included as a contingency in the CEMP, which details the required measures for the Contractor to implement in the event of an emergency on the site. Timing of the proposed works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–March annually), which also avoids the lamprey spawning season, as a precautionary measure.

Secure concrete washout areas have been designated on site and are detailed in the CEMP. Standing water in the excavations at the turbine bases will contain an increased concentration of suspended solids. The excavations will be pumped into temporary settlement basins as necessary which will be lined, and which will drain into existing or proposed drainage channels on site. The settlement basins will be constructed in advance of any excavations for the turbine bases.

A wheel washing facility will be provided at the main site entrance. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a proposed contractor.

Additional silt fencing will be kept on site for the ongoing maintenance of the structures provided. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor and will not be discharged on site.

Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out in designated areas within site the site compound 50m away from watercourses, draining to an oil interceptor. A 100m buffer from watercourses shall apply for any refuelling carried out using mobile bowsers. Drip trays and spill kits will be kept available on site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off site for disposal at an appropriately licensed facility.

Appropriate preventative measures have been detailed within the CEMP to ensure that non-native aquatic/riparian species are not introduced into the site. These measures follow the relevant manual 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' by NRA (2010). While no high threat non-native aquatic invasive species were recorded at the survey sites during the current survey, the potential for the introduction of aquatic invasive species onto the site from other areas remains.

Strict biosecurity measures will be implemented if plant and machinery working in areas with invasive species along the grid route is used at the wind farm site. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

To reduce the risk of invasive species and pathogen introduction (e.g. Crayfish plague), all equipment intended for use within or in the vicinity of aquatic habitats will be thoroughly checked, cleaned and dried in accordance with best practice as specified in the CIRIA C532, C648 and C741 guidelines below. Furthermore, plant machinery which has worked within riparian corridors or come in to contact with water will be steam-cleaned and dried in advance of works commencement in the Blackwater catchment.

Works will adhere to the guidelines set out in the best practice documents as listed below:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.

- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019b). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

In addition to the above, all mitigation measures to protect water quality detailed in Chapter 10 Hydrology and Water Quality shall apply.

4.3.3.5.10 Proposed Mitigation Measures for Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub as well as trimming of trees to facilitate the proposed development will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

Where vegetation removal is required outside this period, vegetation will be inspected for nesting birds by a suitably qualified Ecologist. In the event of birds nesting within areas required to be felled, suitable mitigation including implementation of buffer zones and/or seasonal constraints (based on known breeding cycle of species) and nest monitoring will be put in place. Similarly for swallow, the shed within the proposed northern access track footprint will be checked for evidence of re-occupation by swallows and if any are present, a seasonal restriction on demolition will be implemented. It is noted that nest buffer zones required for different bird species can vary widely. Birds which could be encountered during vegetation clearance include small passerines, woodcock and raptors. On a precautionary basis, a minimum buffer of 10m will be implemented around any active small passerine nests. A 500m buffer will be applied for nests of higher sensitivity raptor species such as kestrel, peregrine or merlin if any become established within the ZoI prior to construction. A 200m buffer will be applied in the same category for lower sensitivity species such as sparrowhawk and buzzard. (Goodship and Furness, 2022). A buffer of 250m is specified for woodcock nests.

A re-confirmatory survey (March/April) will be conducted of the proposed infrastructure to assess any evidence of target species activity or occupation of new territories (e.g. in the case of breeding Snipe or Woodcock). Should any nesting locations be recorded, works at these locations will be restricted to outside the breeding season (March 1st to August 31st inclusive) or until chicks are deemed to have fledged (following monitoring). A 500m buffer is required for breeding snipe. A buffer of 250m is specified for woodcock nests.

Grazing whooper swans using the fields near T1-T3 will be monitored prior to and during construction to detect if any disturbance/displacement occurs, and also to investigate whether habituation to construction disturbance occurs. In the event that wintering whooper swan are regularly using areas within or in close proximity to the proposed wind farm prior to construction, or if significant disturbance/displacement occurs (as determined by the ECoW/Ornithologist), a 600m exclusion zone around winter grazing areas will be implemented until wintering whooper swans have left in spring.

Based on the established absence of breeding kingfisher and poor suitability of riverbank soils along the Fear English River for kingfisher nesting, it is unlikely that breeding kingfisher will move into the ZoI prior to construction. A preconstruction kingfisher survey will be undertaken to reconfirm the baseline. In the event that breeding kingfisher did become established in the ZoI prior to construction, a 50-100m (buffer size dependent on occurrence of existing screening features) exclusion zone will be implemented around active kingfisher nests during the kingfisher breeding season (March - August inclusive), with ecological monitoring to confirm the start and end of the exclusion period.

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance.

Where removed or altered, re-instated hedgerows will be planted with native species of native provenance. This will result in habitat enhancement for local species of conservation importance such as yellowhammer. Further information relating to hedgerow planting are included in Sections 8.10.1, 7.3 and 8.12.5 in Chapter 8-1 Biodiversity.

The measures to protect water quality described in Chapter 8-1 Biodiversity and Chapter 10 Hydrology and Water Quality will benefit kingfisher through protection of aquatic habitats and associated aquatic prey resources.

The use of “white lights” on the turbines will not occur as these can attract night flying birds such as migrants, and insects, which in turn can attract bats. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where required by the IAA Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

The above measures are in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. and Langston, R. H., 2006).

4.3.3.5.11 Habitat & Species Management Plan (HMP)

A Habitat and Species Management Plan (HSMP) has been prepared for the Proposed Development, as detailed in Section 8.12 in Chapter 8-1 Biodiversity. Within this plan, the following measures are applicable to avifauna;

Revegetation of access track buffers and berms in wooded areas through natural recolonisation and targeted planting will offset the potential effect of wooded habitat loss for woodcock and other species. Within wooded areas, bog woodland bare root whips (60-90cm in height), sourced from native stock and disease free will be planted on selected berms outside bat felling buffers. Whips will be planted at 1m centres with the following mix: 20% downy birch (*Betula pubescens*), 10% holly (*Ilex aquifolium*), 15% rowan (*Sorbus aucuparia*), 20% scots pine (*Pinus sylvestris*), 10% pedunculate oak (*Quercus robus*), 10% sessile oak (*Q. petraea*) and 15% willow (*Salix cinerea*). Rabbit/hare protection will be put in place alongside weed suppressing leaf mulch. Any whips that die will be replaced (during the operational phase).

Berms in open agricultural habitats will be planted with native pollinator-friendly species. This will also provide benefits for foraging birds in the form of seeds and insect prey.

Bird boxes (5 No.) will be placed within the limited treelines within the site. This will help to provide further breeding habitat for birds on the site.

Proposed Mitigation Measures for Water Quality

Under Section 173 of the Fisheries (Consolidation) Act, 1959, it is an offence to 'obstruct the passage of the smolts or fry of salmon, trout, or eels or injure or disturb the spawn or fry of salmon, trout or eels or injure or disturb any spawning bed, bank or shallow where the spawn or fry of salmon, trout or eels may be'.

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.

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 any substance that is liable to injure fish; 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.

Under the European Community (Surface Water) Regulations, 2009, it is noted under Part III, Section 33 that 'Failure to achieve good ecological status, or where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water resulting from new modifications or alterations to the physical characteristics of a surface water body, or failure to prevent deterioration of a body of surface water from high status to good status resulting from new sustainable human development activities shall not be a breach of these Regulations when all the following conditions are met:

All practicable steps are taken to mitigate the adverse impact on the status of the body of surface water.

The reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 of the 2003 Regulations and the objectives are reviewed every six years.

The reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives established by Article 28 of these Regulations are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

The beneficial objectives served by these modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option'.

It is therefore imperative that no significant impacts (direct, indirect or cumulative) occur on the streams on the site or the downstream catchment areas during the construction, operation of decommissioning phases of the Proposed Development.

Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined in Section 4.3.5. These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into the nearby watercourses to which the proposed development site discharges.

4.3.3.6 Operational Phase EIAR Mitigation Measures

Mitigation measures outlined in section 10.9.3 and Chapter 10 - Hydrology and Water Quality of the EIAR, will be implemented, in addition to those described in the NIS to minimise and prevent the identified indirect effects on water quality as outlined previously.

4.3.3.6.1 Ecological walkover check - bat felling buffers

An ecological walkover survey covering the bat felling buffers will be undertaken prior to mechanical vegetation clearance to maintain these buffers as tree and scrub-free zones. This survey will ensure any potentially sensitive receptors which may establish in the buffers during the operational phase are detected prior to clearance, allowing significant effects to be avoided via avoidance/timing and other suitable mitigation as required. Species-specific surveys encompassed within the general ecological walkover survey are discussed further where applicable below (Chapter 8.1 Sections 4.3.3.6.2 to 4.3.3.6.6).

4.3.3.6.2 Habitats, Flora & Invasive Species

Mitigation measures outlined in section 10.9.3 and Chapter 10 - Hydrology and Water Quality of this EIAR, will be implemented, in addition to those described in the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

A post-construction Annex I survey and habitat assessment will be carried out on the intact raised bog adjacent to T9 and T10 to determine the habitat condition and monitor the effectiveness of design/avoidance mitigation measures in preventing drying out of this habitat.

Invasive species will continue to be monitored, and where required, treated within the project area according to the invasive species management plan for as long as they persist within the site. Monitoring will entail site-wide checks, and will also focus specifically on the Rhododendron growth 100m east of Proposed Wind Farm/c. 170m north-east of T9, and checking for invasive species in bat felling buffers prior to periodic mechanical clearance works.

In the event that any invasive species are detected during the operational phase in areas where they could potentially interact with/be spread by operational activities, the procedures and control measures detailed in the ISMP (Appendix 8.1-8) will be followed.

4.3.3.6.3 Mammals

In the event that a new badger sett is discovered during maintenance of bat felling buffers (vegetation trimming), NPWS will be informed and the relevant guidance *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* (NRA, 2008c) and will be followed.

The bat buffer pre-clearance badger survey shall extend 50m beyond the bat felling buffers.

4.3.3.6.4 Bats

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed (SNH 2021). This is usually achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn et al., 2008). The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities by up to 50% (SNH 2021). As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

While bat activity varied by species, no locations had activity for any species higher than low/moderate levels (based on Ecobat median percentile scores).

Therefore, increased cut-in speeds are not required from commencement of operation, but will rather be reserved for implementation where required based on operational monitoring (see Sections 0 and 0).

Post Construction Surveys

Monitoring of bat activity at turbine locations using static detectors will take place for at least three years after construction, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment requirements.

During years one to three of operation bat activity will be measured during monitoring periods between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern, remotely-operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful effects to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% and up to 90% (Adams et al., 2021, Arnett et al., 2011, 2013; Baerwald et al., 2009). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Operational Curtailment

Monitoring will be carried out for the first three years of operation, and an annual review at the end of each of these years will determine whether increased cut-in speeds should be implemented.

If, following any of the initial three years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will be implemented.

Alternatively, if it is found that the results of bat activity surveys and fatality searches reconfirm the level of bat activity at turbine locations remains low or low/moderate then curtailment will not be required.

Bat activity will subsequently be monitored in years 5, 10, 15, 20, 25 and 30 with further review after each monitoring period.

Where post construction acoustic surveys are undertaken, they will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by SNH (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

If the requirement for curtailment is identified following the initial 3-year monitoring period, the following measures will be implemented:

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett et al. (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular could benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

If required based on operational monitoring results, cut-in speeds should be increased to 5.5 m/s during the bat activity season (April-October) or where temperatures are optimal for bat activity, from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High and Medium-Risk species and/or if bat carcasses are recorded.

The duration required depends on the level of mitigation required for each individual turbine i.e. a full bat activity season or only spring and autumn (duration will be determined by the first year of surveillance).

Cut-in speed restrictions will be operated according to specific weather conditions:

- When the air temperature is greater than 7°C (as bat activity does not usually occur below this temperature).
- Generally, bat activity peaks at low wind speeds (<5.5m/s). As such, it has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, particularly during late summer and the early autumn months.

Due to the considerable unnecessary down time resulting from the "blanket curtailment" and the advances in smart curtailment a focused curtailment regime is further proposed as an optional means of achieving the level of curtailment indicated as required by operational monitoring.

This will focus on times and dates, corresponding with periods when the highest level of bat activity occur within the Site. This includes the use of the SCADA (Supervisory Control and Data Acquisitions) operating system (or equivalent) to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

Post-construction surveys will be undertaken for the first three years of operation to confirm if curtailment is required in line with post-construction activity levels. The post construction surveys will be used to update the curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

Buffer Zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development.

Due to mitigation by design, turbines will be sited at a suitable separation distance from treelines/hedgerows and trees or vegetation will be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the site). This should be achieved through physical management of habitats without the use of toxic substances.

The radius of each buffer zone as determined by the height of surrounding vegetation is listed in Table 4-2 above.

It is noted that no trees are present within the T3 buffer, and are also absent from other turbine buffers within agricultural land (apart from existing hedgerows). Currently, no management other than removal of trees within these buffers is required, due to ongoing agricultural management limiting vegetation within these buffers to low-growing grassland or cropland. However, vegetation management encompassing the entire extent of the buffers identified in Table 4-2 will apply in the case that regular grazing or tillage of these buffers ceases, and targeted intervention is required to keep vegetation short.

Monitoring of Mitigation Measures

The success of the implemented mitigation measures for bats on the project will be monitored for a period of three years post construction, with further monitoring in years 5, 10, 15, 20, 25 and 30. Appropriate measures will be taken to enhance prescribed mitigation if and where required. A recommended schedule for monitoring is given in Table 4-3 below.

Bat Fatality Monitoring

Whilst no significant residual effects on bats are predicted, the development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule. A comprehensive onsite fatality monitoring programme is to be undertaken following published best practice (e.g. SNH 2021 or equivalent at the time of operation).

The primary components of the mortality programme are outlined below:

1. Carcass removal trials to establish levels of predator removal of possible fatalities. This should be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials should be used for subsequent fatality monitoring.
2. Turbine searches for fatalities should be undertaken following best practice in terms of search area (focusing on hard standing) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (1.) above. [2]
3. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality effect (if any).
4. Recorded fatalities should be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

[2] Suitably trained dogs with handlers are significantly more efficient and faster than humans in locating carcasses and should preferably be used to achieve more robust results. Dog searches are, however, resource-demanding and may not always be necessary to identify if a problem exists.

Monitoring schedule

Table 4-3: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Bat boxes / PRFs	Monitor bat use	Bat boxes and PRFs to be placed at/moved to locations removed from wind turbines as determined by project ecologist/ECoW at least 1 season before construction start. These shall be examined by a licensed bat specialist according to NPWS recommendations. Records should be submitted to Bat Conservation Ireland for inclusion in its bat distribution database. Re-site if necessary. Annual cleaning required if well used by bats or if used by birds. Replacement if damaged/lost.	From mounting to 3 years post construction.
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the effect of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 10, 15, 20, 25 and 30 post construction.
Activity monitoring	Bat activity monitoring	Static detector surveys at detector locations during the bat activity season (between April and mid-October). Assessment of activity levels using Ecobat or other currently accepted analysis methods.	From initial operation conducted during years 1, 2, 3 post construction. Additional years to be surveyed if requirement is indicated by fatality monitoring.

Table 4-4: Summary of Operational-phase mitigation measures for bats

Moderate and Moderate-High Level Bat Mitigation Applies to XX Turbines
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).
Implement a monitoring programme for the first three years of operation to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required.
Continue monitoring for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. The requirement for the continuation of monitoring across subsequent monitoring years (5, 10, 15, 20, 25 & 30) will be reviewed in consultation with NPWS.
Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. Repeat searches in years 5, 10, 15, 20, 25 & 30.
Clear and maintain buffer zone free of woodland/trees within 50m of turbine blade tips.
Maintain buffer zones around wind turbines in a manner that does not attract insects.

4.3.3.6.5 Other Species

Maintenance of bat felling buffers (vegetation trimming), will be undertaken outside the bird breeding season (March- August inclusive). This measure will also avoid potential disturbance to common lizard and bee species during breeding periods.

The pre-clearance bat buffer ecological survey shall include a marsh fritillary habitat appraisal, followed if necessary by a larval web survey. This will ensure that suitable mitigation and avoidance measures can be implemented in the event that marsh fritillary establish in the bat felling buffers during the operational phase.

There is potential for an indirect effect on frogs or smooth newt due to water quality changes from erosion and sediment. Periodic inspections of sediment and erosion control measures will be undertaken until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

4.3.3.6.6 Aquatic Ecology

The operational wind farm will have a negligible effect on aquatic ecological receptors and fisheries, as there are no further potential effects on surface water run-off or watercourses within the site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. However, the transformers will be bunded to over 110 % of the volume of oil within them.

It is not envisaged that maintenance will involve any significant effects on the hydrological regime of the area. Periodic inspections of sediment and erosion control measures will be undertaken until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

Access to the site will be controlled using a gate to prevent harmful activities such as illegal dumping, unlicensed timber or peat extraction, or recreational use of off road vehicles.

4.3.3.6.7 Avifauna

A post construction monitoring programme is to be implemented at the proposed wind farm in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier, and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed:

5. Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice (Shawn et al., 2010; Fijn et al., 2012 and Grunkorn, 2011); the primary components are as follows:
    a) Initial carcass removal trials to establish levels of predator removal of possible fatalities.
    b) This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn et al., 2010).
    c) Turbine searches for fatalities are to be undertaken following best practice (Fijn et al., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.
    d) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
    e) Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

6. Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both vantage point and hinterland surveys as Per SNH (2017) guidance:
    a) Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species, and all wader species.
    b) Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

7. Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period in the monitoring years listed above. This aims to:
    c) Assess displacement levels (if any) of wildfowl such as swans post construction
    d) Assess overall habitat usage changes within the vicinity of the Proposed Wind Farm post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

8. Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (Common Bird Census), following methods used in the baseline survey to be repeated in each monitoring year listed above between early April to early July. This aims to:
    a) Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

9. Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated in each monitoring year listed above during April-May-June.
10. Breeding Woodcock Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated in each monitoring year listed above during April-May-June.

The above surveys are to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

4.3.3.6.8 **Designated Nature conservation sites**

Implement mitigation measures outlined in Chapter 9 'Land, Soils & Geology', and Chapter 10 'Hydrology and Water Quality' of the EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts on water quality as outlined previously.

4.3.3.7 Decommissioning EIAR Stage Mitigation Measures

4.3.3.7.1 Designated Sites

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

4.3.3.7.2 Habitats

Following removal of the turbines, the bat felling buffers will be allowed to succeed to woodland. Pending landowner agreement, targeted removal of non-native species (e.g. conifers) (if they are overly dominant) will be undertaken to favour the establishment of semi-natural woodland. A small proportion of conifers can be retained to maintain a food source for red squirrel.

An appropriately qualified and experienced ecologist will review and, where required, amend the proposed Habitat and Species Management Plan and consult with NPWS to seek their views on the implementation of the proposed measures.

Any re-instated habitats such as Hedgerows will utilise native species suitable for the area.

4.3.3.7.3 Terrestrial Mammals

Similar mitigation measures will apply for the decommissioning phase as for the construction phase.

4.3.3.7.4 Bats

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

4.3.3.7.5 Other Taxa

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

4.3.3.7.6 Aquatic Ecology

In the event of decommissioning of the proposed wind farm, activities will take place in a similar fashion to the construction phase.

Due to the proposed retention of the roads, hard standings and electrical infrastructure, potential for effects on water quality and aquatic ecology will be reduced in comparison to construction. The only potential sources of siltation will be the areas of soil used to cover the turbine foundations. The mitigation measures outlined above for the construction phase will also be implemented as relevant for the protection of aquatic ecological interests during the decommissioning phase.

4.3.3.7.7 Avifauna

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

Decommissioning operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. & Langston, R. H., 2006). Turbines components will be broken up onsite prior to removal, and as such vegetation trimming requirements to facilitate turbine removal will be minimal (reduced in comparison to construction stage) or not required.

Toolbox talks shall be held with construction staff on disturbance to key species during decommissioning. This will help minimise disturbance. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. & Langston, R. H., 2006).

Any re-instated habitats will include native species where possible to enhance diversity of birds. This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. & Langston, R. H., 2006).

4.3.3.8 Habitat & Species Management Plan

The Proposed Wind Farm seeks to further enhance biodiversity (separate from mitigation) where opportunities present themselves.

Drain Blocking

The perimeter drain running to the south-west of T10 located within the Dunfierth Coillte Biodiversity area will be blocked in order to further increase water retention within the intact raised bog. Drainage of a bog to facilitate peat harvesting lowers water levels, killing the peat forming community and drying up bog pools.

The installation of dams will be undertaken by an experienced ecologist. Drains will be dammed using plastic drain piling which is an alternative to peat dams. Plastic drain piling is chosen over peat as peat may not be freely available within the site. Plastic drain piling is light, sturdy, easy to transport and impermeable and has been used extensively used in Irish Peatland Conservation Council's (IPCC) Lodge Bog Nature Reserve, Co. Kildare and by Coillte[3].

Plastic pilling sheets will adhere to that used by the IPCC; 3m lengths, 30cm wide with interlocking tongue and groove system and can be installed using a mallet (see Plate 4-1 below for more information).

Plate 4-1: Plastic pilling being installed within IPCC bog

Sourced from Irish Peatland Conservation Council (IPCC)

Planting of berms

As part of the construction phase, excavated peat will be reused to construct berms. In order to further enhance site biodiversity, berms located in wooded areas outside bat felling buffers will be planted with native bog woodland whips. These planted berms will add to the existing linear habitats in the area and will provide further foraging, cover and commuting habitat for mammals and other fauna.

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[3] Irish Peatland Conservation website; Restoration of Drained Peatlands: http://www.ipcc.ie/advice/peatland-management-diy-tool-kit/restoration-of-drained-peatlands/ Website visited November 2018.

Within wooded areas, bog woodland bare root whips (60-90cm in height), sourced from native stock and disease free will be planted on selected berms outside bat felling buffers. Whips will be planted at 1m centres with the following mix: 20% downy birch (*Betula pubescens*), 10% holly (*Ilex aquifolium*), 15% rowan (*Sorbus aucuparia*), 20% scots pine (*Pinus sylvestris*), 10% pedunculate oak (*Quercus robus*), 10% sessile oak (*Q. petraea*) and 15% willow (*Salix cinerea*). Rabbit/hare protection will be put in place alongside weed suppressing leaf mulch. Any whips that die will be replaced (during the operational phase).

Berms in open agricultural habitats will be planted with native pollinator-friendly species.

Bee Banks

Bee banks will be incorporated within the proposed berms. These will be created and maintained by periodic scraping of vegetation from sections of the berms facing access tracks.

It is important to avoid heavily compacting bee banks with machinery. The road-facing sections of banks will be required to be kept clear of vegetation using mechanical means only. This can be carried out in winter as required (frequency depends on rate of re-vegetation) by scraping away vegetation.

Bird and bat boxes

Bird boxes (5 No.) will be placed within the limited treelines within the site. This will help to provide further breeding habitat for birds on the site.

Bat boxes (5 No.) will be placed in marginal areas with minimal connectivity to the Proposed Wind Farm. This will help to provide further roosting for bats while reducing ready-made commuting and foraging routes leading towards the turbine locations via the access track network. See Appendix 8.1-4 of the EIAR for details.

Within selected areas, bat boxes (see Plate 4-2) will be installed in suitable locations selected by an experienced ecologist.

Plate 4-2: Example of a Bat Box

Source: Paul van Hoof

Within selected treelines, kestrel (no. 2) and barn owl (no. 3) bird boxes (see Plate 4-3 and Plate 4-4) will be installed in suitable locations selected by an experienced ecologist. In the event that the selected treelines are not appropriate for bird box installation, trees within hedgerows where appropriate will be selected and bird boxes installed by an experienced ecologist.

(Source: RSPB)

Plate 4-3: Example of a Kestrel Box

(Source RSPB)

Plate 4-4: Example of a Barn Owl Box

Removal of non-native trees from Raised Bog/Scrub Mosaic

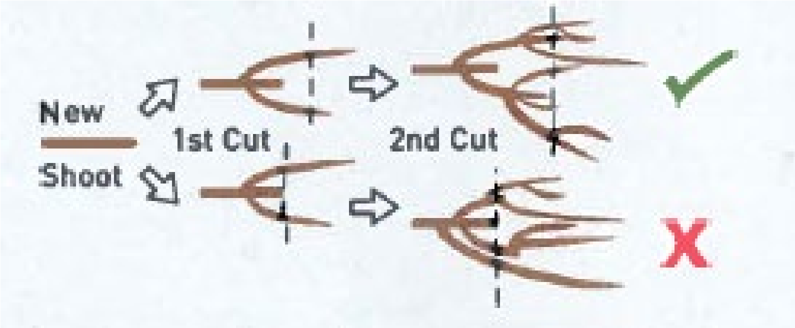
The clearance of the bat felling buffer for T8 will have the effect of enhancing this habitat mosaic by removing tree and scrub including non-native species which are colonising this area of drained degraded raised bog. Removal of these trees, along with periodic maintenance of the felling buffer will return this area to a more semi-natural state.

Enhancement of site hedgerows

In order to enhance hedgerows for biodiversity it is important to maintain hedgerows appropriately; allowing them to become tall and bulky so as to provide shelter and foraging habitat for wildlife. It is also important to fill gaps as they weaken the hedgerows role as wildlife corridors especially for bats.

Where practical, gaps in hedgerows will be filled via laying which is a method of rejuvenating hedgerows. Laying involves cutting hedgerow stems partly through near ground level and bending the stem to the required position to fill a gap. New growth then is produced from the cut which thickens the hedge base and rejuvenates it. Where gaps are too large and to enhance the diversity of the hedgerow, native seed and fruit bearing whip species will be planted.

Site hedgerows will also be allowed to grow bulky where practical; optimum hedgerow dimensions are 4-5m tall x 2-3m wide. The hedgerow will be cut every three to four years in rotation so that some hedgerows are left undisturbed. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. When the hedgerow is cut, stems will be cut a little above the last cut (see Plate 4-5) as cutting back to the exact same point depletes the energy of the hedgerow and forms a build-up of scar tissue which discourages new growth.



Source:Teagasc

Plate 4-5: Hedgerow level of cut

Pine Marten Den Boxes

Den boxes are used to provide artificial breeding sites for pine martens, in areas where there is an absence of natural tree cavities. Five (5 No.) den boxes will be installed within the conifer plantation at the site.

(Source: NHBS)

Plate 4-6: Example of a Pine Marten Den Box

Insect Hotels

Insect hotels shall be installed at 6 locations within the site. The insect hotels will be made from recycled materials such as pallets, bamboo, old carpet, wire mesh (see Plate 4-7 for example). Each hotel will consist of several different sections that provide insects with nesting facilities – particularly during winter, offering shelter or refuge for many types of insects. Insect hotels are used as nest sites by insects including solitary bees and solitary wasps. These insects drag prey to the nest where an egg is deposited. Sections of these hotels will be specifically designed to allow the insects to hibernate, notable examples include ladybirds and butterflies. This shall also provide additional habitat for the Barbut's Cuckoo Bee.

(Source: www.bbcwildlife.org.uk)

Plate 4-7: Example of an Insect Hotel

Lizard Refuges

Artificial lizard refuges, for basking, shall be installed at four locations within the site. Examples of such refuges include corrugated iron sheets, carpet tiles, planks of wood, roofing felt or dark coloured mats. As lizards are cold-blooded, the dark coloured refuges will attract them because it soaks up the heat and it will be warmer than the surrounding ground.

(Source: ebay)

Plate 4-8: Example of a lizard basking platform

Refugia piles/ hibernacula

These provide sheltering locations for a wide range of wildlife; including reptiles, amphibians, small mammals and invertebrates. Refugia piles are produced by piling natural materials; such as logs, sticks and leaves; that can be supported by additional materials such as rubble and bricks to form a structure with many cracks and crevices for sheltering. Hibernacula are produced in a similar way, but often require setting into the ground in a shallow pit and topping with soil to enclose the structure and creating a more stable microclimate suitable for hibernating species. These refugia piles will also offer potential habitat for the larva of the micromoth *Nemapogon koenigi* which is reported to feed on fungus, especially bracket fungus, as well as on decaying wood, especially on birch.

These structures will be installed near hedgerows and in areas of woodland within the site, where they are less likely to be disturbed.

Plate 4-9: Refugia Piles

Retention of felled birch logs

Birch trees and logs felled during site clearance will be retained across the proposed development site in the form of log piles to provide a food source for the rare Micromoth *Nemapogon koenigi*, which has been reported to utilise rotting birch wood as a larval food source.

4.3.3.9 NIS Mitigation Measures

With regard to the proposed development, the following measures were undertaken to reduce impacts on designated sites through avoidance and design:

- The hard-standing areas of the wind farm have been kept to the minimum necessary, including all site clearance works to minimise land take of habitats and flora.
- Larger turbines have been utilised to minimise the number of turbines, reducing the total rotor envelope (less turbines) and footprint of the proposed development.
- Site design and layout deliberately avoided direct impacts on designated sites.
- All cabling with the exception of the locations of the high voltage line loop in is to be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

- Care has been taken to ensure that sufficient buffers are in place between proposed development infrastructure and hydrological features such as rivers, lakes and streams. Access roads were the exception to the rule in that river crossings will have to take place. However, where possible, existing crossings have been utilised. Clear span brides are to be used at the three stream crossing points on site to reduce the potential impact to the stream beds and to avoid instream works (foundation will be located 2.5m from the river edge).
- Any works in or around watercourses will adhere to best practice as per NRA and IFI guidance for works potentially affecting watercourses.
- The grid connection route has been selected with cognisance to ecological features. The cable route will utilise private agricultural grassland, and areas of forestry plantation, thereby minimising land take of potentially sensitive habitats.
- Floating roads will be utilised to minimise impact on the peat, particularly peat hydrology. As there is no excavation required for floating roads, no peat arisings are generated.
- It is proposed to construct clear span bridges at the 3 no. watercourse crossings required within the Proposed Development site to minimise the environmental impacts and avoid any instream works.
- So as not to interfere in any way with the bed or bank of the watercourse, bridge foundations will be designed and positioned at least 2.5 m from the river bank.

Further mitigation measures prescribed to reduce and/or avoid the potential for the proposed works to have an adverse effect on the integrity of the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA are prescribed hereunder.

The NIS mitigation measures are detailed in Table 4-5.

Table 4-5: NIS Mitigation Measures

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
MITIGATION MEASURES TO BE IMPLEMENTED PRIOR TO CONSTRUCTION (AND DECOMMISIONING)				
1	Adherence to the mitigation measures and methodologies specified in the Construction Environmental Management Plan (CEMP) (Appendix 2)	This measure will ensure the mitigation, methodologies and procedures prescribed for the prosed development are implemented correctly at construction stage.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The developer will ensure the CEMP is provided to the contractor. The ECoW will monitor implementation of the CEMP to ensure all measures are carried out correctly and effectively.
2	A preconstruction otter survey will be completed prior to construction.	Reconfirm the baseline conditions relating to otter, informing avoidance and/or implementation of mitigation measures as necessary. Monitoring of all holts located within 150m of works will be undertaken to reconfirm their status prior to construction.	A suitably qualified ecologist will undertake surveys and holt monitoring. The ecologist shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.
3	Preconstruction ornithological surveys shall be carried out during the winter season to record the presence of whooper swan within the site. In the event that whooper swan is recorded as roosting within the site an exclusion zone for works within 500m of a winter roost shall be maintained for the winter period (Oct - the end of March).	Prevent disturbance of roosting whooper swans if present.	A suitably qualified ecologist will undertake surveys. The ecologist shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
4	An invasive species survey will be carried out to confirm the baseline prior to treatment measures and determine the specific volumes and extents of invasive species material requiring treatment.	This measure will provide the detailed information and site familiarisation required by the invasive species contractor to implement the ISMP prior to construction.	A suitably qualified ecologist or invasive species contractor will undertake the surveys and holt monitoring. The ecologist/invasive species contractor shall report their findings, in addition to coordinating and communicating with the developer to keep them informed of conditions onsite. High probability of success.	The developer will ensure these surveys are completed prior to construction. The ECoW will confirm these surveys have been completed as a prerequisite for initiation of construction works.
5	A suitably qualified Ecological Clerk of Works (ECoW) will be appointed to supervise works, undertake monitoring and reporting as required, and carry out water sampling. The ECoW will have full stop-works authority at all times to ensure immediate action can be taken in the event of mitigation failure.	Ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process; supervise works in sensitive areas; undertake water sampling to monitor water quality in the receiving environment during construction.	An Ecological Clerk of Works (ECoW) will be engaged prior to invasive species management and for the duration of construction. All mitigation will be implemented in full. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
6	Invasive species management shall be undertaken by a suitably qualitied contractor in accordance with the invasive species management plan (ISMP) (Appendix 9). This shall include as required the control and removal of invasive species from the works area and adjacent areas, in addition to any measures required to	Remove invasive species from the area of proposed works to allow works to proceed without the risk of causing or accelerating the spread of invasive species to European sites.	The ECoW shall supervise and inspect invasive species management activities, ensuring adherence to the ISMP and protection of sensitive ecological receptors. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	prevent re-infestation prior to and during construction. Cordons and signage will be erected to highlight areas which have been treated, in order to facilitate ongoing monitoring and to aid in implementation of any additional restrictions required for these areas during construction. Disposal of any plant material arising from invasive species management will be disposed of in accordance with the ISMP and in a manner which prevents further spread. Any Schedule III material proposed to be disposed of site will only be transported and disposed of under the required licenses.			Regular reporting to developer and contractor as per each management plan.
7	A further invasive species survey/check covering treated areas will be completed prior to construction to reconfirm if control measures need to be reapplied.	Confirm that invasive species have been removed from all works areas prior to construction.	The ECoW or a suitably qualified ecologist under their supervision shall carry out the survey and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
8	The ECoW will establish contact with IFI & NPWS staff, and facilitate any site inspections they wish to carry out.	Facilitate site access and communication with key stakeholders, and provide additional oversight of mitigation implementation.	ECoW will open lines of communication upon appointment. High probability of success.	ECoW to provide reports of communication and/or site visit findings to update the developer and contractor of input from key stakeholders.
9	As part of a detailed water quality monitoring programme, turbidity meters will be installed prior to construction at five locations within the watercourses draining the site. Levels of turbidity will be monitored pre-construction (post planning) to determine existing levels in the water bodies. These levels will be used to set trigger levels for each location. Should these trigger levels be exceeded during construction, the source of the turbidity will be identified, and immediate action will be taken to identify, contain and eliminate siltation/pollution at the source. See Figure 4-3 for more information.	This measure will reduce the risk of sediment runoff or pollutants reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. High probability of success.	Mitigation measures will be implemented by the developer through the mechanism of its contract with the Contractor. All required mitigation measures will be included as a contractual obligation on the contractor, in combination with competent supervisory staff overseeing the works.
10	The ECoW will establish representative water quality monitoring points up and downstream and undertake baseline physico-chemical water quality sampling.	This will define monitoring locations and establish baseline conditions for construction phase monitoring.	Mitigation measure will be implemented in full by the Developer. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer prior to initiation of construction.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
11	Baseline Q sampling will be completed at suitable representative water quality monitoring points up and downstream.	This will establish a baseline for further periodic monitoring during construction. The use of Q sampling is included to detect any potential longer-term changes to water quality which may not be evident from physico-chemical water quality sampling.	Mitigation measure will be implemented in full by the Developer. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.
12	A suitably qualified Environmental Manager will be engaged to ensure successful implementation of all mitigation measures for water control and management, and to oversee the day-to-day implementation of mitigation measures onsite.	A suitably qualified Environmental Manager (competent in the implementation and management of environmental mitigation measures for construction sites) will be appointed to ensure the effective operation and maintenance of drainage and other mitigation measures associated with water control and management during the construction process. The operations management of the proposed development will include regular monitoring of the drainage system and maintenance in line with all management plans within the CEMP (Appendix 2). The Environmental Manager will be awarded the authority to stop construction activity if there is potential for adverse effects to water control and/or management.	An environmental manager will be engaged by the Developer through the Contractor appointed to construct the proposed development . High probability of success.	The Environmental Manager in co-operation with the ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP ensuring successful implementation. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
13	Prior to vegetation clearance, secure (dug in) double silt fencing and check dams will be installed in or around any drains which could receive runoff or where surface flows may occur during vegetation clearance and subsequent construction, and will remain in place subject to monitoring and maintenance until revegetation is complete The ECoW will survey the site and specify as required where these silt arrest measures are to be placed, and will supervise their installation.	Prevent the escape of silt to European sites via drains or overland flow during vegetation clearance.	Mitigation measure will be implemented in full by the Environmental Manager, subject to supervision and sign-off by the ECoW. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.
14	The ECoW will conduct pre-clearance checks and supervise vegetation clearance. In the event that a new holt is discovered during vegetation clearance, works will cease, applicable guidance will be followed and NPWS will be notified.	Ensure clearance is carried out in accordance with ecological requirements and avoid disturbance to areas outside the construction zone and avoid activities which risk causing indirect effects (e.g. excessive soil disturbance and siltation). Ecological supervision is also required in case sensitive features such as holts are discovered in densely vegetated areas during clearance works.	Mitigation measure will be implemented in full by the by the ECoW. High probability of success.	This measure will be a prerequisite to be signed off on by the Developer and ECoW prior to initiation of construction.
15	Toolbox Talks Toolbox talks will be undertaken with construction staff on the sensitivity of the receiving environment, central role of	Toolbox talks will ensure all staff working on site are aware of mitigation procedures and potential hazards and will be able to comply with measures.	Toolbox talks will be provided to all staff upon induction and at site meetings thereafter. High probability of success.	The ECoW, Environmental Manager and Project Manager will deliver talks as required.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	ecological supervision, and implementation and maintenance of mitigation measures.			
MITIGATION MEASURES TO BE IMPLEMENTED DURING CONSTRUCTION				
16	Monitoring of construction activities and mitigation measures by ECoW.	The ECoW will carry out weekly inspections of the site to ensure mitigation measures are functioning as intended. In addition to weekly inspections, the ECoW will attend the site as required for the following: -Supervise construction of bridges to ensure potential effects on water quality are minimised.	The ECoW in conjunction with the developer will ensure that the contractor implements all mitigation measures in full. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
17	Water quality monitoring	Physico-chemical water quality monitoring will be undertaken on a weekly basis during the site clearance and earthworks stage of the construction period. Following site clearance and earthworks stage of the construction period, sampling will be taken on a monthly basis for the remainder of the construction period.	The ECoW will ensure that this measure is carried out in full and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
18	Q Sampling/Biological water quality sampling	Biological water sampling will be carried out during the site clearance and earthworks stage of the construction period on a monthly basis during the construction phase. Following site clearance and earthworks stage of the construction period, samples will be taken on a quarterly basis, until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.	The ECoW will ensure that this measure is carried out in full and report their findings, in addition to coordinating and communicating with the developer/construction contractor to keep them informed of conditions onsite. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
19	Weekly reports detailing the results of water sampling and operation of on-site mitigation measures will be sent to all stakeholders including the client, contractor and (if requested) IFI and NPWS.	Allow any potential water quality or general mitigation issues to be flagged to determine remedial action.	The ECoW will ensure that this measure is carried out in full to facilitate coordination and communication with the developer/construction contractor. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
20	The ECoW will establish contact with IFI & NPWS staff, and facilitate any site inspections they wish to carry out.	Maintain communication with IFI & NPWS, facilitate site inspections.	The ECoW will ensure that this measure is carried out in full to facilitate communication with these stakeholders. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer and contractor as per each management plan.
21	Existing silt fencing and check dams will be inspected on a daily basis and maintained/repaired as required. Any additional sediment control measures identified by the site manager and/or ECoW during construction will be installed as required as works progress across the site. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off and for repairs. All silt protections will remain in place subject to monitoring and maintenance until revegetation is complete.	Prevent the escape of silt to European sites via drains or overland flow during construction.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
22	Where access tracks pass close to drainage ditches, double silt fencing will be used to protect these features by retaining silt runoff within the access corridor.	Prevent the escape of silt to the river network via drains or overland flow during construction.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
23	Weather forecasts will be reviewed daily, and earthworks will not be undertaken during periods of heavy rainfall (>10mm/hour). A regular review of weather forecasts of heavy rainfall is required.	This measure will minimise the generation of suspended solids, dust and any other contaminant mobilisation which may be washed towards sensitive receptors via surface runoff.	Mitigation measure will be implemented in full by the Environmental Manager. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
24	Drains and rivers receiving runoff from the proposed development and outfalls will be visually inspected on a daily basis. Any indication of elevated sediment levels, pollution, or evidence of defective sediment control measures will trigger remedial measures, and if required, works will cease until all issues have been resolved.	This measure will monitor the effectiveness of mitigation measures to protect water quality, by ensuring any changes in water quality in the receiving environment which could potentially indicate requirement for remedial action are detected.	Mitigation measure will be implemented in full by the Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
25	All access tracks will be capped as soon as possible with material with low content of fines.	Prevent silt generation arising from vehicular disturbance of soil, ensure track capping material does not act as a source of sediment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer and contractor as per each management plan.
26	Stilling ponds will be put in place in advance as construction progresses across the site.	The stilling ponds will have a diffuse outflow and will mitigate any increase in run-off. This will prevent reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.
27	The site drainage has been designed to complement existing overland flow and existing bog, agricultural and forestry drainage. A three-stage treatment train (swale – stilling pond – diffuse outflow) is proposed to retain and treat the discharges from hard surface areas.	This measure will reduce the risk of sediment runoff or pollutants reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
28	The increase in the rate of run-off along the route of the site access roads and hard-standing areas will be mitigated by the proposed drainage system which includes the provision of stilling ponds to reduce the	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	concentration of suspended solids in the run-off from these areas, and the addition of silt fencing where deemed necessary. Drains around hard-standing areas will be shallow to minimise the disturbance to sub-soils. Cross-drains of 450mm diameter will be provided to prevent a risk of clogging for crossings conveying flows from bog drains, agricultural drains and forestry drains across the access roads.	within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	corrective actions required by the ECoW. High probability of success.	
29	During excavation of drains , gravel check dams with silt barrier material will be placed in the swales at 50m intervals. These will be left in place until soils within the swales have stabilised.	This measure will provide an additional layer of protection during and immediately after excavation of drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
30	Interceptor cut-off drains will be provided on the upslope side of the site access roads. These interceptor drains will discharge diffusely over land.	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways within the catchment of the proposed development site.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW.	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
		This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	High probability of success.	
31	Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction.	Reduce the rate of runoff from hard surfaces, reduce concentration of suspended solids in collected runoff. This will limit silt/contaminant laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.
32	Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls. to allow a buffer zone to the outfall.	Will reduce the concentration of suspended solids being conveyed in the surface water run-off into watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
33	Bank protection will be installed as necessary during construction of watercourse crossings to ensure that the existing stream banks are not disturbed during construction.	Will ensure that stream banks are not disturbed during construction.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
34	The excavated material generated during construction of watercourse crossings will be stored at agreed locations within the site in accordance with the Soil Management Plan.	Will ensure that excavated material is stored in a manner and location which prevents siltation of watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
35	Trenches for installation of underground cables will be excavated and re-covered in short sections. During installation, (where required) berms will be formed in open sections of the trench to prevent the trench acting as a conduit for flows of water and to prevent large accumulations of water at the downslope end.	These measures will ensure that trenches excavated for installation of underground cables do not act as drainage channels conveying silted runoff towards the hydrological network.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer and contractor as per each management plan.
36	Any water pumped out of excavations will be directed to the onsite settlement ponds for treatment before being discharged to the surface drainage network.	Prevent sediment arising from de-watering of excavations from being discharged into the hydrological network.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
37	Where necessary, temporary pumps and sumps may be required to maintain a dry, clean formation during installation of gravity foundations.	Prevent washout of foundation materials during construction thus avoiding/minimising potential pollution at the source.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
38	Where the appointed geotechnical engineer or engineering geologist for the works deems that there is a risk of concrete wash-out into the environment during piling, the bored pile will be cast within a permanent casing or geotextile sock/bag to prevent the loss of concrete or drilling fluids such as bentonite and vinyl-polymer.	Prevent potential pollutants arising from piling of excavations from being discharged into the hydrological network.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
39	Earthworks and exposed excavation surfaces will be compacted to minimise potential for washout of loose material.	Reduce potential for washout of sediment from exposed soils.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
40	Where immediate erosion prevention is required for exposed soils, hessian coverings will be installed to minimise potential for erosion.	Reduce potential for washout of sediment from exposed soils.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
41	Where existing drains will be covered with hardcore or infilled, the surface water will be diverted into new drains which will connect to the existing drainage system.	Prevent flooding and introduction of pluvial water contaminated with silt laden water from entering nearby watercourses.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
42	No excavation work will be undertaken during or immediately after heavy rainfall.	Will mitigate against erosion and the production of silt laden run-off. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
			High probability of success.	Regular reporting to developer and contractor as per each management plan.
43	Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion by covering during adverse weather. Where necessary sheet piling or other measures will be used to provide integrity for unstable excavations, particularly within peat, alluvial, gravel or for excavations below the water table.	To protect against the ingress of water or erosion and resulting silt runoff. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
44	Surplus soil, peat or rock excavated during the course of the works will be temporarily stored in a level area and will be re-used on site in the form of landscaping and berms (during construction). Temporary storage within the site may also be required after excavation and prior to transportation within the site.	Will reduce silt run-off reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	Temporary material storage areas will be covered with impermeable sheeting and surrounded with silt fencing, which will be monitored to manage any potential loss of suspended solids to surface waters. Temporary material storage areas will be a minimum of 50m from the bank edge of any watercourse.			
45	No spoil stockpiles will be left on site after construction.	Will reduce silt run-off reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
46	All exposed soil within 50m of watercourses will be planted with a native grass seed and wildflower mix of native provenance to accelerate revegetation and stabilise the soil.	Accelerate revegetation of bare soil, minimising potential for washout of sediment from exposed soils, while also encouraging the growth of native species including plants of value to pollinators.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer and contractor as per each management plan.
47	No construction lighting shall be left on overnight during the construction period.	To minimise the disturbance to nocturnal species including otter.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
48	Compact surface of stored soils during works	This measure will minimise the generation of suspended solids, dust and any other contaminant mobilisation which may be transported to sensitive receptors via wind, surface water runoff or groundwater movement.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
49	Temporary silt fences will be installed around soil stockpiles, and stockpiles will be covered to prevent washout of fine sediment. A twin layer of silt fencing will be installed at all locations. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off and for repairs. A buffer zone will remain between silt trap(s) and watercourses with natural vegetation left intact so as to assist silt interception.	This measure will minimise movement of suspended solids via surface water runoff.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
50	No soil or any material containing sediment may be stored within 50m of drains.	This measure will minimise the risk of discharges of silted water from stored materials to storm and surface water drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
51	Branches, logs or debris from tree felling will not be allowed to accumulate in aquatic zones and will be removed as soon as possible. Additional silt fencing will be erected along the banks of any streams at the location of proposed tree felling to provide additional protection to the watercourses.	Prevent leachate from tree felling entering nearby waterbodies. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
				Regular reporting to developer and contractor as per each management plan.
52	Brash mats will be topped up in sections when they become heavily used or worn. Where damage or serious rutting has started to occur, extraction will be suspended immediately. Relocation of the extraction rack or additional brash will be used to remedy the situation.	To avoid extraction racks acting as a conduit for surface water flows. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
53	A risk assessment will be prepared by the contractor prior to any wet concrete operations being carried out. All concreting works are fully detailed in the CEMP and will be minimised, particularly adjacent to the aquatic environment. Pre-cast concrete will be used whenever possible to reduce the risk to all forms of aquatic life. Concrete mixing and pours onsite will be timed to occur during periods where no rainfall (0mm/hour) would be expected.	This measure will prevent washout of concrete into the surrounding environment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	A regular review of weather forecasts is required (weather forecasts will be checked at least 24 hours in advance of works).			
54	Washout of concrete chutes will only take place in a designated washout area within the site compound which will be self-contained. A designated concrete wash-down area will be constructed 100m away from waterbodies (streams and drainage ditches). Every concrete truck delivering concrete to the site must use this facility prior to leaving the site. Chutes will be washed out, at a designated washout pit. A settlement lagoon will be provided to receive all runoff from the concrete wash down area (to be located no closer than 100m away from waterbodies. Details of settlement lagoons are as follows: • Topsoil and subsoil, where necessary, will be stripped out and placed adjacent to the temporary compound area; • An impermeable membrane will be installed directly onto the topsoil and or subsoil, to form the impermeable concrete wash-out settlement pond;	This measure will prevent washout of concrete into the surrounding environment.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	• A designated truck wash-down concrete apron shall be constructed next to this settlement pond; • Impermeable lined drains will direct the wash-out flow to the wash-out settlement pond; and • The wash water and solids will be disposed of off-site at an appropriate licenced facility. Following construction, any solids, the liner and any remaining wash water in will be removed and disposed of/recycled appropriately and the settlement lagoon will then be reinstated.			
55	Refueling of plant will be carried out at the designated refueling station which will be located in the temporary site compound. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. On demand refueling of plant during construction will only be carried out by trained personnel. Any on-demand refueling of machinery/ plant outside of the designated refueling station will be carried out using a mobile double skinned fuel bowser.	This measure will minimise ingress of hydrocarbons into groundwater.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed for licensed disposal off-site.			
56	Any diesel, fuel or hydraulic oils stored at the site compound will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.	This measure will reduce the risk of hydrocarbons reaching the groundwater within the groundwater body of the proposed remediation works.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
57	Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.	This measure will reduce the risk of hydrocarbons reaching the groundwater within the groundwater body of the proposed remediation works.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
58	Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel at the site	This measure will ensure that no sanitary waste enters the groundwater within the	Mitigation measure will be implemented in full by the Project manager and Environmental Manager,	The ECoW will monitor the implementation of the mitigation measures detailed herein and in

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	compound. Sanitary waste will be removed by a licensed waste disposal contractor.	groundwater body of the proposed remediation works.	subject to inspection and any corrective actions required by the ECoW. High probability of success.	accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
59	Daily road sweeping and maintenance of roads in the vicinity of site access points will prevent soil and mud from earthworks from accumulating on the local road network.	This measure will minimise the potential for sediment to be deposited on the road network where it would constitute a source of silt ingress via roadside storm drains.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
60	Wheel cleaning will prevent soil from earthworks accumulating on the local road network. It will also prevent vegetative material of invasive plant species leaving site. Wash water and any material washed off will be removed to a licensed waste facility.	This measure will minimise generation of suspended solids and dust. It will also prevent the spread of invasive species.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
61	In order to remove the remote chance of the transmission of biohazards/invasive species during the construction of culverts over drainage ditches: • All previously used tools, equipment, PPE are to be visually checked for mud, plant matter, animal mater and invertebrates – if found they are to be removed prior to the construction of culverts. • All tools, equipment, PPE that have been previously used in an area of invasive species or within a waterbody are to be sanitised prior to the construction of culverts.	Prevent the introduction of invasive species/biohazards into the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Project manager and Environmental Manager, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
OPERATIONAL PHASE MITIGATION MEASURES				
62	Site inspections to check revegetation/soil erosion measures. Revegetation will be monitored by an ecologist in the growing season(s) following construction. If monitoring indicates the need for any remedial measures such as additional planting or additional hessian sacking erosion protection, these will be actioned in accordance with the specifications of the ecologist carrying out the inspections.	This measure will ensure that revegetation and long-term soil stabilisation are implemented successfully.	This survey will be carried out by a suitably qualified ecologist who will report their findings to the developer and if required will specify and supervise any necessary remedial measures. High probability of success.	The planning authority will seek confirmation that this mitigation measure has been completed as a condition of planning.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
63	Quarterly visual inspections of outfalls/drains/rivers will be continued during the operation period until satisfactory vegetation is established on site.	Ensure that any potential sources of siltation or pollution are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
64	Substation transformers, oil storage tanks, diesel generator and any diesel or fuel oils stored at the substation will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines)	Prevent fuel laden runoff reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
65	During the operational period, quarterly physico-chemical water sampling will be undertaken until full re-vegetation has occurred, unless otherwise directed by the Planning Authority or Inland Fisheries Ireland (IFI).	Ensure that any potential water quality issues arising post-construction are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
		and River Blackwater SPA downstream.		Regular reporting to developer.
66	Biological water quality samples will be taken on a quarterly basis until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.	Ensure that any potential water quality issues arising post-construction are identified. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
67	A petrol and oil interceptor will be installed to deal with all substation surface water drainage.	Will reduce the concentration of fuel/oil contaminated run-off. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
68	The conceptual drainage has been designed to operate effectively during the operation period. The stilling ponds will be a permanent feature and will continue to be effective in filtering the run-off from the site should any accidental release of silt	To limit silt laden runoff from reaching the waterways within the catchment of the proposed development site. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
	combine with the surface water run-off during operational activities.	the River Boyne and River Blackwater SPA downstream.		Regular reporting to developer.
69	During the operation period the swales will have vegetated and will serve to attenuate flows and remove suspended solids from run-off.	To limit soil erosion and resulting silt laden runoff from entering the Blackwater River and tributaries. This in turn will avoid adverse impacts on the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA downstream.	Mitigation measure will be implemented in full by the Developer, subject to inspection and any corrective actions required by the ECoW. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.
70	During operation, wastewater generated at the substation compound will be collected in a storage tank for disposal offsite. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007, will be employed to transport wastewater away from the site. The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely.	Prevent wastewater pollution at the proposed development and any wastewater generated during operation is stored, transported and treated in a manner which prevents negative effects on the environment.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The ECoW will monitor the implementation of the mitigation measures detailed herein and in accordance with the relevant management plans within the CEMP. Regular reporting to developer.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring Scheme to Prevent Mitigation Failure
DECOMMISSIONING PHASE MITIGATION MEASURES				
All construction phase mitigation will be implemented during the decommissioning phase				

4.3.4 Peat and Spoil Management Plan

This Soil Management Plan (or Peat and Spoil Management Plan) has been prepared for the Proposed Development.

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent.

The contents of the peat and spoil management plan will be updated in the Construction & Environmental management Plan (CEMP) for the construction phase in line with any planning conditions that may apply.

The peat and spoil management plan contains drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in Chapter 10 of the Environmental Impact Assessment Report (EIAR).

The peat depth data was recorded by FT during the site walkovers between 2018 and 2025. It should be noted that the depth of peat at the site varied between 0.0 m(no peat on agricultural lands) to 5.4 m in proximity to the proposed turbine T8. A peat stability analysis was completed and is appended to Chapter 9 of the EIAR.

It is intended to maintain an earthworks balance on site, with all excavated material re-used within the site and minimising the need for removal of any materials for off-site disposal. This will minimise the amount of construction traffic on local roads and reduce the need for off-site disposal. This will in turn lead to the reduction of noise and dust associated with construction traffic.

Aggregate (structural Fill) required for construction will be imported from a local, licensed quarry.

Potential Impacts

The main characteristics of the Proposed Development that could impact on land, soils, and geology are:

- Construction of wind turbine foundations and hardstanding areas
- Construction of access tracks
- Construction of onsite substation
- Cable trench and grid connection construction
- Soil and rock excavation/reuse
- Temporary Material storage areas
- Drainage
- Vehicular movement
- Construction of temporary site compounds

It is considered there will be very few direct impacts during the operational phase of the Proposed Development. The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

Mitigation Measures

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of soil excavation and lengths of track and trench construction. The minimisation of earthworks volumes is achieved as follows:

- All excavated overburden will be retained on-site. The surplus that cannot be used as backfill material will be stored in berms along access tracks and clearfell areas around Turbines T7, T8, T9, T10 and T11, which are designed for that purpose. Permanent storage areas will be landscaped to minimize erosion and visual impact;
- All the access tracks will be floated, excluding the entrance from public road to T1 (0.4m of average excavation depth) and the Overhead line platform (0.3m of average excavation depth);
- Turbine foundations for turbines T8, T9 and T10 and related hardstands will be piled;
- No borrow pits will be used and all fill and aggregate will be imported from local quarries.

Surplus overburden deposits excavated during the course of the works will be temporarily stored in a level area adjacent to the construction phase excavations prior to reuse as backfill or store in the above-mentioned berms and clearfell areas.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement, however no long-term stockpiles of material will remain after construction and no surplus/waste soil or rock will be removed from the Proposed Development site. Temporary stockpiles will be shaped and sealed to prevent the ingress of water from rainfall and placed away from open excavations, sloping / soft ground as not to create an instability risk during temporary works.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that soils outside the work area are not damaged. Excavations will then be carried out from access tracks as they are constructed in order to reduce the compaction of soft ground.

To mitigate against erosion of the exposed soil, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events (>10mm/hour). To mitigate against possible contamination of the exposed underlying soils, refuelling of machinery and plant will only occur at designated refuelling areas.

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel fill will be used to provide additional support to drains where appropriate. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion by covering during adverse weather. Where necessary sheet piling or other measures will be used to provide integrity for unstable excavations, particularly within peat, alluvial, gravel or for excavations below the water table.

Support may also be required to support elevated floating roads which are being excavated for the installation of cable trenches. The stability of all excavations will be assessed in advance by an experienced geotechnical engineer. Temporary works will be such that they do not adversely interfere with existing drainage channels/regimes by the provision of silt traps and silt fencing as required (refer to Chapter 10 of the EIAR – Hydrology and Water Quality).

The proposed turbine locations have been carefully selected in areas of the site which are relatively close to the existing access tracks to minimise the length of new access tracks required. Drainage will be towards the existing drainage network.

Any contaminated soils will be handled, removed and disposed of in accordance with the requirements of the local authority and/or EPA and waste management legislation. In particular, the following measures will be implemented:

- Contaminated material will be left in-situ and covered, where possible until such time as the classification and assessment of waste at the site is undertaken in accordance with the appropriate technical guidance;
- Prior to removal of material from site for disposal WAC (Waste Acceptance Criteria) testing should also be undertaken in accordance with recommended standards and in-line with the acceptance criteria at a suitably licenced landfill or treatment facility;
- Where materials are removed from site for disposal, materials will be transported by a contractor with a valid waste collection permit and recovered/disposed of at an appropriately licensed facility.

Unregulated drainage will not be permitted within the Proposed Development. Any pumping of excavations will be directed into existing drainage networks via settlement ponds and will not be allowed to discharge directly to the ground except under licence.

All fuel and liquids will be stored on site in fully bunded areas as described in detail in Chapter 10 – Hydrology and Water Quality of the EIAR. In addition, an effluent holding tank along with other protection measures will be used at the substation in order to protect the Source Protection Zone and prevent any discharges to ground. These are detailed in Chapter 10 of the EIAR - Hydrology and Water Quality.

Long range weather forecasts should be examined, and the construction phases planned taking cognisance of expected weather conditions. Regular meetings should be held to re-assess construction phases with weather conditions as the project progresses. Excavations will stop during or immediately after heavy rainfall.

Regular meetings should be held between the Geotechnical Engineer appointed by the contractor and the contractor’s Project Manager.

Excavation for hardstands will precede the turbine, cable trench and access track construction, whereby topsoil and soft soils will be excavated and replaced with granular fill where required. Excavation will be carried out from access tracks where possible in order to reduce the compaction of topsoil.

The proposed turbine locations have been carefully selected in areas of the site which is relatively close to the existing access tracks to minimise the length of new access tracks required. Drainage will be collected in the proposed grassy swales, and directed towards the existing drainage network.

Natural re-vegetation is the preferred method of restoration, however, if this is not possible, the re-vegetation process can be encouraged with the use of native grass seed or other suitable planting measures during the growing season. No spoil stockpiles will be left on site after construction is completed. Areas disturbed during construction will be landscaped using locally recovered topsoil to merge with the contours of the existing topography.

Due to the possibility of soil-borne diseases, all topsoil received from each farm property will remain on site. Topsoil will be used for landscaping berms alongside existing and new access tracks where suitable and will also be used for reinstatement purposes around turbine bases and hardstandings.

The contractor's project manager will be responsible for ensuring that the earthworks are done in accordance with the requirements of this plan. The temporary storage areas and the restoration of vegetative material will be inspected regularly from an ecological and water quality perspective.

With regard to slope stability issues, detailed design best practice will be implemented as follows:

- The works will be designed and checked by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer;
- Identified risks will be minimised by the application of the principles of avoidance, prevention and protection;
- A detailed method statement for each element of the works will be prepared prior to any element of the work being carried out;
- Details of the relevant assumptions, relating to methods and sequencing of work are provided in this CEMP. This will be reviewed and updated prior to commencement of construction;
- No amendments to the designed works will be made without the prior approval of a suitably qualified and experienced engineering geologist or geotechnical engineer familiar with wind farm construction works;
- Prior to construction, a site-specific environmental management plan for construction will be prepared, which will incorporate all measures set out in this CEMP, in consultation with the relevant statutory bodies, including the planning authority, Waterways Ireland and the NPWS;
- The environmental management plan for construction will provide for the checking by suitably qualified and experienced staff of equipment, materials storage and materials transfer areas, as well as drainage structures and their attenuation ability, on a regular basis;
- Excavation works will be monitored by suitably qualified and experienced geotechnical personnel;
- The programming of the works will be such that earthworks are not scheduled to be carried out during severe weather conditions.

Other mitigation measures relating to soils and geology include the following:

- Internal haul roads will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off;
- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process;
- Due to the dispersed nature of the site, refuelling of plant during construction will be carried out at a number of dedicated refuelling station locations on site, typically at each compound or at least 100m from a watercourse using mobile double-skinned fuel bowsers;
- Each station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site. Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site;
- Portaloos and/ or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a permitted waste contractor.

In addition, an effluent holding tank along with other protection measures will be used at the substation in order to protect the Source Protection Zone at and prevent any discharges to ground. Other measures include:

- The bunding of the transformer, oil storage tanks, diesel generator and any diesel or fuel oils stored at the substation. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines)
- A petrol and oil interceptor will be installed to deal with all substation surface water drainage.

Operational Phase Mitigation Measures

Mitigation measures for soils and geology during the operational phase are outlined below:

- The use of aggregate from offsite authorised quarries for use in road and hardstand maintenance;
- The substation transformer and oil storage tanks will be in a concrete bund capable of holding 110% of the oil in the transformer and storage tanks as described above. Turbine transformers will be located within the turbines, ensuring any leaks would be contained;
- Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage;
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the refuelling areas and in each item of plant to deal with any accidental spillage.

Due to the reduced magnitude of the impacts, no additional mitigation measures are required for the maintenance and operation of the wind farm, over and above those incorporated into the design of the substation transformer, which will be bunded to protect soils against accidental leakages of oil.

Decommissioning Stage Mitigation Measures

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

Some of the impacts associated with reinstatement of the site (excavation of turbine bases, access tracks etc.) will be avoided by leaving these in place. The bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Access tracks which are not required for farm use will also be covered with topsoil and rehabilitated in a similar manner.

It is considered that leaving the turbine foundations, access tracks and hardstanding areas in-situ will cause less environmental damage than removing and recycling them. Removal of this infrastructure would result in considerable disruption to the local environment in terms of increased sedimentation, erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required by the respective local authority all infrastructure will be removed with mitigation measures similar to those during construction being employed.

Consent for the Proposed Substation is sought in perpetuity and will not be decommissioned with the Proposed Wind Farm.

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 described above.

4.3.5 Surface Water & Drainage Management Plan

This Surface Water and Drainage Management Plan should be read in conjunction with the EIAR. The Surface Water and Drainage Management Plan shall be finalised in accordance with this plan, incorporating any potential requirements of planning conditions, following the appointment of the contractor for the main construction works. The potential impacts on surface waters have been detailed in Chapter 10 of the EIAR.

4.3.5.1 Drainage of the Proposed Development

Sustainable Drainage Systems (SuDS)

The proposed layout of the drainage system is provided in Planning Drawings Series 0101. The drainage strategy within internal areas of the Site will incorporate three main components of Sustainable Drainage Systems (SuDS):

- Interceptor Drains
- Cross Drains
- Diffuser in gravel and stones
- Swales
- Settlement Ponds

Where required, on the upslope side of new sections of access track and hardstanding areas, overland flows will be intercepted in new drainage channels (interceptor drains). The flow will then be discharged diffusely over vegetated areas or diverted to a nearby drain/stream within the existing catchment. The roadside drains (swales) will therefore only carry the site access track runoff. This will ensure that there will be no mixing of ‘clean’ and ‘dirty’ water as shown on Figure 4-1. Thus, erosion risks will be reduced and the quantity of water requiring treatment will be minimised.

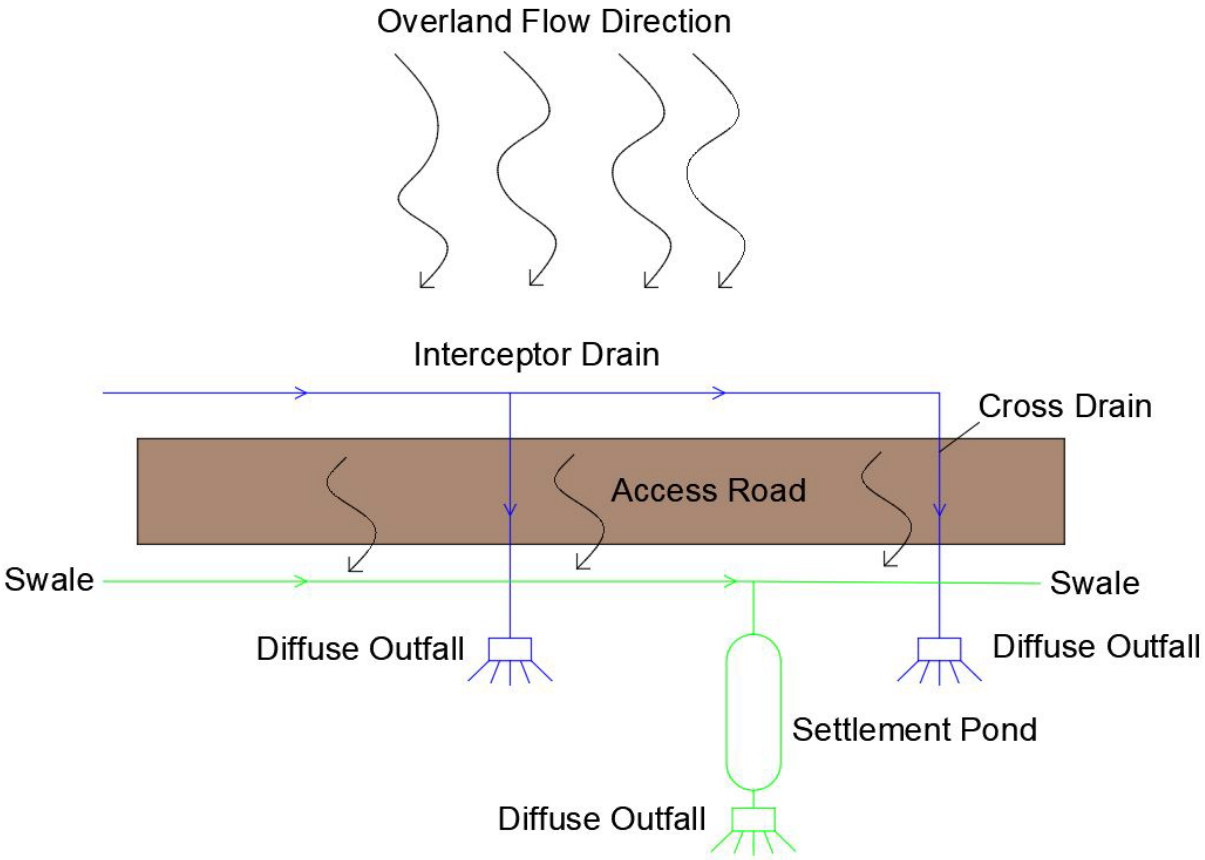


Figure 4-1: Drainage Design Principles

The drainage system outlined below provides for a multi-stage treatment train of the discharges from the development, as recommended in the SUDS manual:

grassed swales removing some of the sediment borne contaminants,

settlement ponds providing retention and treatment of discharges,

diffuse outflow from settlement ponds providing for further retention and settlement of suspended solids by reducing the velocities of flows and increasing the flow path of discharges,

continuation of flows by natural flow paths over vegetated areas before entering the watercourse, providing further retention and treatment of discharges.

The grassed swales will also treat the surface water run-off, removing some of the sediment borne contaminants. These grassed swales will serve to detain flows and reduce the velocities of surface water flows. The swales will be 0.15 m in depth with a bottom width of 0.9 m and side slopes of 1 in 3 (see swale detail in Figure 4-1). The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SUDS.

Stilling ponds will be put in place in advance as construction progresses across the site (see planning drawing P22-242-0300-0030 [included in Appendix 2] for stilling pond details, and photograph example of stilling pond in Figure 4-2 below).

The stilling pond design is based on primary settling out of suspended solids from aqueous suspension. The theory behind the design of the settlement ponds is the application of Stoke's Law. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield run-off rates.

For the preliminary design Stokes' law is used in combination with the Rational Method. The inflow to stilling pond is calculated using Modified Rational Method:

$$Q = 2.78 \times c \times I \times A \text{ (l/s)}$$

C = coefficient runoff, for hardstanding area the value of 0.50 is used.
I = intensity (mm/h) for 1 in 10 years storm event, duration 1h, as pet CIRICA C48
A = contributing area (ha)

According to the CIRIA 648 a pond volume is defined by inflow and retention time:

$$V = Q \times t$$

Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds. After passing through the stilling ponds, the concentration of suspended solids in the surface water run-off due to the excavations will be reduced to within acceptable levels in accordance with Directive 2006/44/EC – European Communities (Quality of Fresh Waters Needing Protection or Improvement to Support Fish Life). In the event of an emergency, the stilling ponds will provide a temporary holding area for any accidental spills on site as it will be possible to block off the outflow from these ponds for a limited period. The stilling ponds will be fenced off for safety. A diffuse outflow will mitigate any increase in run-off. Erosion control and retention facilities, including stilling ponds will be regularly maintained during the construction phase.

Figure 4-2: Grassed Swale along access track

Figure 4-3: Swale draining to Stilling pond

The drainage system including some of the stilling ponds will remain operational and will be utilised for the decommissioning phase to treat any surface water from exposed areas as a result of decommissioning at the site. During decommissioning the turbine base, hardstanding areas and access tracks should remain in place and be covered with local soil/topsoil to minimise disturbance to soils. Removal of this infrastructure would result in considerable disruption to the local environment in terms of increased sedimentation, erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required all infrastructure will be removed with mitigation measures similar to those during construction being employed.

Drainage of Temporary Site Compounds

Drains around the hard-standing areas of the site compound will be in the form of shallow grassed swales to minimise the disturbance to sub-soils.

Filter drains may be used where trafficking by site staff is required to access the temporary site compound. The filter drains/swales will drain to a suitably designed stilling pond.

The stilling pond will be backfilled at the temporary compounds following the construction period and the vacation of the temporary site compounds.

Refuelling of plant during construction will be carried out at refuelling station in the temporary compound, to be located a minimum of 50m from any watercourse. The refuelling station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out at least 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site or at the designated refuelling area and will be towed by a 4x4 jeep to designated re-fuelling areas near to where machinery is located but at distances of greater than 100m from watercourses. Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

Concrete washout will be carried out in a dedicated area of the temporary compound or at a designated washout pit on site. Only the washing of chutes will be permitted. Every concrete truck delivering concrete to the site must use the concrete washout facility prior to leaving the site. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off.

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 tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines).

Portaloos and/ or containerised toilets and welfare units with storage tanks will be used to provide toilet facilities for site personnel during construction. The sanitary waste will be removed from site by a licensed waste disposal contractor. All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase.

Temporary petrol and oil interceptors will be installed at the temporary site compounds and at all locations dedicated for plant repairs/storage of fuel/temporary generator installation. Surface water run-off from the compound will be directed through a Class 1 Full Retention Oil Interceptor before discharge to the dirty water drainage system for the site. This dirty water drain flows to a stilling pond before final discharge over land. A trained and dedicated environmental and fuel spill emergency response team will be set up on site before commencement of construction on-site.

Drainage of Overland Flows

Existing overland flow channels will be maintained, and cross-drains provided in the access tracks to allow continuity of flow. Where required, on the upslope side of new sections of access track and hardstanding areas, overland flows will be intercepted in channels. The flow will then be discharged diffusely over vegetated areas. Cross-drains will be provided where required at a minimum of 200m intervals. The roadside drains will therefore only carry the site access track run-off. This will ensure that there will be no mixing of clean and dirty water and will avoid a large concentration of flows. Thus, erosion risks will be reduced and the quantity of water requiring treatment will be minimised.

Proposed culvert locations have been identified for the Proposed Development and have been sized to convey the appropriate flows, as calculated in Appendix 10.1 of the EIAR (Volume 3).

Drainage of Site Access Tracks

As discussed above, the permitted new site access tracks will be drained via roadside grassed swales with stilling ponds at the end of the swale run. The proposed layout of the drainage system for Proposed Development can be seen in the Planning Application layout Drawings (0101 series) which accompany this application. A cross-section through the proposed site access road construction is shown in Appendix 3.

At slopes greater than 2%, check dams will be required in the swales and interceptor drains to slow down the velocities of flows and prevent erosion occurring, as shown in Figure 4-3.

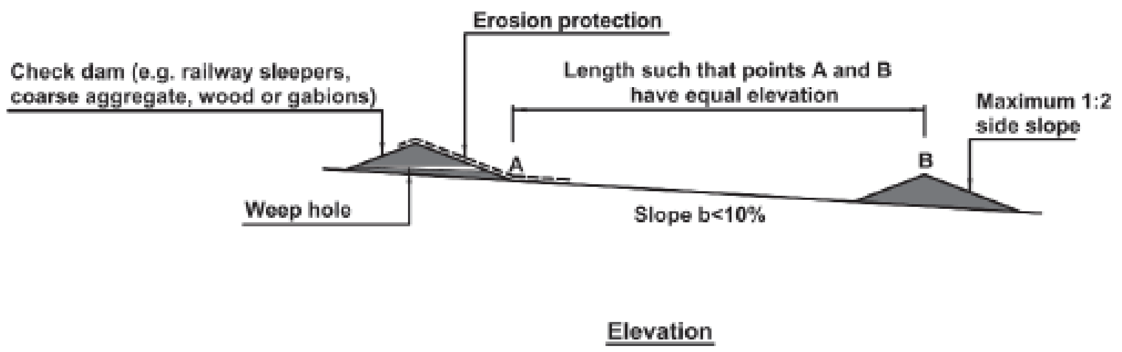


Figure 4-4: Check Dam Details

The roadside swales will drain to stilling ponds before discharging diffusely overland. A portion of the stilling ponds will remain in place following the construction period, as determined by the detailed design.

Silt traps will be provided in swales which will consist of geotextile staked across the swale at regular intervals with clean filter stone weighted across the upstream side of the geotextile to provide further filtration and stability to the silt trap, as shown in Figure 4-4 to Figure 4-6.

Silt fencing will be kept on site and erected at the locations across the site and as required during construction to provide further protection to prevent the ingress of silt into the watercourses. The silt fencing will be kept in place until the natural vegetation has been re-established. Details of the proposed silt fencing are included in the EIAR.

Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have a functioning drainage system in place.

This would be in addition to the measures required in the guidance document 'Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses' by Inland Fisheries Ireland (IFI).

Figure 4-5: Silt Trap across Grassed Swale

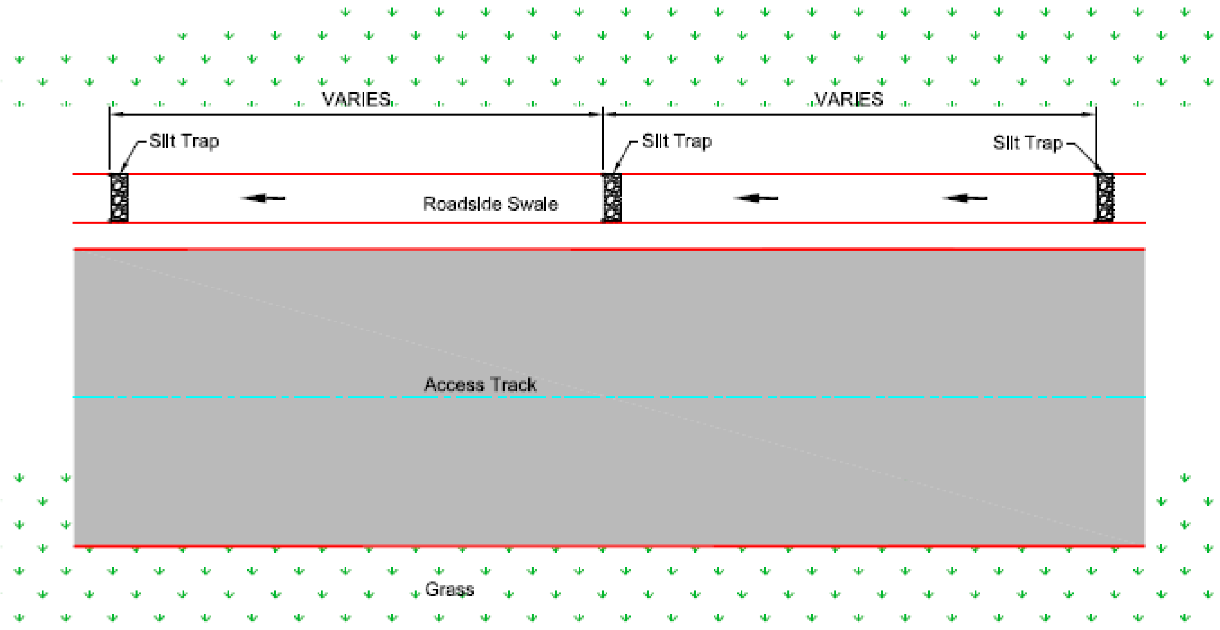


Figure 4-6: Plan of Silt Trap in Swale

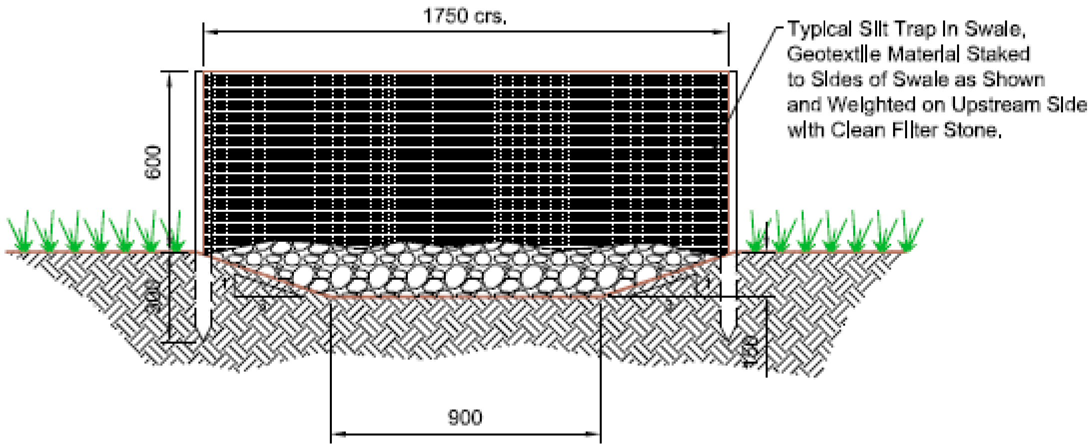


Figure 4-7: Silt Trap Details

Drainage of Turbine Bases and Hardstanding

The excavations for turbines will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases.

As discussed above, the new turbine hard-standing areas will be drained via shallow swales with suitably designed stilling ponds. The stilling ponds will remain in place following the construction period.

Drainage of Cable Trenches

Cables running throughout the wind farm site will be installed in trenches adjacent to site access tracks, where possible. Cable trenches will be excavated using a mechanical excavator and the excavated materials placed in small bunds adjacent to the trenches for back filling, as shown in Figure 4-7.

The seed bank is to be retained for placing back as the top layer of backfill to the trench, to aid successful restoration of vegetation in disturbed areas.

Cable trenches will be excavated during dry periods where possible, in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows. Clay bunds will be constructed at up to 10m intervals within the cable trench.

Figure 4-8: Backfill over Cable Trench

Procedure for Dewatering of Excavations

Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. Water in the excavations for turbines will be pumped into the site drainage system which will be constructed at site clearance stage, in advance of excavations for the turbine bases.

Drainage of Substation

The Proposed Substation is located within a forested area and peat lands which is drained locally by forestry drainage, including a large drain on the western boundary of the substation footprint which forms part of the OPW Arterial Drainage Network. The substation will be drained by a network of piped stormwater drains to a full retention interceptor. Foulwater will be directed to a holding tank as described in Section 4.3.4. A drainage layout drawing for the substation is presented as planning drawing 23727 MWP 00 00 DR C 2100.

Drainage of Stockpiled Material

During the construction period, the excavated material will be used to reinstate the turbine bases.

All excavations shall be constructed and backfilled as quickly as possible. Excavation will stop during or immediately after heavy rainfall.

Excavation will precede the turbine base construction, cable trench and access track construction. Soil will be excavated and replaced with granular fill where required. Excavation will be carried out from access tracks where possible in order to reduce the compaction of topsoil.

During the construction period, spoil heaps from the excavations for the turbine bases will be stored temporarily. These temporary spoil heaps will be covered if required and surrounded by silt fences to filter sediment from the surface water run-off from excavated material.

Surplus soil or rock excavated during the course of the works will be used on site in the form of landscaping including low berms, where appropriate. No spoil stockpiles will be left on site after construction is completed.

Material will only be stockpiled on the site where there will be immediate backfilling of the excavation with the excavated material e.g. cable laying etc., or material will be stockpiled temporarily at the excavation point ready for collection off site. In an emergency such as flash flooding, these spoil heaps will be covered and surrounded by silt fences to filter sediment from the surface water run-off from excavated material.

It should be noted that any stockpiling will be short-term and temporary and will occur only within the site boundary as the construction proceeds. The site drainage system will be put in place prior to excavation, therefore the discharge routes from any temporary stockpiling will be via the site drainage system as detailed in the planning drawings. A minimum buffer of 50m will be provided between temporary stockpiles and the nearest watercourse. There will be no permanent or long-term stockpiling of material on the site.

Reinstated areas and berms will by preference re-vegetate naturally, and further measures will be undertaken in the form of erosion control matting, for example, if deemed to be required.

<u>Watercourse Crossings</u>

Existing stream crossings will be protected using silt fencing.

Minor drains such as manmade agricultural and bog drains will be crossed using suitably designed pipe culverts per the locations and specifications set out in Section 3.4.1.8.

Turbine delivery will not take place during extreme weather conditions.

<u>Climate Change</u>

To accommodate the effect of future climate change in Ireland, the 100-year peak flow values for stream crossing designs have been multiplied by 1.2 to obtain the design 100-year flood value for the crossing. The bridge designs presented within the planning drawings for the Proposed Development have been designed with sufficient freeboard accordingly, as detailed in Appendix 10.1 of the EIAR (Volume 3).

<u>Wash Down from Concrete Trucks and Cement Mixers</u>

Concrete washout will be carried out in a dedicated area of the temporary compound or at a designated washout pit on site. Only the washing of chutes will be permitted. Every concrete truck delivering concrete to the site must use the concrete washout facility prior to leaving the site. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off.

An adequately designed settlement lagoon will be provided to receive all run-off from the concrete wash down area. Regular inspections of the wash down areas and associated settlement lagoons shall be carried out and adequate records kept.

The settlement lagoon shall be lined using a 1mm LDPE impermeable liner. A sump will be provided at this location which will collect the wash water from the concrete trucks. The excavated material will be kept on site for reinstatement following the construction period.

During construction, wash water and any solids in the sump will be removed periodically to an appropriate licensed facility. The sump can be emptied daily if required. Following construction, any solids, the liner, and any remaining wash water in the sump will all be removed to an appropriate licensed facility for disposal. The sump will then be reinstated.

4.3.5.2 Mitigation Measures for Flooding

Increase in run-off as a result of the Proposed Development has been calculated and it has been determined that there is no significant flood risk posed to downstream sites as a result of this increase in run-off. Furthermore, the three-stage treatment train (swale – stilling pond – diffuse outflow) proposed to retain and treat the discharges from hard surface areas as a result of the development will reduce any risk of flooding downstream.

To mitigate against the potential for flood events impacting on the T6 turbine as outlined in Section 10.7 of the EIAR, the ground will be raised locally at the T6 location, so that the turbine foundation and hardstanding has a finished level that is at least 300 mm above the modelled flood level. The finished level of the hardstanding will be 79.5 mOD as can be seen on P22-242-0300-0006, which exceeds the 300 mm above the modelled flood level.

Raising the ground locally to elevate the T6 foundation and hardstanding will displace a volume from the flood capacity in the area, and therefore flood "compensation" must be provided to return the flood capacity to the same as pre-development. This will be achieved by providing a "flood compensation area" immediately adjacent to the T6 hardstanding, as shown on planning drawing P22-242-0101-0033 (included in Appendix 2). The flood compensation area will comprise a depression in the local ground, excavated to 1.5 m below existing ground level, to cover an area as shown in the planning drawing P22-242-0101-0033 which will provide a compensation of flood capacity to cancel the volume displaced by raising the T6 foundation and hardstanding. The result of this is that flood extents in the local area are unchanged for a given flood event, as the capacity for the land to absorb flood water remains the same post-development.

4.3.5.3 Mitigation Measures for Pollution Control to Protect Water Quality in Downstream Receptors

All personnel working on site will be trained in pollution incident control response. An emergency response procedure is prepared in Section 4.3.5.4 which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.

Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where haul roads pass close to watercourses, silt fencing will be used to protect the streams.

Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.

Stilling ponds will be put in place in advance as construction progresses across the site. The stilling ponds with a diffuse outflow detail will mitigate any increase in run-off and treat suspended solids in the surface water run-off. Erosion control and retention facilities, including stilling ponds will be regularly maintained during the construction phase.

In the unlikely event of accidental break out of silt, this will be dealt with in the Emergency Response Procedures, included herein.

All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt run-off, where necessary.

Adequate security will be provided to prevent spillage as a result of vandalism.

Drains around hard-standing areas will be shallow to minimize the disturbance to sub-soils.

Suitably sized cross-drains will be provided for drainage crossings to convey flows from agricultural drains and forestry drains across the access tracks, to prevent a risk of clogging. Culverts have been located and sized as detailed in Appendix 10.1 of the EIAR (Volume 3).

Tracks will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off.

All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed stilling ponds.

Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction, to further ensure that there is no impact from the development to streams and rivers crossing the site.

During the construction period an emergency facility will be provided to control the discharge from the stilling ponds. This will mitigate the risk of any accidental spillage on site affecting watercourses.

Where internal haul roads pass close to watercourses, silt fencing will be used to protect the streams. Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall.

Refuelling of plant during construction will be carried out at a designated station within the temporary compound, which will be located a minimum of 50m from any watercourse. The refuelling station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site or at the designated refuelling area and will be towed by a 4x4 jeep to designated re-fuelling areas near to where machinery is located but at distances of greater than 100m from watercourses. Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

Concrete washout will be carried out in the dedicated washout area of the temporary compound. Only the washing of chutes will be permitted. Every concrete truck delivering concrete to the site must use the concrete washout facility prior to leaving the site. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off.

Any diesel, fuel or hydraulic oils stored at the temporary site compound will be bunded with a bund capacity as described earlier in Section 4.3.5.1.

Vehicles entering the site should be in good working order, free from leakage of fuel or hydraulic fluid.

A wheel wash will be provided at the site entrance. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a proposed contractor. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.

Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licenced waste disposal contractor.

Silt fencing will be erected at the location of stream crossings along the cable route. Silt curtains and floating booms will also be used where deemed to be appropriate, in consultation with IFI and this will be assessed separately at each individual location.

4.3.5.4 Emergency Silt Control and Spillage Response Procedures

All personnel working on site will be trained in pollution incident control response. The emergency response plan will be expanded upon to account for any relevant planning conditions, post consent; which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall is required, and a contingency plan will be prepared for before and after such events. A record will be kept of daily visual examinations of watercourses which receive flows from the permitted development, during and for an agreed period after the construction phase. Procedures for particular accidental spillages, from leaking or damaged fuel lines or a break out of silt are outlined below.

Oils, Fuels and Site Vehicles

Refuelling of plant during construction will be carried out at the temporary compound, or at least 100 m from any watercourse, as described earlier in Section 4.3.5

Details of tests to be carried out on Storage tanks to a recognised standard together with a secondary containment system to provide at least 110% of the maximum tank capacity are as follows:

All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

a. 110% of the capacity of the largest tank or drum within the bunded area; or

b. 25% of the total volume of substance which could be stored within the bunded area.

Detail of oil spill protection measures adjacent to a watercourse are outlined above. Procedures for particular accidental spillages, from leaking or damaged fuel lines are outlined below.

Accidental spillage from leaking or damaged fuel lines

Emergency drip trays and spill kits will be kept available on site for use in emergencies to ensure that any spills from vehicles are contained and removed off site.

Each refuelling station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site.

In the event of pollution or potential risk of pollution Kildare County Council will be informed immediately. In the case of water pollution in addition to the Local Authority, Inland Fisheries Ireland should also be informed immediately.

In the event of an accidental spillage from leaking or damaged fuel lines, the spillage will be cleaned up with absorbent material e.g. sand or turf mould and placed in a designated bunded location while awaiting removal offsite to a licensed facility.

In the event of an emergency, the stilling ponds will provide a temporary holding area for any accidental spills on site as it will be possible to block off the outflow from these ponds for a limited period.

Accidental break out of silt

A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the Proposed Development will include regular monitoring of the drainage system and maintenance as required.

Additional silt fencing will be available on site for use in emergencies.

An emergency preparedness and response procedure is required to prevent environmental pollution incidents.

Maintenance of Site Drainage Systems

The drainage system for the Proposed Development should be maintained regularly to keep it operating effectively. The maintenance should include the following:

- inspection and maintenance of swales;
- inspecting cross-drains for any blockages;
- inspecting stilling ponds and outfalls;
- inspecting the stream crossings and piped crossings for obstructions;
- inspecting the progress of the re-establishment of vegetation;
- implementing appropriate remedial measures as required after the above inspections.

4.3.5.5 Construction Stage Mitigation Measures

As mentioned in Section 4.3.4, long range weather forecasts should be examined, and the construction phases planned taking cognisance of expected weather conditions. The Drainage Engineer should have the authority to suspend the works if weather conditions are deemed too extreme for the effective protection of receiving watercourses. Regular meetings should be held to re-assess construction phases with weather conditions as the project progresses and to establish an operational drainage system in advance of the progression of the works. Regular meetings should be held between the Drainage Engineer appointed by the contractor and the contractor's Project Manager. The planning of traffic routes through the site should be agreed in advance, in order to plan appropriate construction drainage management. Mitigation measures to protect receiving watercourses will be put in place as directed by the Drainage Engineer in advance of extreme forecasts.

The following construction drainage management elements are to be implemented in advance of and during construction:

- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the wind farm will include regular monitoring of the drainage system and maintenance as required. The increase in the rate of run-off along the route of the site access roads and hard-standing areas will be mitigated by the proposed drainage system which includes the provision of stilling ponds to reduce the concentration of suspended solids in the run-off from these areas, and the addition of silt fencing where deemed necessary.

- As mentioned in Section 4.3.5.1, stilling ponds will be put in place in advance as construction progresses across the site. The stilling ponds with a diffuse outflow detail will mitigate any increase in run-off. Erosion control and retention facilities, including stilling ponds will be regularly maintained during the construction phase. The three-stage treatment train (swale – stilling pond – diffuse outflow) proposed to retain and treat the discharges from hard surface areas as a result of the development will reduce any risk of flooding downstream.
- As mentioned in Section 4.3.5.1, standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations for turbines will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases. As the majority of turbine excavations will be within low permeability peat or glacial till, groundwater inflow is expected to be small.
- In areas of higher permeability soils, flows may be higher and exclusion techniques such as sheet piles may be required to control groundwater flow and stabilize excavations, particularly close to the river where a higher water table is expected.
- The excavated subsoil material will be removed, either to the designated material storage areas or stockpiled close to the excavation and used as backfill material if suitable. Temporary material storage areas will be covered with impermeable sheeting and surrounded with silt fencing, which will be monitored to manage any potential loss of suspended solids to surface waters. Temporary material storage areas will be a minimum of 50 m from the true bank edge of any watercourse.
- As mentioned in Section 4.3.5.3, drains around hard-standing areas will be shallow to minimise the disturbance to sub-soils.
- Cross-drains will be provided at the locations, and sized as per the calculations completed in Appendix 10.1 of the EIAR (Volume 3).
- All tracks will be surfaced with clean well graded stone with the minimum of fines which will be imported, to mitigate the conveyance of silt-laden run-off in the track drainage.
- Silt fencing will be used as an additional protection to watercourses where deemed necessary, where floating roads are to be constructed.
- As detailed in Section 4.3.5.1, interceptor cut-off drains will be provided on the upslope side of the site access roads to prevent the mixing of overland flows with the drainage for the proposed development. These interceptor drains will discharge diffusely over land.
- As mentioned in Section 4.3.5.1, cables will be installed in trenches adjacent to the site access roads, or laid within the access road line, where required. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within the cable trench at regular intervals.
- The routes for the proposed access tracks are laid out to follow the existing tracks where practicable. Site access roads have been laid out to reduce the longitudinal slope of roadside drains and to follow natural flow paths where possible. Where roadside drains are laid at slopes greater than 2%, check dams will be provided. This is unlikely to occur as the slopes on the site are flat, however the check dams, if required, will reduce the effective slope and run-off velocities and any consequent potential for erosion.
- Culverts have been sized in accordance with CIRIA C689 Culvert Design and Operation Guide, the Office of Public Works (OPW) guidance and the guidance provided by IFI in the design of the proposed stream crossings. A Section 50 Application will be prepared for all new stream crossings to obtain the consent of the OPW at detailed design stage.

- Where agricultural tracks, bog tracks and forestry tracks will be used to access the development, the roadside drains alongside these roads will be cleared of obstructions, should it be found that debris and vegetation are impeding flows. Silt traps will be provided at regular intervals to reduce the concentration of suspended solids in the surface water run-off being conveyed in the existing drains, which may result from vehicles trafficking these roads from the construction areas.
- All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed stilling ponds.
- The conceptual site drainage has been designed to complement existing overland flow and existing bog, agricultural and forestry drainage.
- Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction, to further ensure that there is no impact from the development to streams and rivers crossing the site.
- As mentioned above in this Section, all personnel working on site will be trained in pollution incident control response. Emergency Silt Control and Spillage Response Procedures contained within the Site Drainage Management Plan of the Construction Environmental Management Plan (CEMP) will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall is required, and a contingency plan will be prepared for before and after such events. A record will be kept of daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase. Water samples will be taken, and water quality will be monitored in accordance with a water monitoring programme, which will be agreed with Kildare County Council.
- The developer will ensure that erosion control, namely silt-traps, silt fencing and swales are regularly maintained during the construction phase.
- As mentioned in Section 4.3.5.1, existing overland flow channels will be maintained, and cross-drains provided in the access roads to allow continuity of flow. Interceptor drains will be constructed upslope where there are no existing channels, with cross-drains provided at regular intervals. The roadside drains will therefore only carry the site access road run-off and so avoid carrying large volumes of water and concentrating flows.
- During the construction period, an emergency facility will be provided to control the discharge from the stilling ponds. This will mitigate the risk of any accidental spillage on site affecting watercourses.
- As detailed in Section 4.3.5.3, roads will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids being conveyed in the run-off into the drainage system.
- As mentioned in Section 4.3.5.3, where access tracks pass close to watercourses, silt fencing will be used to protect the streams by reducing the concentration of suspended solids being conveyed in the surface water run-off into watercourses. Silt traps will also be provided at outfalls from roadside swales to existing drains. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall.
- Wheel wash facilities will be located at the main site entrance to reduce construction traffic fouling public roads. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a permitted contractor. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.
- Silt traps and silt fencing for the proposed wind farm development are proposed and will be put in place in advance as construction progresses across the site.

- Tree felling will be undertaken in accordance with the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) (1) and Forest Harvesting and Environmental Guidelines (2000) (2), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff. This is further detailed below in the Tree Felling Plan in Section 4.3.6
- Roadside swales will serve to attenuate any increase in surface water run-off due to new hardcore tracks or existing track widening.
- Refuelling of plant during construction will only be carried out at dedicated refuelling station locations on site or at least 100m from a watercourse using mobile, double-skinned bowsers. This will reduce any risk of pollutants being conveyed in the surface water run-off, into the drainage system and subsequently into watercourses. Each station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. Only emergency breakdown maintenance will be carried out on site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.
- Temporary petrol and oil interceptors will be installed at the site compound and at all locations dedicated for plant repairs/storage of fuel/temporary generator installation. Surface water run-off from the compound will be directed through a Class 1 Bypass Separator before discharge to the potential silt laden water drainage system for the site. This dirty water flows to a stilling pond before final discharge over land.
- As detailed in Sections 4.3.5.1 and 4.3.5.3, to avoid any risk of groundwater contamination resulting from the foul drainage for the site, portaloos and/ or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licenced waste disposal contractor.
- Where existing drains will be covered with hardcore as part of modifications for road widening to facilitate the turbine delivery route, the surface water will be temporarily culverted beneath the fill material to maintain the existing drainage regime.
- A buffer zone will remain between silt traps and watercourses with natural vegetation left intact so as to assist silt interception.
- Clear span bridge structures shall be used for the crossings of the Fear English River in accordance with planning drawings drawings P22-242-0300-0021 to P22-242-0300-0023 (included in Appendix 2). The extent of the excavation for bridge supports will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter. Bridge foundations will be designed and positioned at least 2.5m from the river bank

A detailed water quality monitoring programme will be undertaken during the construction phase of the proposed development, as detailed below in Section 4.3.5.5.1, so as to ensure the effective implementation of the proposed mitigation measures.

4.3.5.5.1 Water Quality Monitoring Plan

A monitoring programme will be established to ensure that the water quality is maintained and to ensure the effectiveness of designed control and other mitigation measures. The details of this programme are outlined below.

- Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering the streams and rivers of the site, to identify any obstructions to channels, and to allow for appropriate maintenance of the drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.
- Fortnightly visual inspections will be continued during the operation period until satisfactory vegetation is established on site.
- Prior to construction, turbidity monitors will be put in place downstream of the site and a baseline will be formed of existing levels in the water bodies. These levels will be used to set trigger levels for each location. Should these trigger levels be exceeded during construction, works in the area of the effected watercourse will be stopped until the source of the turbidity can be identified. Any additional mitigation will be implemented if necessary to reduce turbidity to acceptable levels.
- Chemical water quality sampling will be undertaken from a representative number of locations upstream and downstream to provide a baseline against which samples taken during the construction stage can be assessed. Trigger values will be defined based on the pre-construction monitoring results however maximum guideline values are provided in below; and are based on S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988.
    - Chemical water sampling will be taken from several sample sites; both up and downstream of watercourses. Water samples will be analysed via a licensed laboratory for the following parameters: pH, dissolved oxygen, suspended solids, total ammonia, nitrites, biochemical oxygen demand (BOD), total ammonium and total residual chlorine.
    - Chemical water sampling will be taken on a weekly basis during the site clearance and earthworks stage of the construction period.
    - Following site clearance and earthworks stage of the construction period, sampling will be taken on a monthly basis until full re-vegetation has occurred, unless otherwise directed by the Planning Authority or Inland Fisheries Ireland (IFI).
- Biological water sampling will be undertaken from the same representative number of locations upstream and downstream to provide a baseline against which samples taken during the construction stage can be assessed.
    - Biological sampling will be undertaken via kick sampling, using Q-Value or Small Stream Risk Assessment (whichever is the most appropriate for the available habitat). Macroinvertebrates will be identified where possible on the banks of sample site.
    - Biological water sampling will be carried out during the site clearance and earthworks stage of the construction period on a monthly basis during the construction phase.
    - Following site clearance and earthworks stage of the construction period, samples will be taken on a quarterly basis, until full re-vegetation has occurred or unless otherwise directed by the planning authority or IFI.

Table 4-6: Water Quality Monitoring Parameters

Parameter	Maximum Guideline Value
pH	≥6 ≤9
Dissolved Oxygen (mg/litre O_2)	50% ≥ 9

Parameter	Maximum Guideline Value
Suspended Solids (mg/l)	≤25
Total Ammonia (mg/l N)	≤0.02
Biochemical Oxygen Demand BOD (mg/l O_2)	≤5
Nitrites (mg/l NO_2)	≤0.05
Total Ammonium (mg/l NH_4)	≤1
Total residual Chlorine (mg/l HOC1)	≤0.005
pH	≥6 ≤9
Dissolved Oxygen (mg/litre O_2)	50% ≥ 9

The grab samples will be taken on a monthly basis during the site clearance and earthworks stage of the construction period. Following this stage, the samples will be taken on a quarterly basis, unless otherwise directed by the planning authority or IFI.

4.3.5.6 Operational Phase Mitigation Measures

It is not envisaged that the operation of the Proposed Development will result in significant impacts on the hydrological regime or water quality of the area, as there will be no further disturbance of soils post-construction, and only a minimum of traffic movement.

The conceptual drainage has been designed to operate effectively during the operation period. A portion of the stilling ponds will be a permanent feature and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.

During the operation period the swales will have vegetated and will serve to attenuate flows and remove suspended solids from the run-off.

Oil used in transformers (at the substation and within each turbine) and storage of oils in tanks at the substation could leak during the operational phase and impact on groundwater quality. The substation transformer and oil storage tanks will be in a concrete bunded with a holding capacity as detailed in Section 4.3.5.1. Turbine transformers are located within the turbines, so any leaks would be contained.

A monitoring programme will be established to ensure that the water quality is maintained. The details of this programme are outlined above. This programme will ensure that designed measures are working to ensure water quality is not affected.

Visual inspections will be continued during the operational period until satisfactory vegetation is established on site at intervals to be agreed with Kildare County Council/IFI.

4.3.5.7 Decommissioning Stage and Mitigation Measures

As in the construction phase silt protection controls would again be put in place. The drainage system will remain operational during the decommissioning phase and will serve to treat any sediment laden surface water run-off due to a renewed disturbance of soils. Revegetation following the backfilling of hardstanding areas will be monitored. If it is deemed necessary, erosion control matting will be used to assist in the re-establishment of vegetation.

4.3.6 Tree Felling Plan

A total area of 28.4 ha of wooded habitats will be subject to tree felling as part of the proposed development. The proposed area of tree felling will be limited to:

- Areas adjacent to turbines T6, T7, T8, T9, T10 and T11 so that the required infrastructure can be facilitated at these locations;
- Minimal trimming along existing access tracks to ensure that the widened footprint of these access tracks can be accommodated;
- Corridors along the proposed new access tracks to ensure that the footprint of these can be accommodated;

This tree felling will be the subject of a Felling Licence from the Forest Service (as described in Section 4.2.3) and will be in accordance with the conditions of such a licence. The planting of trees in replant lands in considered in the replanting impact assessment.

To ensure a tree felling method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

Before any felling commences on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The surface water management plan, the construction environmental management plan and any contingency plans;
- Environmental issues relating to this project and the site of the proposed development;
- The outer perimeter of all buffer and exclusion zones; and
- All health & safety issues relating to the site.

The harvester represents the first point of contact between machinery and the ground and therefore the layout of the extraction racks is critical.

The layout of extraction racks or routes will be designed to:

- Avoid streams or other watercourses;
- Be as short as possible;
- Avoid any areas of poor crop or bare areas; and
- Generally, extract to access tracks with the extraction racks laid out at right angles to the road to prevent water flowing down wheel ruts.

Brash management will include the immediate removal of loosed material. In addition, dense, fresh brash mats will be utilised in order to minimise soil damage, erosion and sedimentation during felling.

These will be designed and installed to protect the underlying soil from damage and will be maintained throughout the felling operation. Their purpose is to prevent breaking of the ground surface thus preventing silt or nutrient run-off.

Brash mats will be topped up in sections when they become heavily used or worn. Where damage or serious rutting has started to occur extraction will be suspended immediately. Relocation of the extraction rack or additional brashing will be used to remedy the situation.

Extraction routes will be as short as possible and will avoid the crossing of watercourses. Trees will be felled away from aquatic zones. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed immediately to mitigate against nutrient losses, particularly phosphorus. Additional silt fencing will be erected along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area. To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

The brash will be bundled and recovered from the site as felling progresses in a process known as forest residue recovery. Double-wheeled machinery and corduroy rafts (close poling) will be used as necessary to maximise the recovery of brash and where the bearing capacity of the ground is poor. Extraction and cutting will be suspended during and following heavy rainfall periods.

No significant increase in the rate of run-off is anticipated as a result of felling nor is the risk of downstream flooding or sedimentation due to erosion increased. Mitigation measures for the protection of surface water during felling are detailed in Section 4.3.5.

4.3.7 Archaeological Management Plan

The Proposed Development will have no direct impact on any UNESCO World Heritage Site, National Monument, protected structures, NIAH sites or features, NIAH garden survey sites or on Architectural Conservation Areas. There are no protected structures located within the proposed wind farm boundaries and few sites of recorded architectural interest or significance are within the surrounding area.

The Proposed Development will have no setting impacts on any UNESCO World Heritage Sites or candidate sites on the tentative list. During the operational phase the wind farm could potentially affect the setting of 6 heritage assets, level of impacts ranges from not significant to slight for these sites.

As with any developments proposed within a greenfield environment, there is a potential that previously unknown below ground remains of an archaeological interest will be revealed as a result of earthmoving activity associated with the development. The following are areas of archaeological potential:

- Dryland/ Wetland interface potential
- Former bogland
- Forest plantation on former dryland
- River Crossings

Mitigation Measures

The following mitigation measures will be carried out at the earliest stages of construction/ during the site preparation phase. All archaeological works will take place under licence to the National Monuments Service of the Department of Housing, Local Government and Heritage (DHLGH).

Archaeological monitoring of all earth-moving works will be undertaken at all earthmoving/excavation works associated with the development of:

- Turbine foundations
- Access tracks
- Hardstands
- Internal cables
- Temporary construction compounds
- Earthen berms and landscaping along the access tracks and around the turbines

The purpose of monitoring is to determine if any archaeological material or features are uncovered during ground disturbance works. In the event of the discovery of archaeological finds or remains, the DHLGH and the NMI will be notified immediately. Provision will be made to allow for, and fund any, archaeological work that may be needed if any remains are noted. If features are revealed, the immediate area will be investigated, allowing no further development to take place until the site is fully identified, recorded and excavated or alternatively avoided to the satisfaction of the statutory authorities. In accordance with best practice and legislative requirements this provision would include the production of written reports on the findings, with post-excavation analyses and publications of the results of the works, where appropriate.

Turbine Delivery Routes

As a best practice measure a baseline condition survey will be carried out at Johnstown Bridge (RPS B04-25). This will be undertaken to record baseline data which will be monitored during construction phase.

Indirect effects on setting mitigation

There is no mitigation possible for this potential impact; instead, mitigation by design was actively carried out during the EIAR process. Using a GIS spatial data, the archaeological, architectural and cultural heritage features identified during the baseline study and field survey work were used as a tool by all consultants. Arriving at the final proposed layout was through a series of iterative phases and interaction with all of the technical consultants.

General

Attention is drawn to National Monuments Acts (as amended) which still active, and the Historic and Archaeological Heritage and Miscellaneous Provisions Act (2023) (Appendix 14, Section 14.1), which states that in the event of the discovery of archaeological finds or remains, the Department of Housing, Local Government and Heritage and the National Museum of Ireland should be notified immediately. In such a scenario, the archaeological finds or remains will need to be investigated, and no further development will take place in that area until the finds or remains are resolved in agreement with the relevant authorities.

During the construction phase all mitigation measures will be undertaken in compliance with national policy guidelines and statutory provisions for the protection of the archaeological, architectural and cultural heritage.

4.3.8 Waste Management Plan

It will be the objective of the Developer in conjunction with appointed contractor to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the development construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compounds during construction.

This Construction Waste Management Plan has been prepared for the Proposed Development in line with the" Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects" (2006) as published by the Department of the Environment, Community and Local Government and supported by the Eastern-Midlands Region Waste Management Plan 2015-2021.

The Waste Management Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and will take cognisance of any planning conditions attached to the consent. This plan should be read in conjunction with the EIAR.

Assignment of Responsible Personnel

It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste. The waste manager will have overall responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements. They will ensure that at an operational level that each crew foreman is assigned direct responsibility.

Waste Generated

It is envisaged that the following categories of waste will be generated during the construction of the project:

- municipal solid waste (MSW) from the office and canteen
- construction and demolition waste
- waste oil/hydrocarbons
- paper/cardboard
- timber
- steel

A fully authorised waste management contractor will be appointed prior to construction works commencing. This contractor will provide appropriate receptacles for the collection of the various waste streams and will ensure the regular emptying/and or collection of these receptacles.

Waste Minimisation/Reduction

All efforts will be made by site management to minimise the creation of waste throughout the project. This will be done by:

- material ordering will be optimised to ensure only the necessary quantities of materials are delivered to site
- material storage areas will be of a suitable design and construction to adequately protect all sorted materials to ensure no unnecessary spoilage of materials occurs which would generate additional waste
- all plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of waste oil/hydrocarbons on site
- all operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc. for example cutting of plywood, built into the amount ordered
- educating foremen and others to cut/use materials such as ply wisely for shutters etc.
- prefabrication of design elements will be used where suitable to eliminate waste generation on site
- where materials such as concrete are being ordered, great care will be practiced in the calculation of quantities to reduce wastage.

Waste Reuse

When possible, materials shall be re used onsite for other suitable purposes e.g.

- re-use of shuttering etc. where it is safe to do so
- re-use of rebar cut-offs where suitable
- re-use of excavate materials for screening, berms etc.
- re-use of excavated material etc. – where possible will be used as suitable fill elsewhere on site for the new site tracks, the hardstanding areas and embankments where possible.

Waste Recycling & Recovery

In accordance with national waste policy, source separation of recyclable material will take place. This will include the provision of receptacles for the separation and collection of dry recyclables (paper, cardboard, plastics etc.), biological waste (canteen waste) and residual waste.

Receptacles will be clearly labelled, signposted and stored in dedicated areas.

The following sourced segregated materials container will be made available on site at a suitable location:

- timber
- ferrous metals
- aluminium
- dry mixed recyclables
- packaging waste
- food waste.

The materials will be transported off-site by a licensed contractor to a proposed recovery centre and these materials will be processed through various recovery operations.

Waste Disposal

Residual waste generated on-site may require disposal. This waste will be deposited in dedicated receptacles and collected by the licensed waste management contractor and transported to an appropriate facility. All waste movements will be recorded, of which records will be held by the waste manager on-site.

Contaminated Material

Any contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste. In particular, the following measures will be implemented:

- Contaminated material will be left in-situ and covered, where possible until such time as WAC (Waste Acceptance Criteria) testing is undertaken in accordance with recommended standards and in-line with the acceptance criteria at a suitably licenced landfill or treatment facility. This will determine firstly the nature of the contamination and secondly the materials classification i.e. inert, non-hazardous or hazardous,
- If the material is deemed to be contaminated, consultation will take place with the respective local authority and/or EPA on the most appropriate measures. Such materials will be excavated, transported by a contractor with a valid waste collection permit and recovered/disposed of at an appropriate facility.

Training

Copies of the project waste management plan will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the Plan and informed of the responsibilities that fall upon them as a consequence of its provisions.

It will be the responsibility of the contractors appointed (Waste Manager) to ensure that all personnel are made aware of their responsibilities under the plan via a toolbox talk or otherwise.

4.3.9 Traffic Management Plan

This document is the Construction Traffic Management Plan (TMP) for the Proposed Development site. The Construction Traffic Management Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and the turbine supply contract.

Please note that some items in this plan can only be finalised with appropriate input from the contractor who will actually carry out and schedule the works. Furthermore, it is appropriate that the Project Supervisor Construction Stage (PSCS), when appointed, should have an active role in the preparation/review of the Traffic Management Plan.

This plan should be read in conjunction with Chapter 13 of the EIAR.

The contractor is required to prepare the necessary Site-Specific Traffic Management Plans prior to the construction works commencing in accordance with Chapter 8 of the Traffic Signs Manual and subject to load permits.

The contractor will be responsible for the implementation of all agreements between the developer and Kildare County Council with the objective that the transportation needs for the proposed development will have a minimal impact on the road network and local communities.

As with any construction development project, the transport of materials onto the site will give rise to increased traffic and associated impacts. However due to the very nature of construction these impacts will be temporary.

Construction traffic will require regular access to the site at varying times throughout the construction phase.

The aim of this TMP is to put in place procedures to manage traffic effectively on site and in the immediate vicinity of the proposed development, to ensure the continued movement of traffic on the public roads and to minimise disturbance during transportation of materials particularly oversize loads.

The correct implementation of this TMP will ensure that appropriate procedures are in place to minimise any effects on the safety and movement of the general public.

Prior to the commencement of construction, the TMP will be reviewed by the main contractor (and any sub-contractors) and will be updated as necessary.

General Traffic Management Measures

General measures that shall be addressed in the TMP shall include:

1. **Traffic Management Coordinator** - A dedicated competent Traffic Management Coordinator 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 on the project.
2. **Road Pre- Construction Condition Survey** - A pre-condition survey will be carried out in advance of any construction works on the public roads that will be agreed to be used as haul routes in connection with the works to record the condition of the road. The specification and timing of the pre-construction survey will be agreed with Kildare County Council and TII as appropriate. A joint survey shall be undertaken if required by the relevant roads authority.
3. **Site Inductions** - All workers will receive a comprehensive site induction which shall include, as appropriate, a section on traffic management and clear guidance on the routes which should and should not be used.
4. **Public Consultation** - Subject to agreement with the planning authority, a letter drop will be carried out to notify members of the public living near the proposed site/route/roadworks, to advise them of any particularly significant upcoming traffic related matters e.g. temporary lane/road closures, delivery of turbine components at night.
5. **Signage** - A system of clear signage relating to the project, both temporary and permanent, will be agreed with the planning authority. These signs will also identify those roads to be used (and not to be used) for accessing the site in line with the objectives of the Construction TMP.
6. **24 Hour Emergency Phone Number** - A 24-hour emergency phone number will be maintained for the duration of the construction works and the number will be noted on temporary signage at each works area (for cable works) and at the site entrance at a minimum.
7. **On-Site Vehicle Cleaning** - Temporary wheel washing facilities will be located at the site entrance, subject to agreement with the planning authority, to prevent soil/dirt from being transported onto the public road network.
8. **Road Cleaning and Maintenance** - Road sweepers will be utilised to maintain the public roads in a clear condition. This will apply especially during the earthworks stages of the project.

9. **Road Opening Licensing** - Road works associated with the cabling on the public road will be undertaken in line with the requirements of the road opening licence, the terms of which will be set out by Kildare County Council.

10. **Adjacent Dwellings** - A number of mitigation measures shall be put in place so as to reduce the impact on the residential dwelling (family member of involved landowner) adjacent to the site entrance during construction. These include the following:

    a. All construction traffic shall follow the identified haul route, as such, any temporary noise from construction will be moving away from the dwelling on entering the site.

    b. A noise attenuation barrier will also be put in place along the boundary of the site to reduce any further temporary noise impacts on the dwelling. This can be done in consultation/agreement with the neighbouring residents if permitted.

    c. A commitment is given that no construction traffic vehicles will loiter outside the dwelling.

    d. The residents will be kept informed of the traffic movements during construction by way of leaflet drops so they are aware of different stages of development/construction.

    e. Commitment to keep speed below 20-30kph beside the dwelling to reduce noise/vibration from passing trucks.

    f. Dust monitoring will take place at the site entrance and there will be done daily visual checks for dust deposition. Dust screens or other suitable measures will be put in place , as required.

11. **Local Access** - Reasonable access to local dwellings, farms, and businesses is to be maintained at all times during any road closure associated with the cable works. The details of this will be agreed with the roads authority in advance of the works, in consultation with the local residents in so far as is practicable. The section of local road impacted during cable works is a cul de sac and therefore diversions are not suitable. Reasonable access will be retained and the works will be short term in duration for the impact owing to the cabling works.

12. **Road Safety Assessment Stage 1 of 2** - A Road Safety Assessment has been carried out by an independent consultancy JB Barry & Partners Ltd. in March 2019 for the proposed development, specifically, to consider the suitability of the haul routes indicated in the previous 2018 EIAR for use. The findings of this RSA resulted in a number of local roads in the site vicinity being removed as potential haul routes (the L5024, L5017, L5011). The RSA also advised that, where possible, bypass routes of urban centres should also be used (for example, the urban centres of Prosperous, Clane, Enfield, Naas, etc. should be avoided by haul traffic where possible).

    The Road Safety Assessment has been carried out to confirm the suitability of the existing road network, from a safety point of view, to accommodate the proposed construction traffic. The following paragraphs identify the links on the road network surrounding the proposed development. The findings and recommendations of the RSA have been incorporated into current the approach.

M4

The M4 is a dual carriageway motorway, designed and constructed in compliance with NRA/TII guidelines. Road Safety Audits are carried out on all motorways as part of the various stages of the design and construction process. The M4 will be used for transporting materials as well as turbine components to the site. This road carries large volumes of traffic and functions as a strategic national route. It is therefore suitable for use by HGV traffic for material deliveries to the site. The Turbine Delivery Report (TDR), which is included in Appendix 13.1 of the EIAR (Volume 3), assesses the suitability of a route for abnormal load delivery, such as turbine blades or tower sections for the turbines. This TDR report also outlines accommodation works required to facilitate these deliveries on the preferred route. The M4 was selected as the preferred route as alternatives would require vehicles to pass through areas of soft ground or towns such as Edenderry. Accommodation works are not required on the M4 itself. The Enfield Interchange (Junction 9 on the M4) requires minor accommodation works but these do not raise any safety concerns. Any signs to be removed to facilitate deliveries will be reinstalled immediately following the delivery, and deliveries will be coordinated in conjunction with An Garda Síochána.

R402

The R402 is a regional road which will be used for HGVs and general traffic to and from the proposed development, as well as forming part of the turbine delivery route. It forms the main road between Edenderry and the M4. This is generally a wide and flat road with one lane in each direction, approx. 7m wide, with good visibility. There are a number of bends on the road, but it is reasonably heavily trafficked, and no safety concerns are anticipated for use by general traffic, including HGVs. This section of the R402 was upgraded in recent years and the junction of the R402/L5025 was widened and upgraded to include left-turn and right-turn pockets. This junction is considered to provide sufficient visibility and geometry to allow HGV movements in all directions. Minor accommodation works are required to facilitate turbine delivery; however, these are generally limited to temporary removal of signage and a street light, which will be reinstated immediately following the deliveries. As with the M4, turbine deliveries will be coordinated in conjunction with An Garda Síochána.

R403

The R403 is a regional road connecting Carbury and Allenwood. It is proposed to use this for HGV traffic approaching the site from the south. Similar to the R402, it is a single carriageway road with generally good visibility. It is not proposed to route turbine deliveries via the R403.

L5025

The L5025 is a local road which provides the access route to the site itself from the R402. It will therefore be used by all traffic entering and exiting the site.

Turbine deliveries via this route will require accommodation works including paving an area of verge on the southern side of the road, and potential trimming of hedgerows. Turbine deliveries will be coordinated in conjunction with An Garda Síochána to ensure safe navigation of this stretch of road.

The L5025 is narrower than the regional roads and carries lower volumes of traffic. Visibility is good and there are locally widened areas. It should be noted that this road passes through a rural area and therefore is regularly used by agricultural vehicles, with approx. 60 HGVs currently passing along it in both directions each day. HGVs and site traffic will therefore use this road in both directions and it is not anticipated that there will be any particular safety concerns on this section of road for delivery vehicles. Prior to construction, the appointed contractor will liaise with Kildare County Council with regard to the Construction-stage Traffic Management Plan, including any construction stage speed limits that may be required on the L5025.

L50242

The L50242 local road is a cul de sac located in a central location of the proposed development site. The L50242 will be utilised for cable installation so as to connect the northern and southern section of the site. The road will also be utilised as a connection between the southern and northern sections of the site throughout construction with a secondary construction entrance on the L50242.

L5012

Prior to construction, the appointed contractor will liaise with Kildare County Council with regard to the Construction-stage Traffic Management Plan, including any construction stage speed limits that may be required on the L50242 and the L5012.

Mitigation Measures –Turbine Delivery Route

1. **Programme of Deliveries** – As agreed with Kildare County Council, a programme of deliveries will be submitted to Kildare County Council in advance of deliveries of turbine components to site. The programme will include details of the dates and times of each turbine component delivery along with the weight of each load, the route to be taken and details on support vehicles.
2. **Reinstatement** – Any areas affected by the works to facilitate turbine delivery will be fully reinstated to their original condition.
3. **Consultation** with the local authorities should be included in the contractor's traffic management plan to manage turbine component deliveries where necessary.
4. **Detailed Structural Surveys of Crossings -** Visual inspections indicate that all existing crossings along the TDR between the M4 and the proposed site entrance are capable of safely carrying the expected loads. Where required structural surveys of selected crossings along the TDR can take place during the detailed design phase prior to commencement.

Mitigation Measures – Operational Phase

No mitigation measures required.

Mitigation Measures – Decommissioning

All decommissioning works are to be carried out in accordance with a decommissioning plan (including details of traffic management) to be agreed with the planning authority in advance of the works.

Construction Staging

The approximate period of construction for completion of the total scheme is estimated to take 18 months. Once the bulk civil works are completed, grid connection works will take place, followed by an element of testing and commissioning of the wind farm and substation. It is anticipated that traffic associated with this element of the works will be minimal, with between 2 and 4 crew vans accommodating the movement of staff to and from the different WTG sites within the wind farm site.

The construction of Proposed Development will generally include a sequence of distinct construction activities:

- Construction of main road access, site entrances and amenity trail.
- Initial installation of on-site access tracks and fence lines.
- Development of the construction compounds and other temporary works.

- On-site tracks and drainage.
- Preparation of crane hard standings.
- Construction of foundations.
- Installation of cabling within wind farm.
- Installation of Wind Turbine Generators (WTGs).
- Installation of cabling, substation and control building.
- Grid connection works.
- Land reinstatement.

Construction Plant and Vehicles

The typical construction plant and vehicles used as part of the construction of a wind farm site are as follows (non-exhaustive):

- Hydraulic Excavators
- Dump Trucks
- General construction delivery vehicles (e.g. steel reinforcement bar, electrical components etc.)
- Concrete trucks and pumps
- Cranes of various lifting capacities (up to 1000 tonnes)
- Oversized articulated delivery vehicles (for turbine component transport)
- Site Jeeps (off-road 4x4 all purpose vehicles)
- Private vehicles of those employed on site for the construction phase

It should be noted however that final selection of construction plant and vehicles may vary depending on suitability, availability, contractor's choice, etc.

Plant operators will be responsible for the upkeep and maintenance of construction plant and vehicles, ensuring good working order prior to use. Should emergency maintenance need to be carried out on site, this will be carried out at a designated area away from sensitive receptors and will ensure that a spill kit is nearby.

The hours of construction activity will be agreed with Kildare County Council and 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. It should be noted that it may be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process.

Work on Sundays or public holidays will only be conducted in exceptional circumstances, to be agreed with Kildare County Council, or in an emergency. Additional emergency works may also be required outside of normal working hours as quoted above.

Construction commencement dates are yet to be confirmed at this stage; these will be made known to the Planning Authority by way of formal Commencement Notice.

Consultation and Notification

An Garda Síochána

Following the appointment of the successful contractor for this project, this Transport Management Plan shall be finalised following the appointment of the contractor for the main construction works. The contractor will liaise directly with An Garda Síochána in relation to the plan and any concerns/requirements they have will be incorporated in to the plan. This may include details in relation to the escorting of oversized loads.

The necessary permits (including approved route permits) will be applied for and obtained from An Garda Síochána.

County Council

The contractor will liaise directly with the County Council in relation to the plan and any concerns/requirements they have will be incorporated in to the plan. The contractor will also liaise with other local authorities, as necessary, along the final turbine delivery route.

The necessary permits (including standard permits) will be applied for and obtained from the relevant local authorities.

Local Residents

The following measures will be used to communicate the necessary information to the households along the local road to be used as a haul road:

(a) Information signs will be erected in advance of the construction/transportation works.
(b) A flyer drop will be carried out to advise households along the local road leading to the site in relation to the programme of construction works and especially in relation to oversized load movements.
(c) Contact details for a Liaison Officer will be provided so that any concerns can be easily channelled to the Developer.

Complaints will be entered into the site complaints log and the relevant site environmental officer will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager.

Key Personnel and Responsibility

Once prepared and agreed with Kildare County Council and An Garda Síochána the contractor will implement the project specific Traffic Management Plan (TMP).

Please note that some items in this plan can only be finalised with appropriate input from the contractor who will carry out and schedule the works. Furthermore, it is appropriate that the Project Supervisor Construction Stage (PSCS), when appointed, should have an active role in the preparation/review of the Traffic Management Plan.

The following members of the contractors' staff will have responsibility for adherence to the TMP as follows:

Traffic Management Coordinator

The Traffic Management Coordinator will be responsible for maintaining regular contact with An Garda Síochána, Kildare County Council, the statutory bodies and the client concerning traffic control, interference with services and co-ordination of crossings at roads, rivers and railways.

The Transport Management Coordinator will contact the relevant bodies in relation to method statements prior to the work taking place. The Transport Management Coordinator will be responsible for instructing the Construction Manager, Foreman and all other personnel on the information in the agreed method statement prior to the work commencing and ensuring that the method statement is adhered to.

The Transport Management Coordinator will be responsible for ensuring that the Traffic Management Plan will be implemented in full.

Safety Officer

The Safety Officer will be responsible for implementing all safety requirements detailed in the Project Safety Plan. Ensure that all operatives receive site safety induction prior to commencing work on site. They will ensure that all plant, particularly lifting equipment, on site has the relevant certification and are checked regularly by a competent person. The Safety Officer will carry out safety audits and checks on a regular basis and amend procedures where necessary.

Construction Manager

The Construction Manager will be responsible for overall supervision of the operations to ensure they are constructed in a safe and efficient manner. They will ensure that sufficient resources are available to meet the programme and that the necessary information is provided to the appropriate staff.

Foreman

The Foreman is responsible for ensuring that the crew carry out the work in accordance with the method statement and contract specifications and drawings using good working practices in a safe manner. They will supervise construction personnel ensuring their competence. He will check all plant and equipment on a regular basis ensuring it is maintained and in good working order.

Wind Turbine Generator Deliveries

A detailed turbine delivery route assessment has been carried out for the project which can be found in Appendix 1 of this CEMP.

The components of 11 no. Wind Turbine Generators (WTG's) will be transported by road to the proposed development for on-site assembly, using the access route outlined in the above Turbine Delivery Route Assessment Report.

Wind turbine component deliveries, cranes and all large plant associated with turbine installations will use the turbine delivery route shown in Figure 2-1.

Restricted Public Road Use by Construction Traffic

The local authority may impose restrictions on the use of some local roads. These will be agreed in liaison with Kildare County Council prior to construction and will be outlined in this section, as well as specific signage requirements for construction works.

Materials will be delivered to site where possible via the indicative haul routes shown in Figure 4-8.

Road Closures, Diversions and Safety Measures for Road Crossings

There will be a small section of cable installed over Circa 1.38km of the public road L50242 required in order to connect the northern and southern turbines. It is important to note that the road works and the associated impact will move as the works progress and therefore the impact along this one stretch of road will be temporary.

In order to maintain this local access it is proposed to trench the cabling within the grass verge along the section of the route where local access needs to be maintained. This prevents the requirement for full road closures for the entire length of the cable route and effectively maintains local access where it is required. All traffic management measures will be developed and agreed in advance with KCC.

The L50242 cul de sac is at present too narrow for vehicles to pass each other except for where passing bays exist. There are existing passing bays on the route, which provide good visibility along the route and thus will continue to operate effectively in combination with the use of a banksmen at the site entrances on the L50242 and passing bays in order to hold vehicles until the route ahead is clear, allowing for HGVs to pass. The L50242 will operate effectively through the use of these existing passing bays combined with the use of banksmen, the good forward visibility currently present for vehicles and the relatively low frequency of vehicles on the route (owing to the fact that there are only two dwellings along the stretch of road in question).

Road Cleaning

Public roads shall be kept free of mud, dust, spillages and debris from the construction site, construction plant or haulage vehicles. Any necessary measures shall be put in place at the site entry/exit points.

Carriageway/ Road Reinstatement

It is anticipated that the proposed haul routes will be capable of accommodating the construction traffic associated with the project. After the main contractor is appointed and the haul routes are agreed with Kildare County Council. In the event that there are concerns around the structural capacity of a road on a proposed haul route, a structural survey shall be carried out to determine suitability of the existing roads to carry the loading. Where the structural survey indicates that a proposed haul route is not in a suitable condition, details of any upgrading works required shall be submitted to Kildare County Council for approval. The developer shall upgrade the road or junction in advance of haulage operations.

A pre-condition survey of haul routes, consisting of a video survey and photographs shall be carried out and a copy submitted to Kildare County Council. Any damage caused to the road shall be repaired to its previous condition, to the satisfaction of Kildare County Council. Any defects that appear during the haulage period shall be rectified by the project owner.

Additional Information and Mitigation Measures

Turbine Delivery Route

The TDR has been considered and chosen following route analysis by North Kildare Wind Farm Ltd. The TDR selection report is provided in Appendix 1 and is referred to hereunder as the "TDR Report".

The report identifies all alterations needed at bends and junctions required for turbine component delivery to the Proposed Development site.

The selection of the TDR has been undertaken to eliminate as far as possible and minimise any disruption to the road network to facilitate the delivery of wind turbine generators from the M4 motorway to the site.

It is proposed to deliver turbines to the site from the M4 motorway, then the R402 to the junction of the L402/L5025 and follow the L5025 to the main site entrance.

The appointed contractor will undertake adequate traffic management when performing these works to minimise impacts on local road users. Boundaries will be reinstated, and hedge planting undertaken as required following delivery of the turbine components.

- Programme of Deliveries – As agreed with Kildare County Council, a programme of deliveries will be submitted to Kildare County Council in advance of deliveries of turbine components to site. The programme will include details of the dates and times of each turbine component delivery along with the weight of each load, the route to be taken and details on support vehicles.
- Reinstatement – Any areas affected by the works to facilitate turbine delivery will be fully reinstated to their original condition.
- Consultation with the local authorities should be included in the contractor's traffic management plan to manage turbine component deliveries where necessary.
- Detailed Structural Surveys of Crossings - Prior to commencement of works on site, a structural survey of crossings along the TDR between the M4 and the site entrance be carried out by a suitably qualified engineer.

Cable Works

- Road Opening Licence - The road works associated with the cabling will be undertaken in line with the requirements of A road opening licence as agreed with Kildare County Council.
- Maintain local access during diversions and road closures – reasonable access to local dwellings, farms and businesses will be maintained at all times during any road closures associated with the cable works. The details of this will be agreed with the roads authority in advance of the works in consultation with the local residents in so far as is practicable. 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 cabling works.
- Road Cleanliness - Appropriate steps will be taken to prevent soil/dirt generated during the trenching works from being transported on the public road. Road sweeping vehicles will be used to ensure that the public road network remains free of soil/dirt from the site.
- Temporary Trench Reinstatement - Trenches on public roads, once backfilled, will be temporarily reinstated without delay to the satisfaction of the roads authority.

- Surface Overlay after Trench Reinstatement – Following temporary reinstatement of trenches on public roads, and subject to agreement with the roads authority, sections of public roads along which the cable route travels will receive a surface overlay.
- Haul Route Interface - Aggregate imported to the Proposed Development from indicative quarry locations would be managed where possible to not coincide with the grid connection works.

Haul Routes

The indicative haul route, as presented on Figure 4-8, shows the routes that will be taken by most construction traffic to the wind farm from indicative quarry locations.

The proposed site entrance design is shown on planning application drawing P22-242-0300-0015 in Appendix 2.

The site entrance location on the L5025 shall provide 160m visibility to the north and 155m to the south when developed. It is considered that the sightline of 155m to the south will provide adequate visibility to oncoming traffic for traffic exiting the site, and vice versa. Advance signage will be provided on the L5025 in both directions to alert road users to the presence of HGVs and the proximity of the construction site.

Minor roadside hedgerow trimming will be required immediately to the east and west of the proposed entrance in order to maintain the above-mentioned sightlines. The proposed design has been developed with an “X” distance of 3m which is the allowable relaxed standard for new accesses on regional and local roads.

The internal road layout of the Proposed Development has been designed to ensure connectivity between various parts of the Proposed Development without the need to use existing local roads. The design of this internal road network and the connectivity it provides will significantly reduce the need to use local roads during the construction of the proposed development.

Operational Stage Impacts and Mitigation

There will be no significant operational stage traffic impacts associated with the proposed development.

Decommissioning Stage

On decommissioning, the adoption of and adherence to a decommissioning plan which will include traffic management proposals will ensure that the residual impacts on traffic and transport at the decommissioning stage will not be significant.

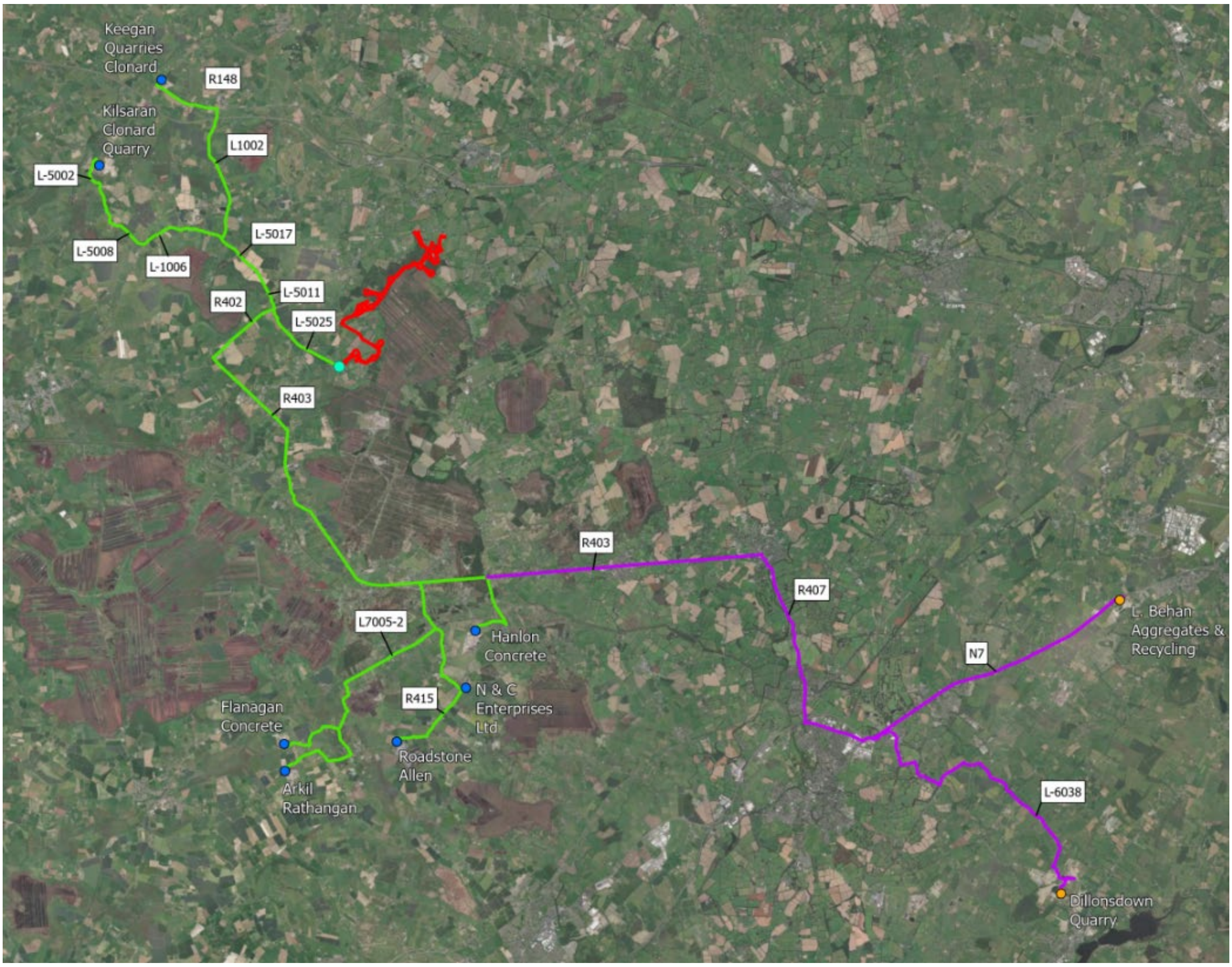


Figure 4-9: Quarry Locations and Indicative Haul Routes

4.3.10 Decommissioning Plan

The decommissioning phase works will be completed to approved standards, which include specified materials, standards, specifications and codes of practice (at the time decommissioning takes place).

An experienced main contractor will be appointed to undertake the of the decommissioning of the wind farm development. The main contractor will comply with the Construction and Environmental Management Plan (CEMP) prepared for the construction phase and the Operation and Environmental Management Plan (OEMP) implemented during operation and any revisions made to those documents throughout the phases in which they were adopted. The contractor will produce a detailed and site-specific Decommissioning Plan prior to commencement of decommissioning.

The key site targets are as follows;

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation;
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community;

- Ensure decommissioning works and activities have minimal impact on the natural environment;
- Adopt a sustainable approach to decommissioning;
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials, if possible, e.g. soil and overburden material for backfilling and reinstatement;
- 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 sustainable drainage system (SuDS) drainage design principles;
- Keep impact of decommissioning works 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;
- Monitoring of the works and any adverse effects that it may have on the environment. Decommissioning methods will be altered where it is found there is the potential to have an adverse effect on the environment;

An overview of the anticipated decommissioning methodologies is provided below.

Wind Turbines

Prior to any works being undertaken on wind turbines, they will be disconnected from the grid by the site operator in conjunction with ESB Networks and EirGrid. The dismantling and removal of wind turbines of this scale is a specialist operation which will be undertaken by the turbine supplier that completed the installation where possible. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction. A number of large-scale cranes will be brought back to site utilising the existing hard stand areas. The dismantling of turbines will be bound by the same safety considerations as was the case during construction in terms of weather conditions where works will not be undertaken during adverse weather conditions and in particular not during high winds.

The turbines will most likely be removed from site in a similar manner to how they were transported to the site originally in extended articulated trucks. The destination of the turbines post decommissioning is unclear at this time as a re-use option may be sourced if early decommissioning occurs.

The transport of disassembled turbines from the site will be undertaken in accordance with a Decommissioning Transport Management Plan which will be issued to and agreed with the competent authority at that time as part of a permit application for the delivery of abnormal loads using the local roads under the Road Traffic (Special Permits for Particular Vehicles) Regulations 2007. The Transport Management Plan will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site, with turbine blades expected to be broken down, and removed using standard HGVs.

Turbine Foundations

On the dismantling of turbines, it is not intended to remove the concrete foundation from the ground. The foundation pedestals will be covered over and allowed to re-vegetate naturally. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust.

Therefore, the turbine foundations will be backfilled and covered with soil material which will comprise the usable soil or overburden material on the site after construction. The soil will be spread and graded over the foundation using a tracked excavator and revegetation allowed to occur naturally.

It is proposed that all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for agriculture. Turbine foundation pedestals and hardstandings will be covered over with topsoil previously stripped and used for landscaping purposes during the construction stage and left to revegetate naturally.

Underground Cabling

The 33kV electrical and fibre optic cabling will be removed from the cable ducting. The cabling will be pulled from the cable duct using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at each of the joint bays/pull pits along the cable. The road will be excavated using a mechanical excavator at each cable pulling pit location and will be fully re-instated once the cables are removed. A decommissioning phase Traffic Management Plan will be prepared for these works. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation.

Grid connection infrastructure including the on-site substation and ancillary electrical equipment will form part of the national grid and will be left in situ.

It is expected that the decommissioning phase will take no longer than 6 months to complete.

4.4 Environmental Management Team - Structure and Responsibility

A preliminary organisation chart is included in Figure 4-9. Revisions to the project organisation chart shall be controlled independently of this plan following the appointment of the Contractor for the main construction works.

The Contractor's Project Manager will be responsible for the delivery of all elements of the Environmental Management Plan.

The Contractor's Project Manager will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan throughout.

4.5 Training, Awareness and Competence

All site personnel will receive environmental awareness information as part of their initial site briefing. The detail of the information should be tailored to the scope of their work on site.

The contractor for the main construction works may decide to conduct the environmental awareness training at the same time as Health and Safety Training (often referred to as Site Inductions).

This will ensure that personnel are familiar with the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

The CEMP will be posted on the main site notice board during the project. The environmental performance at the site is on the agenda of the monthly project management meetings for the project.

Elements of the CEMP will be discussed at these meetings including objectives and targets, the effectiveness of environmental procedures etc. Two-way communication will be encouraged by inviting all personnel to offer their comments on environmental performance at the site.

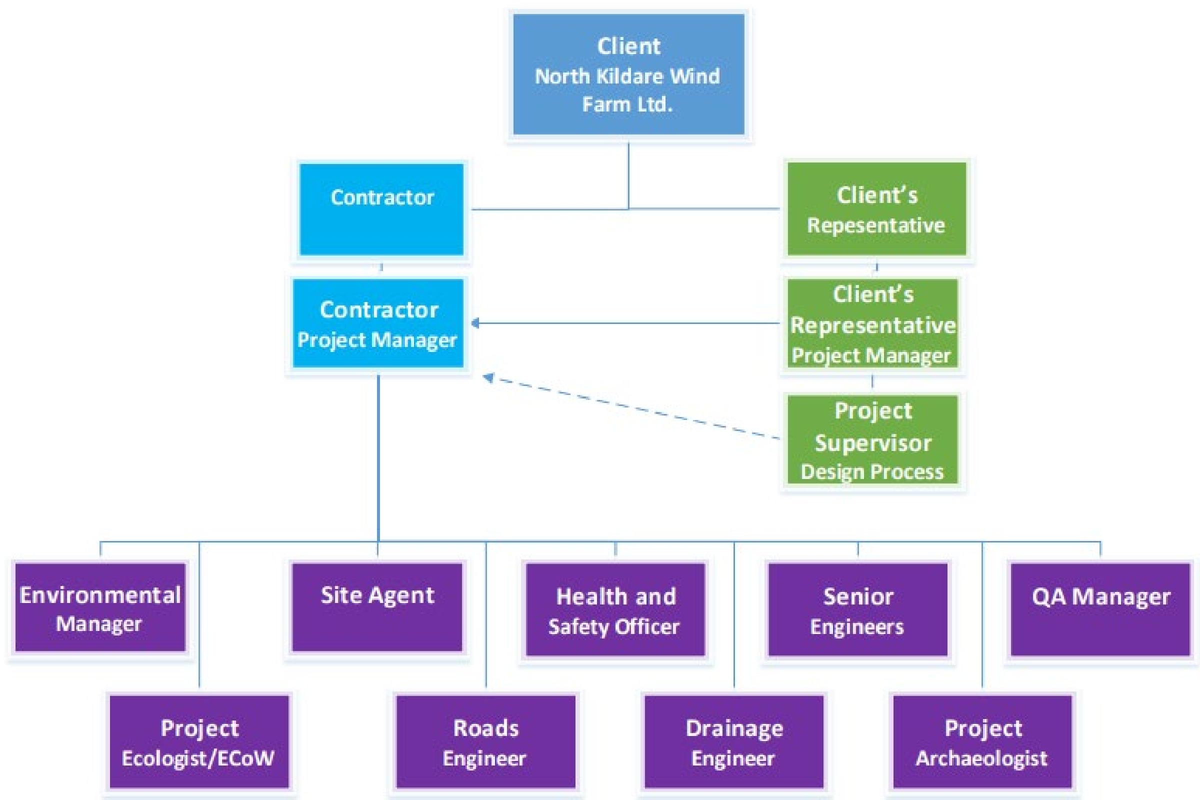


Figure 4-10: Project Management Team Organogram

4.6 Environmental Policy

The contractor is responsible for preparing and maintaining an Environmental Policy for the site. The policy should be appropriate to the project, commit to continuous improvement and compliance with legal requirements and provide a framework for objectives and targets. This will be communicated to all site personnel and will be available on site notice boards.

4.7 Register of Environmental Aspects

The contractor is responsible for preparing and maintaining a *Register of Environmental Aspects* pertaining to the site. This register will identify the environmental aspects associated with activities onsite and determine which aspects have or can have a significant impact on the environment.

4.8 Register of Legislation

The contractor is responsible for preparing and maintaining a register of key environmental legislation pertaining to the site. This register will reference all current environmental legislation and will be inspected, reviewed and updated regularly to ensure compliance.

4.9 Objectives and Targets

Objectives and targets are required to be set to ensure that the project can be constructed and operated in full accordance with the EIAR, planning conditions and legislative requirements, with minimal impact on the environment.

Environmental objectives are the broad goals that the contractor must set in order to improve environmental performance. Environmental targets are set performance measurements (key performance indicators or KPI's) that must be met in order to realise a given objective.

The contractor will set objectives based on each significant environmental impact. Key objectives are likely to include the following:

- To ensure that the rivers and streams are not negatively impacted by construction works.
- To ensure that humans are not negatively impacted by dust generated by construction works.
- To ensure that humans are not negatively impacted by noise or vibration generated by construction works.
- To ensure that impacts to habitats and wildlife are minimised during works.
- To ensure that a waste management plan for this site will be fully implemented.
- To ensure that the visual impact during the construction work is minimised.
- To ensure is constructed in compliance with the EIAR and planning conditions

Performance in relation to each of these objectives will be reviewed on a regular basis by means of inspections, audits, monitoring programmes, etc.

4.10 Non-Conformance, Corrective and Preventative Action

Non-Conformance Notices will be issued where there is a situation where limits associated with activities on the project are exceeded, or there is an internal/external complaint associated with environmental performance.

Non-Conformance is the situation where essential components of the EMS are absent or dysfunctional, or where there is insufficient control of the activities and processes to the extent that the functionality of the EMS in terms of the policy, objectives and management programmes, is compromised. A Non-Conformance register should be controlled by the contractor.

The EMS and all its components must conform to the EMP, objectives and targets and the requirements of the ISO 14001 management standard.

In the event of non-conformance with any of the above, the following must be undertaken:

- Cause of the non-compliance;
- Develop a plan for correction of the non-compliance;
- Determine preventive measures and ensure they are effective;
- Verify the effectiveness of the correction of the non-compliance;
- Ensure that any procedures affected by the corrective action taken are revised accordingly.

Responsibility must be designated for the investigation, correction, mitigation and prevention of non-conformance.

4.11 EMS Documentation

The Contractor is required to keep the following documentation in relation to the environmental management of the project (as a minimum):

- Construction Environmental Management Plan for the Proposed Development
- Register of Environmental Impacts
- Register of Planning Conditions
- Monitoring Records
- Minutes of Meetings
- Training Records
- Audit and Review Records

All of these documents and records are to be available for inspection in the site office. The documentation shall be up to date and shall be reviewed on a regular basis with revisions controlled in accordance with the site quality plan.

4.12 Control of Documents

The Contractor will establish, implement and maintain a procedure to control CEMP documents and records so they are clearly identifiable, organised, current, easily located and revised when necessary.

5. SAFETY & HEALTH MANAGEMENT PLAN

5.1 Introduction

This Safety and Health Management Plan (SHMP) defines the work practices, procedures and management responsibilities relating to the management of health and safety during the design, construction and operation of the Proposed Development and shall be read in conjunction with the Preliminary Safety & Health Plan prepared for the project by the Project Supervisor for the Design Process. The Safety and Health Management Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works.

This SHMP describes how the contractor for the main construction works will implement a site safety management system (SMS) on this project to meet the specified contractual, regulatory and statutory requirements, environmental impact statement mitigation measures and planning conditions. It is the contractor's responsibility to implement an effective safety management system to ensure that the developer's safety requirements for the construction of this project are met.

All site personnel will be required to be familiar with the requirements of the safety management plan as related to their role on site. The plan describes the project organisation and sets out the health and safety procedures that will be adopted on site.

- The Safety and Health Plan is a controlled document and will be reviewed and revised as necessary.
- A copy of the Safety and Health Plan will be located on/near the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the SHMP and its contents.

5.2 Project Obligations

The construction of the Proposed Development will impose numerous safety management obligations on the developer, designer and contractor. As well as statutory obligations, there are a number of specific obligations set out in the EIAR and in the planning conditions for the proposed development These obligations are set out below. The contractor for the main construction works and all of its sub-contractors are to ensure that they are fully aware of and in compliance with these safety obligations.

5.2.1 EIA Obligations

EIAR obligations are described in Section 4.2.1.

5.2.2 Planning Permission Obligations

Planning permission obligations will be fully outlined in the Contractor's CEMP.

5.2.3 Statutory Obligations

The Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013 place a responsibility on the Developer as the "Client", the Designer, the Project Supervisors and the Contractor.

The Client must:

- Appoint a competent and adequately resourced Project Supervisor for the Design Phase (PSDP)
- Appoint a competent and adequately resourced Supervisor for the Construction Stage (PSCS)
- Be satisfied that each designer and contractor appointed has adequate training, knowledge, experience and resources for the work to be performed
- Co-operate with the project supervisor and supply necessary information
- Keep and make available the safety file for the completed structure
- Provide a copy of the safety and health plan prepared by the PSDP to every person tendering for the project
- Notify the Authority of the appointment of the PSDP.

Designers must:

- Identify any hazards that their design may present during construction and subsequent maintenance
- Eliminate the hazards or reduce the risk
- Communicate necessary control measures, design assumptions or remaining risks to the PSDP so they can be dealt with in the safety and health plan
- Co-operate with other designers and the PSDP or PSCS
- Take account of any existing safety and health plan or safety file
- Comply with directions issued by the PSDP or PSCS.

The PSDP must:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project
- Where possible, eliminate the hazards or reduce the risks
- 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
- Prepare a safety file for the completed structure and give it to the client.

The PSCS must:

- Co-ordinate the identification of hazards, the elimination of the hazards or the reduction of risks during construction
- Develop the Safety and Health Plan initially prepared by the PSDP before construction commences
- Co-ordinate the implementation of the construction regulations by contractors
- Organise cooperation between contractors and the provision of information

- Co-ordinate the reporting of accidents to the Authority
- Notify the Authority before construction commences
- Provide information to the site safety representative
- Co-ordinate the checking of sage working procedures
- Co-ordinate measures to restrict entry on to the site
- Co-ordinate the provision and maintenance of welfare facilities
- Co-ordinate arrangements to ensure that craft, general construction workers and security workers have a Safety Awareness card, e.g. Safe Pass and a Construction Skills card where required
- Co-ordinate the appointment of a site safety representative where there are more than 20 persons on site
- Appoint a safety adviser where there are more than 100 on site
- Provide all necessary safety file information to the PSDP
- Monitor the compliance of contractors and others and take corrective action where necessary;
- Notify the Authority and the client of non-compliance with any written directions issued.

The Contractor must:

- Co-operate with the PSCS
- Promptly provide the PSCS with information required for the safety file
- Comply with directions of the project supervisors
- Report accidents to the Authority and to the PSCS where an employee cannot perform their normal work for more than 3 days
- Comply with site rules and the safety and health plan and ensure that your employees comply
- Identify hazards, eliminate the hazards or reduce risks during construction
- Facilitate the site safety representative
- Ensure that relevant workers have a safety awareness card and a construction skills card where required
- Provide workers with site specific induction
- Appoint a safety officer where there are more than 20 on site or 30 employed
- Consult workers with site specific induction
- Monitor compliance and take corrective action.

Consequently, at all stages of the project there are statutory requirements for the management of safety, health and welfare of all involved in or affected by the development. As previously outlined this CEMP and specifically the Safety and Health Management Plan addresses key construction management issues associated with the proposed wind farm. This plan will be developed further at the construction stage, on the appointment of the Contractor for the main construction works.

5.2.4 The Management of Health and Safety during the Design Process

Egan Safety Solutions (ESS) have been appointed Project Supervisor for the Design Process for the development stage. ESS are competent to fulfil this role in accordance with the Safety, Health and Welfare at Work (Construction) Regulations, 2013.

It is ESS's policy to comply fully with all health and safety legislation, in particular the Safety, Health and Welfare at Work Act, 2005, Safety, Health and Welfare at Work (General Application) Regulations 2007, and the Safety, Health and Welfare at Work (Construction) Regulations 2013.

ESS has developed in-house procedures for execution of the PSDP Role which are detailed in inhouse document ESS-HS-PROC-001 "Project Supervisor Design Process (PSDP) Procedure"

The purpose of this procedure is to define the requirements for the management of health & safety during design projects, to ensure that the PSDP role is fully discharged. ESS fulfils its obligations by carrying out the following main activities;

- Ensuring that Designers design in accordance with the General Principles of Prevention.
- Ensuring Co-ordination between Designers
- Taking account of information in existing safety files and conveying this information to the design team
- Maintaining a Hazard Diary for the duration of the project which indicates hazards which have been eliminated (design out in accordance with the General Principles of Prevention) and issues which require communication to other parties (e.g. Other Designers, PSCS)
- Ensuring that all hazards which may pose a "particular risk" as defined by the relevant legislation are clearly identified and measures necessary to control these are clearly documented as part of the design risk assessments.
- Reviewing design risk assessments from designers and requesting amendments where required.
- Preparing a Preliminary Safety and Health Plan
- Ensuring that the PSCS receives all relevant information to allow preparation of the Construction Stage Safety and Health Plan
- Co-operating with the PSCS throughout the construction period.
- Compiling the Safety File.

ESS promotes a collaborative approach to health and safety on site where the Client, PSDP, Designers, Contractors and PSCS co-operate with each other and share information. Joint site safety audits and/or walk-downs are carried out as part of this collaboration and safety is monitored and addressed on site on an ongoing basis. The regular safety meetings are held to document this ongoing co-operation, get an over-view of works currently in hand onsite and about to commence and share information.

The Preliminary Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 a Preliminary Safety & Health Plan will be required as part of the design process. This plan will be further developed by the PSCS on appointment and maintained as a live document during construction and commissioning of the development.

The safety and health plan is required to include the following information:

- a general description of the project;
- details of other work activities taking place on site;
- works involving particular risks;
- the timescale for the project and the basis on which the time frame was established;
- conclusions drawn by designers and the PSDP having taken into account the General Principles of Prevention and any relevant Safety and Health Plan or Safety File;
- the location of electricity water and sewage connections so as to facilitate early establishment of welfare facilities.

In accordance with the PSDP's procedures the Preliminary Safety & Health Plan for the proposed development should include the following sections and subsections to ensure the PSCS is aware of the health and safety issues at tender stage and enable them to price accordingly:

Preamble:

1 General Project Information:
- 1.1 Title
- 1.2 Description of Project
- 1.3 Employer
- 1.4 Designers / Other Consultants
- 1.5 Project Supervisor Design Process
- 1.6 Drawings, Specifications and Other Documents
- 1.7 Intended Contract Commencement Date
- 1.8 Intended Contract Completion Date
- 1.9 Basis for Contract Duration
- 1.10 Restrictions on Working Hours
- 1.11 Notification of Project
- 1.12 Termination of the PSCS Appointment

2 The Existing Environment:
- 2.1 Site Location
- 2.2 Relevant Adjoining Land Uses
- 2.3 Site Restrictions
- 2.4 Restrictions on Access
- 2.5 Hazardous Area Classification
- 2.6 Existing Services
- 2.7 Ground Conditions
- 2.8 Existing Hazards
- 2.9 Liaison with Statutory Bodies

3 Other Work Activities:
- 3.1 Other Contracts Which May Affect Work
- 3.2 Occupation of Site
- 3.3 Building Activities
- 3.4 Other Work Activities

3.5 Emergency Procedures in Place on Site

4 Particular and Residual Risks:
- 4.1 Works Which Puts Persons at Work at risk
- 4.2 Work Which Puts Persons at Risk from Chemical or Biological Substances
- 4.3 Work with Ionising Radiation
- 4.4 Work near High Voltage Power Lines
- 4.5 Work Exposing Persons at Work to the Risk of Drowning
- 4.6 Work on Wells, Underground Earthworks and Tunnels
- 4.7 Work Carried Out by Divers at Work Having a System of Air Supply
- 4.8 Work Carried Out in a Caisson with a Compressed Air Atmosphere
- 4.9 Work Involving the Use of Explosives
- 4.10 Work Involving the Assembly or Dismantling of Heavy Prefabricated Components
- 4.11 Work Involving Hazardous Material
- 4.12 Residual Risks

5 Additional Information:
- 5.1 Existing Documents
- 5.2 Site Possession
- 5.3 Site Rules
- 5.4 Site Specific Safety Objectives
- 5.5 Phasing of Works
- 5.6 Permits / Authorisation Required
- 5.7 Maintenance
- 5.8 Continuing Liaison
- 5.9 Specific Recommendations

6 Information Required for Safety File:
- 6.1 Information Required for Safety File from PSCS

5.2.5 The Management of Health and Safety during the Construction Phase

The selection criteria for the Contractor for the works will be based on the ability to construct the works in a manner that will not endanger the safety, health and welfare of any parties and competence to fulfil the role of PSCS.

The contract will be awarded on the basis of assessment of the candidates against relevant health and safety criteria including experience of similar projects, knowledge of the construction processes involved and training of their management and staff who will be involved in carrying out the works.

5.2.6 The Construction Stage Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 the preliminary Safety & Health Plan prepared by the PSDP will be further developed by the PSCS before the commencement of the construction work and updated on a regular basis during the construction phase of the project.

The document will include the following sections and subsections to ensure the management of health and safety during the construction phase of the project:

1. Description of Project:
    - project description and programme details
    - details of client, PSDP and PSCS, designers
    - main contractor and other consultants
    - extent and location of existing records and plans
    - arrangements for communicating with Contractors, PSDP and others as appropriate
2. Communication and Management of the Work:
    - management structure and responsibilities
    - safety and health goals for the project and arrangements for monitoring and review of safety and health performance
    - arrangements for:
        - regular liaison between parties on site
        - consultation with the workforce
        - the exchange of design information between the Client, Designers, Project Supervisor for the Design Process, Project Supervisor Construction Stage and Contractors on site
        - handling design changes during the project
        - the selection and control of contractors
        - the exchange of safety and health information between contractors
        - security, site induction, and on-site training
        - welfare facilities and first aid
        - the production and approval of risk assessments and method statements
        - the reporting and investigation of accidents and other incidents (including near misses)
    - site rules
    - fire and emergency procedures
3. Arrangements for Controlling Significant Site Risks:
    - safety risks
        - services, including temporary electrical installations
        - preventing falls
        - work with or near fragile materials
        - control of lifting operations
        - dealing with services (water, electricity and gas)
        - the maintenance of plant and equipment
        - poor ground conditions
        - traffic routes and segregation of vehicles and pedestrians
        - storage of hazardous materials
        - dealing with existing unstable structures
        - accommodating adjacent land use
        - other significant safety risks
    - health risks:
        - removal of asbestos

- dealing with contaminated land
- manual handling
- use of hazardous substances
- reducing noise and vibration
- other significant health risks

The construction stage safety and health plan will be maintained on site by the PSCS and will be communicated to all relevant parties on an ongoing basis through inductions, site safety meetings and tool box talks etc. as required.

6. EMERGENCY RESPONSE PLAN

6.1 Introduction

This chapter of the CEMP presents an Emergency Response Plan for the proposed development. The Emergency Response Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and following detailed design development.

This Emergency Response Plan contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of Proposed Development. This outlines the immediate response to an emergency or disaster situation and will be developed by the main construction works contractor and PSCS as part of their construction stage Safety and Health Plan.

An emergency is any disruptive or harmful event that endangers people, environment, property or assets. Emergencies can be small, as in a fire contained by employees using firefighting equipment or large, as in a disaster resulting from a storm.

In the context of the Proposed Development, examples of Emergency Response Plan emergency events are:

- medical emergency
- explosion
- overheated equipment
- chemical and fuel spill
- fire
- loss of power
- vehicle incidents

Example sources of emergency or disaster events are:

- unstable/inappropriate stockpiles on site
- faulty or incorrect use of equipment
- falls from height
- smoking
- storm/adverse weather
- power failure
- fuel spill
- road failure
- serious vehicle collisions or overturning

6.2 Emergency Response Plan

An emergency response plan deals with the immediate physical effects of a disaster and outlines the initial response.

6.2.1 Emergency Response Liaison

The contractor/PSCS will designate an individual to serve as the Emergency Response Liaison for this project. The emergency response liaison will coordinate the emergency response for the duration of any emergency at or nearby the project site.

Kildare County Council, An Garda Síochána and the HSE Ambulance Co-ordinator will be provided with the construction programme and the onsite contact information from the Emergency Response Liaison prior to construction.

The Emergency Response Liaison will be immediately reachable at all times during project construction. The Liaison will coordinate with the above agencies to establish emergency procedures for access to and within the site in the event of an emergency.

6.2.2 Reporting Emergencies

In the event of fire, storm, flood, serious injury or other emergency, contact:

ALL ON SITE EMERGENCIES DIAL 999

6.2.3 Designated Responder

A map depicting tower locations with the emergency meeting point will be furnished to Kildare County Council Fire Department and HSE ambulance co-ordinators.

Upon arrival on the scene, the senior EMS Officer will set up the incident command structure. The Emergency Response Liaison and all contractor's personnel will cooperate with directions of the incident commander and assist as directed.

The nearest emergency services, ambulance and Accident & Emergency (A&E) facilities are:

Service:	Contact Details:	
Accident & Emergency (A&E)	Naas General Hospital	(045) 849 500
Ambulance Service	Dial 112 or 999	
Fire Services	Dial 112 or 999	
Garda Station	Enfield Garda Station	(046) 954 1002
District HQ:	Trim Garda Station	+353 46 9481547
Divisional HQ:	Navan Garda Station	+353 46 9036300

Each member of the contractor's site team who are First-Aid and Cardiopulmonary Resuscitation (CPR) trained personnel will be identifiable with a hard hat sticker indicating their training.

6.2.4 Emergency Alarm

The emergency alarm will be raised on site as soon as an emergency situation is detected, the alarm will be identified (contractor to check those that apply):

	Air Horn		Radio		Voice		Hand Signals		Siren

6.2.5 Emergency Reporting

In the event of an emergency the nearest supervisor with radio equipment/mobile phone will be notified. The degree of emergency will be reported to the Emergency Response Liaison who will contact the Emergency Services and request the appropriate emergency service.

6.2.6 Medical Protocol

In the event of a major medical emergency, the emergency centre (999) will be notified and an ambulance and emergency medical team will respond to the scene. All major medical cases require professional (ambulance) transportation. In the event of a minor medical case, the affected employee can be transported via company vehicle in the escort of a foreman or site engineer (with first aid training).

6.2.7 Emergency Response

Upon notification, the Emergency Response Liaison will respond to the emergency scene and manage emergency operations:

1. Assess hazards and make the area safe – If you cannot enter the area without risking your safety, don't do it, call the Emergency Services immediately and wait for them. If you think you can safety enter the area, look around the emergency scene for anything that can be dangerous or hazardous to you, the casualty, or anyone else at the scene. Bystanders can help with making the area safe. First aid kits will be available on site. Operators that have been first aid/CPR/AED trained will be listed on site and easily identifiable by a hard hat sticker.

2. Take charge of the situation – if you are the first-aid provider on the scene act fast. If someone is already in charge, briefly introduce yourself and see if that person needs any help. If there is any chance the casualty could have a head or spinal injury, tell them not to move.

3. Get Consent – always identify yourself as a first-aid provider and offer to help. Always ask for consent before touching a conscious adult casualty and always ask for consent from a parent or guardian before touching an unconscious or conscious child or infant. With an unconscious adult casualty consent is implied as it is generally accepted that most people want to live. Remember to protect yourself first by wearing gloves and eye protection.

4. Assess Responsiveness – is the casualty conscious or unconscious? Note their response while you are asking them for their consent. If they respond, continue with the primary survey, and if they don't respond, be aware that an unconscious casualty is or has the potential of being a breathing emergency.

5. Call out for help – this will attract bystanders. Help is always useful in an emergency situation. Someone can be called over to phone for medical help. Others can bring blankets if needed, get water, etc. a bystander can help with any of the following:

- Make the area safe.
- Find all the casualties.
- Find the first aid kit, or any useful medical supplies.
- Control the crowd.
- Call for medical help.
- Help give first aid, under your direction.
- Gather and protect the casualty's belongings.
- Take notes, gather information, be a witness.
- Reassure the casualty's relatives.
- Lead the ambulance attendants to the scene of the emergency.
- Notify Emergency Services as soon as you can. Either send a bystander or call yourself.

In the event of a major medical emergency the Emergency Response Liaison, as the person-in-charge of the emergency scene, will dispatch someone to the site access point nearest the emergency scene to direct and lead arriving outside responders to the emergency scene. The designated meeting point will be agreed prior to the commencement of construction. Emergency personnel will be met at this meeting point communicated by management during the 999 call. The emergency personnel escort will use the hazard lights on their vehicle, so they are easily identified.

6.2.8 Escape and Evacuation Procedure

Dependent upon the degree of the emergency and if safe to do so, employees will evacuate to the designated assembly area where the designated wardens shall account for all employees and determine if anyone still remains within the emergency scene.

Should a wild land fire or peat slippage occur, and the designated assembly area is compromised other locations will be designated as secondary assembly areas.

6.2.9 Tower Rescue Procedure

In the event personnel are trapped or injured in an elevated tower position the following protocol will be initiated:

1. The Emergency protocol will be initiated
2. Emergency Response Liaison will be notified
3. Tower Rescue Team will be activated and respond to the scene
4. Outside medical and Rescue Teams will be notified and respond to the scene.

Tower Rescue Procedure:

1. Upon learning of an emergency, the on-scene foreman shall assess the emergency and ascertain its degree, location and the extent of any injuries.
2. Upon confirming that an emergency exists the on-scene foreman notifies the Emergency Response Liaison and the project Office.

3. Upon notification of the emergency the Emergency Response Liaison shall notify senior project supervision and the local emergency centre (999) of the emergency.
4. The Emergency Response Liaison shall inform the dispatcher of the location, tower number, the degree of the emergency and the extent of injuries.

6.2.10 Prevention of Illness/Injury Due to Weather/Elements

1. All employees will have access to shelter and heat in the event of inclement weather.
2. Employees will have access to at least a litre of water at all times.
3. High wind warnings and weather forecast will be discussed every morning with the crews. Weather conditions and forecast will be monitored regularly by management.
4. No Employee will work alone. A buddy system will be used so employees can contact a supervisor in case of an emergency.

6.2.11 Environmental Emergency Procedure

An emergency preparedness and response procedure is required to prevent environmental pollution incidents. Emergency Silt Control and Spillage Response Procedures are included in Section 4.3.3 of this CEMP.

Suitable spill kits and absorbent material for dealing with oil spills will be maintained on site. In the event of pollution or potential risk of pollution the Local Authority should be informed immediately.

In the case of water pollution in addition to the Local Authority, Inland Fisheries Ireland should also be informed immediately.

6.2.12 Emergency Response Plan – Haul Routes

Emergency Response Procedure relating to transportation of plant, equipment and materials to site to be developed by the main contractor during the construction phase of the Proposed Development.

6.2.13 Emergency Events – Wind Turbine Damage/Failures

Each wind turbine, incorporating the tower, blades, gearbox and ancillary equipment in the tower and nacelle is a machine under the European Machinery Directive [2006/42/EC]. The duties of designers and manufacturers of machinery are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations [S.I.No.407/2008] (as amended). All wind turbines will be CE marked, which is in effect, a mark of assurance that the wind turbine complies with the essential health and safety requirements (EHSRs) of EU supply law. In all cases, the manufacturer or the manufacturer's authorised representative will compile information in a technical file confirming how the machine complies with these requirements. The commissioning of turbines and ancillaries will only be carried out by competent, trained and qualified personnel. The system of work for commissioning must be planned, organised, maintained and revised to ensure safety of personnel.

Potential emergency events associated with wind turbines include:

- Blade loss;
- Fire;
- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure).

The primary mitigation against an emergency catastrophic event that may endanger the health and safety of the public is implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of impact in the event of wind turbine collapse.

Peat slippage contingency measures have been included in Section 6.2.14 below in the unlikely event of landslide scenario.

6.2.14 Land Slippage Contingency Measures

6.2.14.1 Excessive Movement

Where there is excessive 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.

1. All activities (if any) shall cease within the affected area.
2. Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
3. Re-commencement of activities shall only start following a cessation of movement and a review by an experienced geotechnical engineer.

6.2.14.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following will be carried out.

4. On alert of a peat slide incident, all activities (if any) in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.
5. 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 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.
6. All relevant authorities will be notified if a peat slide event occurs on site.

7. 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 an experienced geotechnical engineer and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 1

Turbine Delivery Report
(TDR Report)

Pell Frischmann

Drehid Wind Farm

Route Survey Report

December 2024

10109576

Report Ref.		**241218 Drehid Rsr**				
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Appendices

1 Introduction

1.1 Purpose of the Report

Pell Frischmann (PF) has been commissioned by North Kildare Wind Farm Limited to undertake an route access review of the potential delivery route for wind turbine Abnormal Indivisible Loads (AIL) associated with the construction and development of Drehid Wind Farm, located southeast of Kilshanroe, Co. Kildare.

The Route Survey Report (RSR) has been prepared to help inform the developer on the likely issues associated with the development of the site with regards to off-site transport and access for AIL traffic. The report identifies the key issues associated with AIL deliveries and notes that remedial works, either in the form of physical works or as traffic management interventions will be required to accommodate the predicted loads.

The detailed assessment and subsequent designs of any remedial works are beyond the agreed scope of works between PF and North Kildare Wind Farm Limited at this point in time.

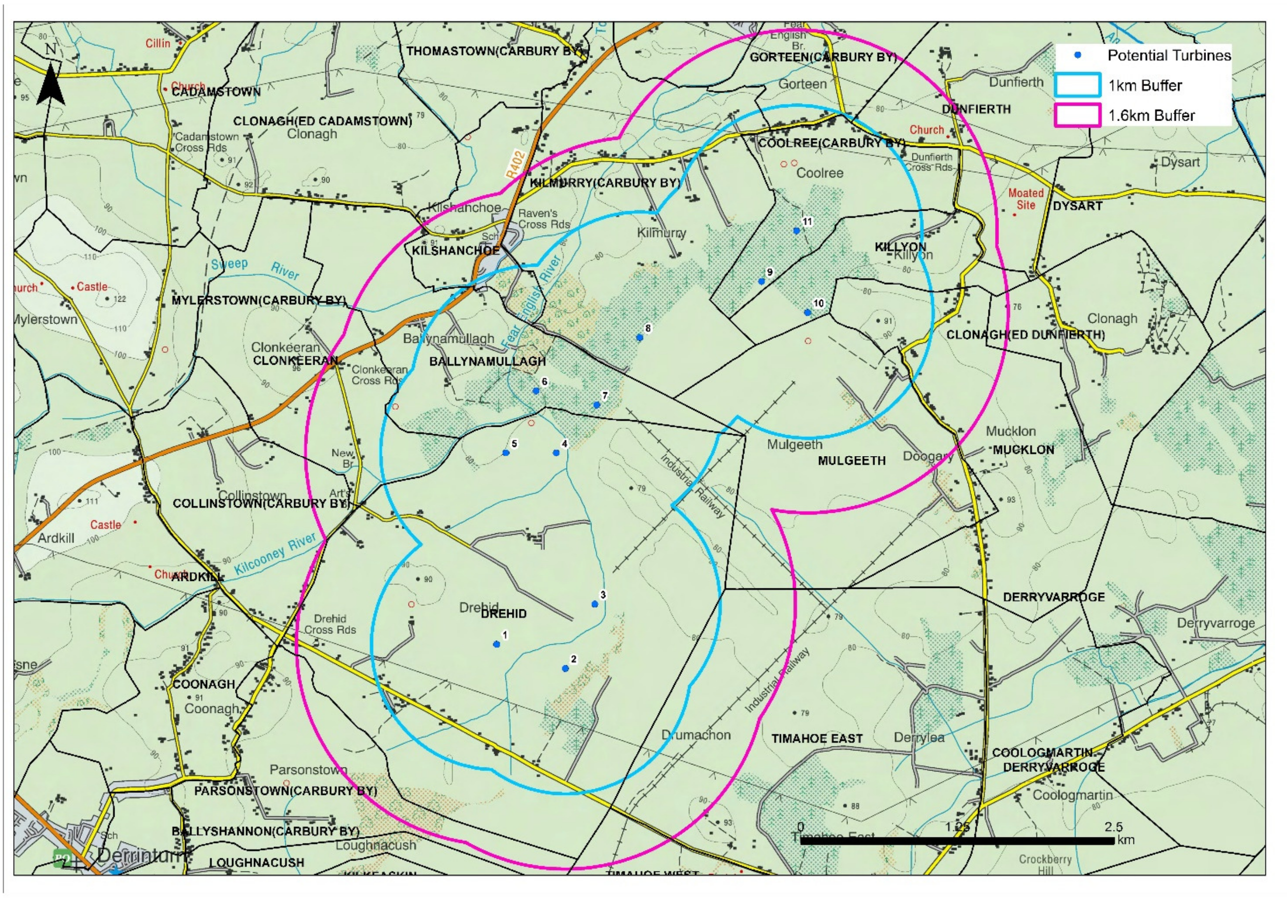
It is the responsibility of the wind turbine supplier to ensure that the entirety of the proposed access route is suitable and meets with their satisfaction. The turbine supplier will be responsible for ensuring that the finalised proposals meet with the appropriate levels of health and safety consideration for all road users has been made in accordance with the relevant legislation at the time of delivery.

2 Site Background

2.1 Sites Location

The development site is located to the southeast of Kilshanroe, Co. Kildare. Figure 1 illustrates the general site location.

Figure 1: Site Location Plan



2.2 Candidate Turbine

North Kildare Wind Farm Limited have indicated that they wish to consider the use of a Nordex N133 on a TS 100 tower. This assessment has considered the N133 blade (total length of 65.5m) and a worst-case tower section (26.9m in length x 4.3m in diameter) to consider access for all components.

2.3 Proposed Delivery Equipment

To provide a robust assessment scenario based upon the known issues along the access route, it has been assumed that all blades would be carried on a Super Wing Carrier trailer to reduce the need for mitigation in constrained sections of the route.

Towers would be carried in a 4+7 clamp adaptor style trailer, whereas loads such as the hub, nacelle housing and top towers would be carried on a six-axle step frame trailer.

Figure 2: Super Wing Carrier Trailer

Figure 3: Tower Trailer

Where access constraints are extreme, it is proposed that the blade would be transferred from the Super Wing trailer to a blade lifting trailer. This trailer can lift blades up to a maximum angle of 60 degrees to clear potential constraints and shortening the length plan view. An example trailer is illustrated in Figure 4.

Figure 4: Example Blade Lifting Trailer

To undertake the transfer between trailers, a blade transfer area will need to be constructed. The area of land required will need to be circa 175m x 60m and will need to include two crane pads. Storage for up to six blades should also be available, with all infrastructure designed in accordance with turbine supplier standards.

The proposed location for the transfer station is the southern development area of the proposed wind farm and as such, no additional third party land areas are required.

3 Access Route Review

3.1 Proposed Access Route

As requested by North Kildare Wind Farm Limited, access has been considered from the M4 motorway. Access from the port to the M4 will be undertaken once the turbine haulier has been engaged by the developer, post planning determination.

Access to the site will be taken from the south for all loads. Access from the south to the northern turbine locations is not possible using internal access tracks, so all northern turbine components will need to access the southern junction where blades will be transferred to a blade lifting trailer (required to overcome physical constraints) at a blade transfer area. Tower and all other loads will undertake a U turn in the southern area, and will then backtrack until the R402 Raven Junction, where they will turn right for the northern access junction.

The proposed access route is as follows:

- Loads will depart the M4 at Junction 9 and will join the R402, southbound;
- Loads will pass through Johnstown Bridge and Kilshancoe;
- All loads will turn off the R402 onto the L5025, turning left at The Sweep Crossroads junction;
- Loads will continue on the L5025 heading southeast to the site access junction. At the site access junction, loads will turn left into a purpose designed junction;
- Blade loads for the northern turbines will be transferred onto a blade lifting trailer. All other northern turbine loads will undertake a U-turn and will rejoin the L5025, proceed northwest;
- Northern turbine loads will turn right onto the R402 and will proceed northbound;
- At the Raven Junction, loads will turn right onto Kilshanroe Road and will continue eastbound to the northern access junction.

The proposed access route from the M4 to the development site access junctions is shown in Figure 5 for the southern access. Figure 6 illustrates the route from the blade transfer area to the northern access junction.

Figure 5: Proposed Access Route from M4 to Southern Access Junction

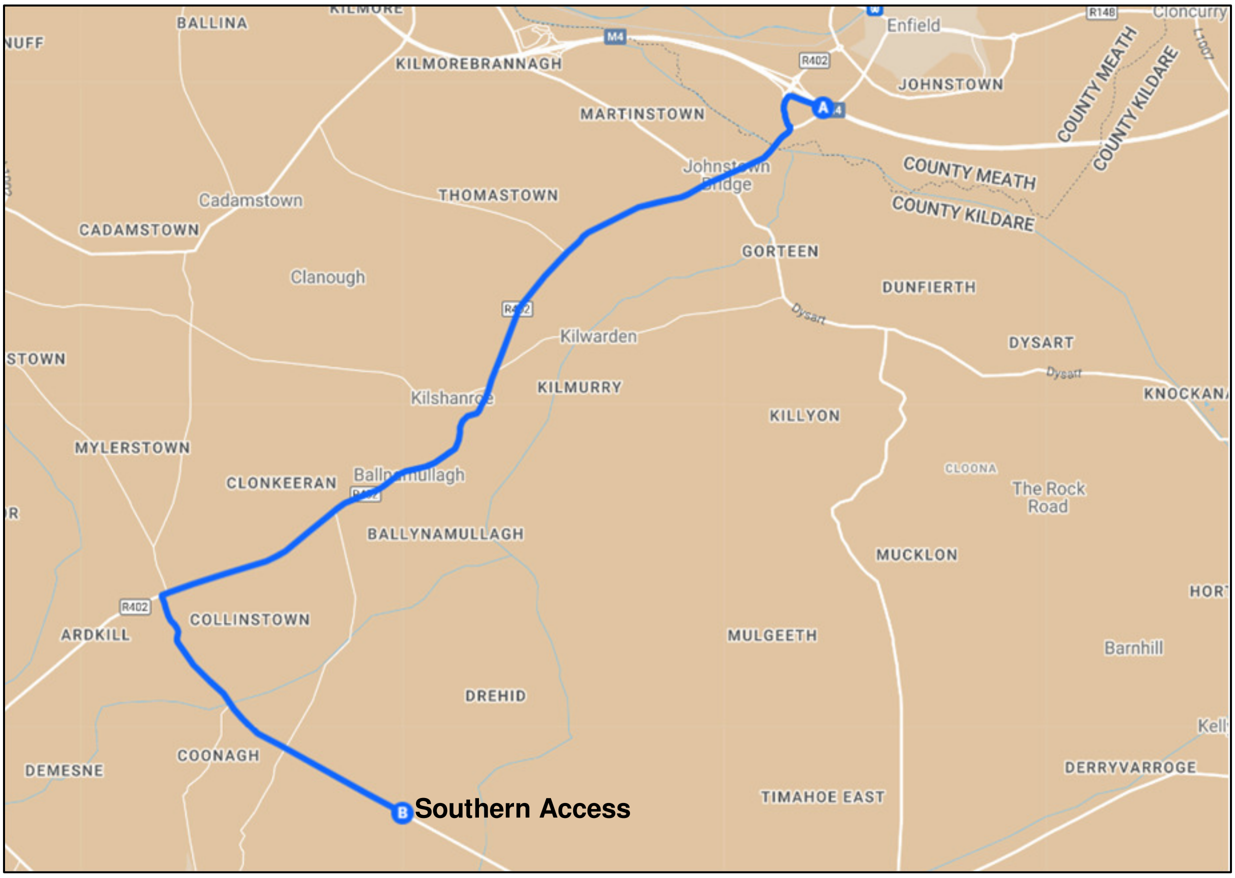
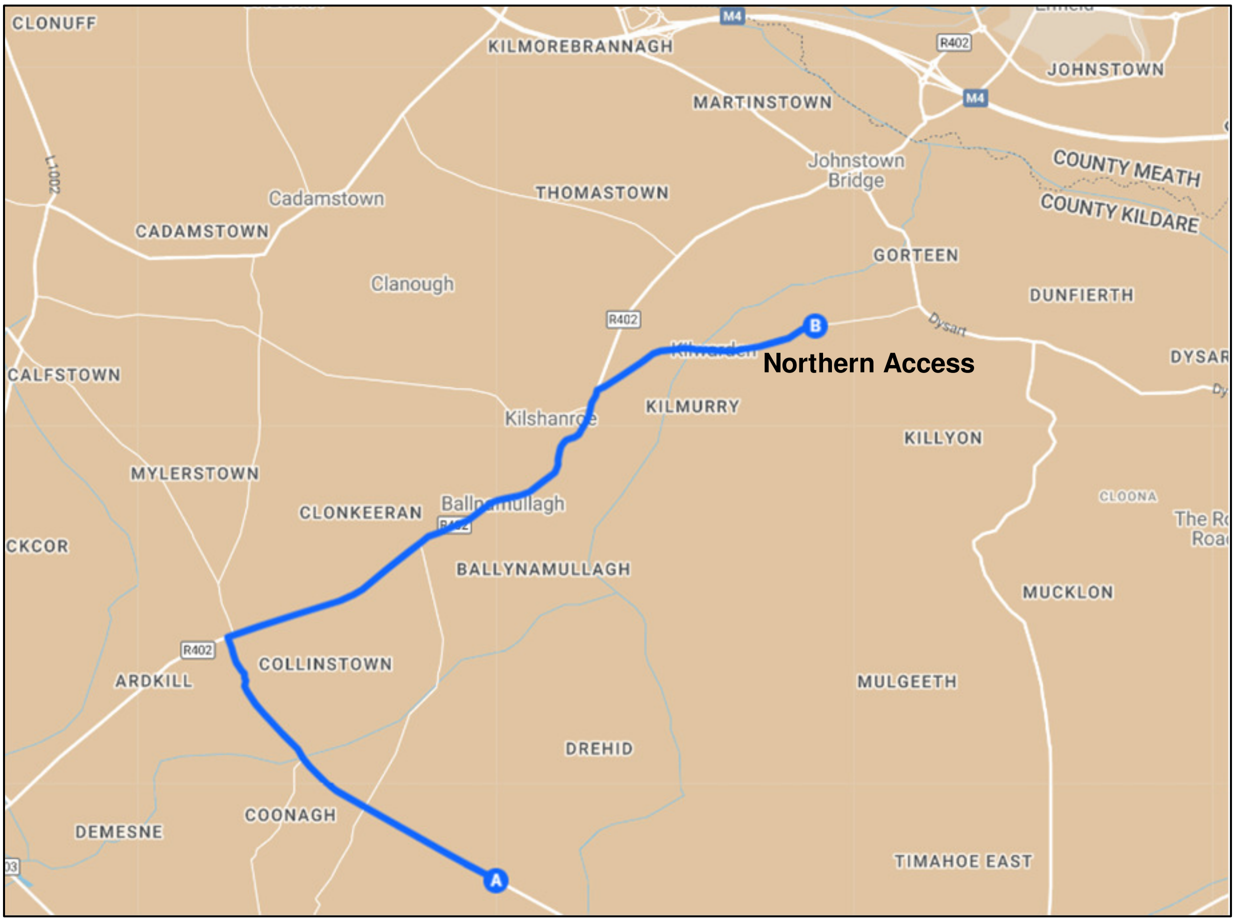


Figure 6: Proposed Access Route from Blade Transfer Area to Northern Access



3.2 Route Constraints

The constraints noted during the access route review are provided in the tables below. These cover all constraints from the M4 through to the proposed site entrance. No consideration of the transport issues within the port or development site have been undertaken and this includes the design of the site access junction.

Plans illustrating the location of the constraints are provided in Appendix A.

Table 3-1: Constraint Points and Details

POI	Key Constraint	Details
1	**M4 Junction 9 Slip Road** 	Loads will depart the M4 at Junction 9 and will take the first exit at the roundabout with the R402 (southbound). A swept path assessment has been undertaken and indicates that loads will oversail the entry verge where two road signs should be removed. Loads will require an over-run surface on the central island of the roundabout where one chevron sign should be removed. On exiting the junction, loads will over-run the splitter island where three road signs should be removed. Verge vegetation trimming is required on the exist.
2	**R402 / Johnstown Road Roundabout** 	Loads will continue southbound on the R402. At the roundabout with Johnstown Road, loads will take the second exit and will continue southbound on the R402. A swept path assessment has been undertaken and indicates that loads will over-run the entry splitter island, central island and exit splitter island of the roundabout. Load bearing surfaces are required. Two road signs on the entry splitter island, two chevron signs on the central island and two signs on the exit splitter island should be removed. Following the roundabout, loads will continue southbound, heading through Johnstown Bridge and Kilshanroe. Loads will need to exercise care passing through both villages and oncoming traffic should be held back to allow loads access to both lanes in sinuous sections. Care should be exercised when passing over traffic calming measures noted on the road.
3	**R402 / L5025 Access Junction** 	**Southern Access Route** Loads will turn left onto the L5025 and will continue eastbound to reach the southern access junction. A swept path assessment has been undertaken and indicates that loads will oversail the inside of the junction where two road signs and a barrier should be removed. It is recommended that the load suspension settings are increased to account for any changes in vertical clearance on the L5025. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads will turn right at this junction. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
4	**L5025 Bend 1** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
5	**L5025 Bend 2**  	**Southern Access Route** Loads will proceed ahead on the L5025, passing through the two bends. A swept path assessment has been undertaken at this location and indicates that loads will oversail both sides of the road. Hedge trimming works will be required in the western verge along with an area of load bearing surfacing. Tree canopy trimming is required. A minor area of load bearing surface is required in the eastern verge along with the removal of a utility pole stay wire. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
6	**L5025, north of the River Kilooney Bridge** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
7	**L5025, south of the River Kilooney Bridge** 	**Southern Access Route** Loads will proceed ahead on the L5025. A swept path assessment has been undertaken at this location and indicates that that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads continue ahead. The swept path assessment also covers this movement. All overhead utilities on the L5025 should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
8	**Southern Site Access Junction** 	**Southern Access Route** Loads will turn left into a new site access junction. A swept path assessment has been undertaken at this location and indicates that loads will require the removal of a section of fence, access gate and hedge to enable the construction of the access junction. **Northern Access Route** Loads that are destined for the northern access will have turned at the facilities accessed from the southern junction. When travelling back on the L5025, loads will turn right out of the site. The swept path assessment also covers this movement. All overhead utilities on the L5025 and inside the access site should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
9	**R402 Raven Junction** 	**Northern Access Route** Loads for the northern access junction will turn right at the junction. A swept path assessment has been undertaken at this location and indicates that loads will oversail the inside of the junction where verge vegetation trimming is required. It is recommended that the load suspension settings are increased to account for any changes in vertical clearance on the Kilshanroe Road.
10	**Kilshanroe Road Bend 1** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
11	**Kilshanroe Road Bend 2** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
12	**Kilshanroe Road Bend 3** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. A section of verge hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
13	**Kilshanroe Road Bend 4** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. Two lengths of hedge should be trimmed on the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.
14	**Kilshanroe Road Bend 5** 	**Northern Access Route** Loads for the northern access junction will proceed ahead on Kilshanroe Road. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. A minor area of load bearing surface is required in the northern verge. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road.

POI	Key Constraint	Details
15	**Northern Site Access** 	**Northern Access Route** Loads will turn right into a new site access junction. A swept path assessment has been undertaken at this location and indicates that trees should be removed to enable the construction of the site access junction. A swept path assessment has been undertaken at this location and indicates that loads will oversail both verges. Tree canopy trimming to accommodate the raised blade will be required. All overhead utilities on Kilshanroe Road should be lowered or relocated to enable the raised blade for the northern turbines to pass along the road. Engagement on with the power line operator is recommended.

3.3 Swept Path Assessment Results and Summary

The detailed swept path drawings for the locations assessed are provided in Appendix B for review. The drawings in Appendix B illustrate tracking undertaken for the worst-case loads at each location.

The colours illustrated on the swept paths are:

- Grey / Black – OS / Topographical Base Mapping;
- Green – Vehicle body outline (body swept path);
- Red – Tracked pathway of the wheels (wheel swept path); and
- Purple – The over-sail tracked path of the load where it encroaches outwith the trailer (load swept path).

Where mitigation works are required, the extents of over-run and over-sail areas are illustrated on the swept path drawings.

3.4 Overhead Constraints

Overhead utilities will foul the raised blade when this is carried in the upright position. Where the blade is raised, these will need to be relocated, lowered or removed. It is assumed in this assessment that the blade tip is raised from the southern access junction, through to the northern access junction. As such, all overhead utilities would need to be removed.

A detailed overhead utility review is required prior to loads being transported and engagement with utility providers will be required.

Overhead utilities on the R402 should also be removed. It may be possible, depending upon the views of the Garda and haulier to lower the blade on straight sections of the R402 and early engagement with both is recommended.

3.5 Summary Issues

It is strongly suggested that following a review of the RSR, North Kildare Wind Farm Limited should undertake the following prior to the delivery of the first abnormal loads, to ensure load and road user safety:

- A review of clear heights with utility providers and the transport agencies along the route to ensure that there is sufficient space to allow for loads plus sufficient flashover protection (to electrical installations);
- That any verge vegetation and tree canopies which may foul loads is trimmed prior to loads moving;
- That a review of potential roadworks and or closures is undertaken once the delivery schedule is established in draft form;

- That a test run is completed to confirm the route and review any vertical clearance issues; and
- That a condition survey is undertaken to ascertain the extents of road defects prior to loads commencing to protect the developer from spurious damage claims.

4 Summary

4.1 Summary of Access Review

PF has been commissioned by North Kildare Wind Farm Limited to prepare a Route Survey Report to examine the issues associated with the transport of AIL turbine components to Drehid Wind Farm.

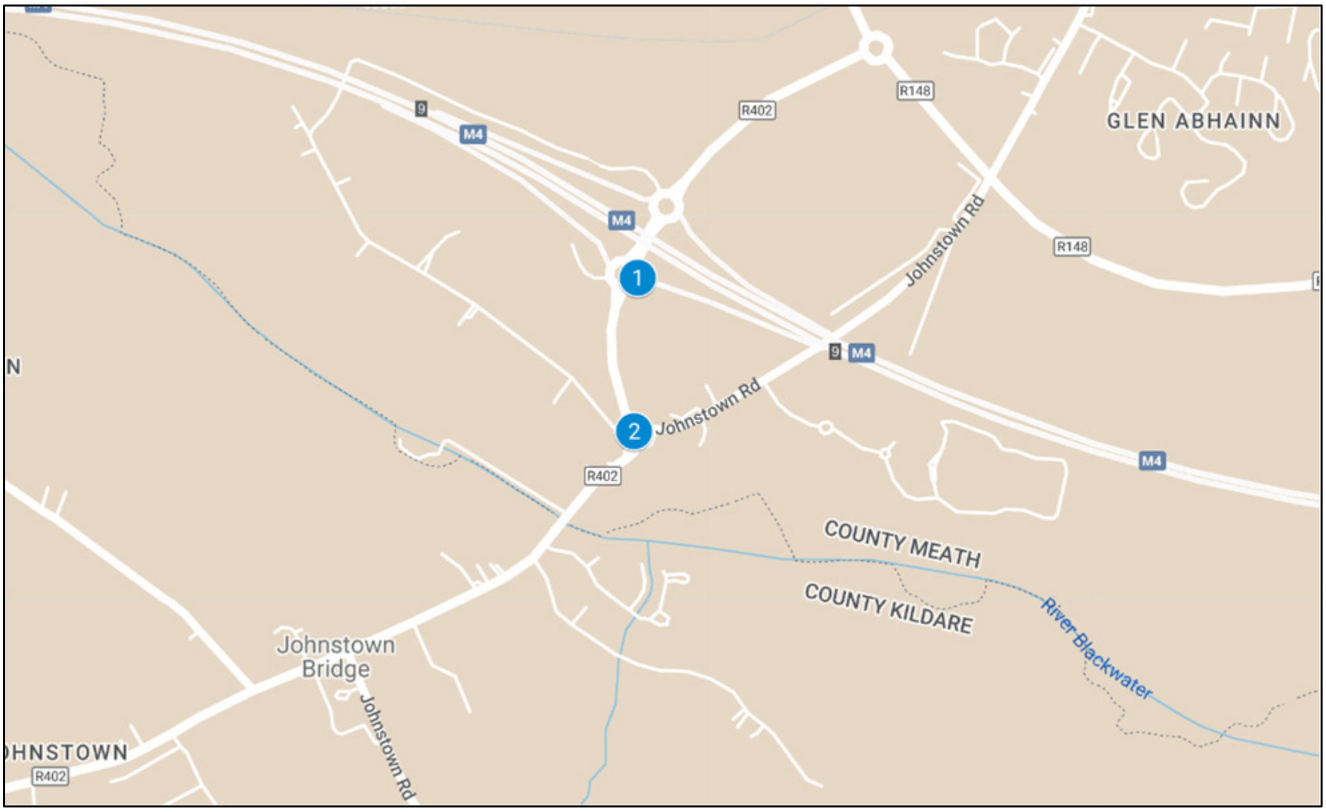
This report identifies the key points and issues associated with the proposed routes and outlines the issues that will need to be considered for successful delivery of components.

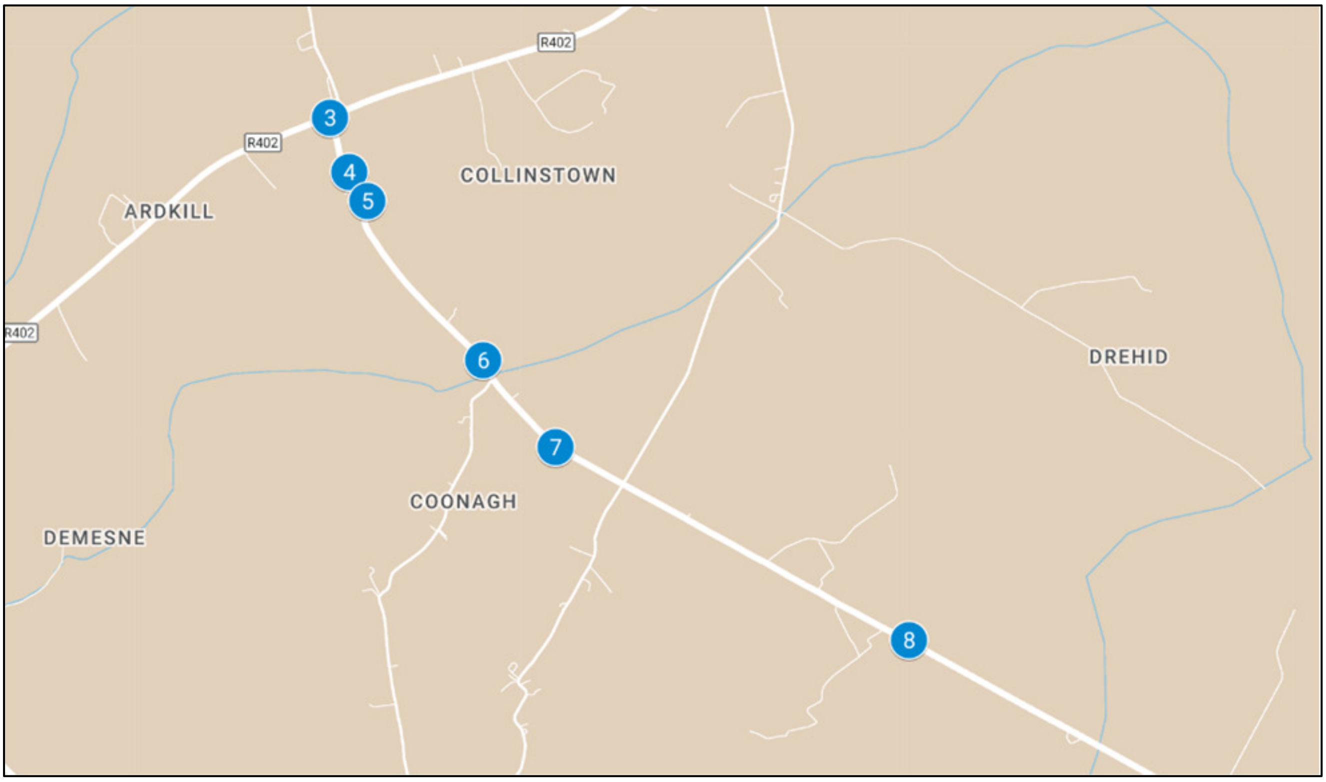
This report has been based upon a worst case of Nordex N133 turbine sections and has been undertaken on the basis of a Superwing Carrier blade trailer, transferring to a blade lifting trailer for access to the northern development area.

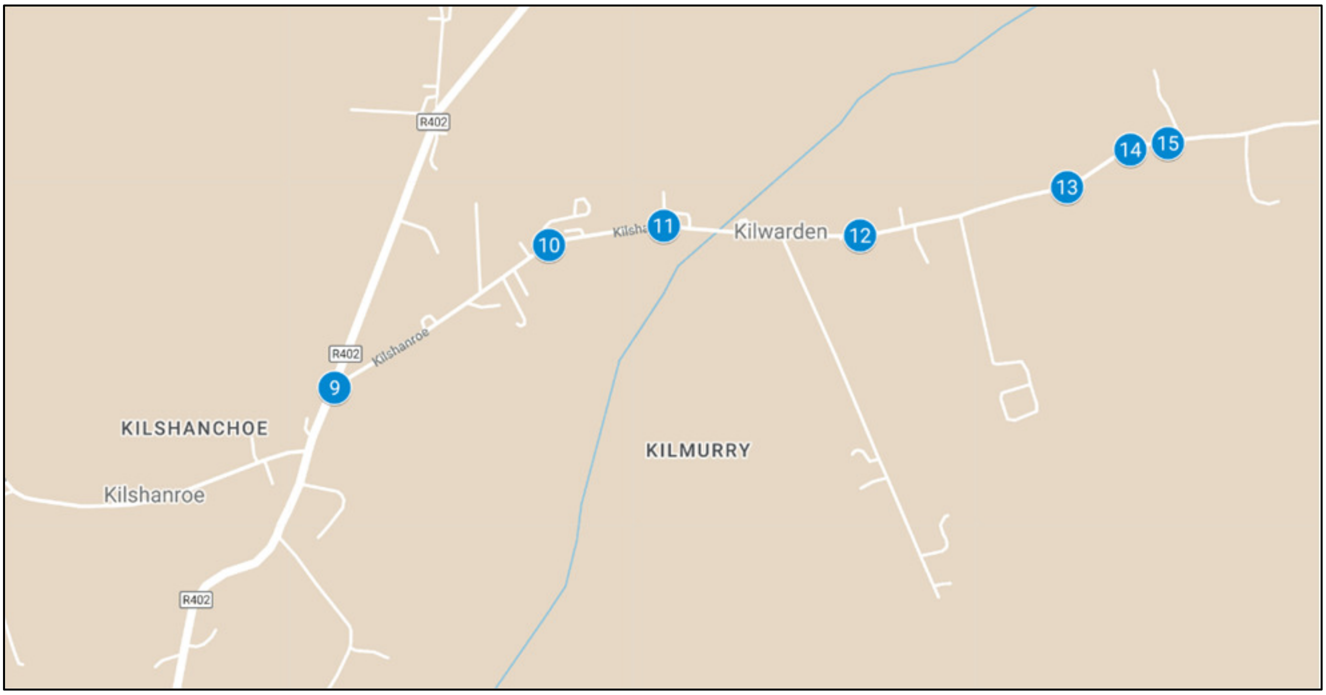
The report is presented for consideration to North Kildare Wind Farm Limited. Various road modifications and interventions are required to successfully access the site.

Appendix A Points of Interest

An electronic version of the POI plan can be found here:
https://www.google.com/maps/d/edit?mid=1Vm6M6mS4QLn5zg9k91_iL_p2v2ojopw&usp=sharing






R402
R402
R402
Kilshanroe
Kilsha
Kilwarden
KILSHANCHOE
Kilshanroe
KILMURRY
9
10
11
12
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Appendix B Swept Path Assessment Drawings

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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	M4 Junction 9 Slip Road

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		1

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK01

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: M4 Junction 9 Slip Road

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

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File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK01A

Revision: 00

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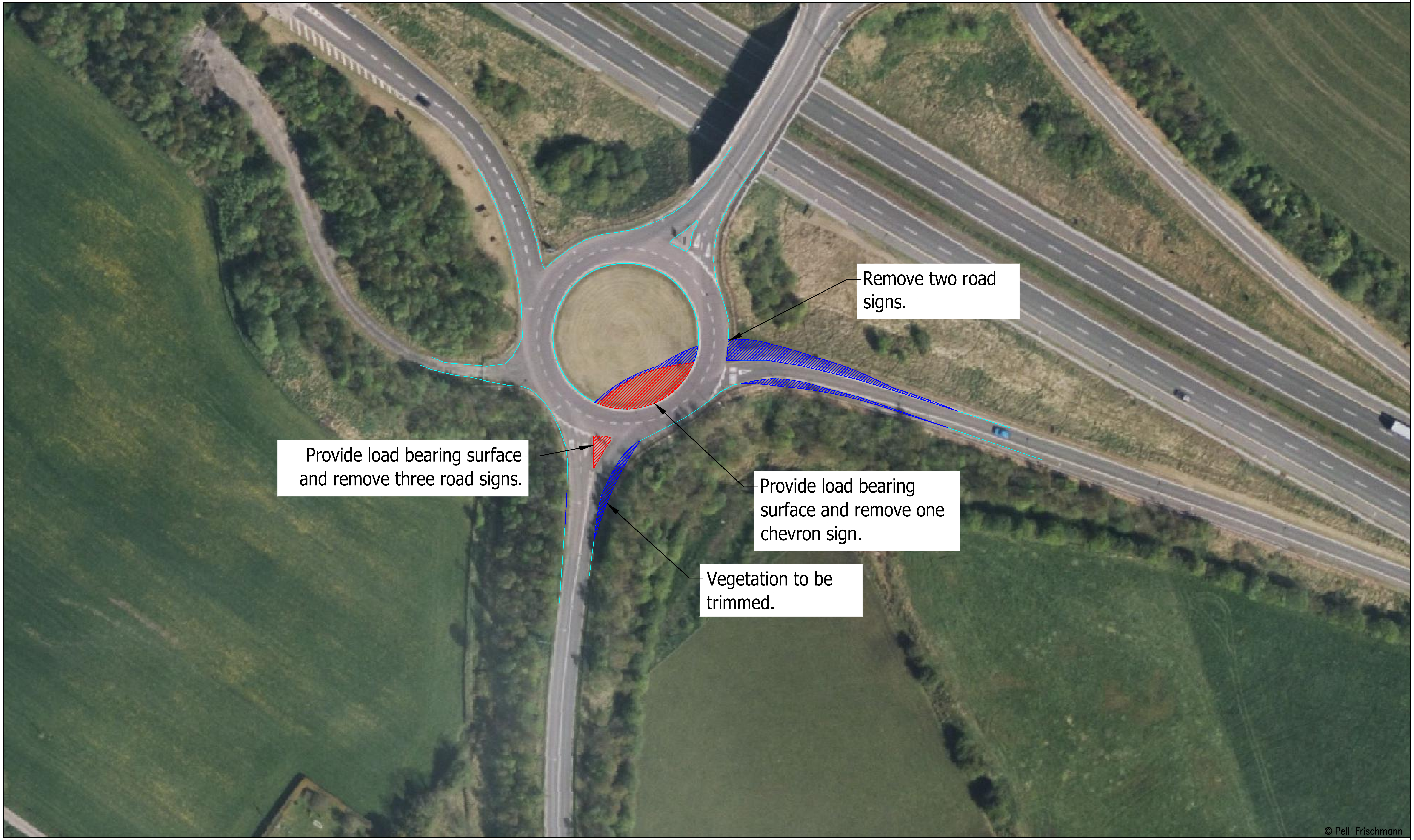

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: M4 Junction 9 Slip Road

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Designed	GB	18/12/2024
Checked	TL	18/12/2024
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File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK01B

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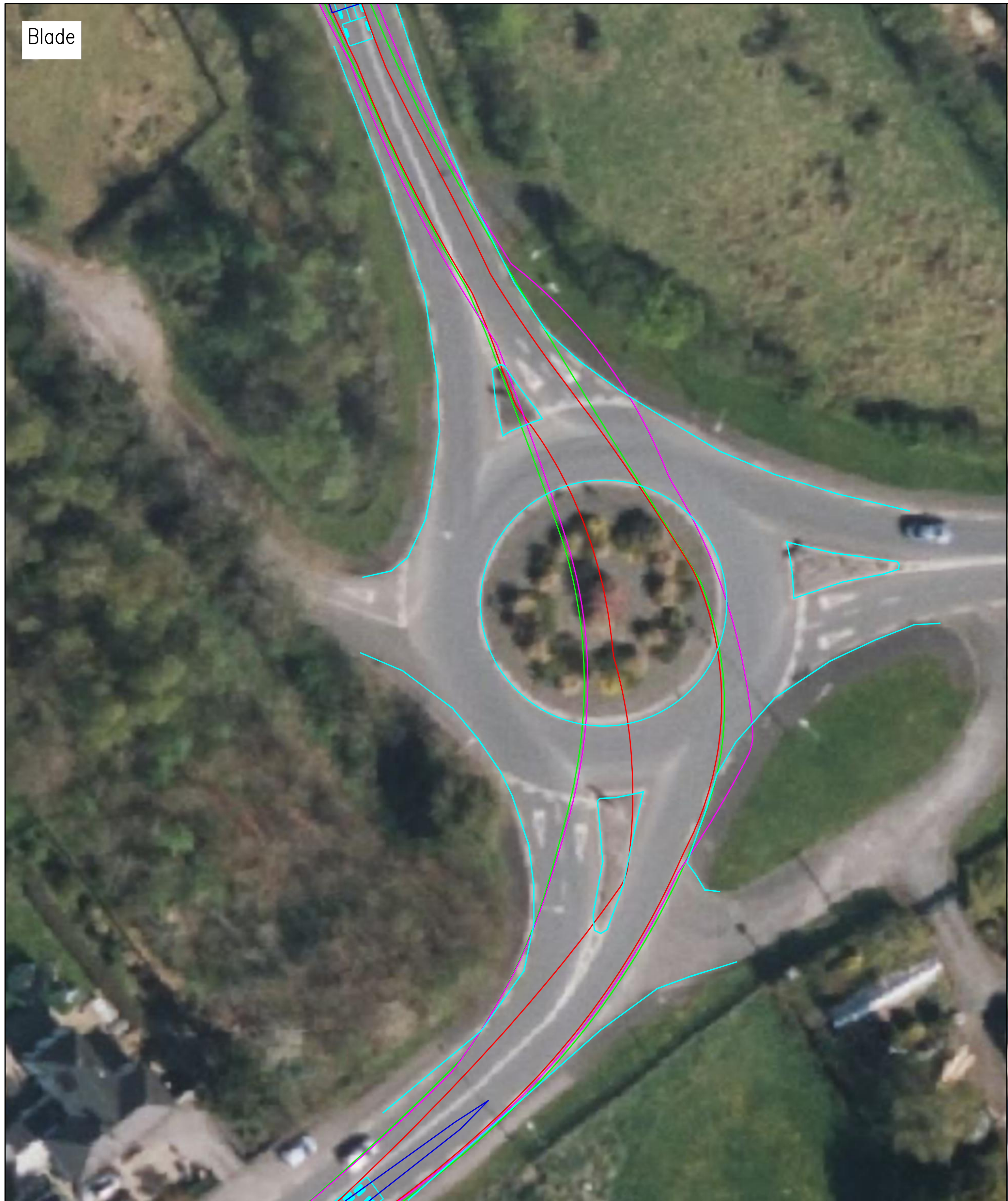

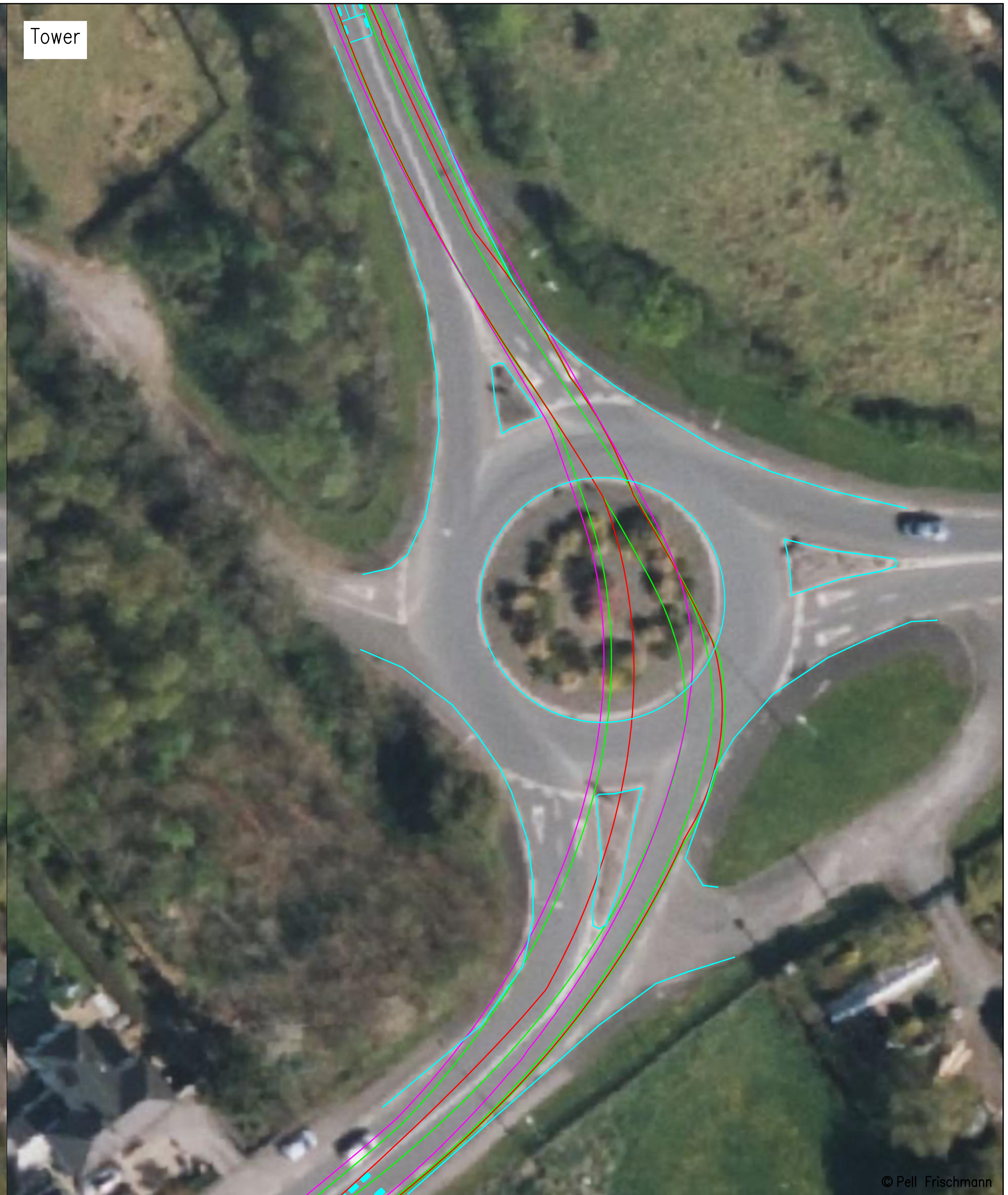

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / Johnstown Road Roundabout

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

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Drawing Status: Draft

Drawing No.: SK02

Notes:
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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / Johnstown Road Roundabout

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK02A

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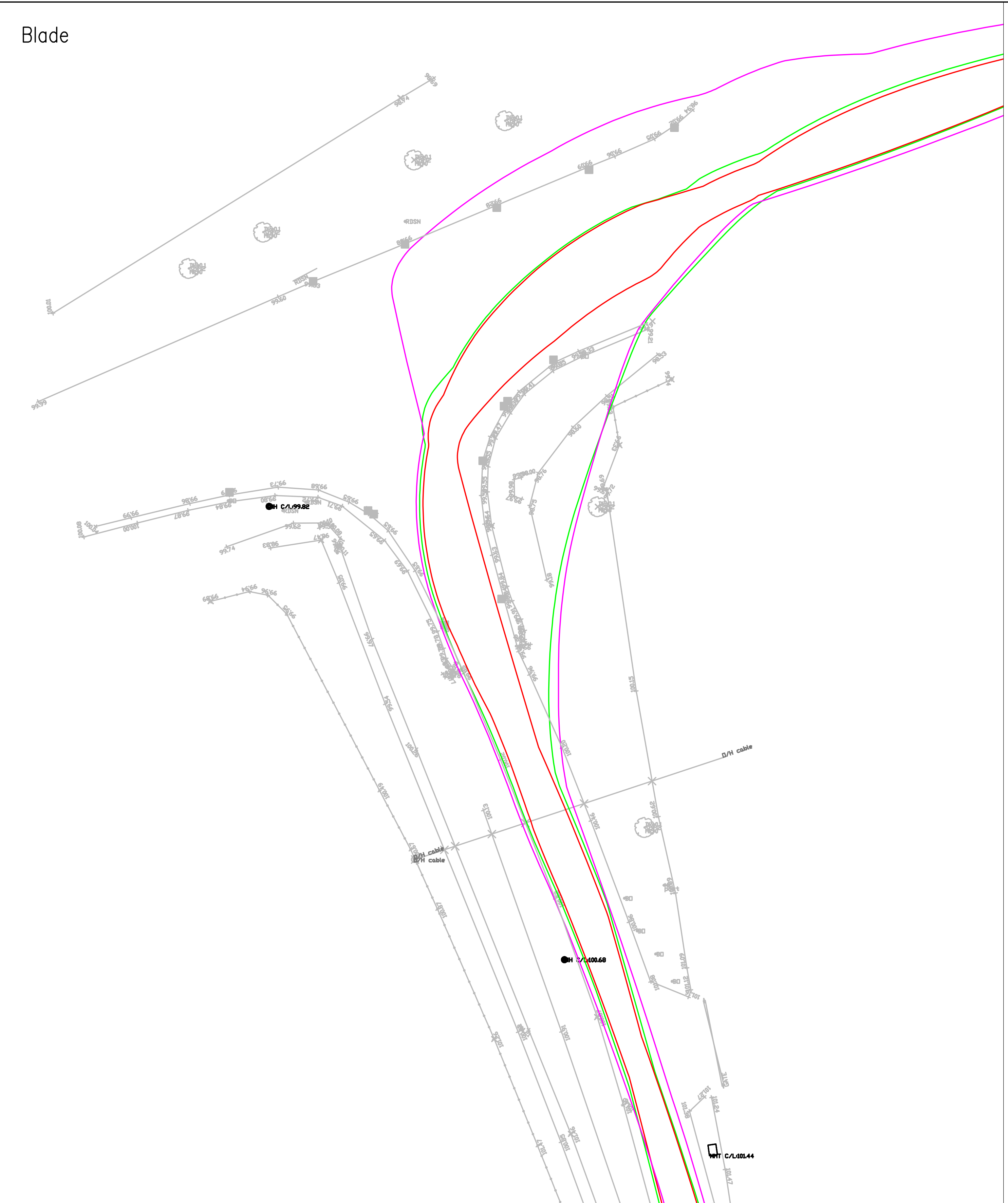

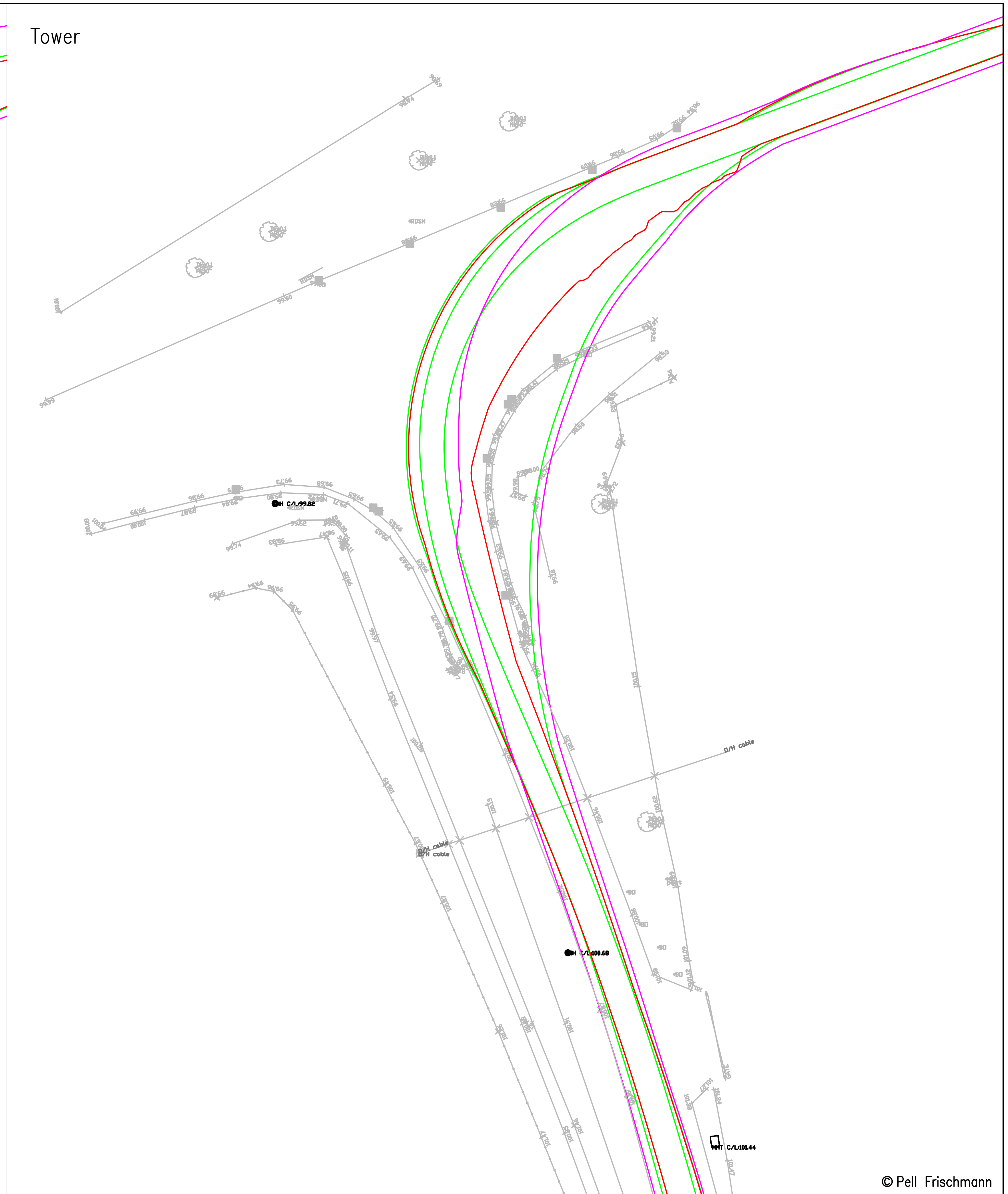

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / L5025 Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Designed	GB	18/12/2024
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Drawing Status: Draft

Drawing No. SK03

Notes:
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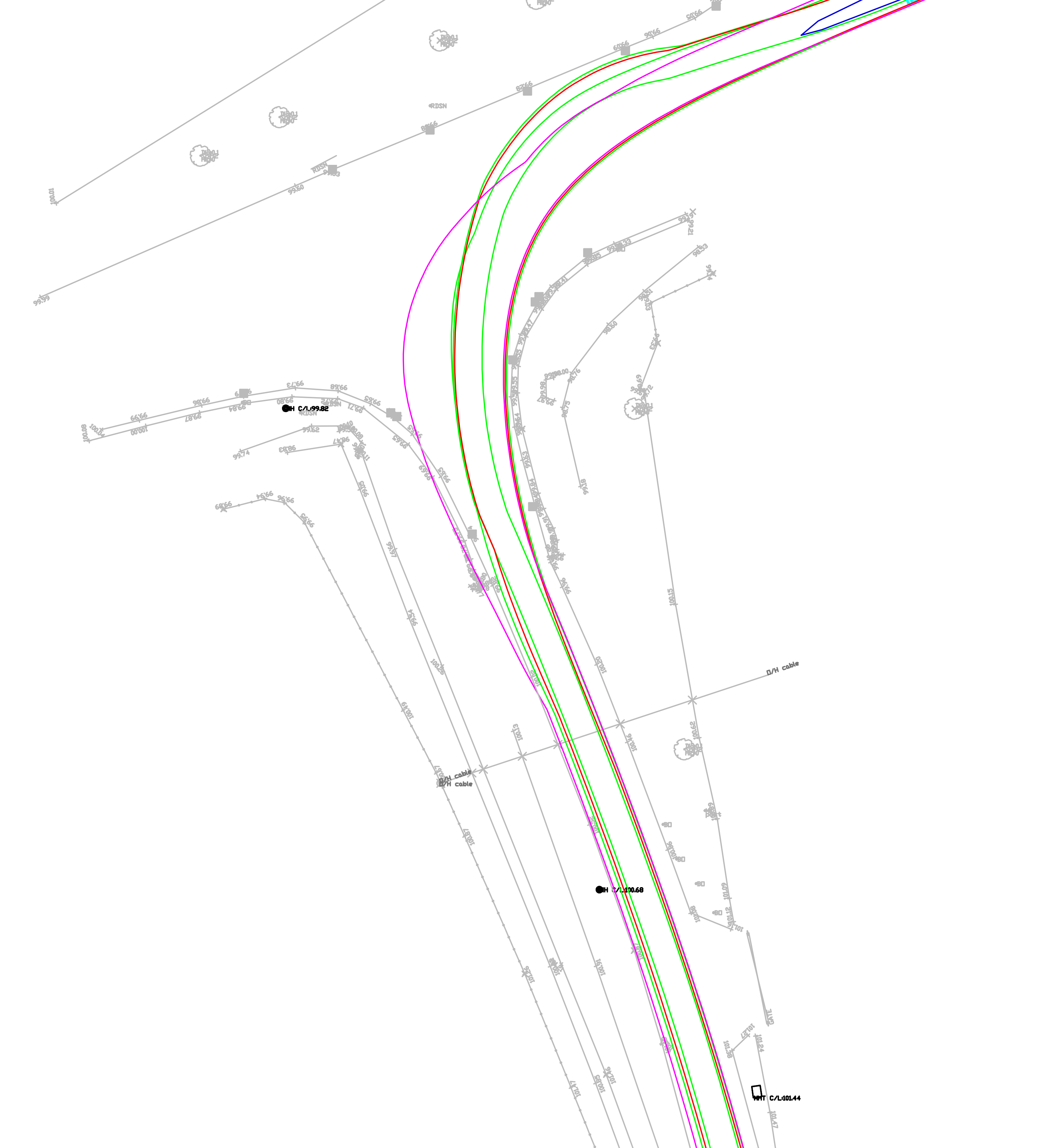
Revision: 00

North Access
Review:
Blade Lifting
Trailer



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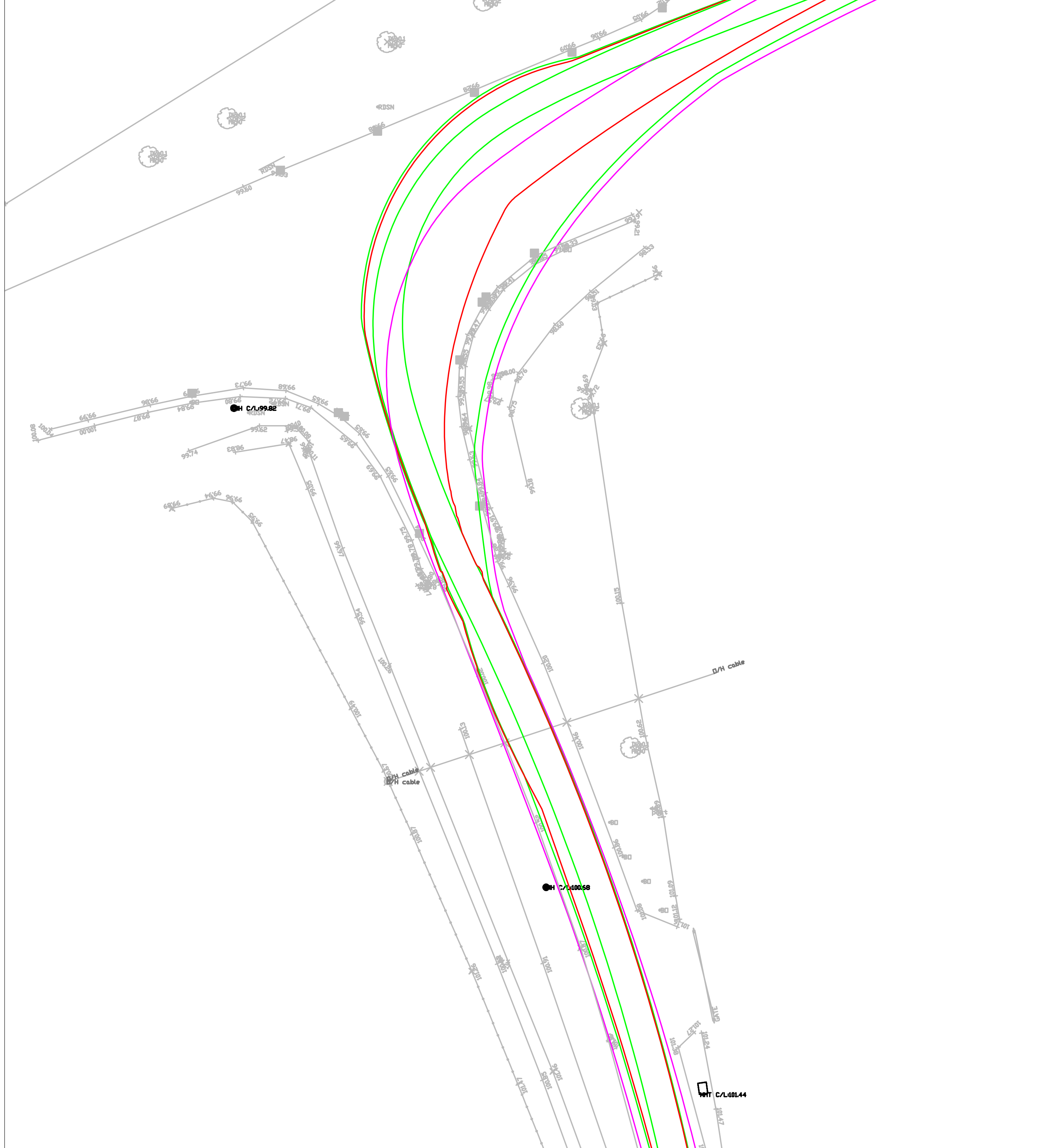
Review:
Tower



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 / L5025 Junction

	Name	Date
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Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		3

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK03A

Notes:
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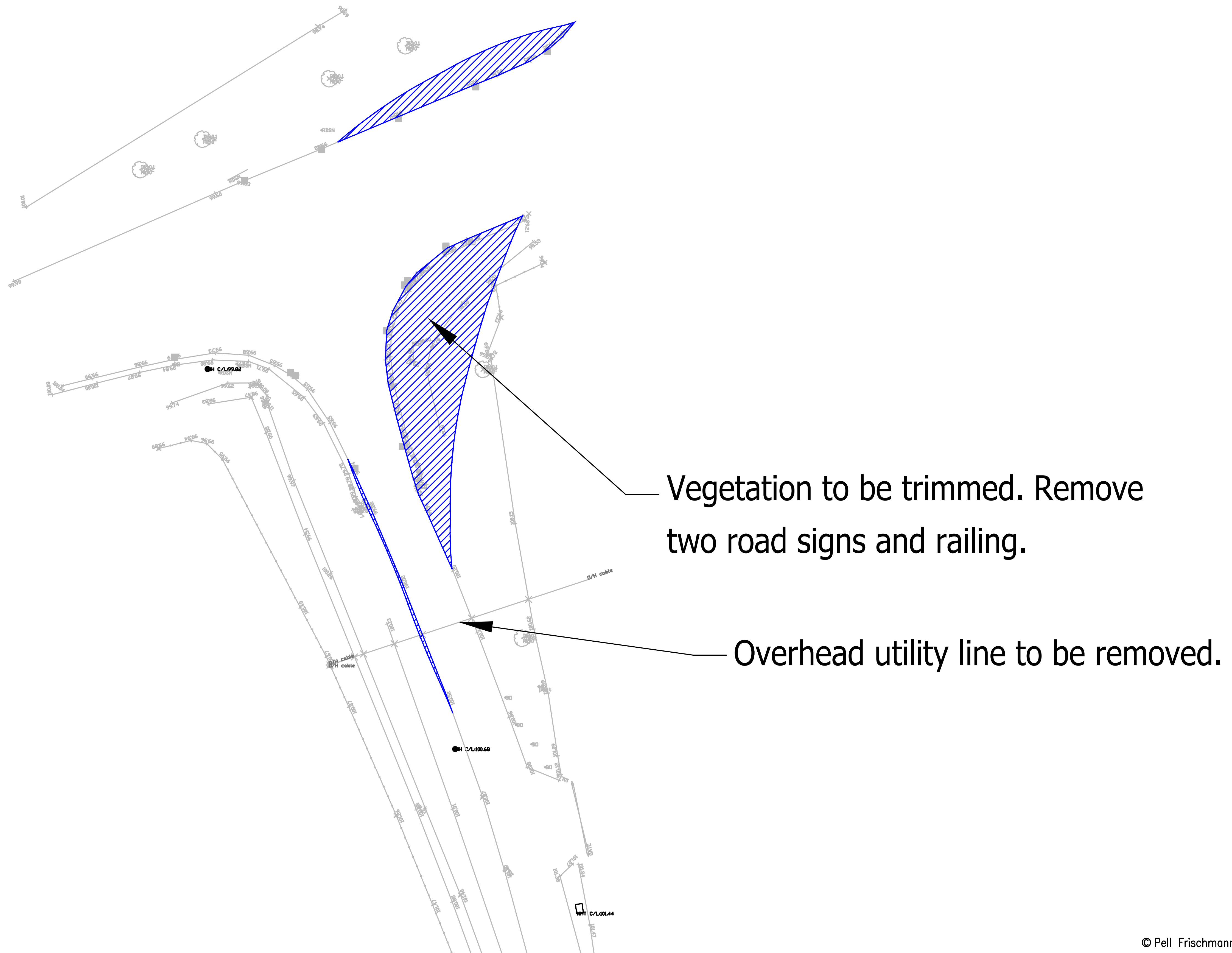
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	R402 / L5025 Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		3

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Drawing No.	SK03B
Revision	00

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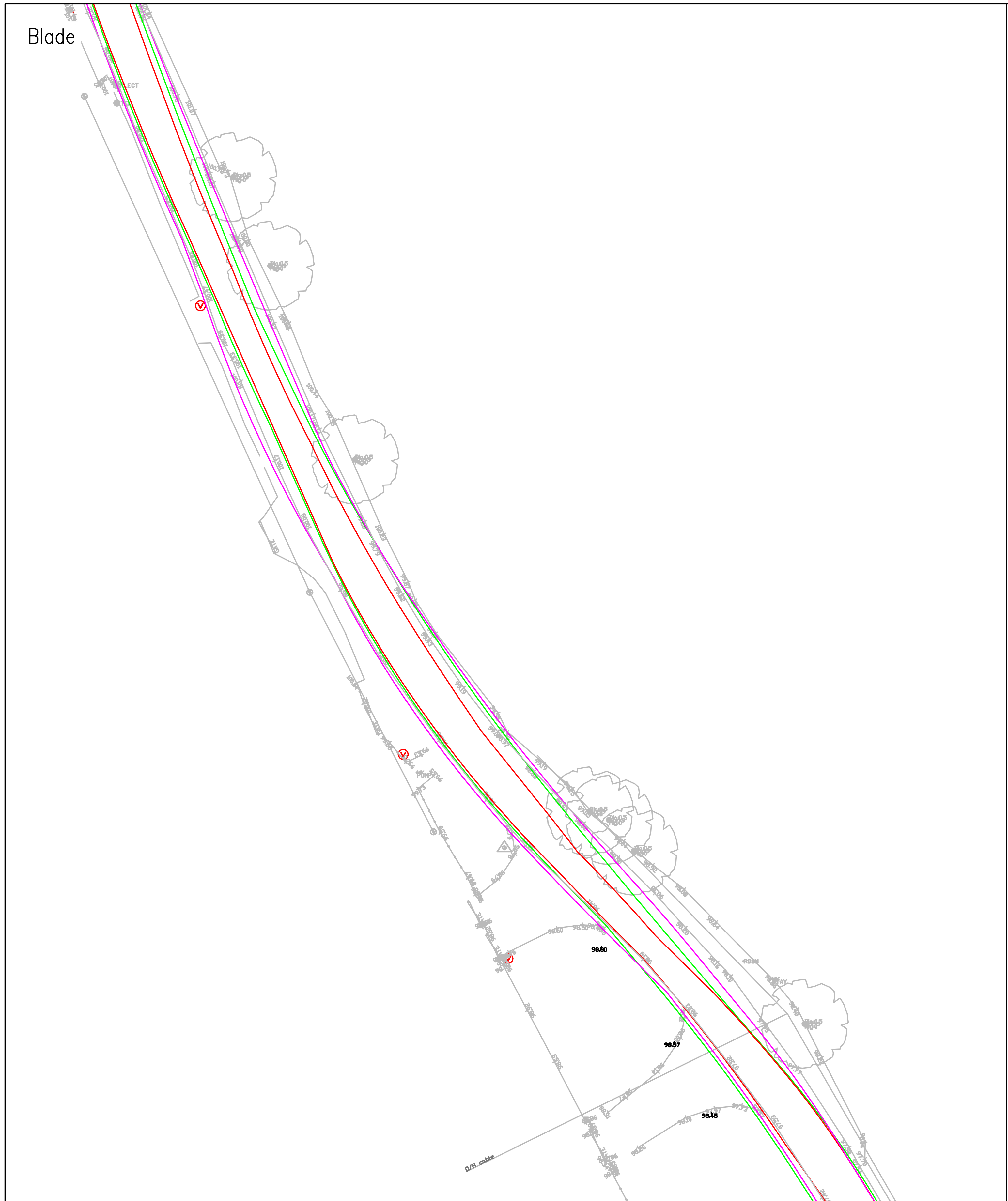

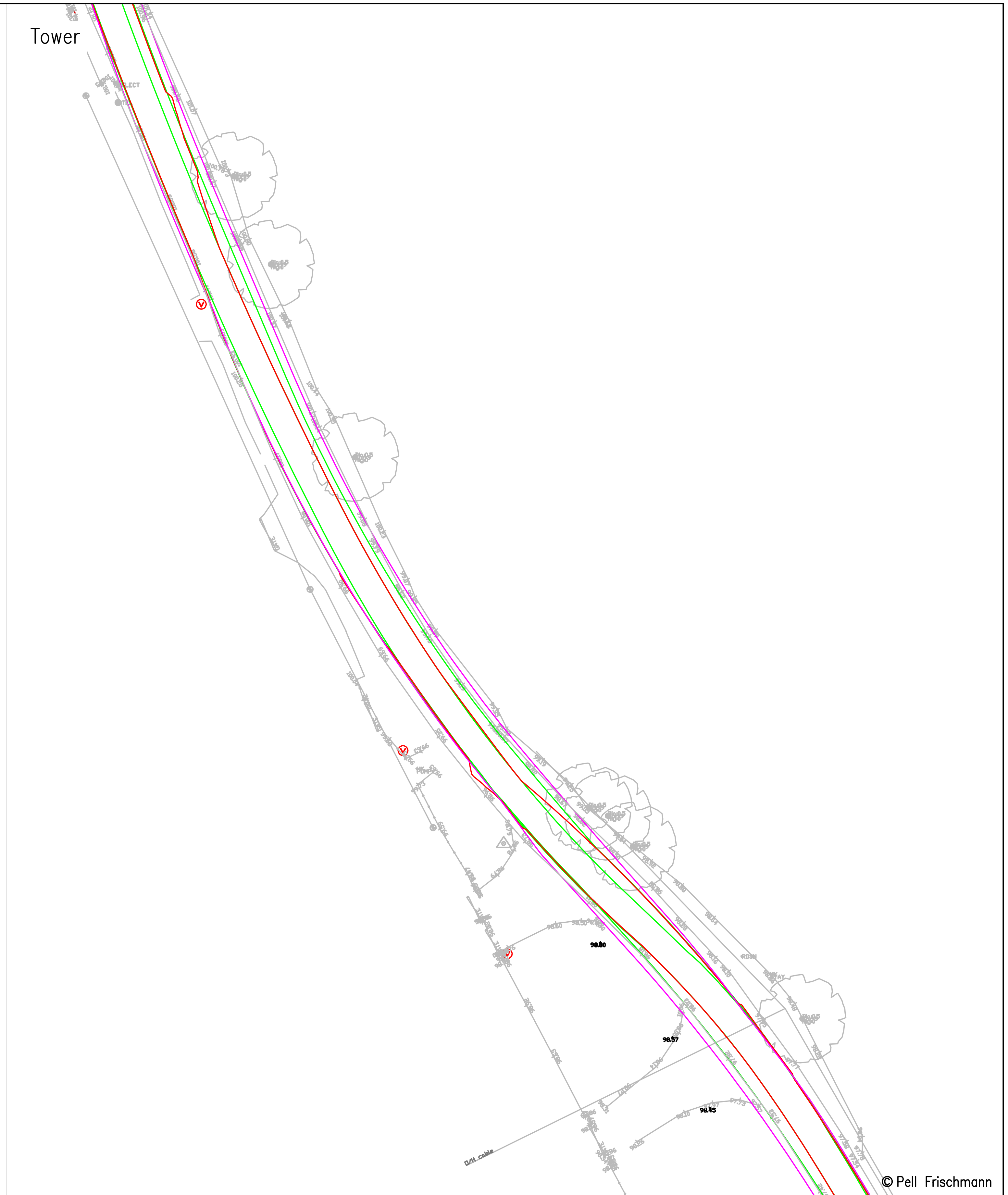

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 1

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

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Designed	GB	18/12/2024
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Point of Interest		4

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK04

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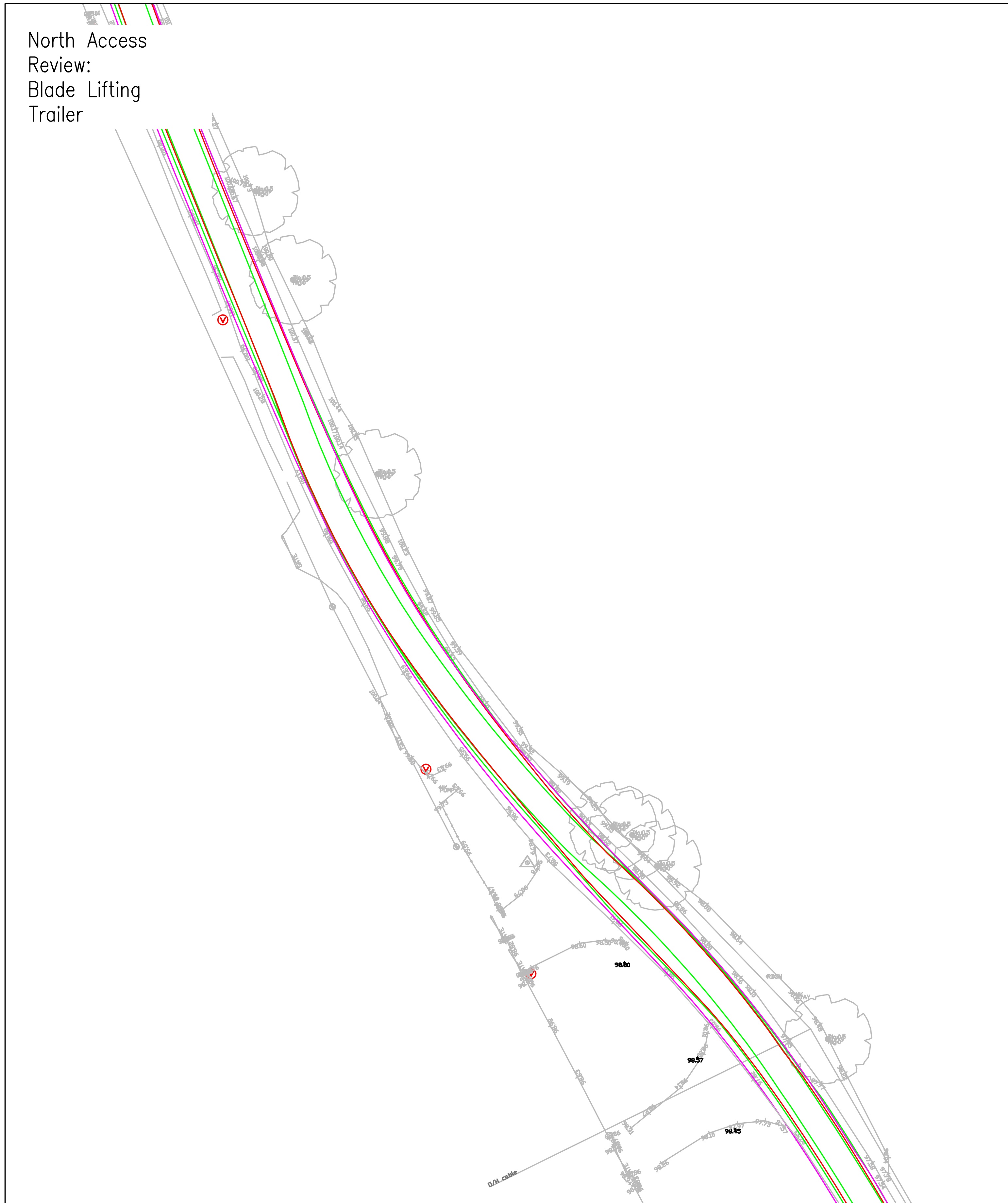
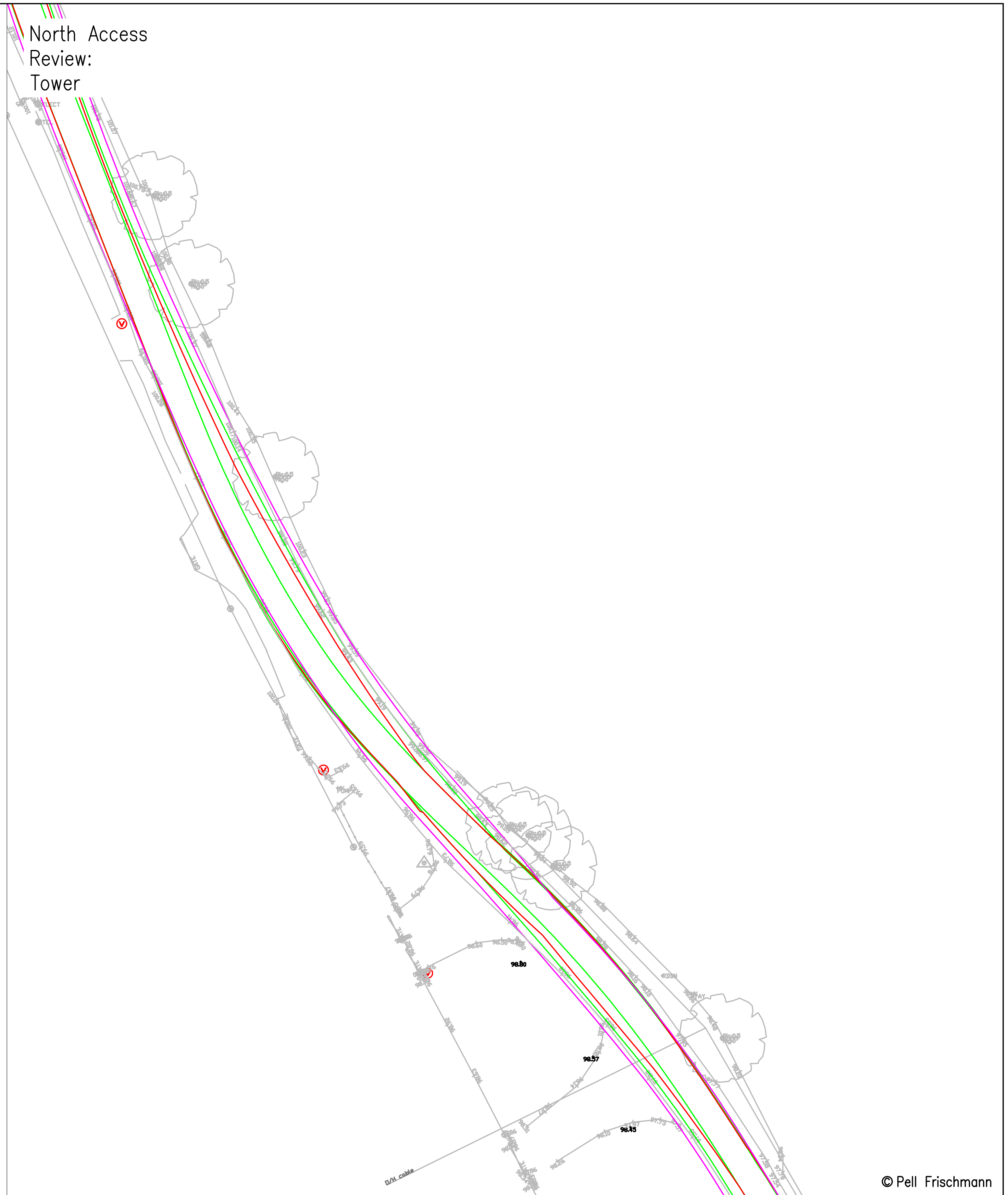
Revision: 00





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Email: pfedinburgh@pellfrischmann.com
www.pellfrischmann.com

Project	DREHID WIND FARM		Name	Date
		Drawn	GB	18/12/2024
		Designed	GB	18/12/2024
		Checked	TL	18/12/2024
Client	NORTH KILDARE WIND FARM LTD.	Point of Interest		4
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER	Drawing No.	SK04A	
SPA Location	L5025 Bend 1			

Scale: 1:500 @ A3

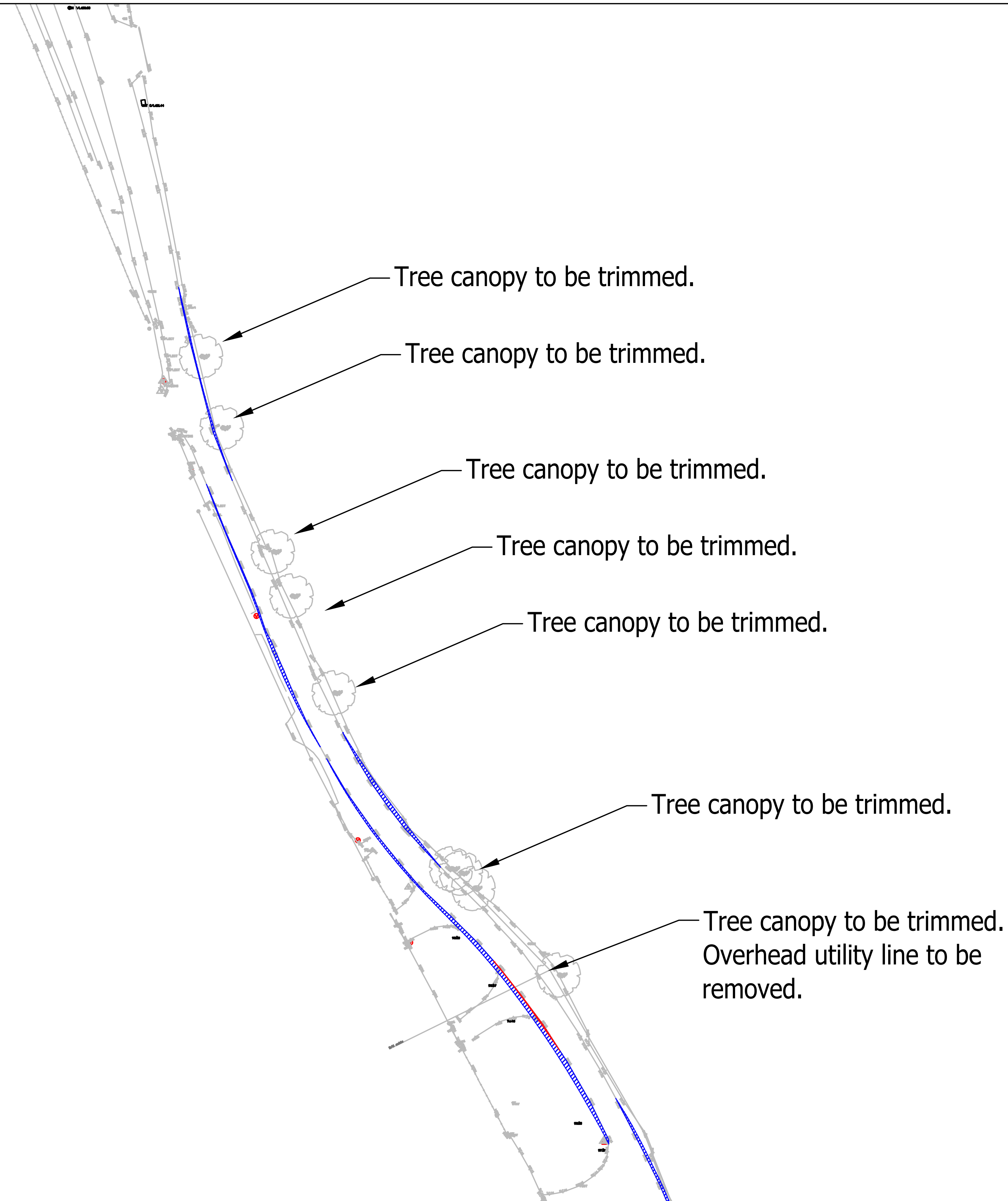
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Revision: 00

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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www.pellfrischmann.com

Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 1

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	4	

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK04B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	5	

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK05

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01

North Access
Review:
Blade Lifting
Trailer

North Access
Review:
Tower

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

Key: Wheel SPA — Body SPA — Load SPA — Indicative — Overrun — Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		5

Scale: 1:1000 @ A3

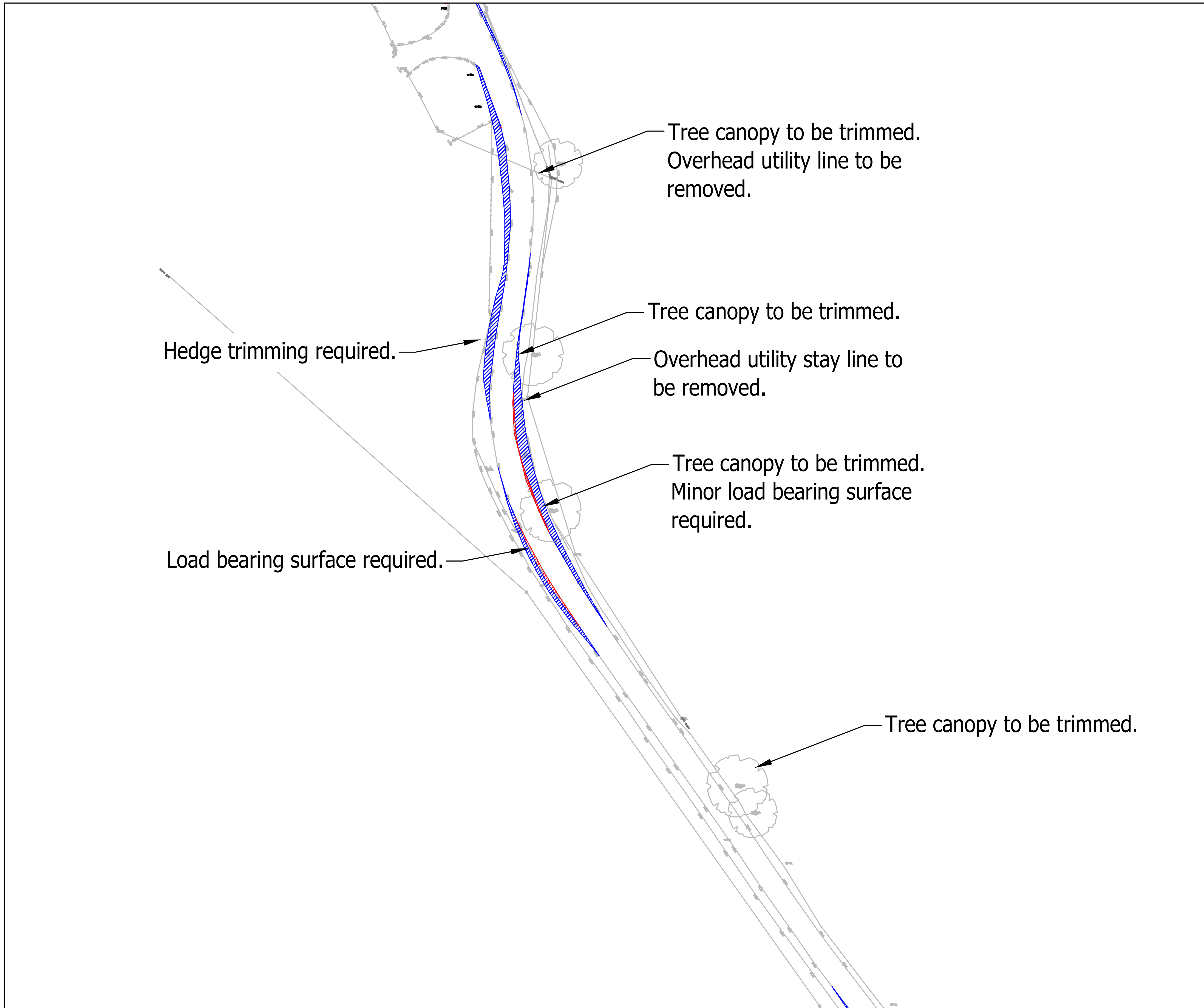
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK05A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 Bend 2

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		5

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

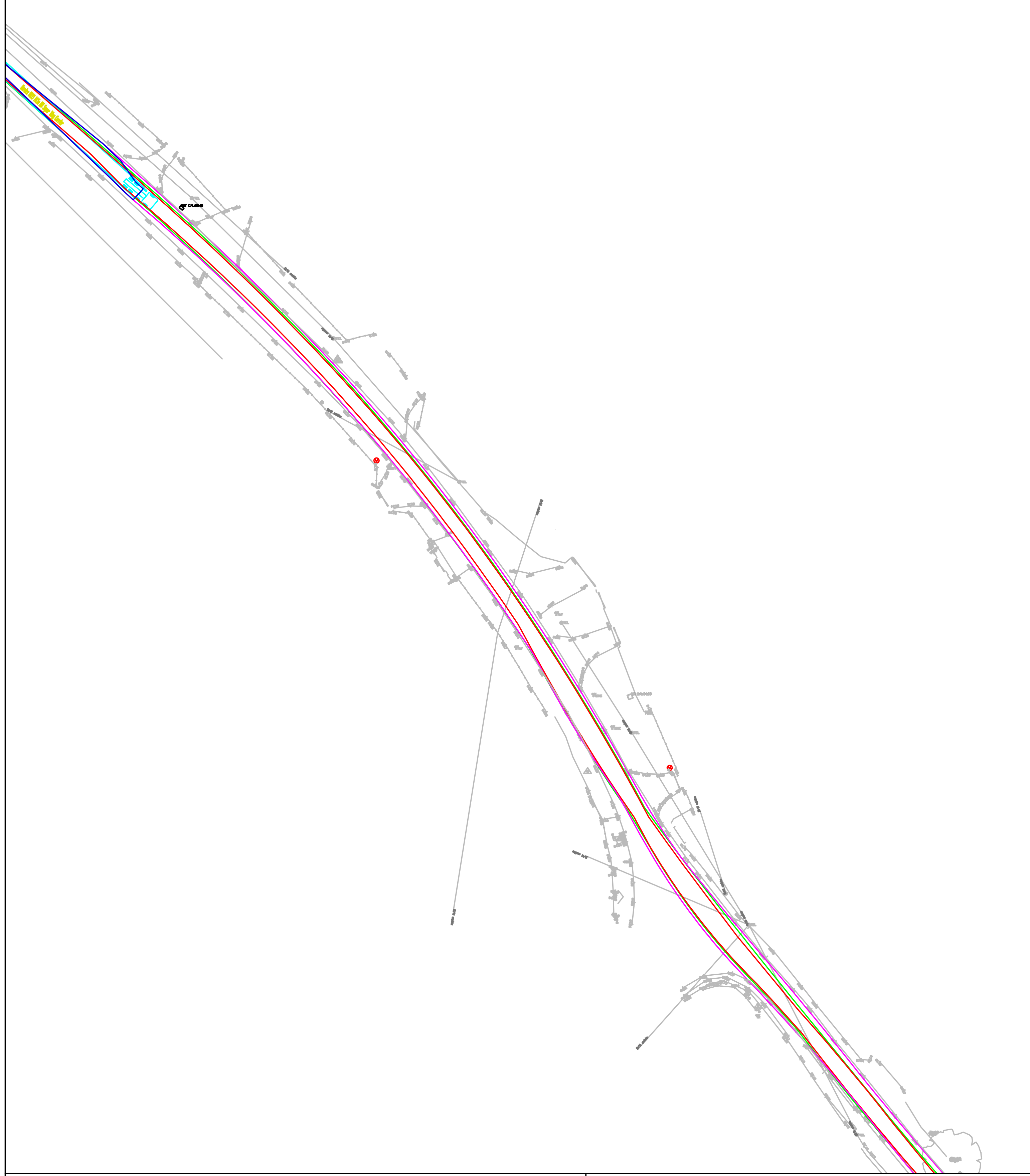
Drawing Status: Draft

Drawing No. SK05B

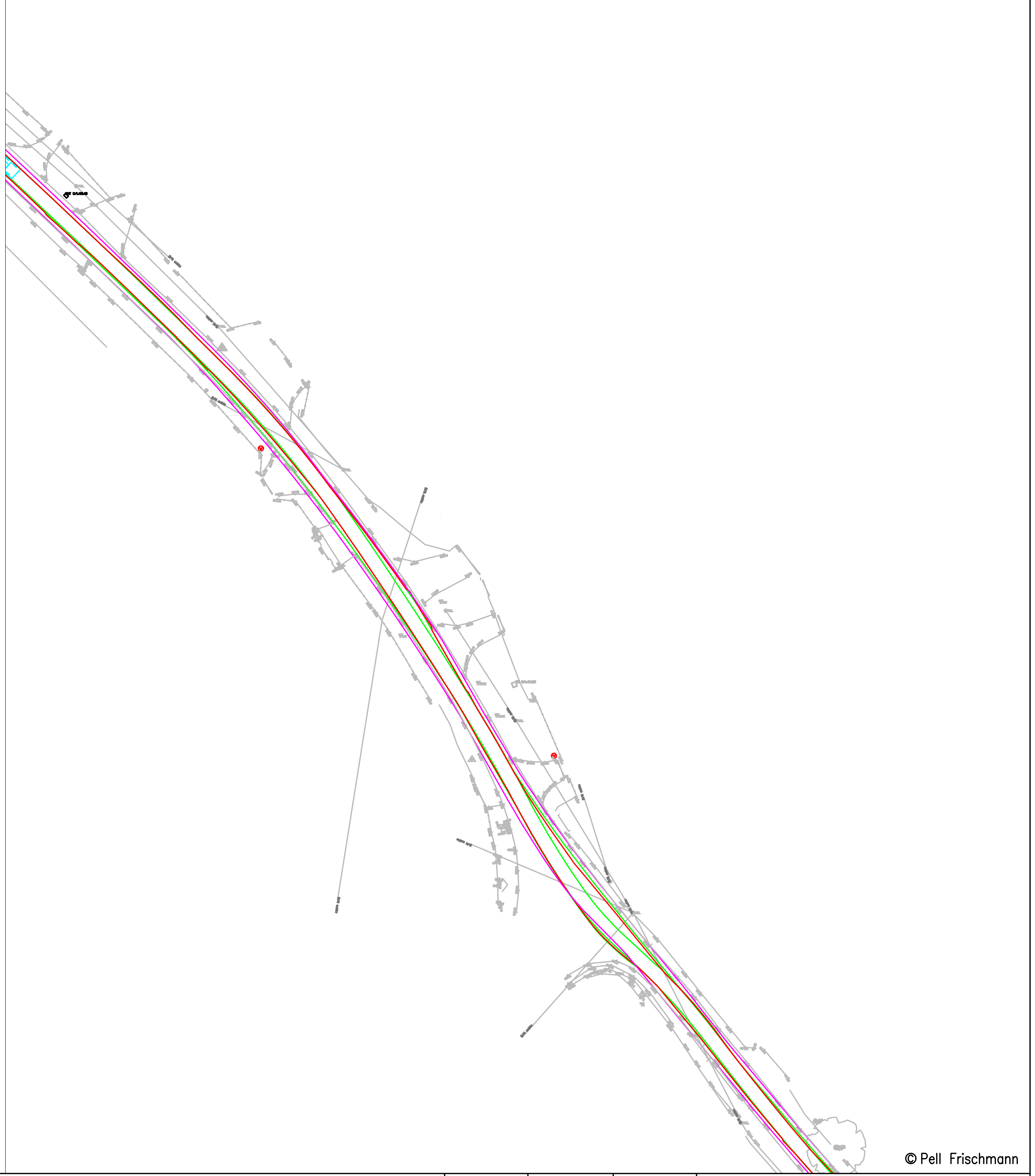
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01

Blade



Tower



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www.pellfrischmann.com

Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	L5025 North of River Kilooney Bridge

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	6	

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK06

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 North of River Kilooney Bridge

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest	6	

Scale: 1:1000 @ A3

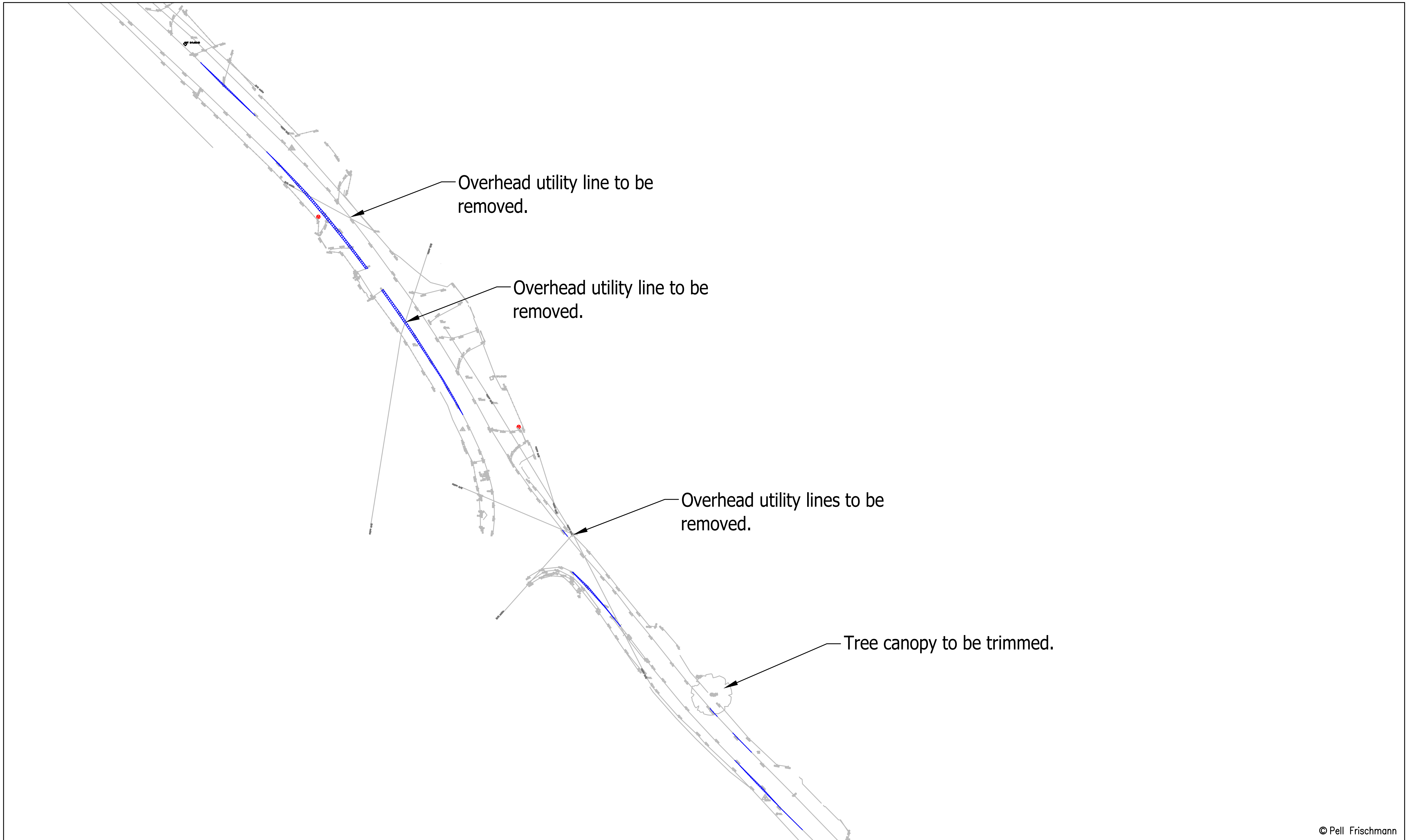
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK06A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 North of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		6

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

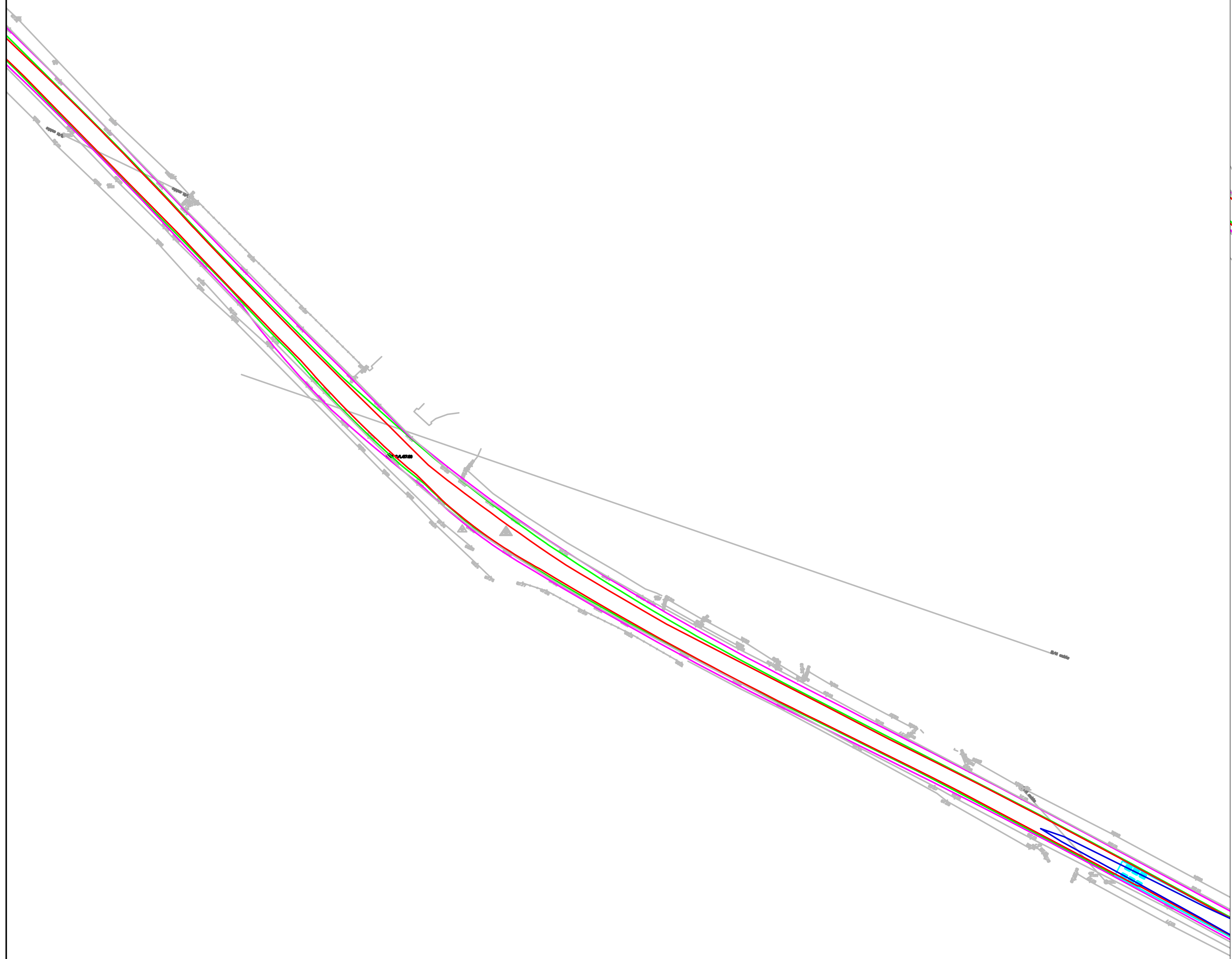
Drawing Status: Draft

Drawing No. SK06B

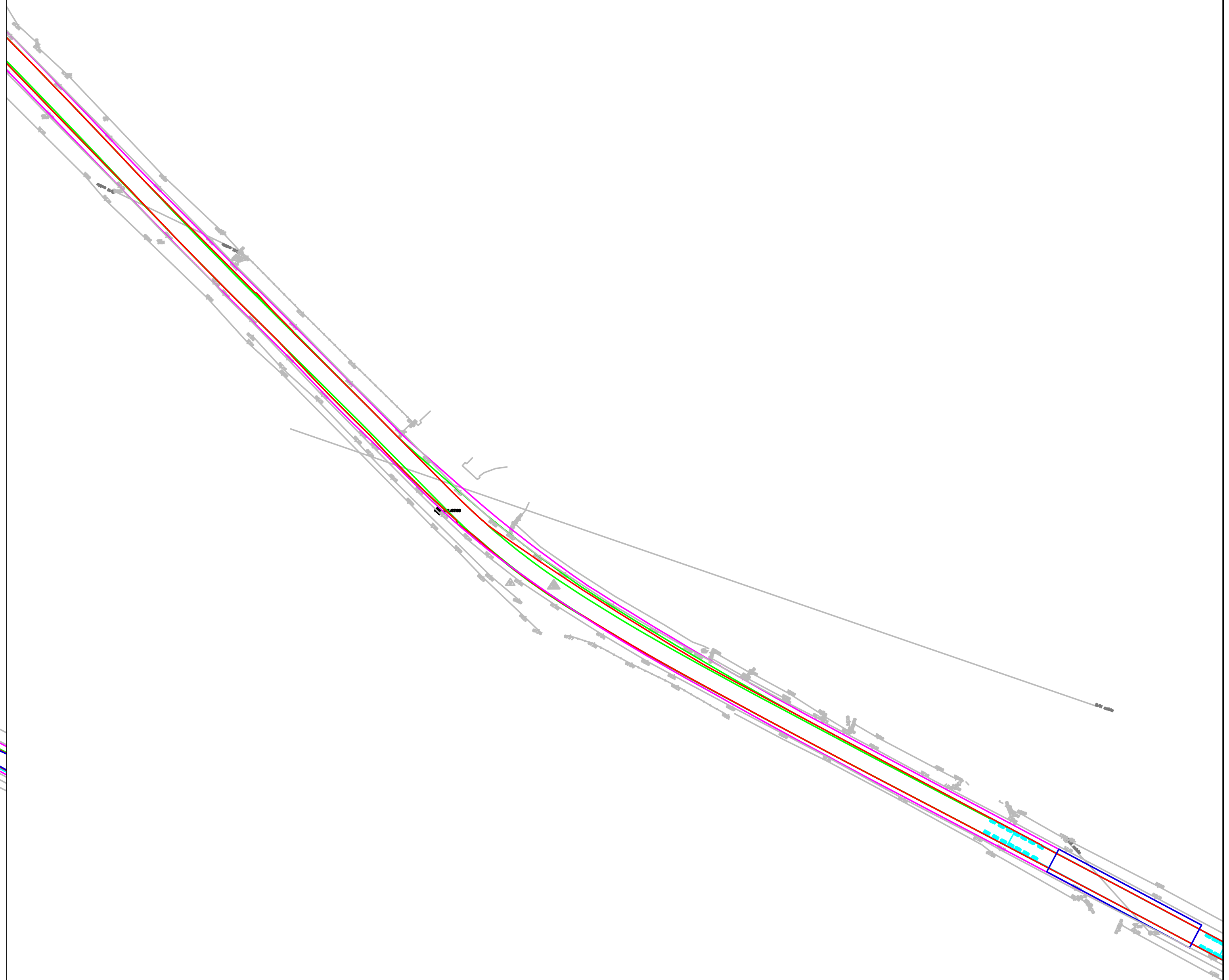
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

Blade



Tower



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 South of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

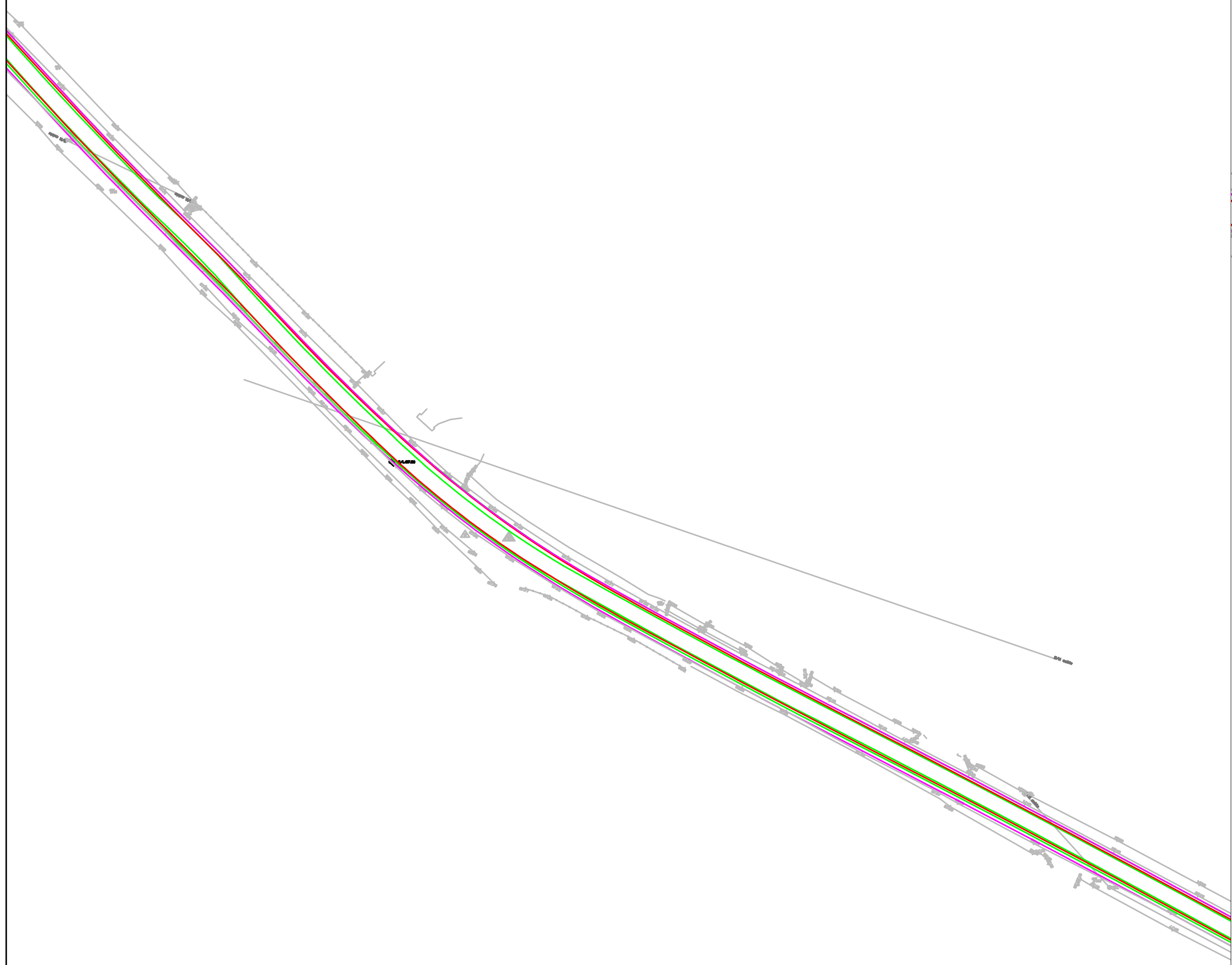
Drawing Status: Draft

Drawing No. SK07

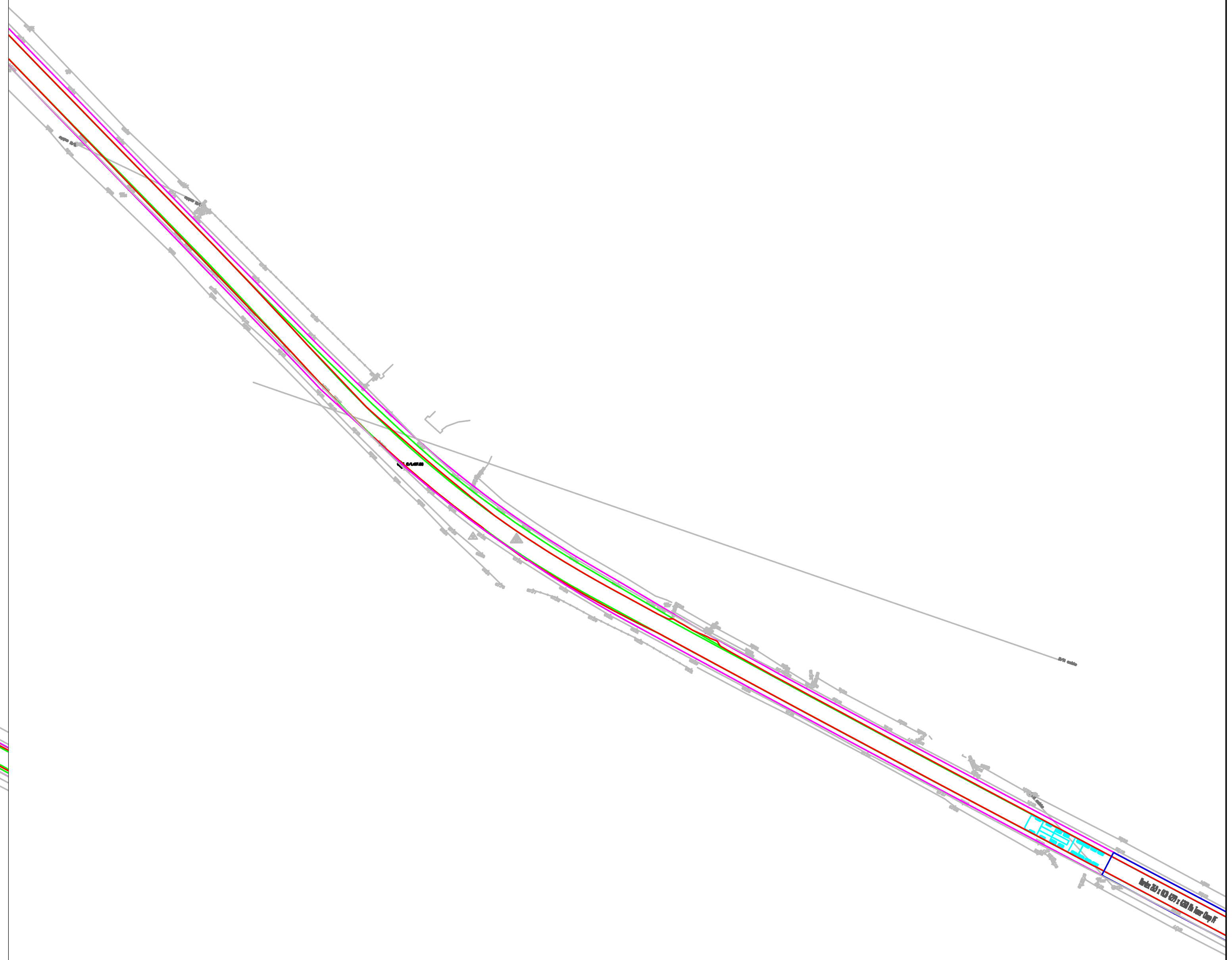
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

North Access
Review:
Blade Lifting
Trailer



North Access
Review:
Tower



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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 South of River Kilooney Bridge

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

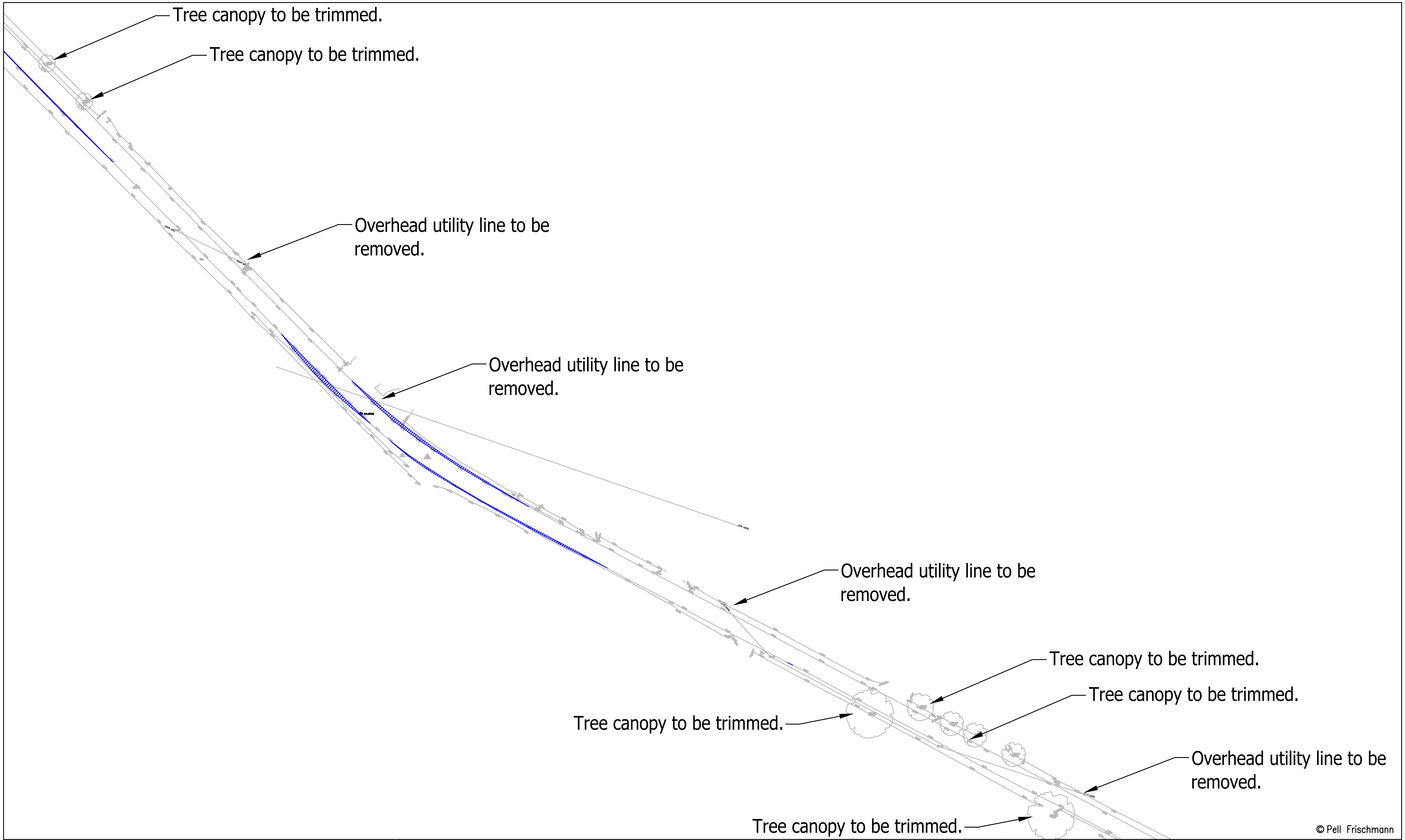
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 South of River Kilooney Bridge

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

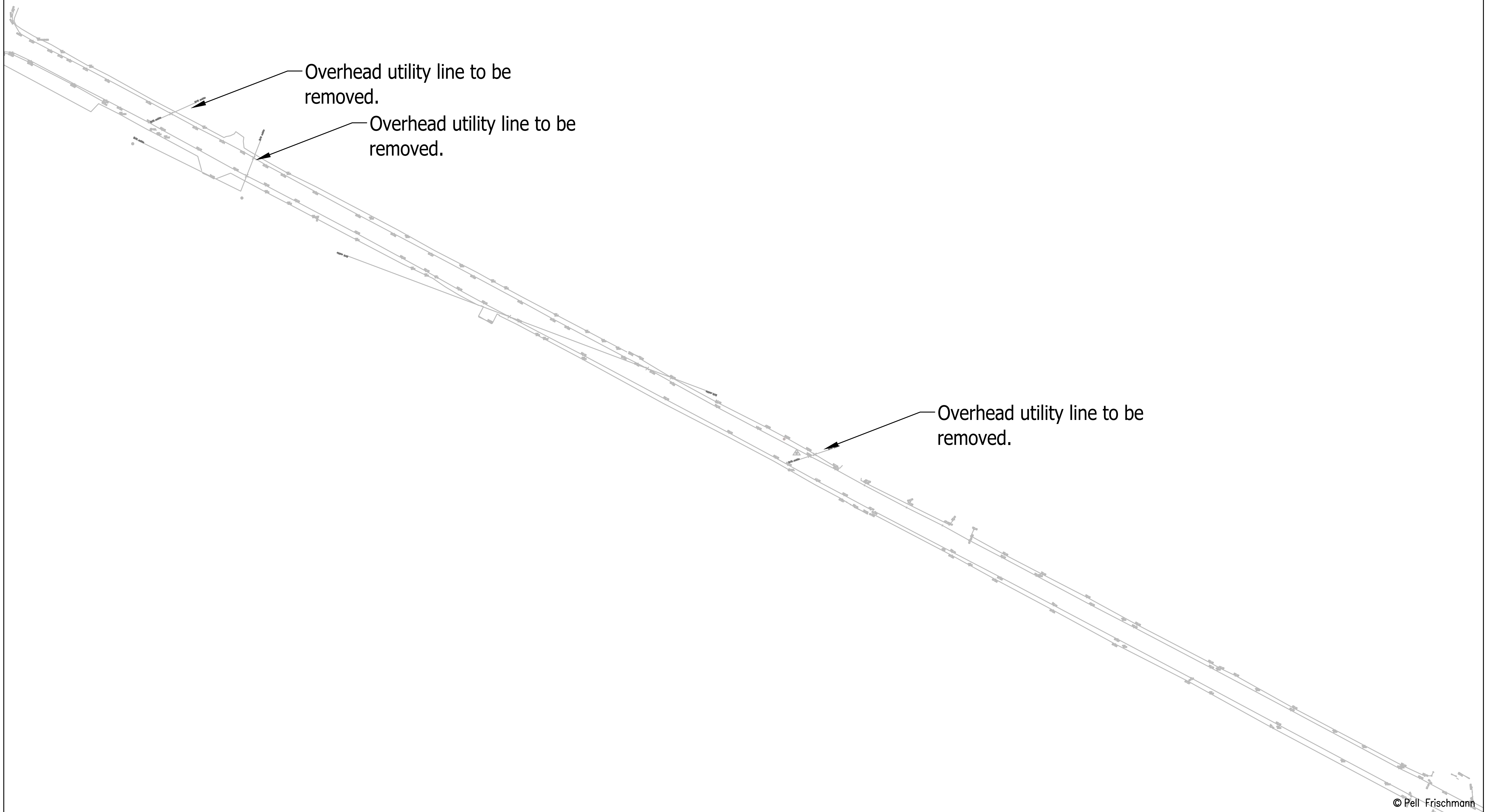
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Project	DREHID WIND FARM		Name	Date
		Drawn	GB	18/12/2024
		Designed	GB	18/12/2024
		Checked	TL	18/12/2024
Client	NORTH KILDARE WIND FARM LTD.	Point of Interest		7
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER	Drawing No.	SK07C	
SPA Location	L5025 East of River Kilooney Bridge			

Scale: 1:1000 @ A3

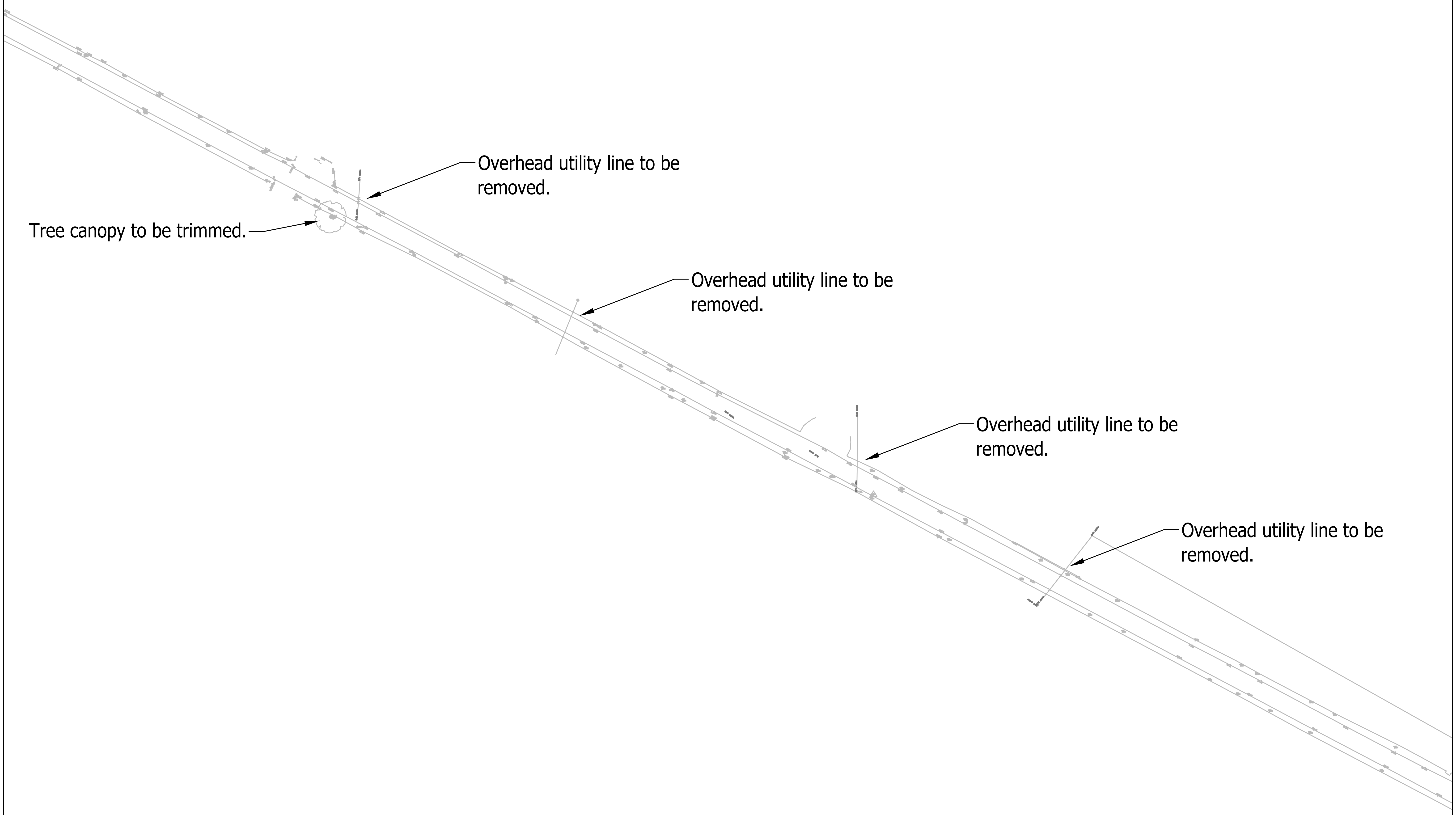
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Revision: 00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail



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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: L5025 East of River Kilooney Bridge

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		7

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK07D

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Southern Site Access Junction

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK08

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Project	DREHID WIND FARM	
Client	NORTH KILDARE WIND FARM LTD.	
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER	
SPA Location	Southern Site Access Junction	

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale	1:1000 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK08A
Revision	00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Southern Site Access Junction

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		8

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK08B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client	NORTH KILDARE WIND FARM LTD.	Project	DREHID WIND FARM
		Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
		SPA Location	R402 Raven Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		9

Scale: 1:500 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK09

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Project: DREHID WIND FARM

Client: NORTH KILDARE WIND FARM LTD.

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: R402 Raven Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		9

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK09A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Kilshanroe Road Bends 1 & 2

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		10&11

Scale: 1:1000 @ A3

File No.: 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No.: SK10

Revision: 00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Project	DREHID WIND FARM
Client	NORTH KILDARE WIND FARM LTD.
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 1&2

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		10&11

Scale: 1:1000 @ A3
File No. 241218 Drehid RSR Tracking.dwg
Drawing Status: Draft
Drawing No. SK10A
Revision: 00

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Kilshanroe Road Bend 3

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		12

Scale: 1:1000 @ A3

File No.: 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No.: SK11

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Email: pfedinburgh@pellfrischmann.com
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Project	DREHID WIND FARM		
Client	NORTH KILDARE WIND FARM LTD.	Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
		SPA Location	Kilshanroe Road Bend 3

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		12

Scale: 1:1000 @ A3

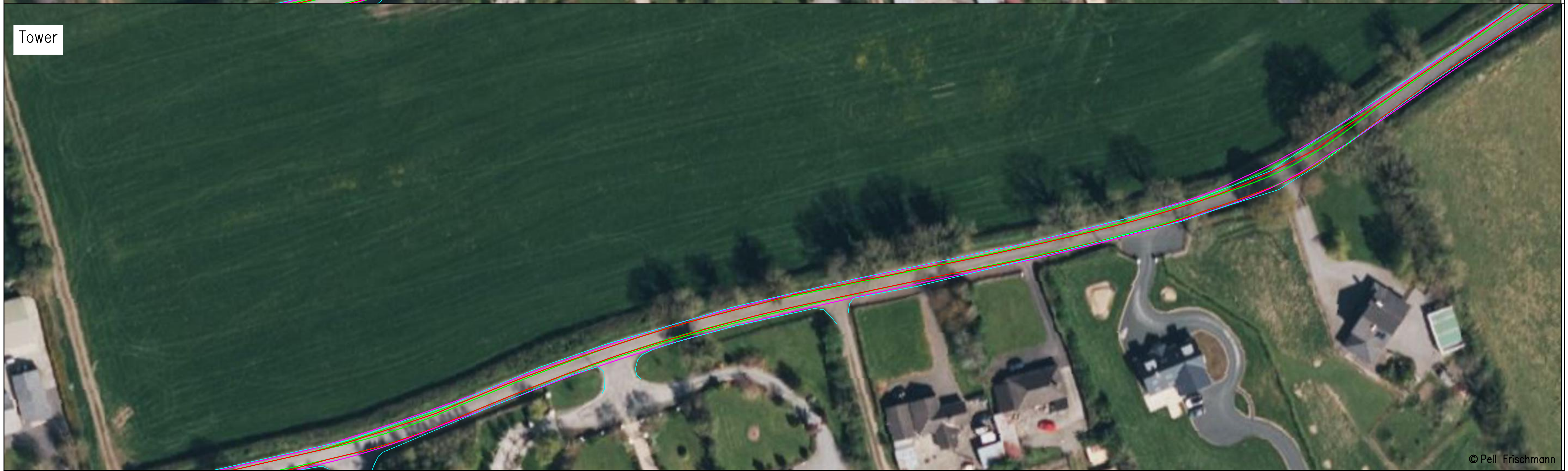
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK11A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00



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Email: pfedinburgh@pellfrischmann.com
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Client	NORTH KILDARE WIND FARM LTD.
Project	DREHID WIND FARM
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 4

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		13

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK12

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 00

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Email: pfedinburgh@pellfrischmann.com
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Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Kilshanroe Road Bend 4

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		13

Scale: 1:1000 @ A3

File No. 241218 Drehid RSR Tracking.dwg

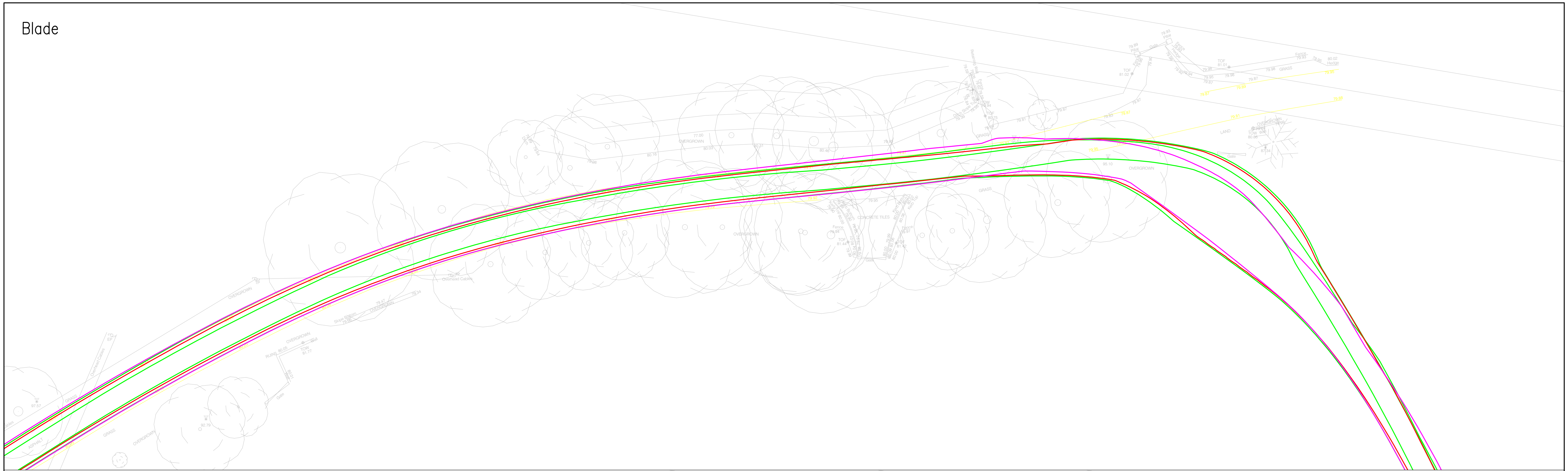
Drawing Status: Draft

Drawing No. SK12A

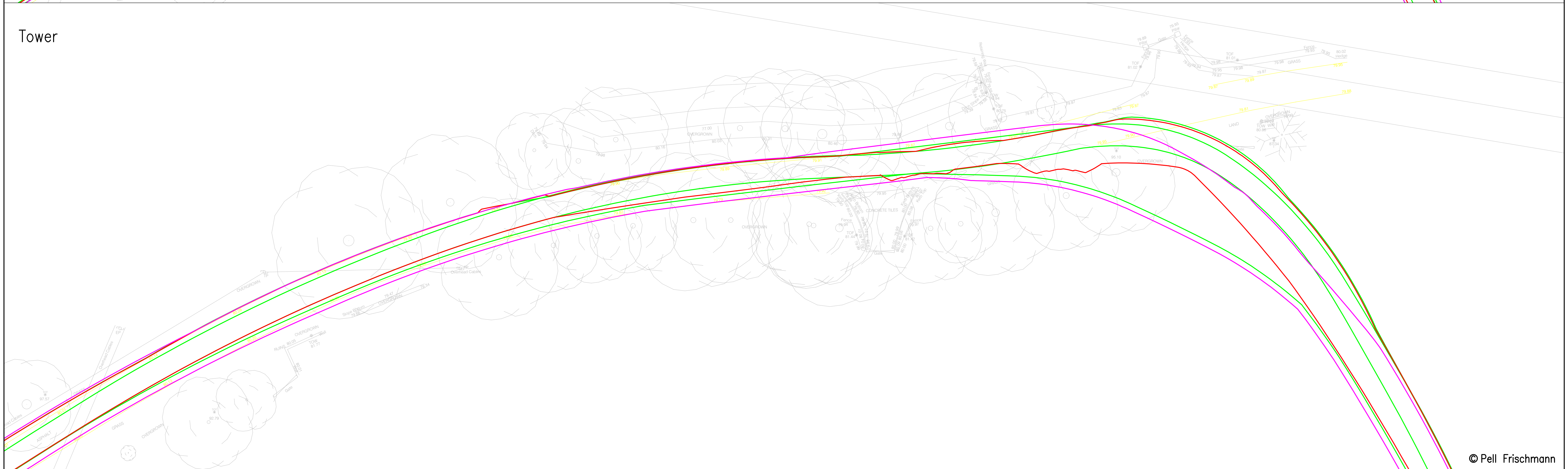
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01

Blade



Tower



Pell Frischmann
93 GEORGE STREET, EDINBURGH. EH2 3ES
Tel: +44 (0)131 240 1270
Email: pfedinburgh@pellfrischmann.com
www.pellfrischmann.com

Client: NORTH KILDARE WIND FARM LTD.

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Overrun | Oversail

Project: DREHID WIND FARM

Drawing Title: NORDEX N133 BLADE & N133 TS100 TOWER

SPA Location: Kilshanroe Road Bend 5 and North Site Access

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		14&15

Scale: 1:500 @ A3

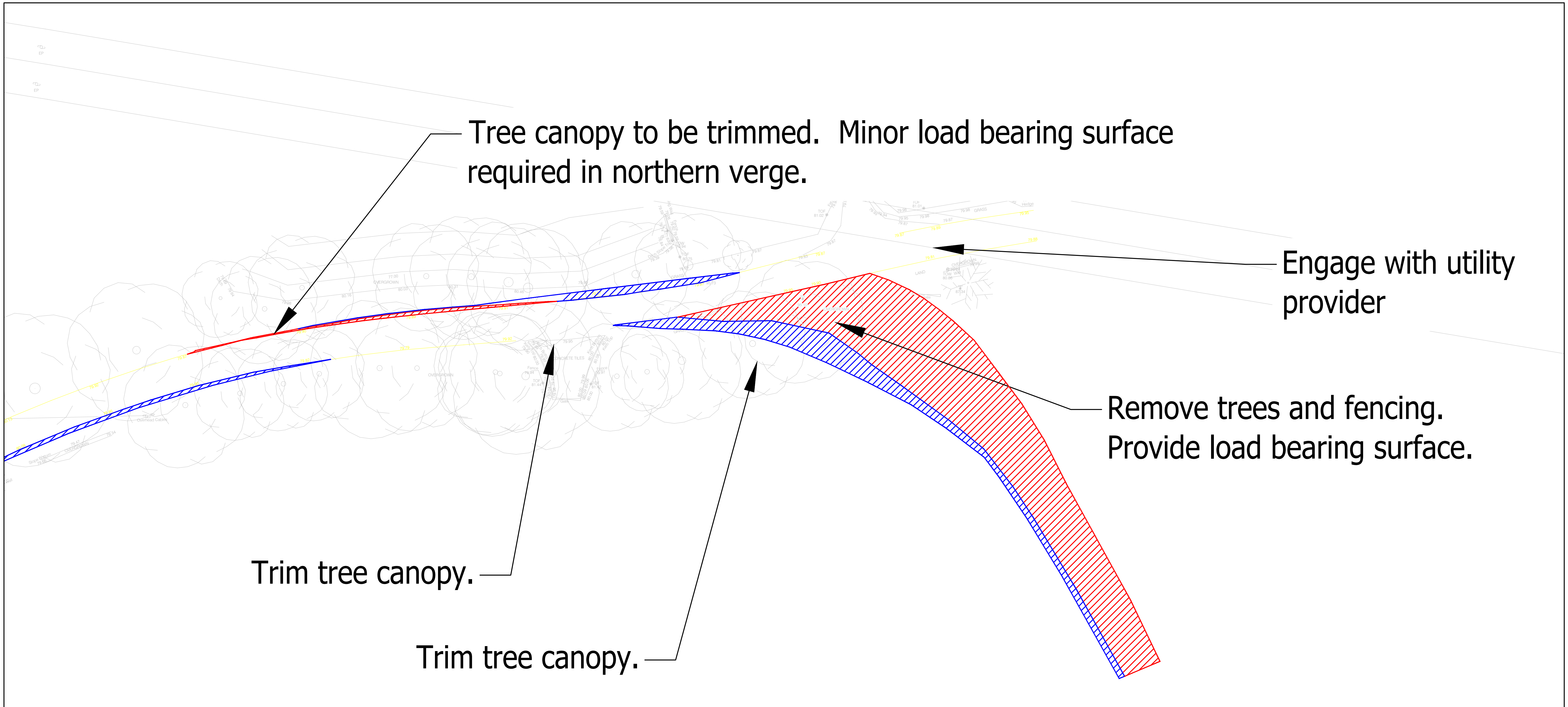
File No. 241218 Drehid RSR Tracking.dwg

Drawing Status: Draft

Drawing No. SK13

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 01



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93 GEORGE STREET, EDINBURGH. EH2 3ES
Tel: +44 (0)131 240 1270
Email: pfedinburgh@pellfrischmann.com
www.pellfrischmann.com

Client	NORTH KILDARE WIND FARM LTD.
Key	Wheel SPA, Body SPA, Load SPA, Indicative, Overrun, Oversail
Project	DREHID WIND FARM
Drawing Title	NORDEX N133 BLADE & N133 TS100 TOWER
SPA Location	Kilshanroe Road Bend 5 and North Site Access

	Name	Date
Drawn	GB	18/12/2024
Designed	GB	18/12/2024
Checked	TL	18/12/2024
Point of Interest		14&15

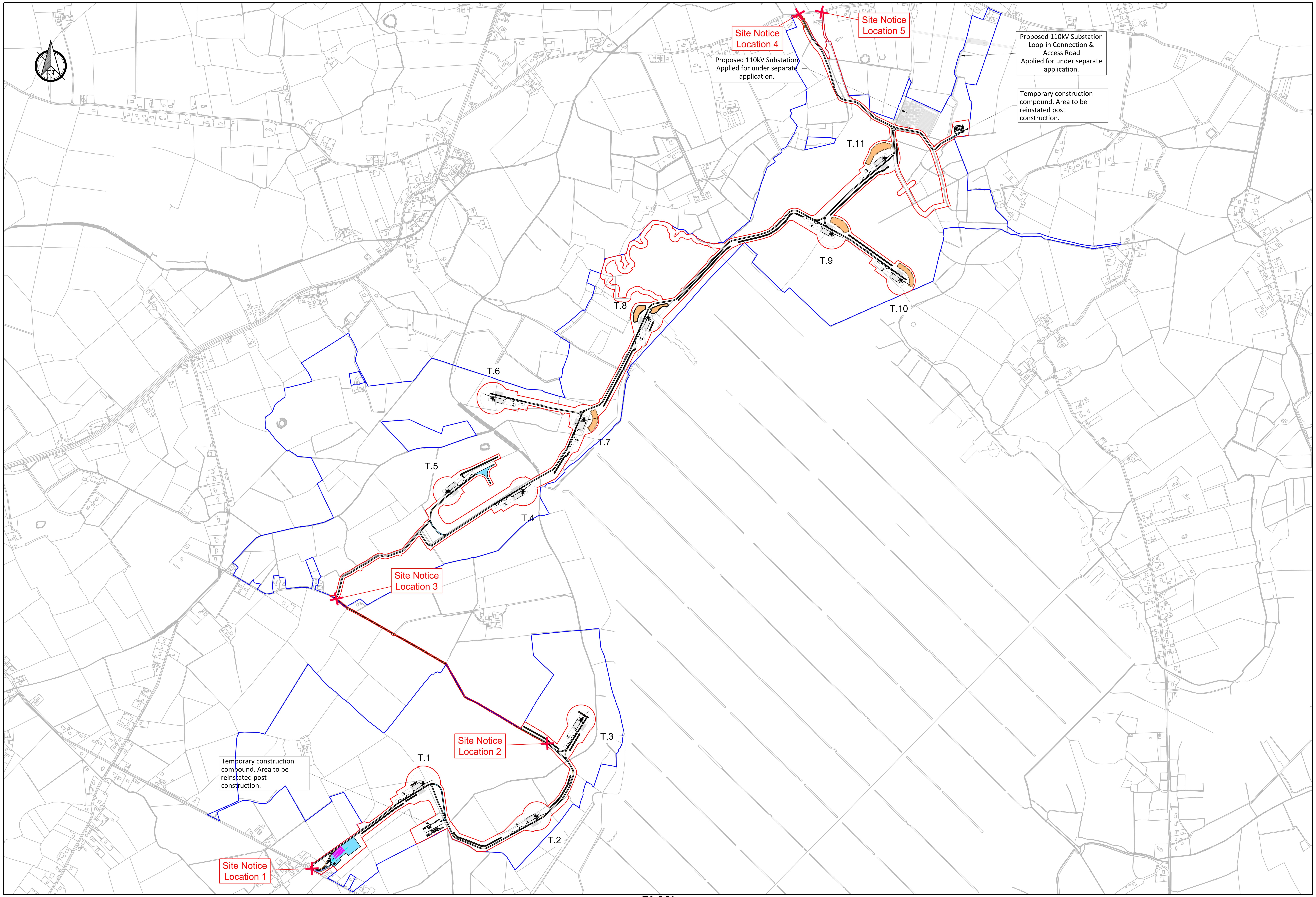
Scale	1:500 @ A3
File No.	241218 Drehid RSR Tracking.dwg
Drawing Status	Draft
Drawing No.	SK13A
Revision	01

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 2

Referenced Planning Application Drawings



PLAN

Scale 1:10000

If Applicable : Ordnance Survey Ireland Licence No. EN 0001218 © Ordnance Survey Ireland and Government of Ireland
OSI SHEETS 3122-C, 3122-D,3187-A,3187-B,3187-C,3187-D,3188-A,3188-B,3188-C,3188-D,3253-A,3253-B,3253-C,3253-D,

Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).

0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m

Scale 1:10000

FEHILY TIMONEY

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	1:10000 SITE LOCATION
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:10000
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0100-0001
Rev	A

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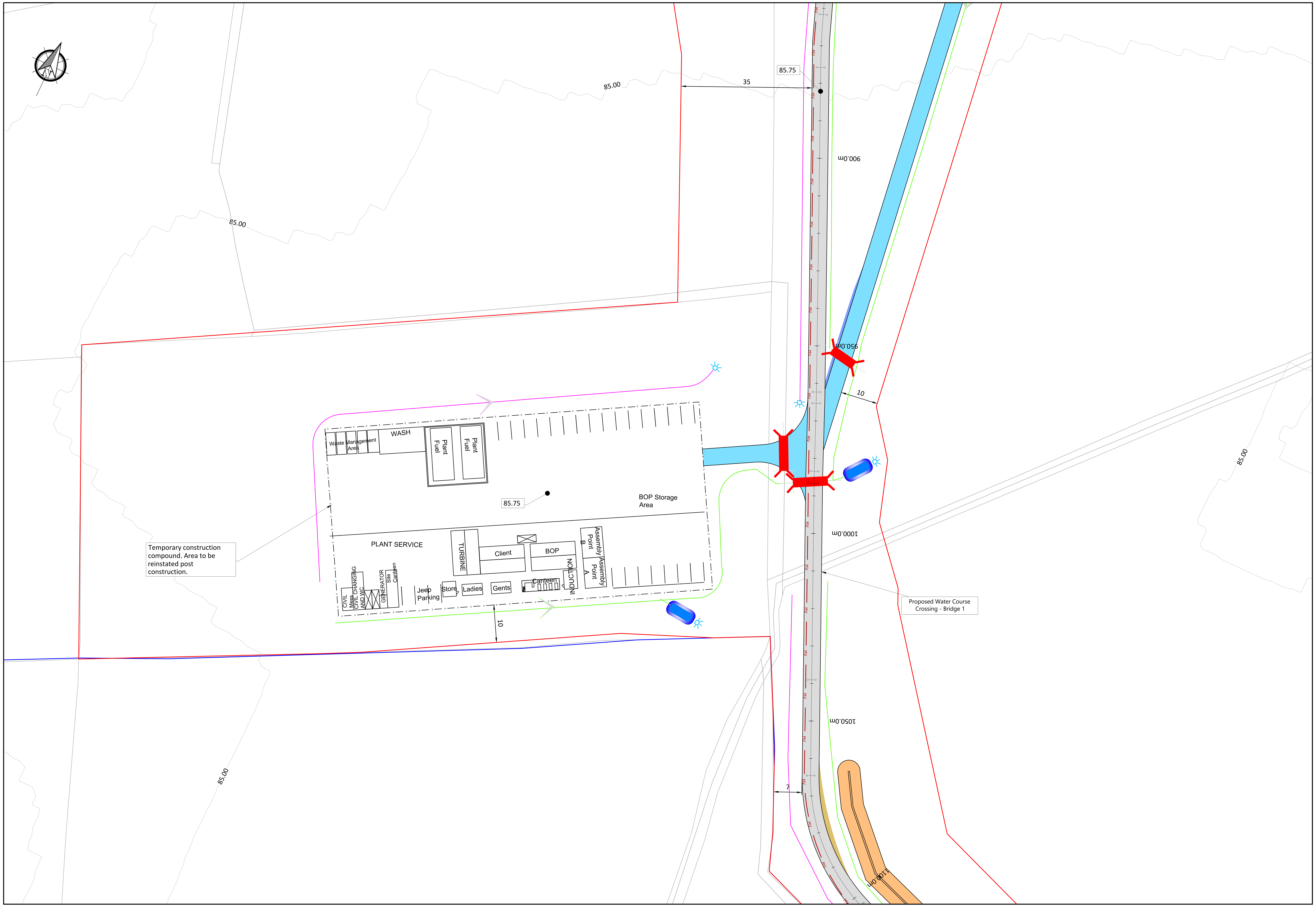
21 May 2025

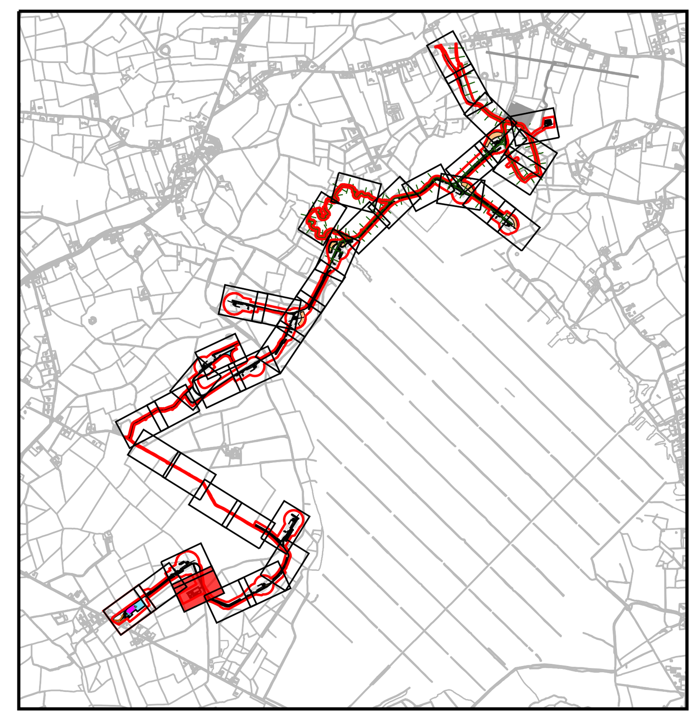


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT
DREHID WIND FARM & SUBSTATION

CLIENT
NORTH KILDARE WIND FARM Ltd.

SHEET
1:500 SITE LAYOUT PLAN SHEET 4 OF 40

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	1:500

Drawn by	Drawing Number	Rev
CS	P22-242-0101-0004	A
Checked by BC		

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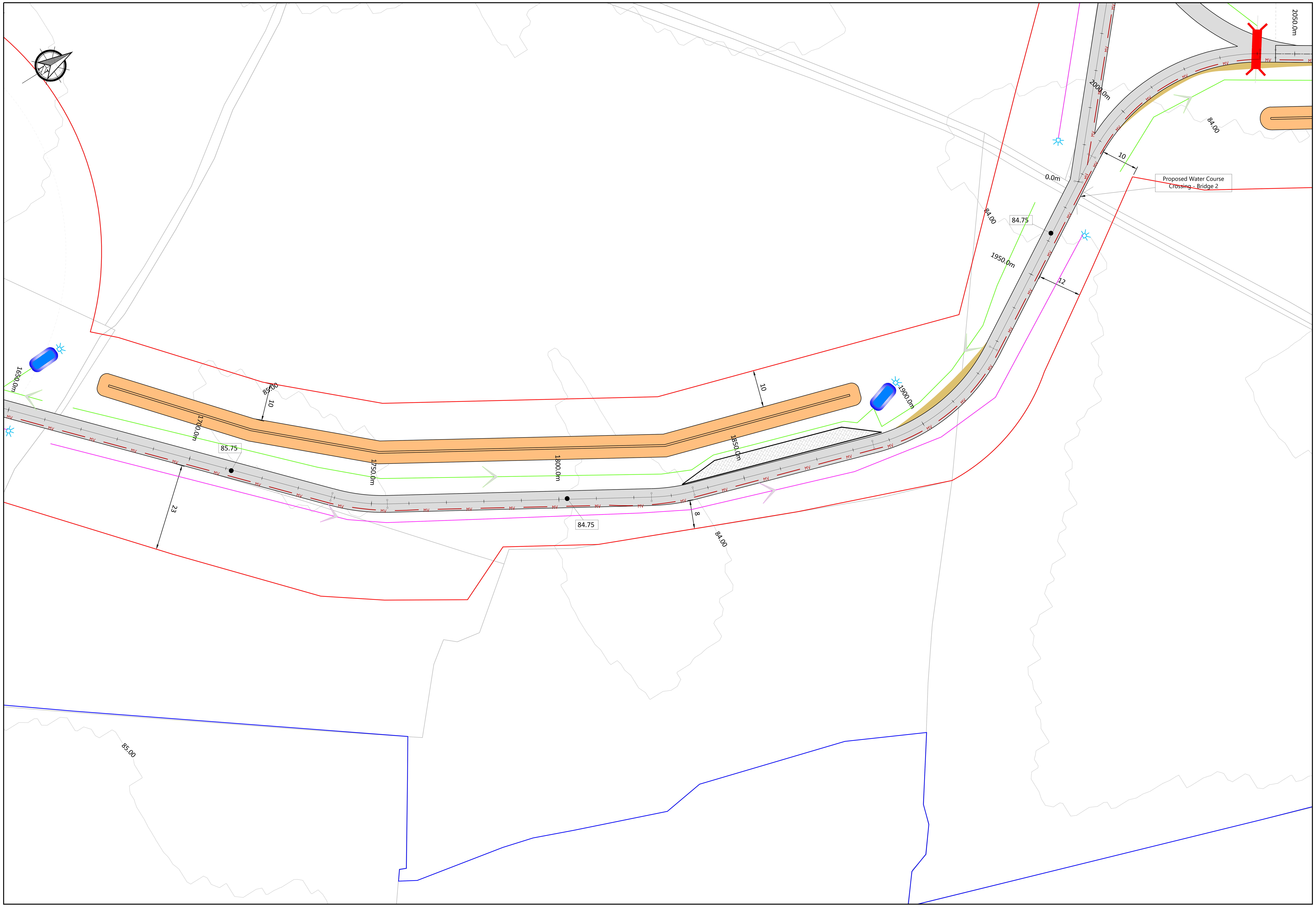
21 May 2025

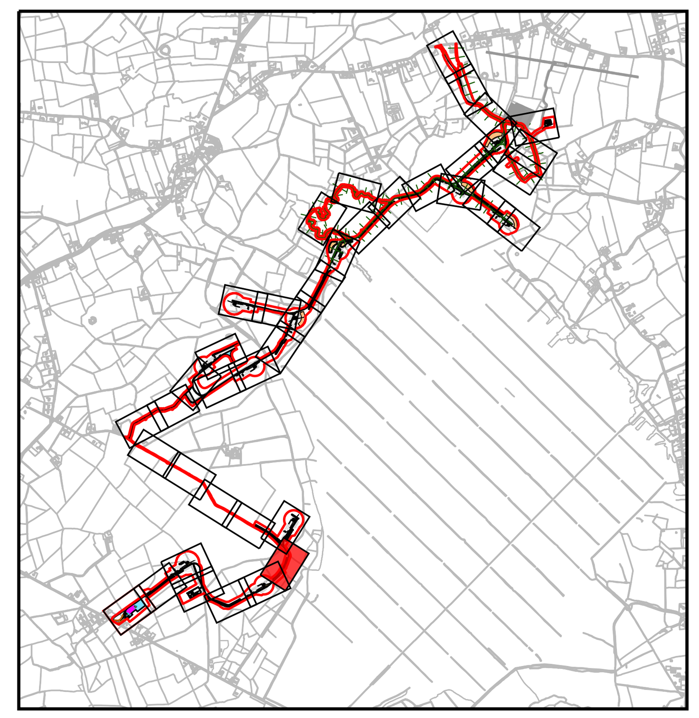


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT

DREHID WIND FARM & SUBSTATION

CLIENT

NORTH KILDARE WIND FARM Ltd.

SHEET

1:500 SITE LAYOUT PLAN SHEET 7 OF 40

Date 11.03.25	Project number P22-242	Scale (@ A1-) 1:500	
Drawn by CS	Drawing Number P22-242-0101-0007		Rev A
Checked by BC			

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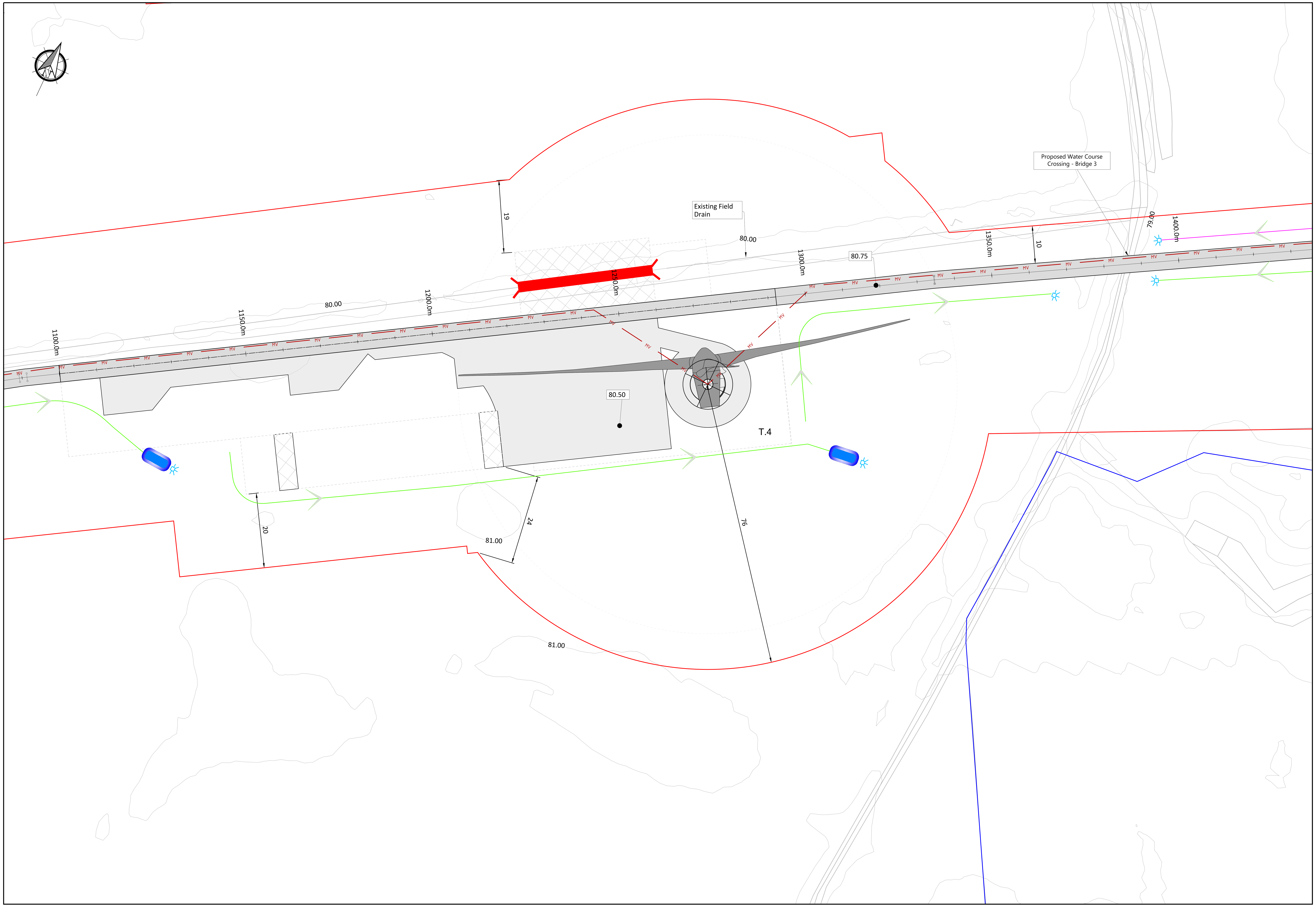
21 May 2025

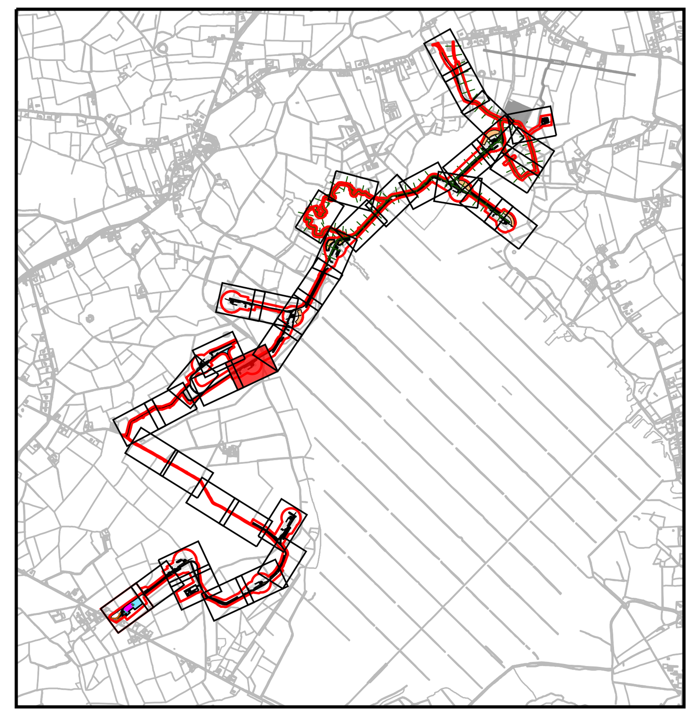


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track (Temporary Widening Areas)
- Temporary Construction Phase Surfaces (Temporary Widening Areas)
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT
DREHID WIND FARM & SUBSTATION

CLIENT
NORTH KILDARE WIND FARM Ltd.

SHEET
1:500 SITE LAYOUT PLAN SHEET 18 OF 40

Date	11.03.25	Project number	P22-242	Scale (@ A1-)	1:500
Drawn by	CS	Drawing Number	P22-242-0101-0018	Rev	A
Checked by	BC				

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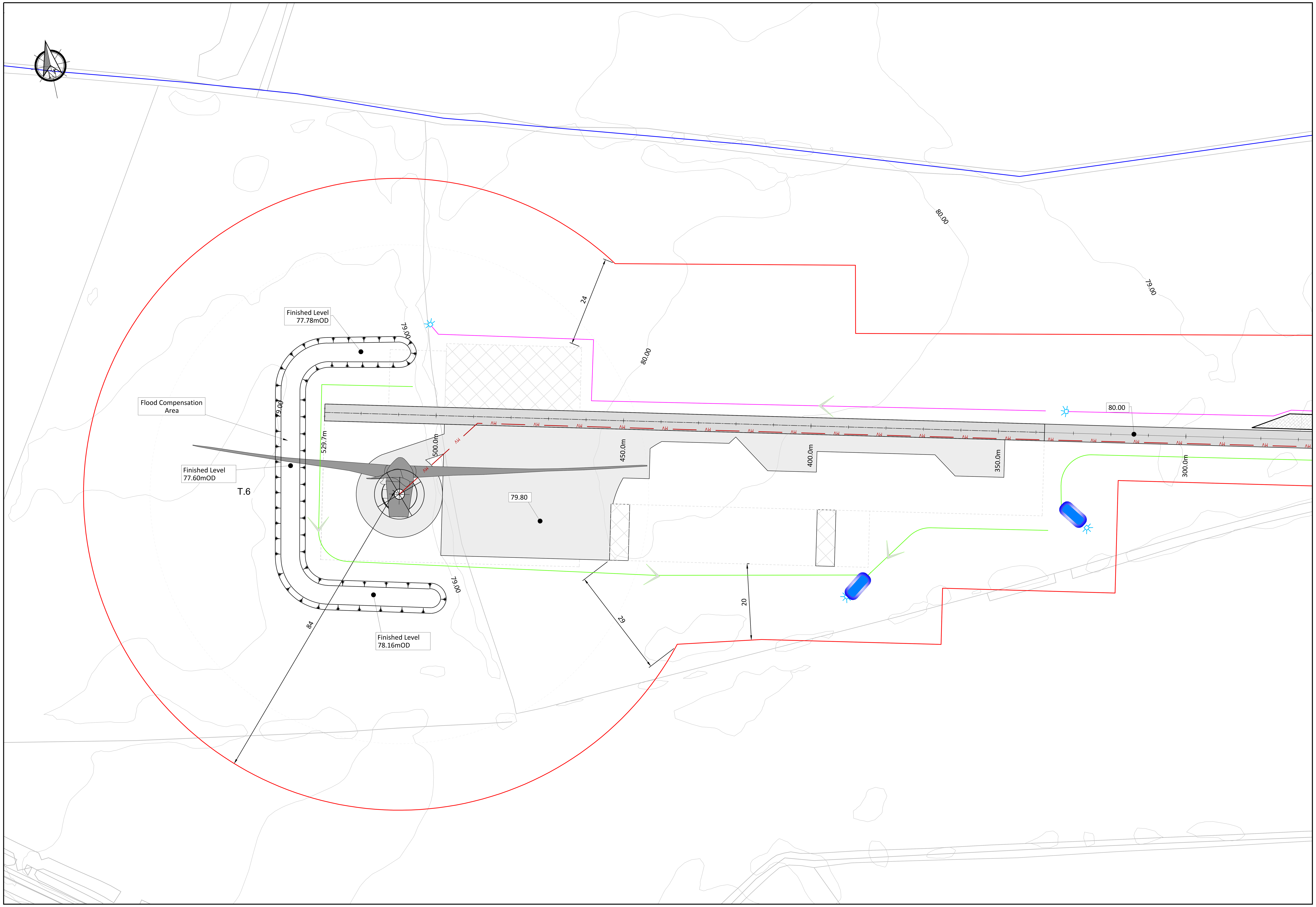
21 May 2025

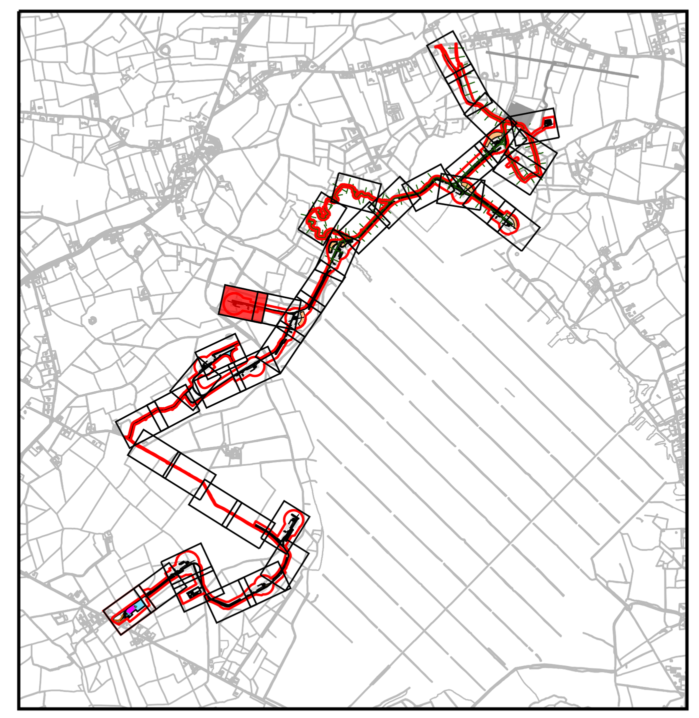


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT
DREHID WIND FARM & SUBSTATION

CLIENT
NORTH KILDARE WIND FARM Ltd.

SHEET
1:500 SITE LAYOUT PLAN SHEET 33 OF 40

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	1:500

Drawn by	Drawing Number	Rev
CS	P22-242-0101-0033	A
Checked by BC		

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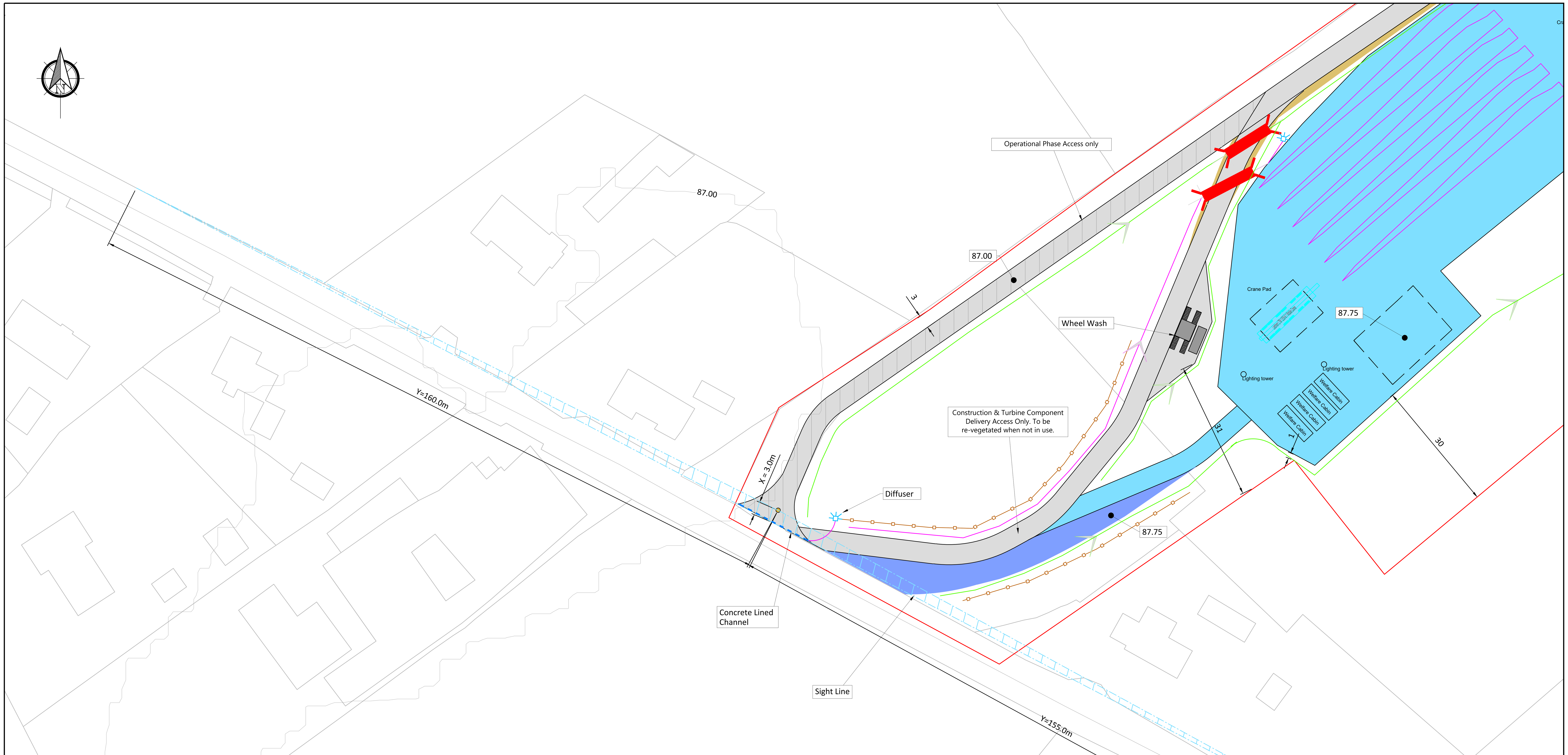
21 May 2025



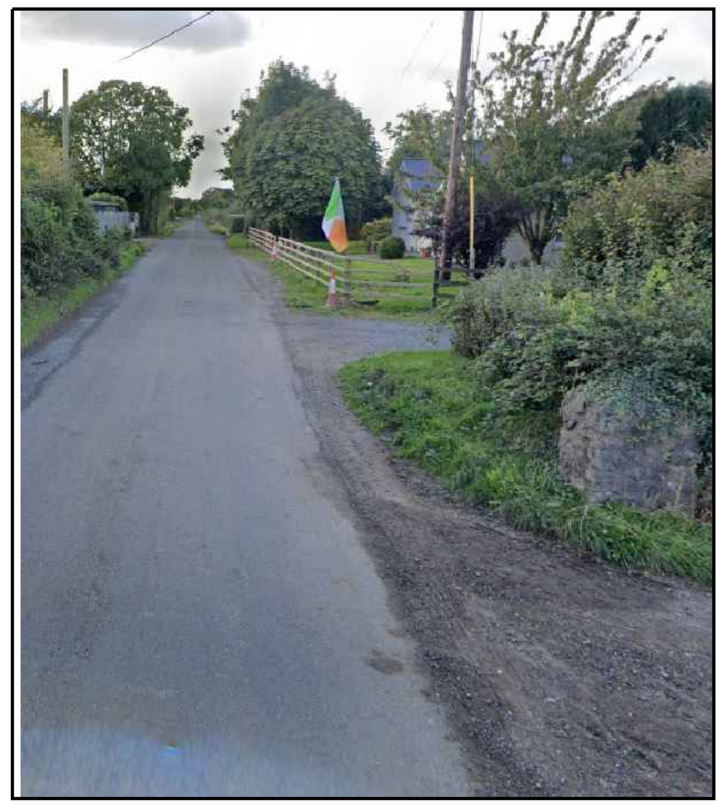
Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Internal Access Track (Temporary Widening Areas)
- Temporary Construction Phase Surfaces (Temporary Widening Areas)
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

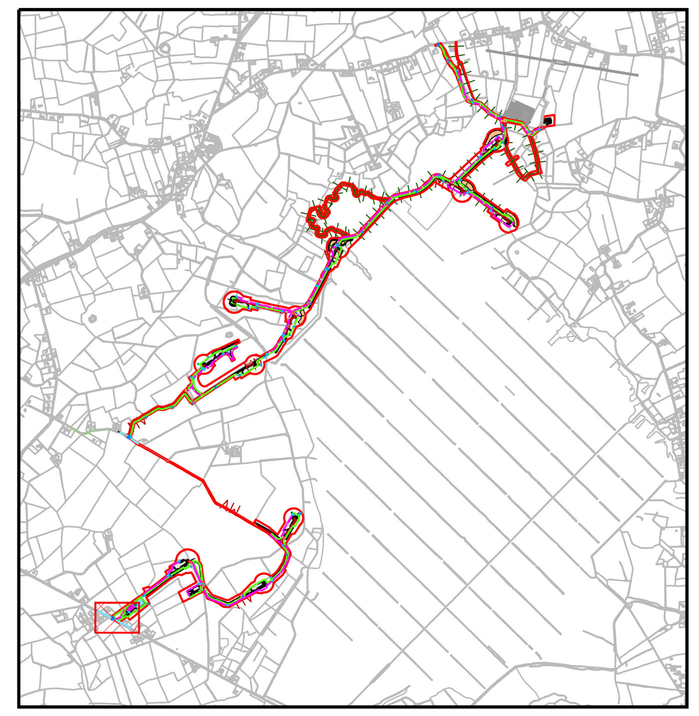
Notes.

1. All dimensions in metres.
2. Entrance surfaces to be graded -2.5% with fall towards the development to ensure surface water does not discharge to public road.
3. Proposed entrance geometry and sight lines are designed in accordance with TII publications DN-GEO-03060 and DN-GEO-03031.
4. This entrance will be used by construction HGVs, LGVs and turbine component delivery vehicles.

VIEW EAST FROM ENTRANCE



VIEW WEST FROM ENTRANCE



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

OSI SHEETS 3122-C, 3122-D,3187-A,3187-B,3187-C,3187-D,3188-A,3188-B,3188-C,3188-D,3253-A,3253-B,3253-C,3253-D,

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	SITE ACCESS MAIN ENTRANCE
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:500
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0015
Rev	A

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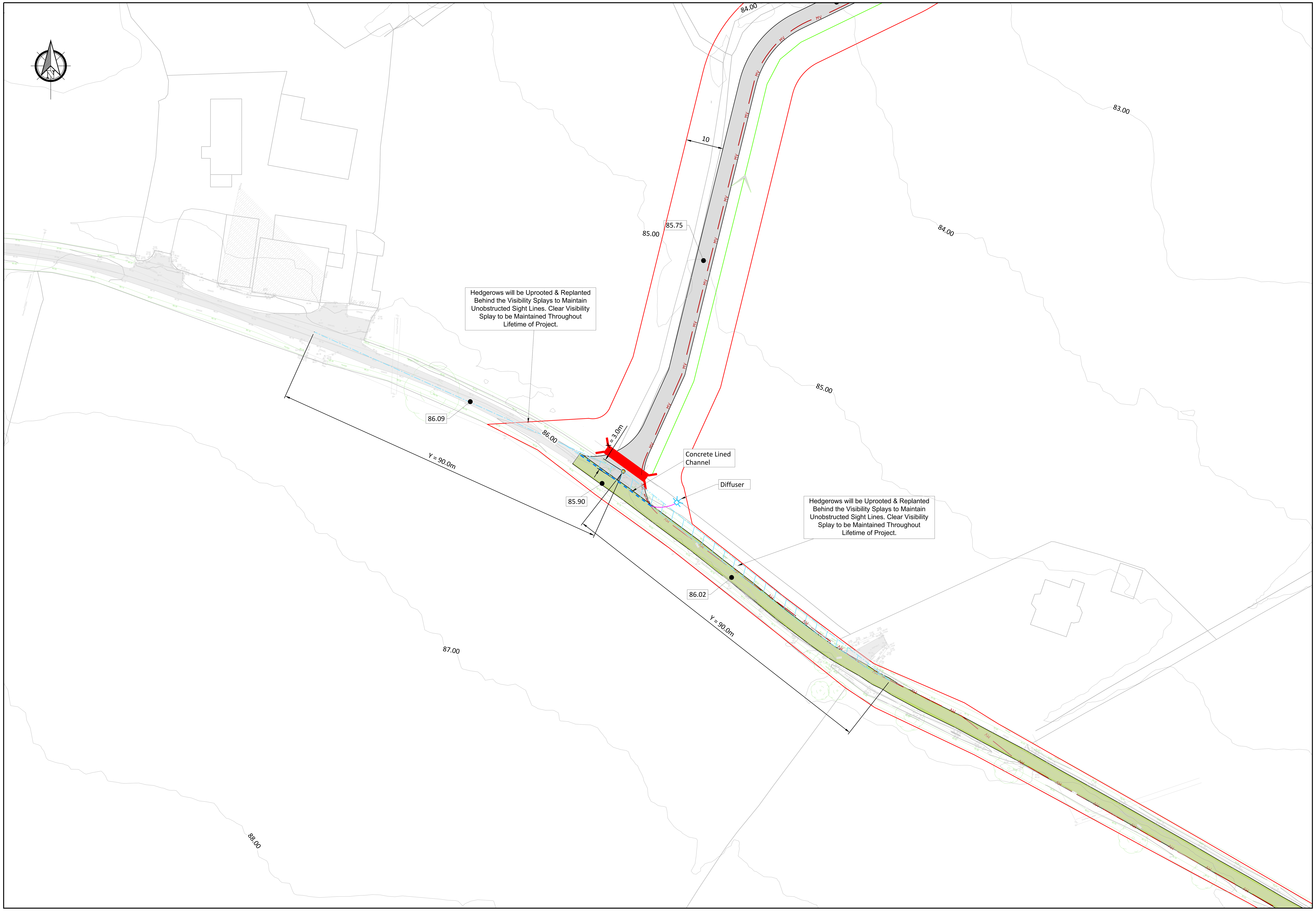
21 May 2025

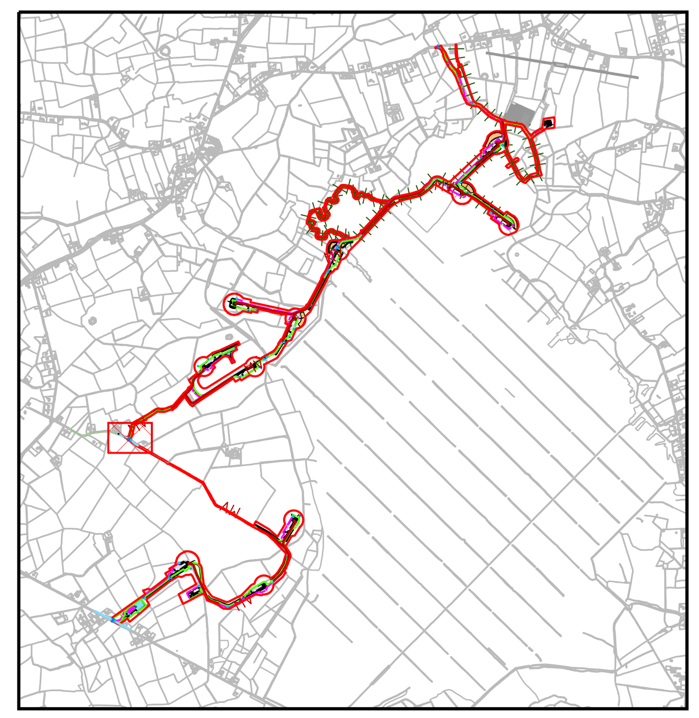


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing

Notes.

1. All dimensions in metres.
2. Entrance surfaces to be graded -2.5% with fall towards the development to ensure surface water does not discharge to public road.
3. Proposed entrance geometry and sight lines are designed in accordance with TII publications DN-GEO-03060 and DN-GEO-03031.
4. This entrance will be used by construction HGVs & LGVs only and will not be used by turbine component delivery vehicles.



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	SITE ACCESS ENTRANCE 2
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:500
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0016
Rev	A

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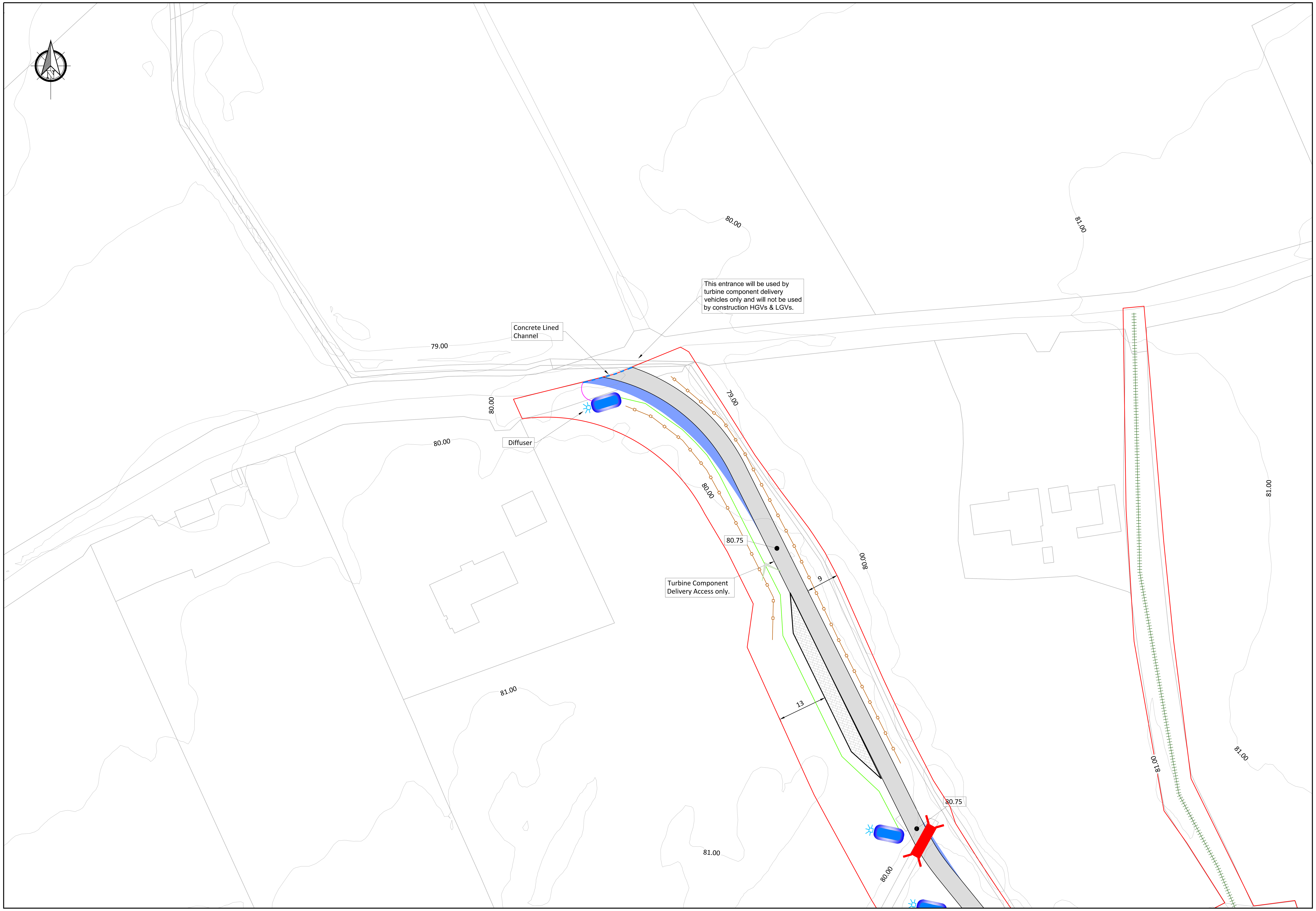
21 May 2025

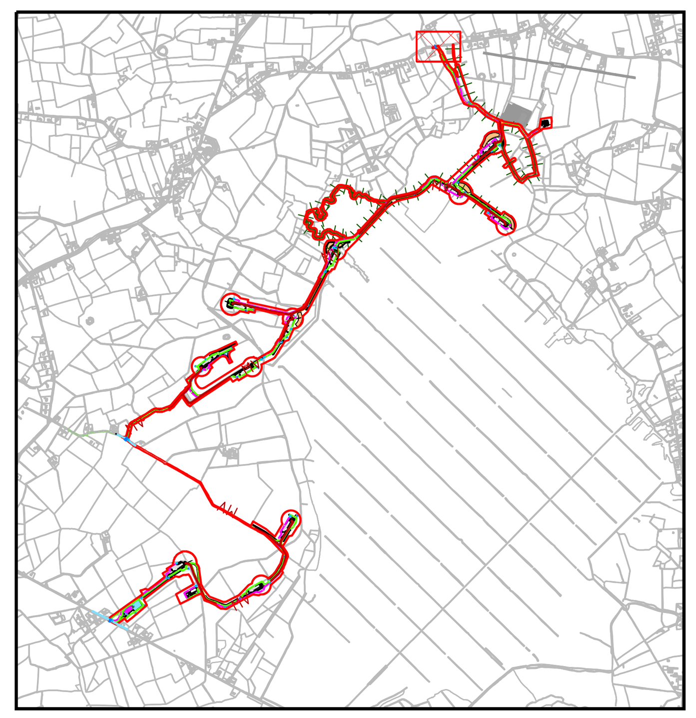


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms

Notes.

1. All dimensions in metres.
2. Entrance surfaces to be graded -2.5% with fall towards the development to ensure surface water does not discharge to public road.
3. Proposed entrance geometry is designed according to turbine delivery vehicle swept path analysis with consideration for vehicle overrun and load oversail extents.
4. This entrance will be used by turbine component delivery vehicles only and will not be used by construction HGVs & LGVs.
5. Advanced warning signage will be erected at appropriate distances on approach to the entrance in accordance with the latest Irish Traffic Signs Manual at construction stage.



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	SITE ENTRANCE TO ACCOMMODATE TDR
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:500
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0017
Rev	A

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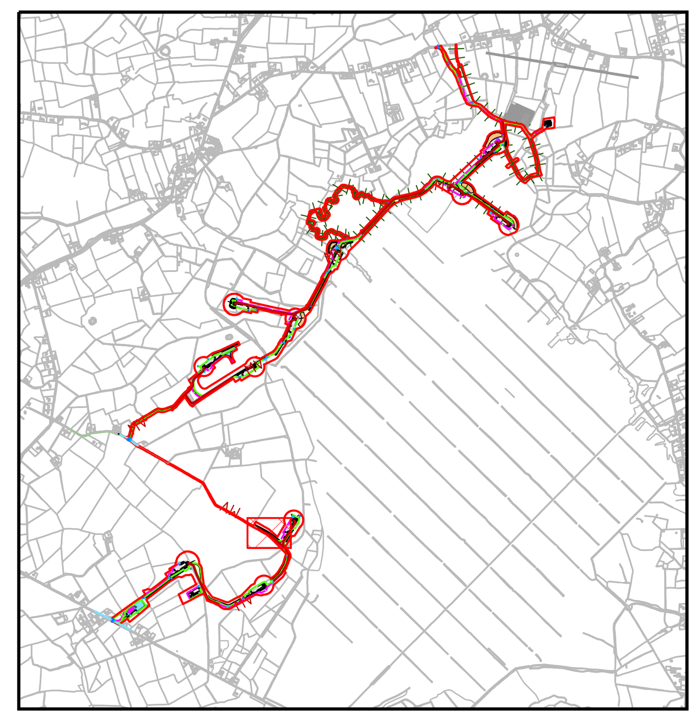
21 May 2025

Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms



KEY PLAN

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	SITE ACCESS ENTRANCE 3
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:500
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0018
Rev	A

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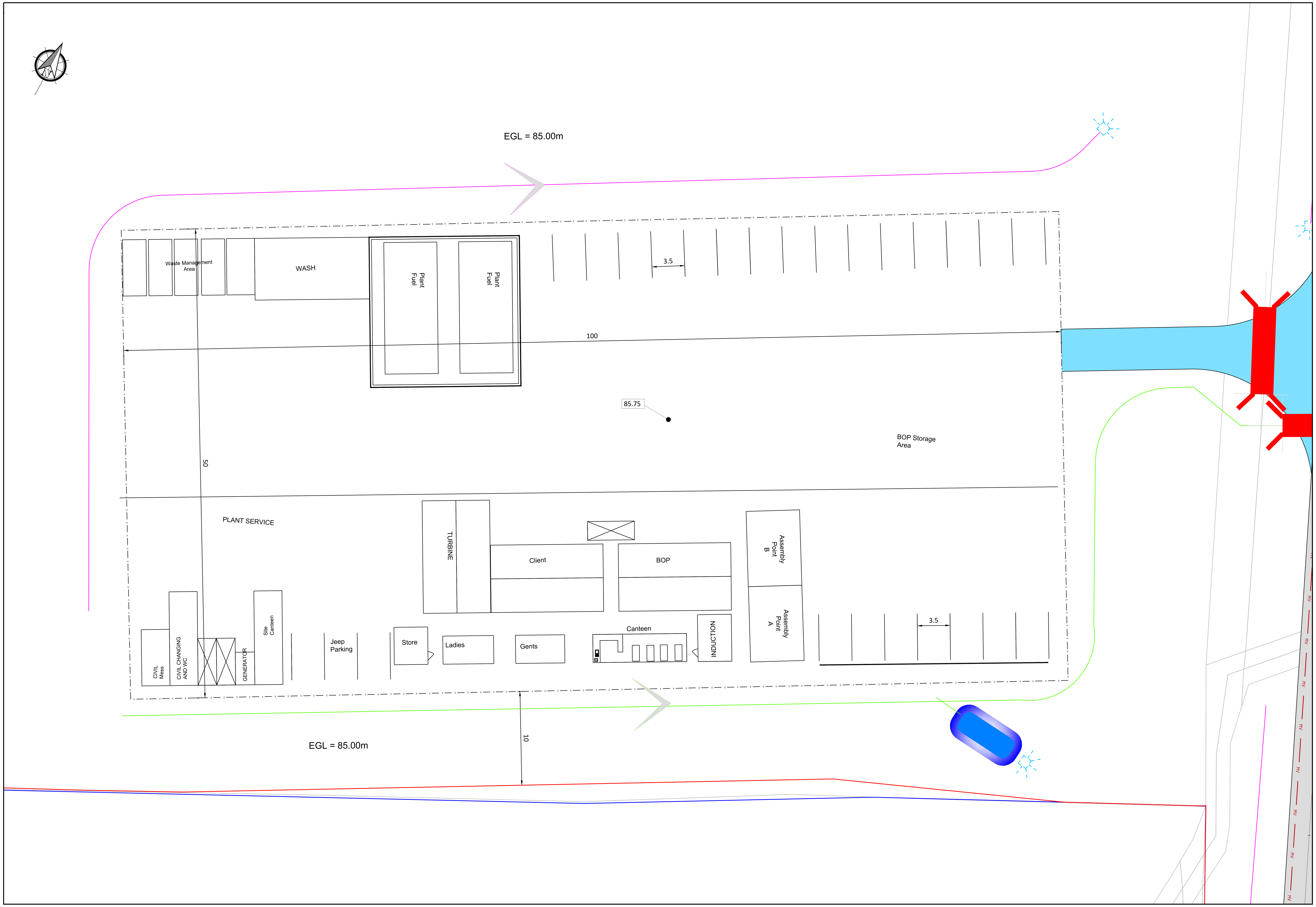
21 May 2025

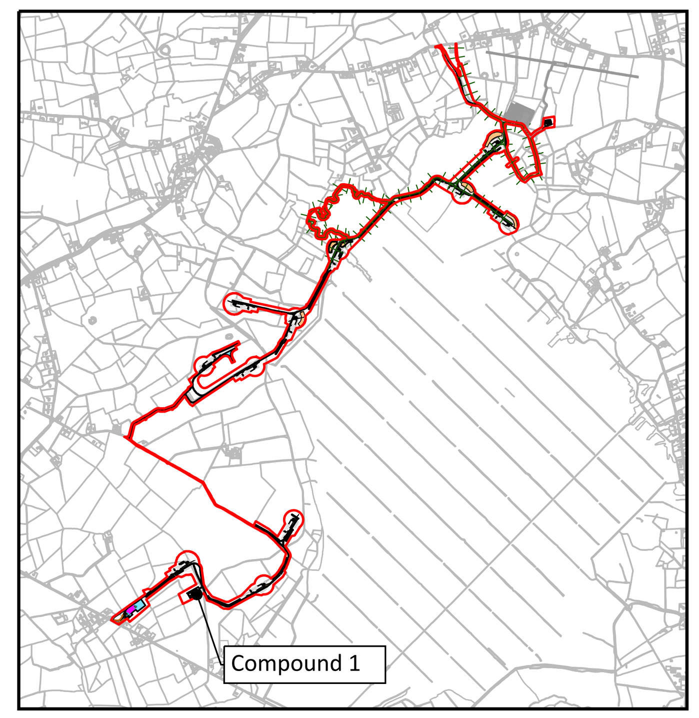


Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 2m 4m 6m 8m 10m 12m 14m 16m 18m 20m

Scale 1:200

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT

DREHID WIND FARM & SUBSTATION

CLIENT

NORTH KILDARE WIND FARM Ltd.

SHEET

TEMPORARY CONSTRUCTION COMPOUND 1 LAYOUT

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	1:200

Drawn by	Drawing Number	Rev
CS	P22-242-0300-0019	A

Checked by: BC

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21 May 2025

Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
  - Laydown Areas
  - Hardstand
  - Turbine Swing Footprint
- Proposed Internal Access Track (Temporary Widening Areas)
- Temporary Construction Phase Surfaces (Temporary Widening Areas)
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
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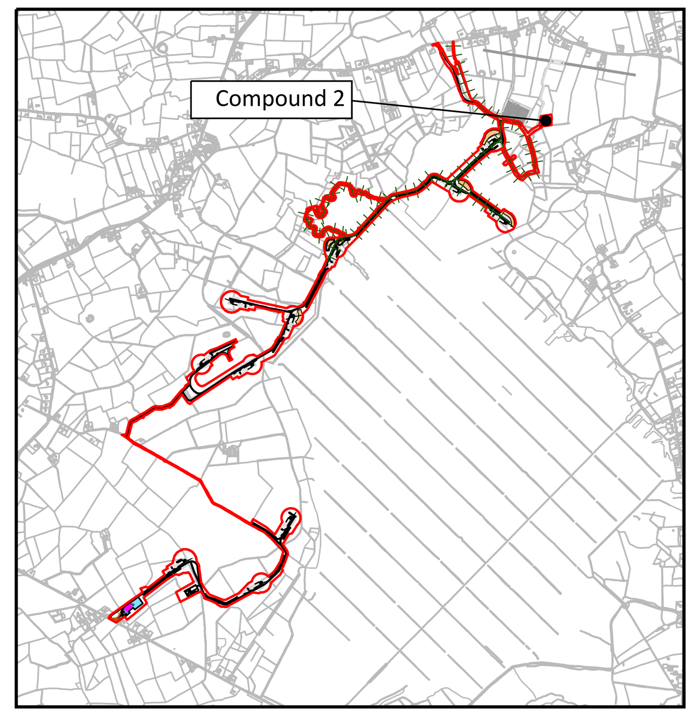
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.

1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).



KEY PLAN

0m 2m 4m 6m 8m 10m 12m 14m 16m 18m 20m

Scale 1:200

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	IH	11.03.25

PROJECT
DREHID WIND FARM & SUBSTATION

CLIENT
NORTH KILDARE WIND FARM Ltd.

SHEET
TEMPORARY CONSTRUCTION COMPOUND 2 LAYOUT

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	1:200

Drawn by	CS
Checked by	BC

Drawing Number: **P22-242-0300-0020**
Rev: **A**

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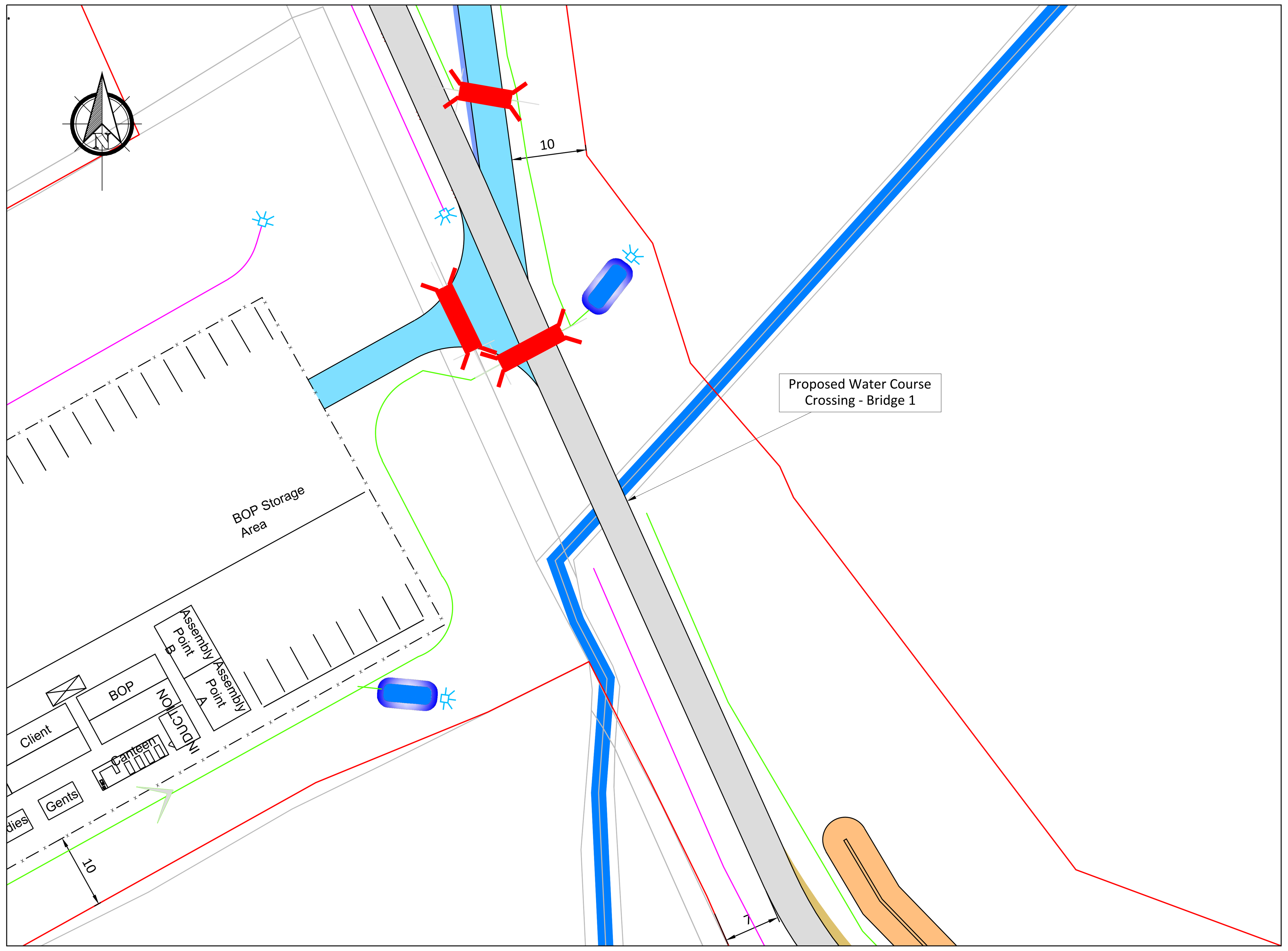
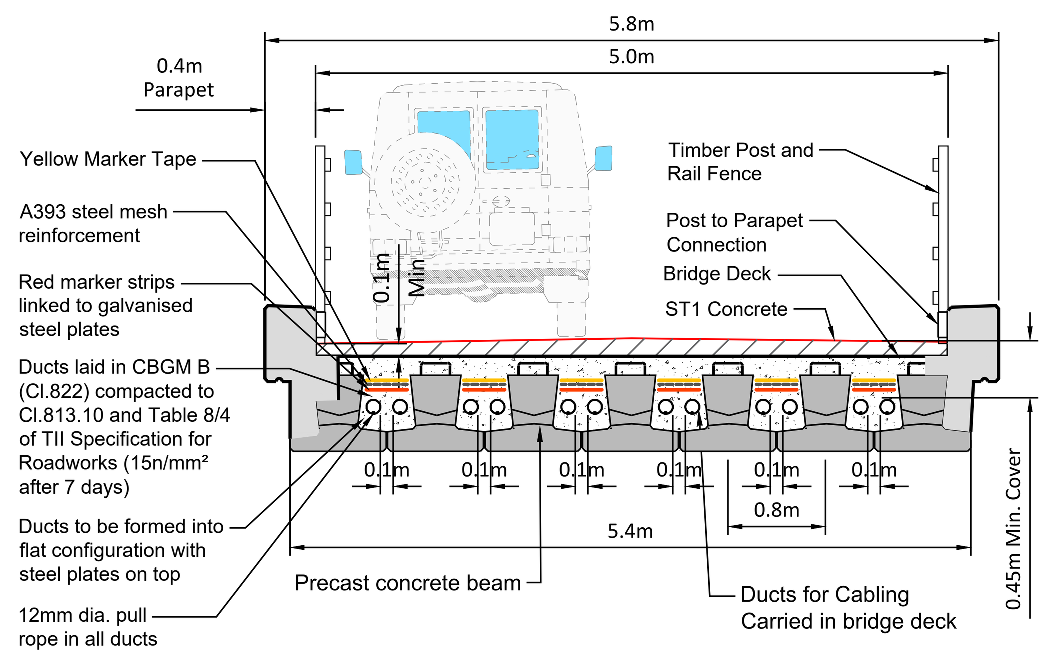
21 May 2025



PROPOSED WATER COURSE CROSSING - BRIDGE 1

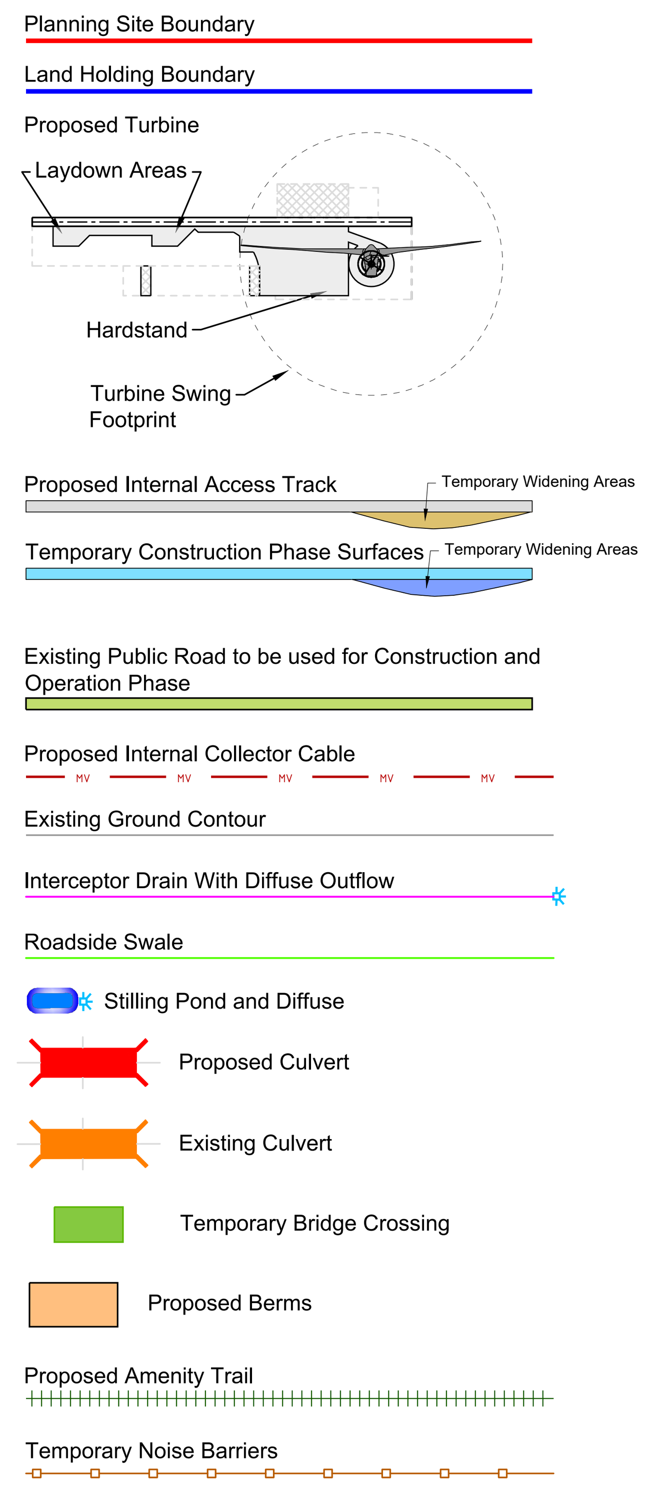
Scale 1:500



BRIDGE 1 SECTION

Scale 1:50

Legend



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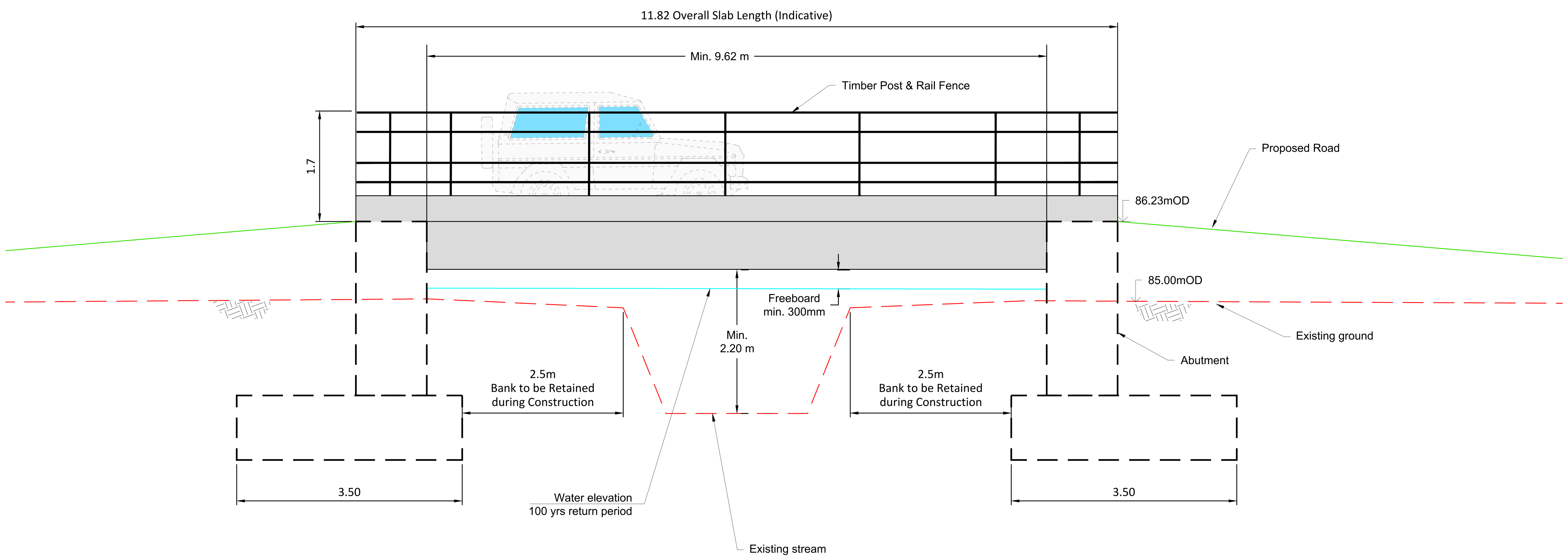
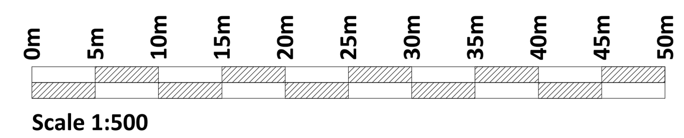


BRIDGE 1 ELEVATION

Scale 1:50



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A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT: DREHID WIND FARM & SUBSTATION

CLIENT: NORTH KILDARE WIND FARM Ltd.

SHEET: PROPOSED WATER COURSE CROSSING - BRIDGE 1 PLAN & DETAILS

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	1:500

Drawn by	Drawing Number	Rev
CS	P22-242-0300-0021	A

Checked by: BC

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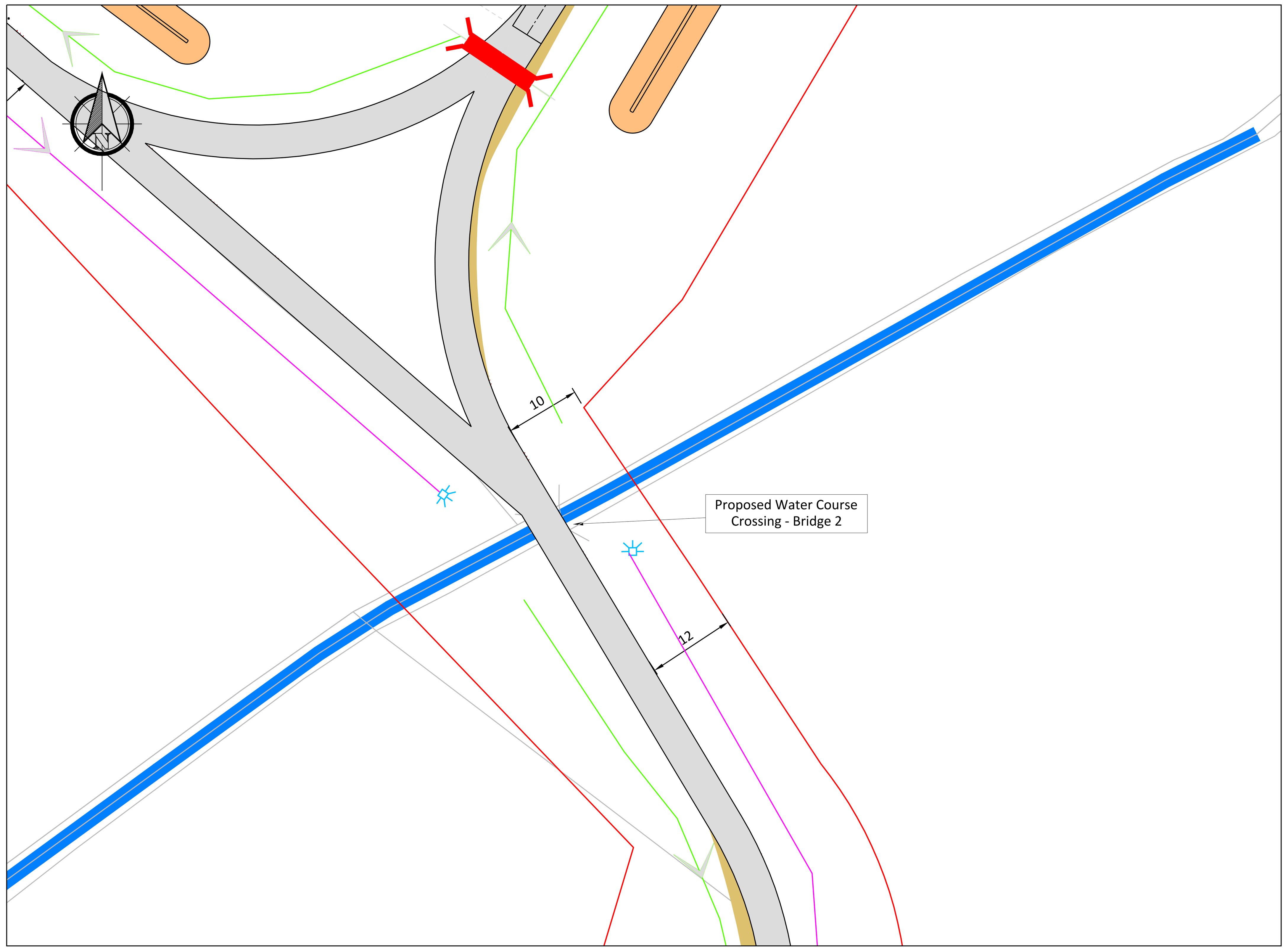
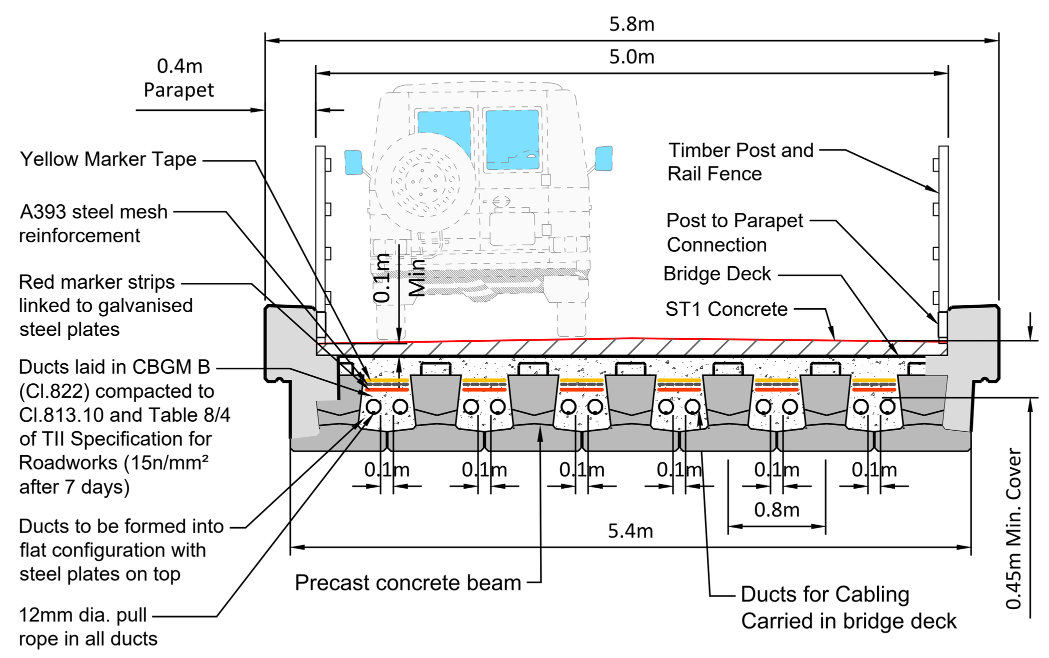
21 May 2025



PROPOSED WATER COURSE CROSSING - BRIDGE 2

Scale 1:500



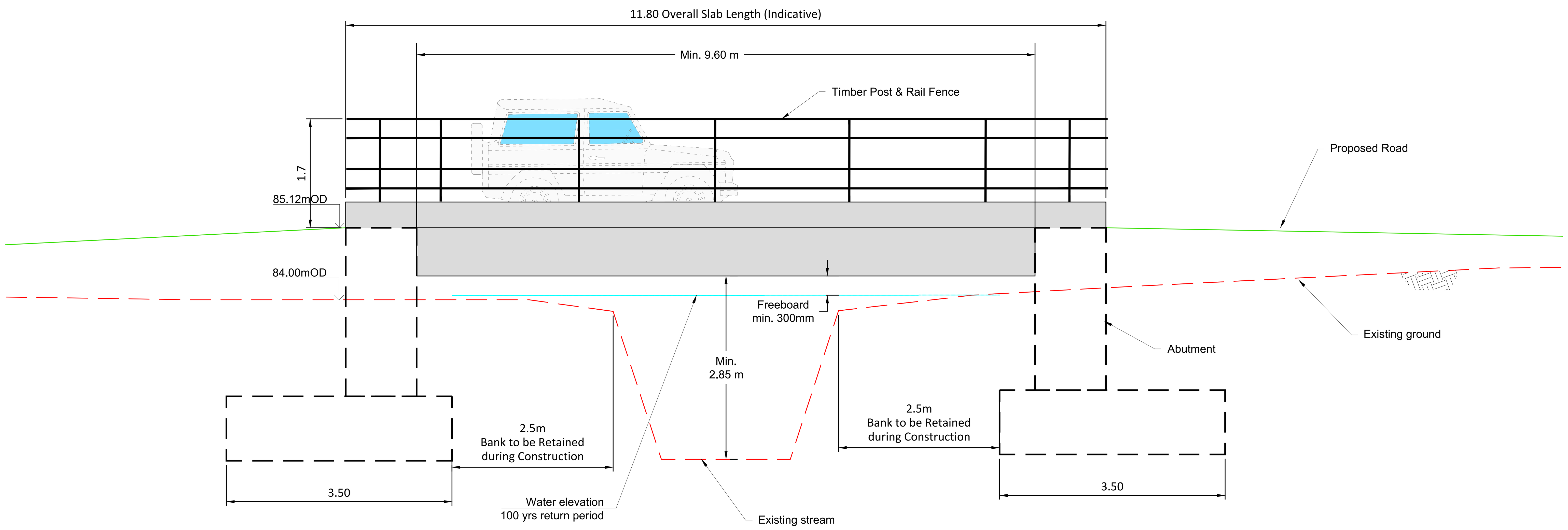
BRIDGE 2 SECTION

Scale 1:50

Legend

- Planning Site Boundary
- Land Holding Boundary
- Proposed Turbine
- Laydown Areas
- Hardstand
- Turbine Swing Footprint
- Proposed Internal Access Track — Temporary Widening Areas
- Temporary Construction Phase Surfaces — Temporary Widening Areas
- Existing Public Road to be used for Construction and Operation Phase
- Proposed Internal Collector Cable
- Existing Ground Contour
- Interceptor Drain With Diffuse Outflow
- Roadside Swale
- Stilling Pond and Diffuse
- Proposed Culvert
- Existing Culvert
- Temporary Bridge Crossing
- Proposed Berms
- Proposed Amenity Trail
- Temporary Noise Barriers

Notes.



BRIDGE 2 ELEVATION

Scale 1:50

0m 5m 10m 15m 20m 25m 30m 35m 40m 45m 50m

Scale 1:500

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OSI SHEETS 3122-C, 3122-D,3187-A,3187-B,3187-C,3187-D,3188-A,3188-B,3188-C,3188-D,3253-A,3253-B,3253-C,3253-D,

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A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	PROPOSED WATER COURSE CROSSING - BRIDGE 2 PLAN & DETAILS
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:500
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0022
Rev	A

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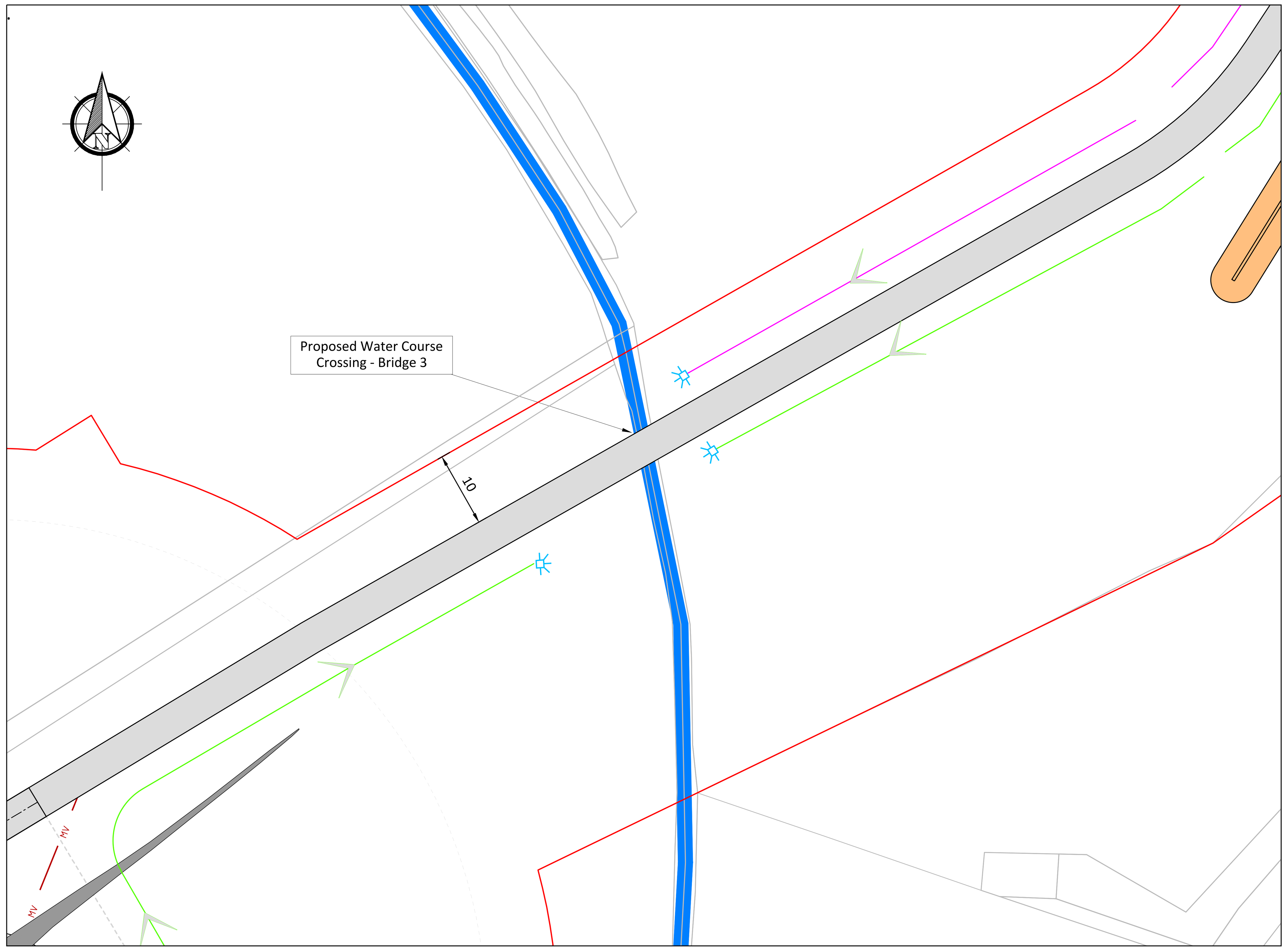
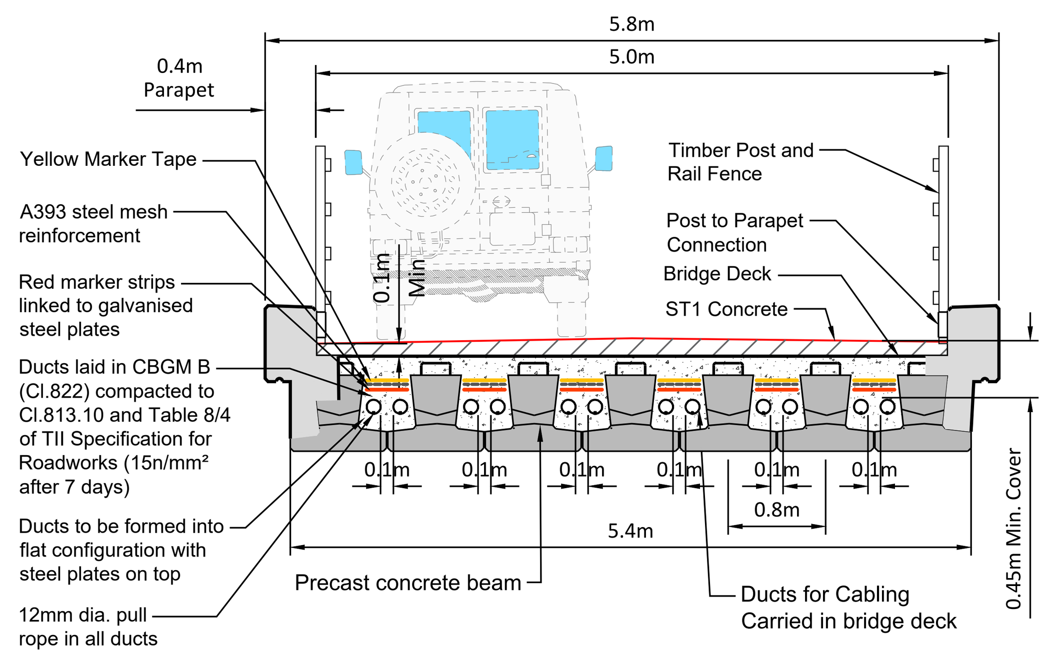
21 May 2025



PROPOSED WATER COURSE CROSSING - BRIDGE 3

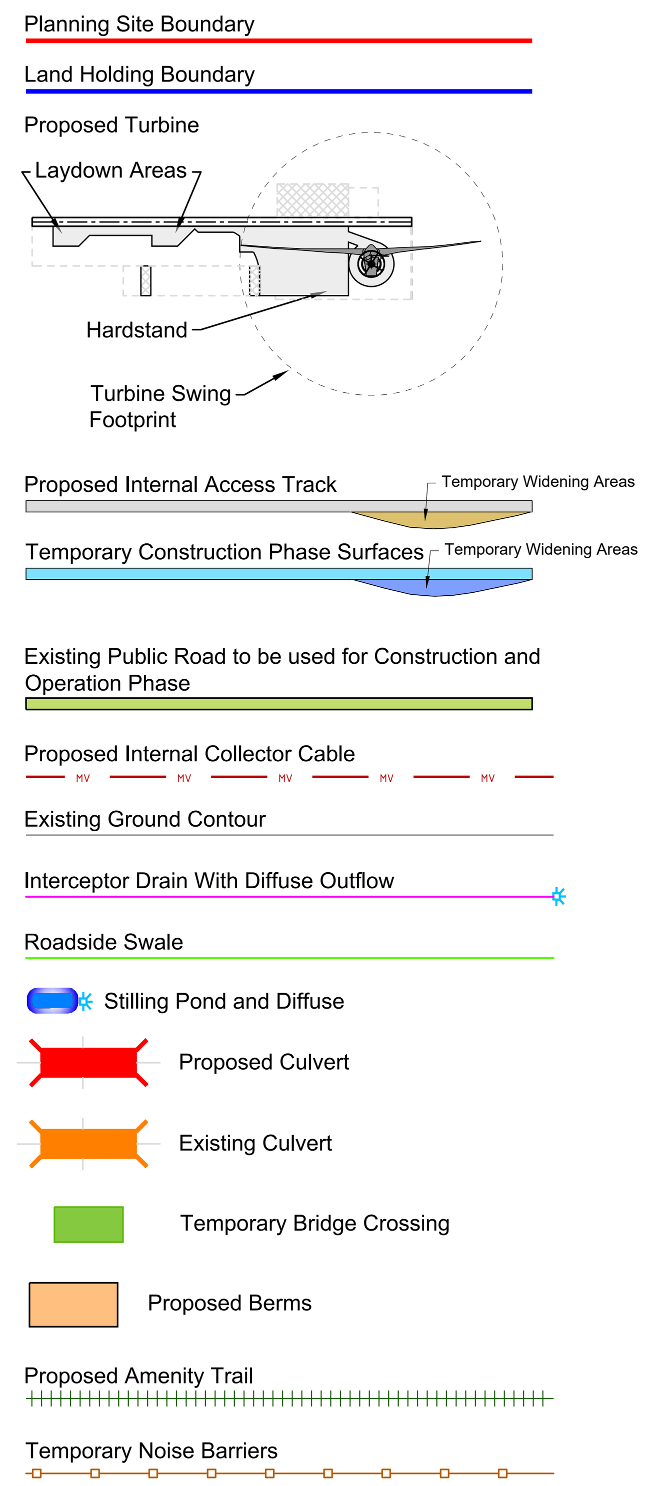
Scale 1:500



BRIDGE 3 SECTION

Scale 1:50

Legend



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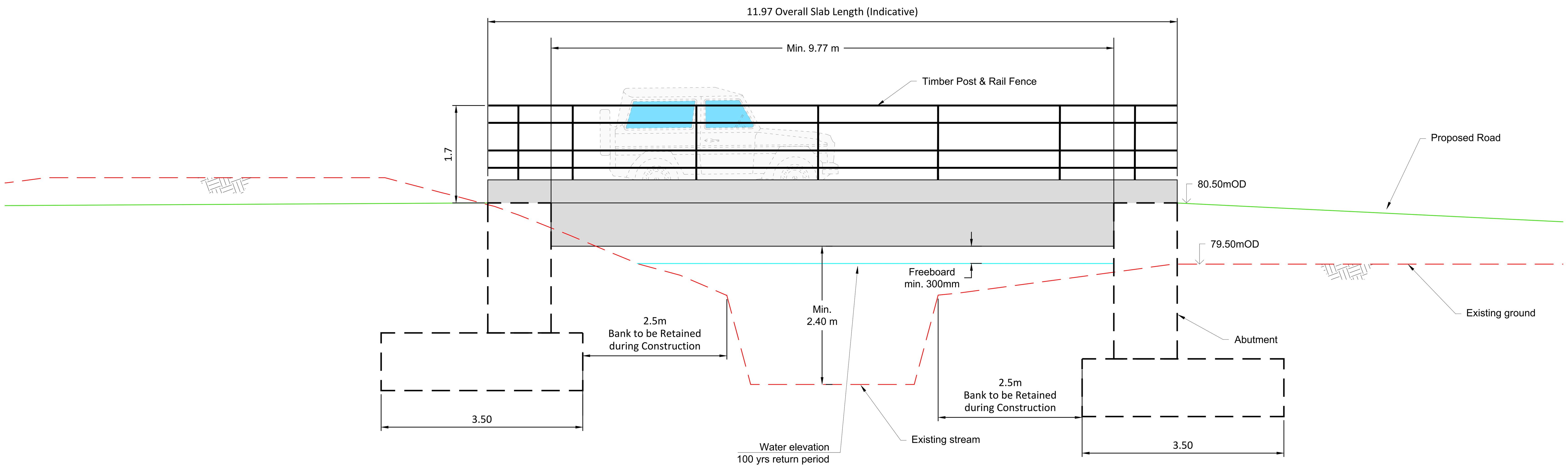

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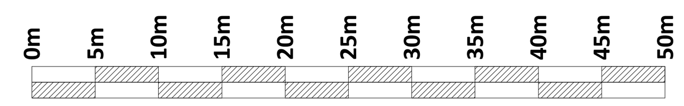

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT DREHID WIND FARM & SUBSTATION	CLIENT NORTH KILDARE WIND FARM Ltd.
SHEET PROPOSED WATER COURSE CROSSING - BRIDGE 3 PLAN & DETAILS	Date 11.03.25 Drawn by CS Checked by BC Project number P22-242 Scale (@ A1-) 1:500 Drawing Number P22-242-0300-0023 Rev A

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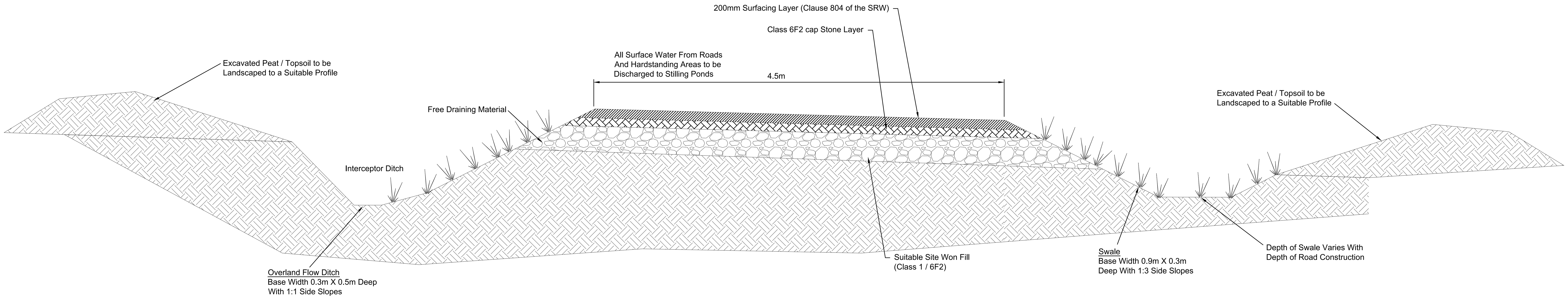
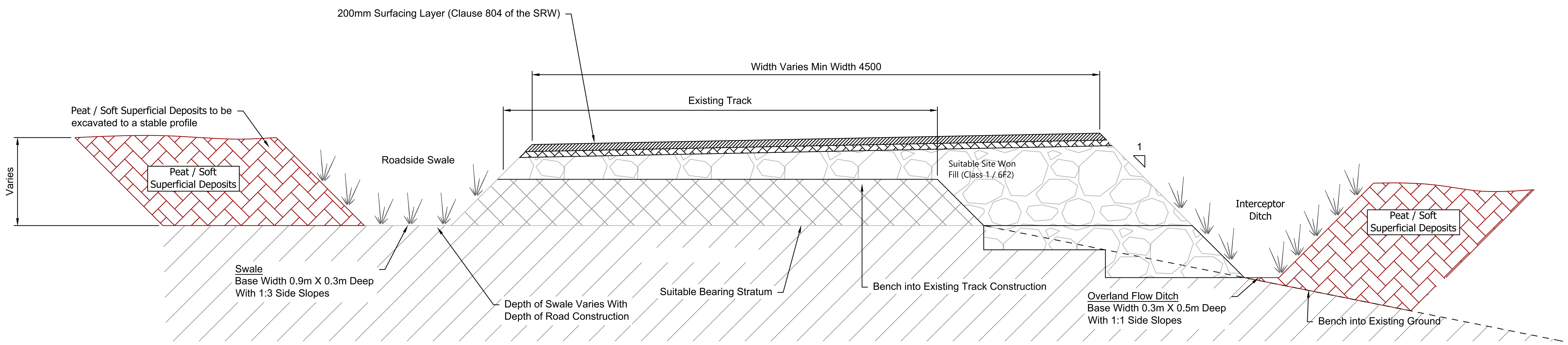
21 May 2025



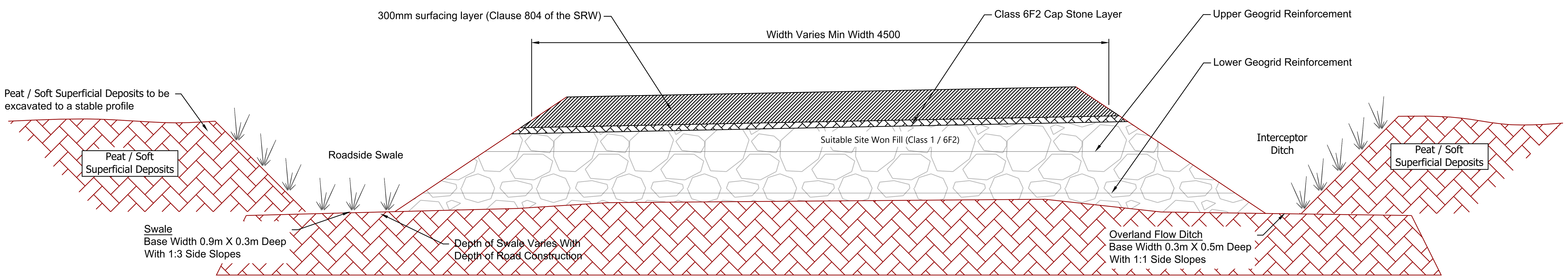
NEW ROAD DETAIL

Scale 1:25



UPGRADED ROAD DETAIL

Scale 1:25



FLOATING ROAD DETAIL

Scale 1:25

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A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT	DREHID WIND FARM & SUBSTATION
CLIENT	NORTH KILDARE WIND FARM Ltd.
SHEET	ACCESS TRACK DETAILS
Date	11.03.25
Project number	P22-242
Scale (@ A1-)	1:25
Drawn by	CS
Checked by	BC
Drawing Number	P22-242-0300-0026
Rev	A

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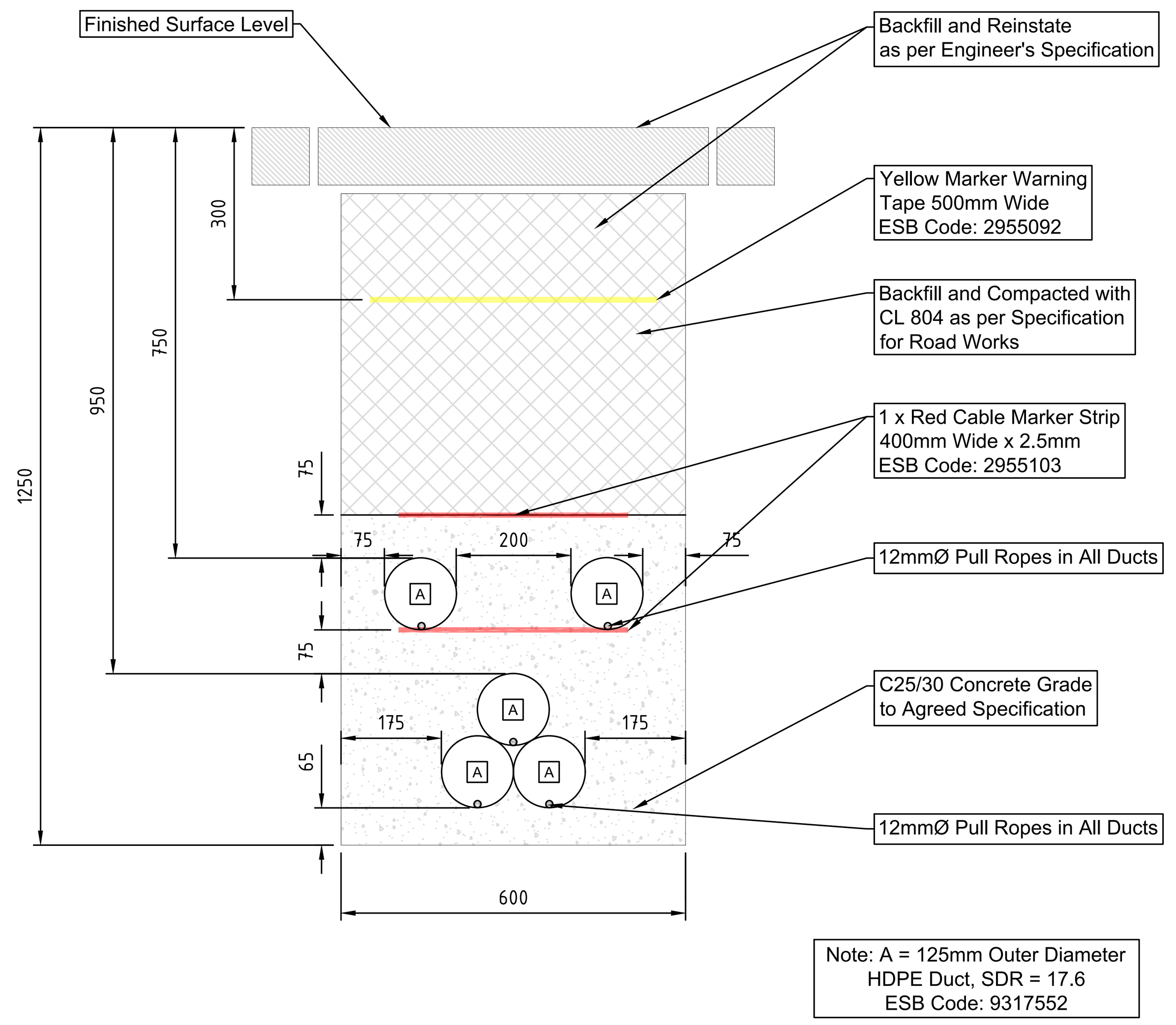
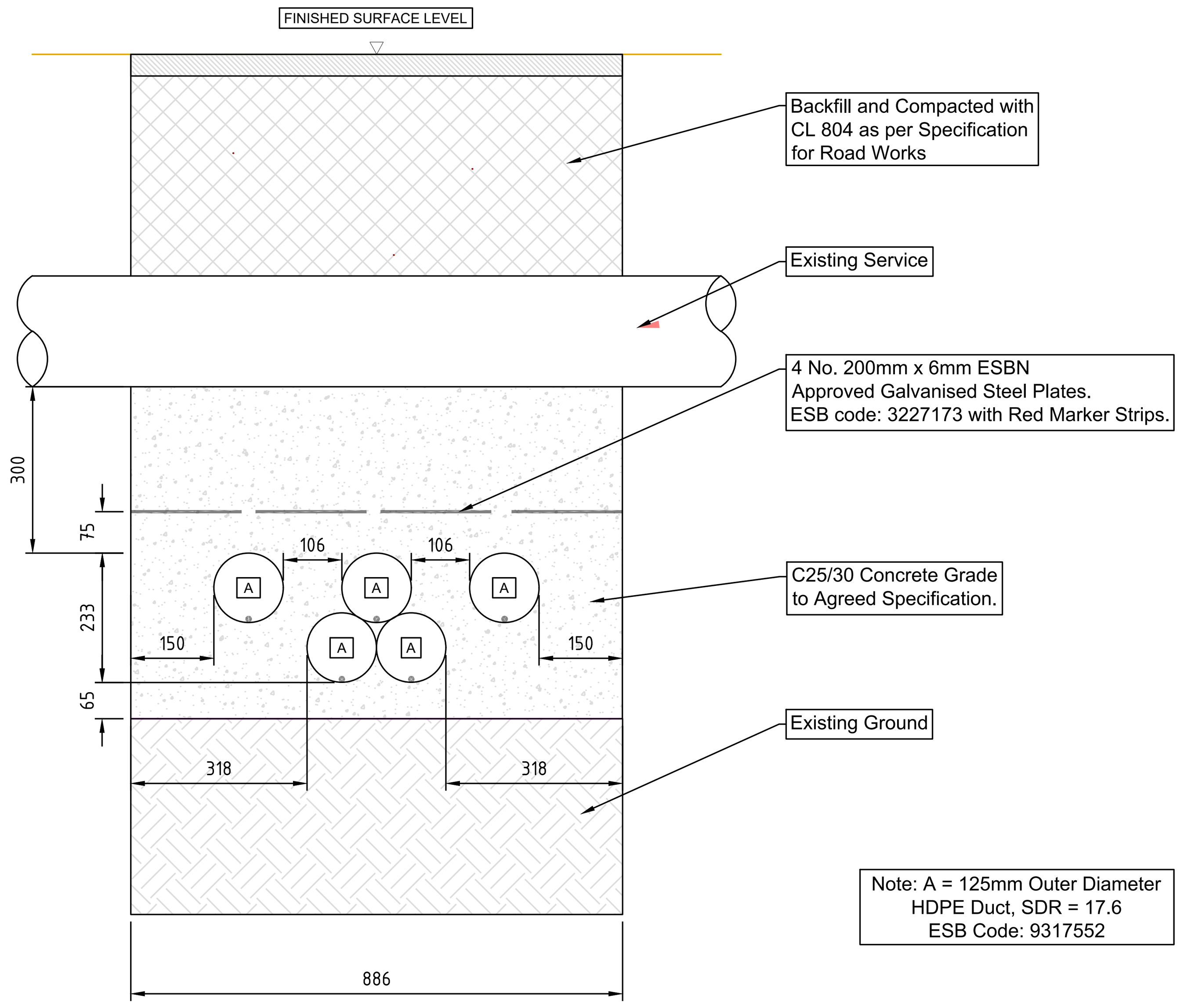


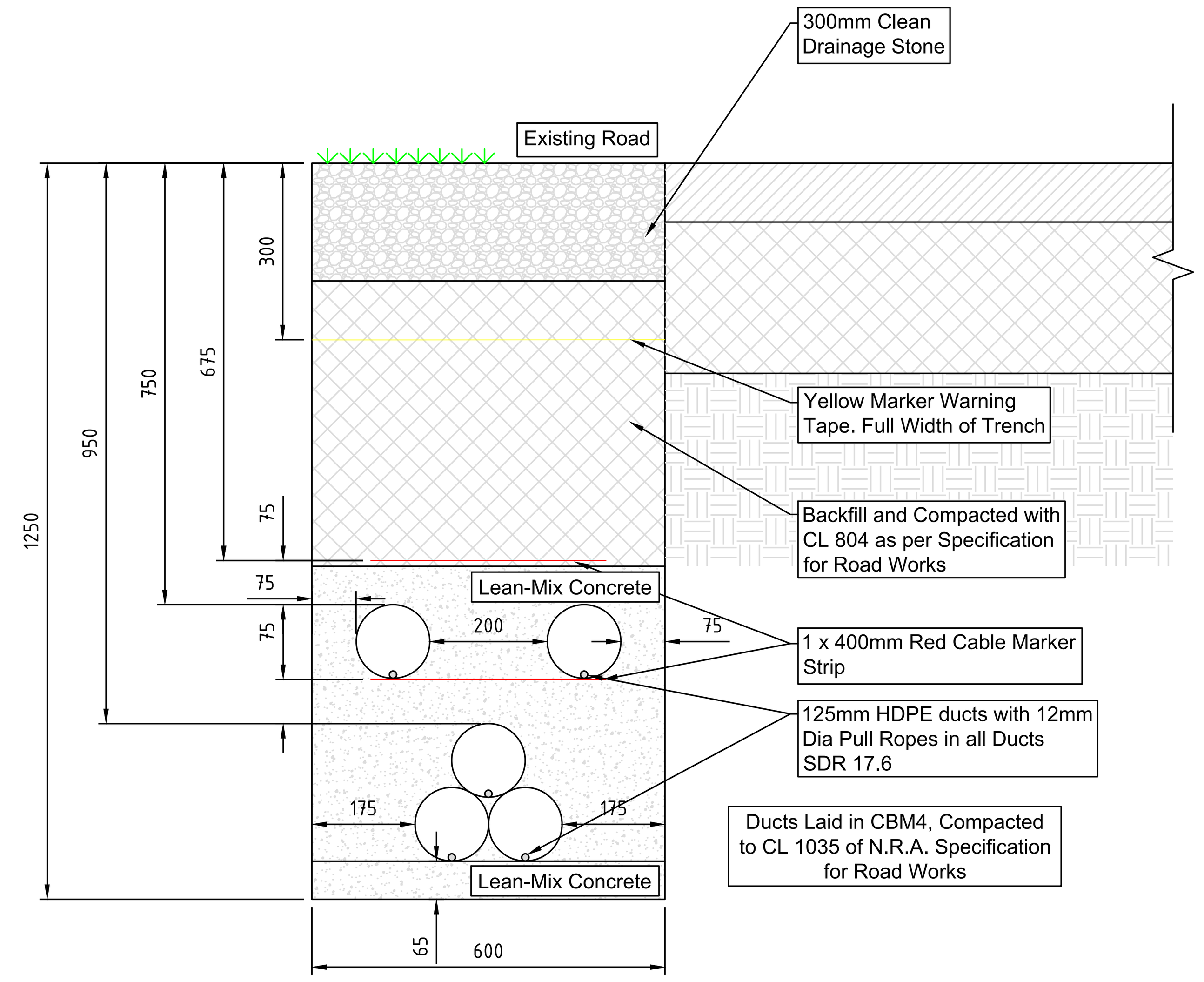
DETAIL A - STANDARD TRENCH ARRANGEMENT IN PUBLIC ROAD

Scale 1:10



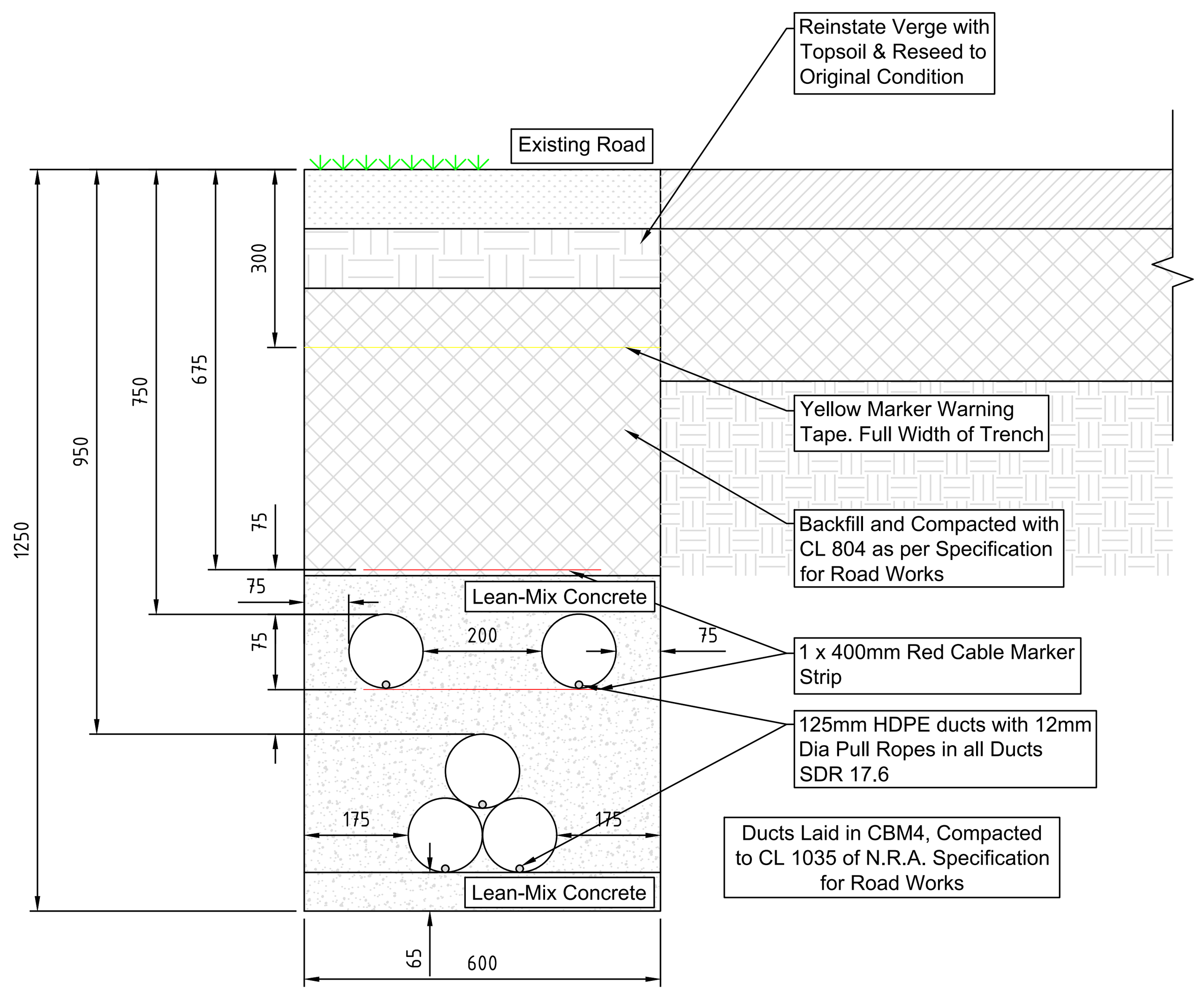
DETAIL B - STANDARD TRENCH CROSSING UNDER EXISTING SERVICES

Scale 1:10



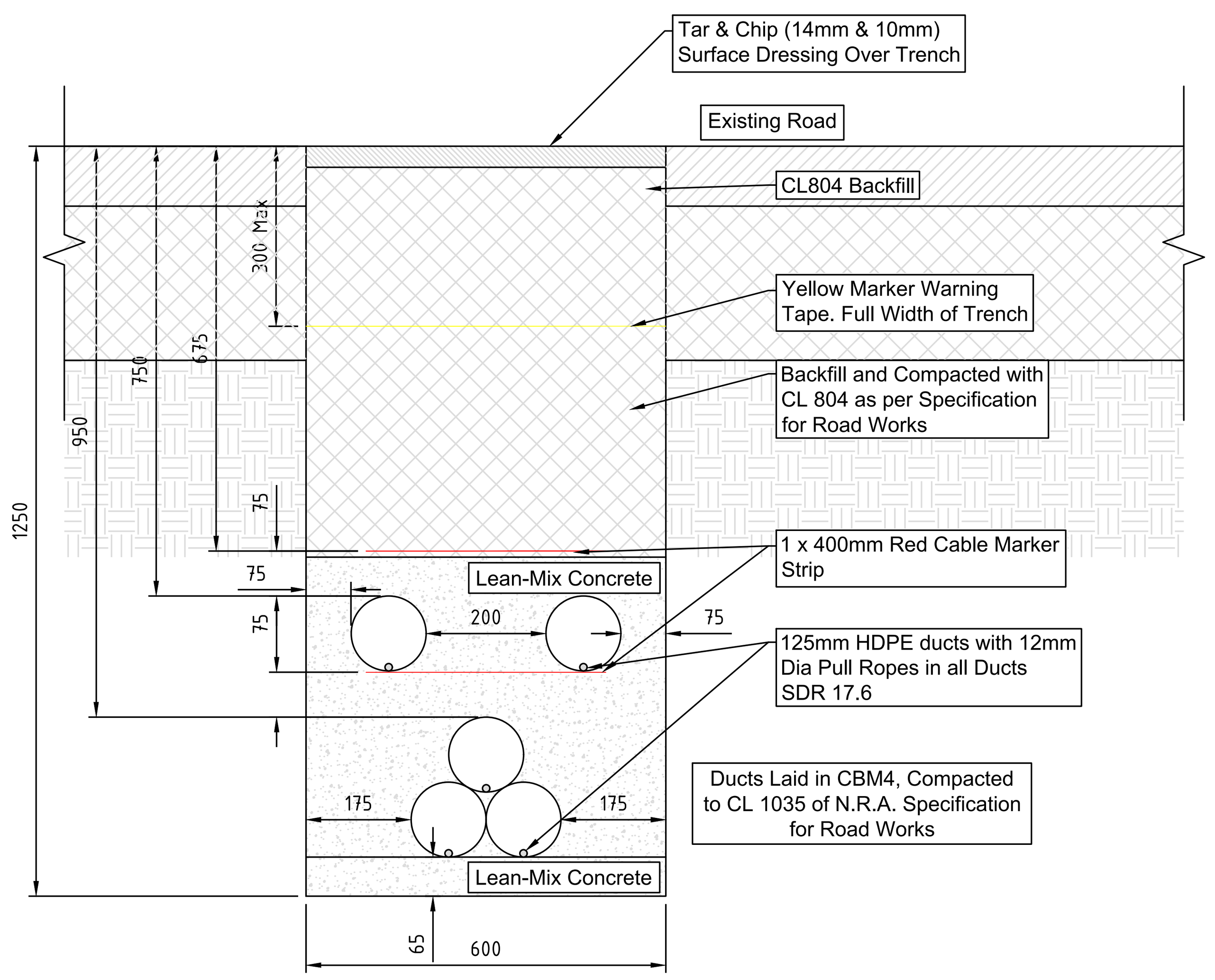
DETAIL C - STANDARD TRENCH ARRANGEMENT IN PUBLIC ROAD VERGE WHERE SHALLOW SURFACE DRAIN PRESENT

Scale 1:10



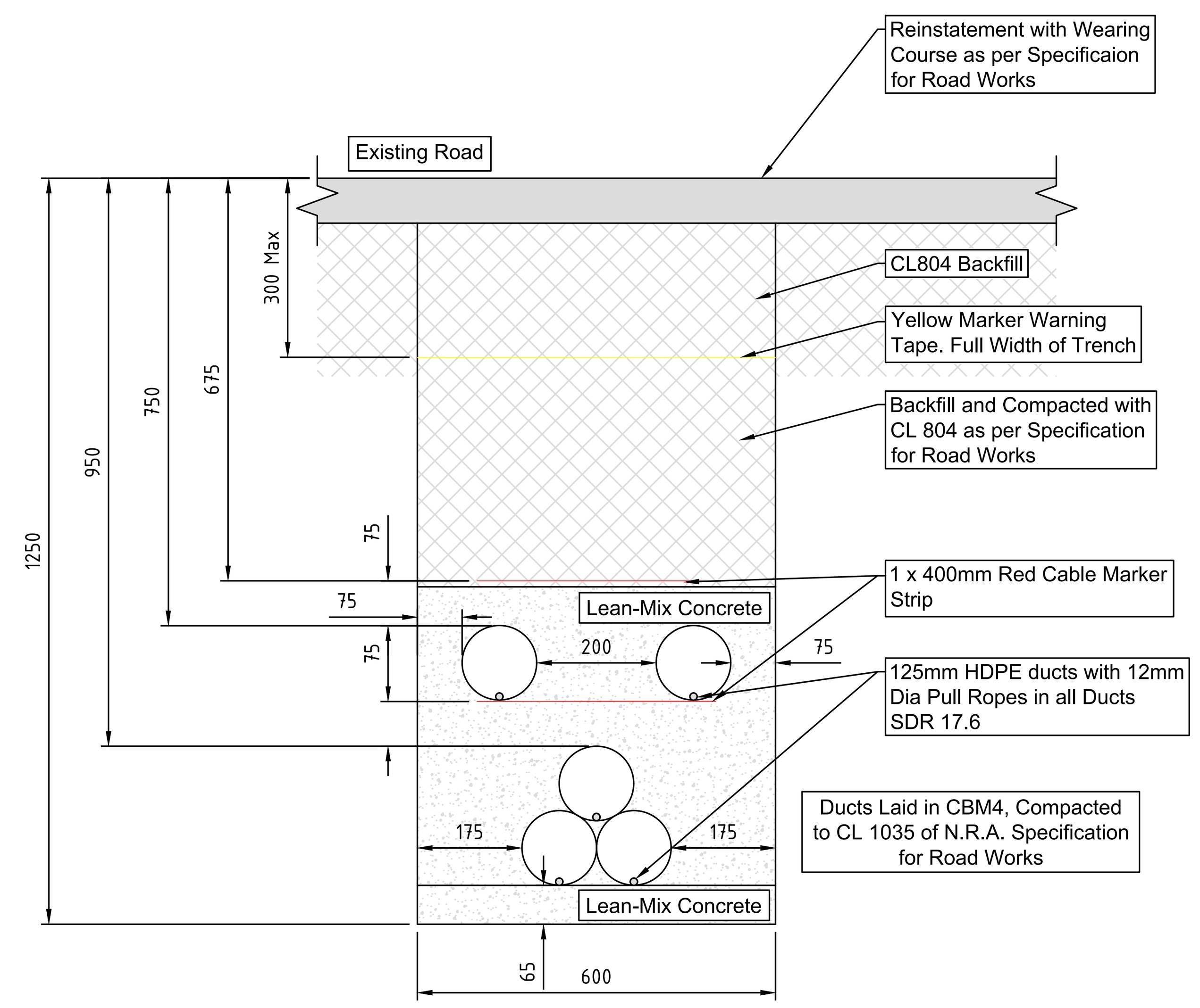
DETAIL D - STANDARD TRENCH ARRANGEMENT IN PUBLIC ROAD VERGE

Scale 1:10



DETAIL E - TYPICAL CROSS SECTION OF TEMPORARY ROAD REINSTATEMENT

Scale 1:10



DETAIL F - TYPICAL CROSS SECTION OF PERMANENT ROAD REINSTATEMENT

Scale 1:10

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	11.03.25

PROJECT: DREHID WIND FARM & SUBSTATION

CLIENT: NORTH KILDARE WIND FARM Ltd.

SHEET: TRENCH DETAILS FOR INTERNAL COLLECTOR CABLES

Date	Project number	Scale (@ A1-)
11.03.25	P22-242	As Shown

Drawn by: CS

Checked by: BC

Drawing Number: P22-242-0300-0028

Rev: A

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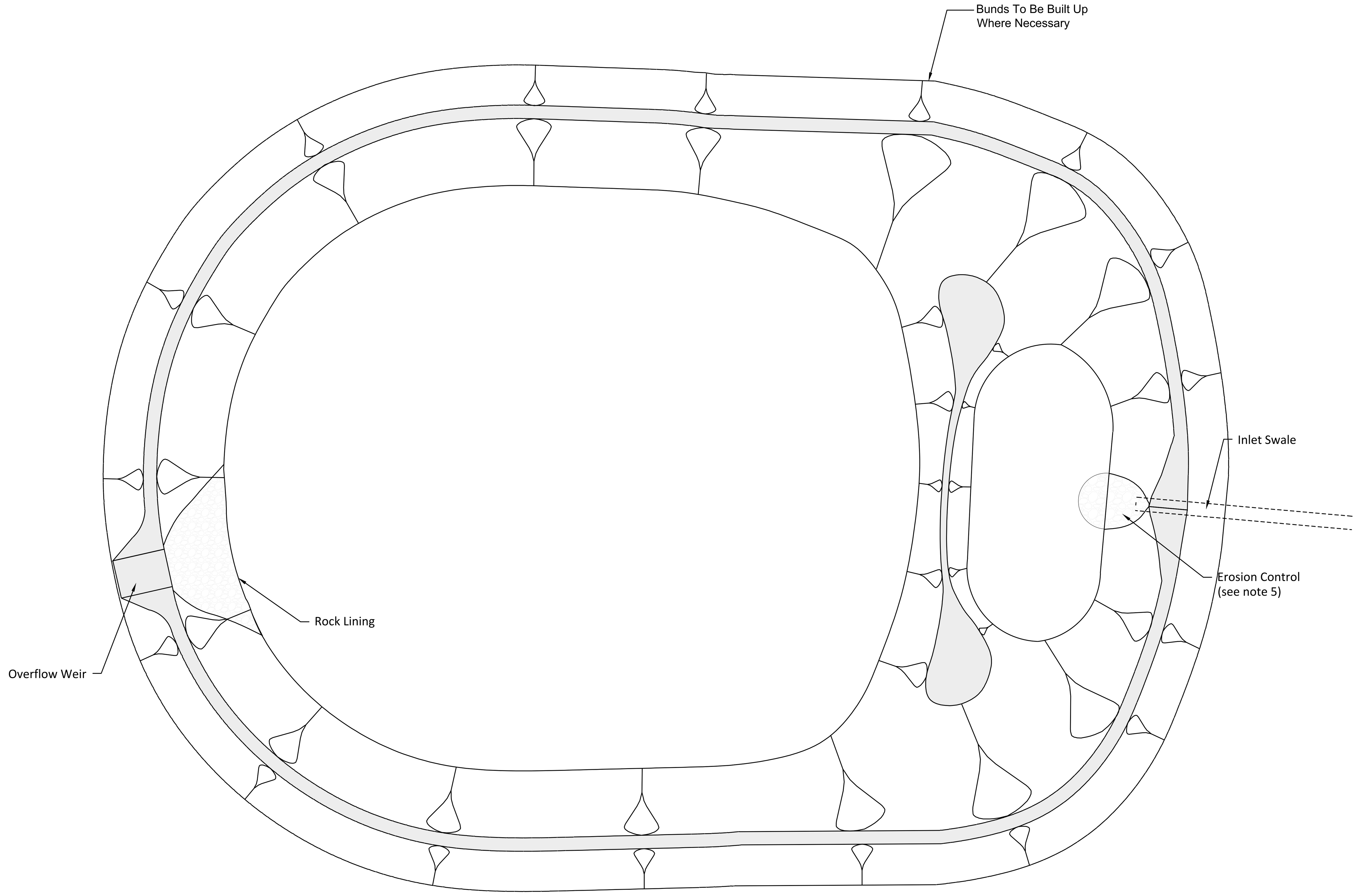
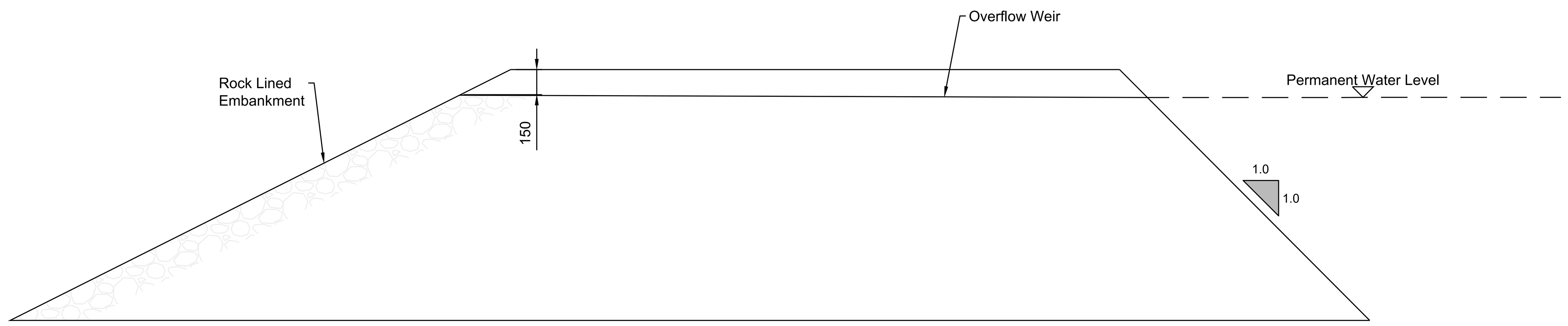
21 May 2025



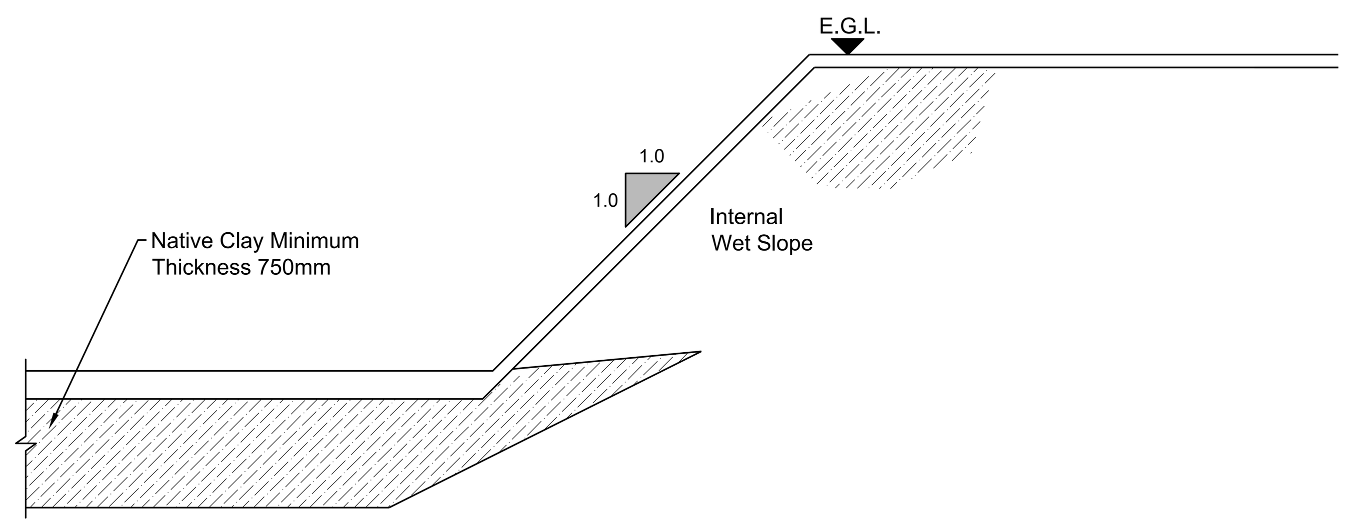
STILLING POND LAYOUT

Scale 1:250



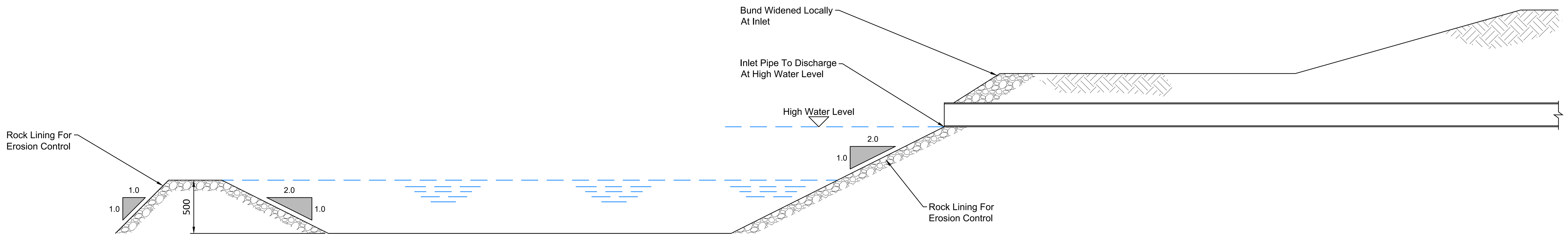
SECTION AT OUTLET

Scale 1:25



BUND CONSTRUCTION
(Where Pond is Below Ground Level)

Scale 1:25



SECTION THROUGH FOREBAY

Scale 1:25

NOTES
1. This drawing should only be read in relation to subject of the title. Other information shown on drawing is to be considered indicative only.
2. All dimensions are in millimetres unless otherwise stated.
3. The pond base and sides below the permanent water level should be made impermeable by:
Cohesive material using native clay or a synthetic liner 1 mm LLDPE.
4. Bunds in ponds to be constructed from native clay.
5. Erosion control to be rock lining. Extent to be agreed on site.
6. Rock lining to be a 125mm thickness of Class 1B material.
7. Refer to stilling pond schedules for pond sizes.
8. Swale inlet at 0.15 m below top of pond.
9. All ponds to be fenced off.

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	19.05.25

PROJECT
DREHID WIND FARM & SUBSTATION

CLIENT
NORTH KILDARE WIND FARM Ltd.

SHEET
STILLING POND DETAILS

Date	Project number	Scale (@ A1-)
19.05.25	P22-242	As Shown

Drawn by: CS
Checked by: BC
Drawing Number: P22-242-0300-0030
Rev: A

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21 May 2025

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DESIGNING AND DELIVERING
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APPENDIX 6

Aquatic Ecology

DREHID WIND FARM

AQUATIC ECOLOGY ASSESSMENT

Version : 14th May 2025

ecofact
biodiversity + ecology

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 Foreword

This report provides a baseline description of the aquatic ecology receiving environment for the proposed Drehid wind farm. The results of a new updated survey completed in December 2023 are included. The watercourses have previously been surveyed in detail in 2018, 2019, 2021. This report provides an updated description of the affected areas - however none of the conclusions of the previous surveys and evaluation of the watercourses have changed.

The proposed Drehid Wind farm is located south-west of Enfield town, Co. Meath. This document provides an aquatic ecology assessment and includes aquatic habitats, aquatic ecological communities, and individual aquatic species. The aims of the aquatic ecology 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 baseline fisheries and aquatic ecological survey of the affected aquatic areas;

Field survey work to inform the current assessment included kick/sweep sampling and visual assessments completed during September 2018, 2019, and 2021. An additional walkover survey was completed during December 2023. Electrical fishing surveys were conducted in September 2010 and September 2021.

Figure 1 shows the location of the proposed Drehid wind farm. This report has been prepared by Ecofact Environmental Consultants Ltd.

1.2 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.

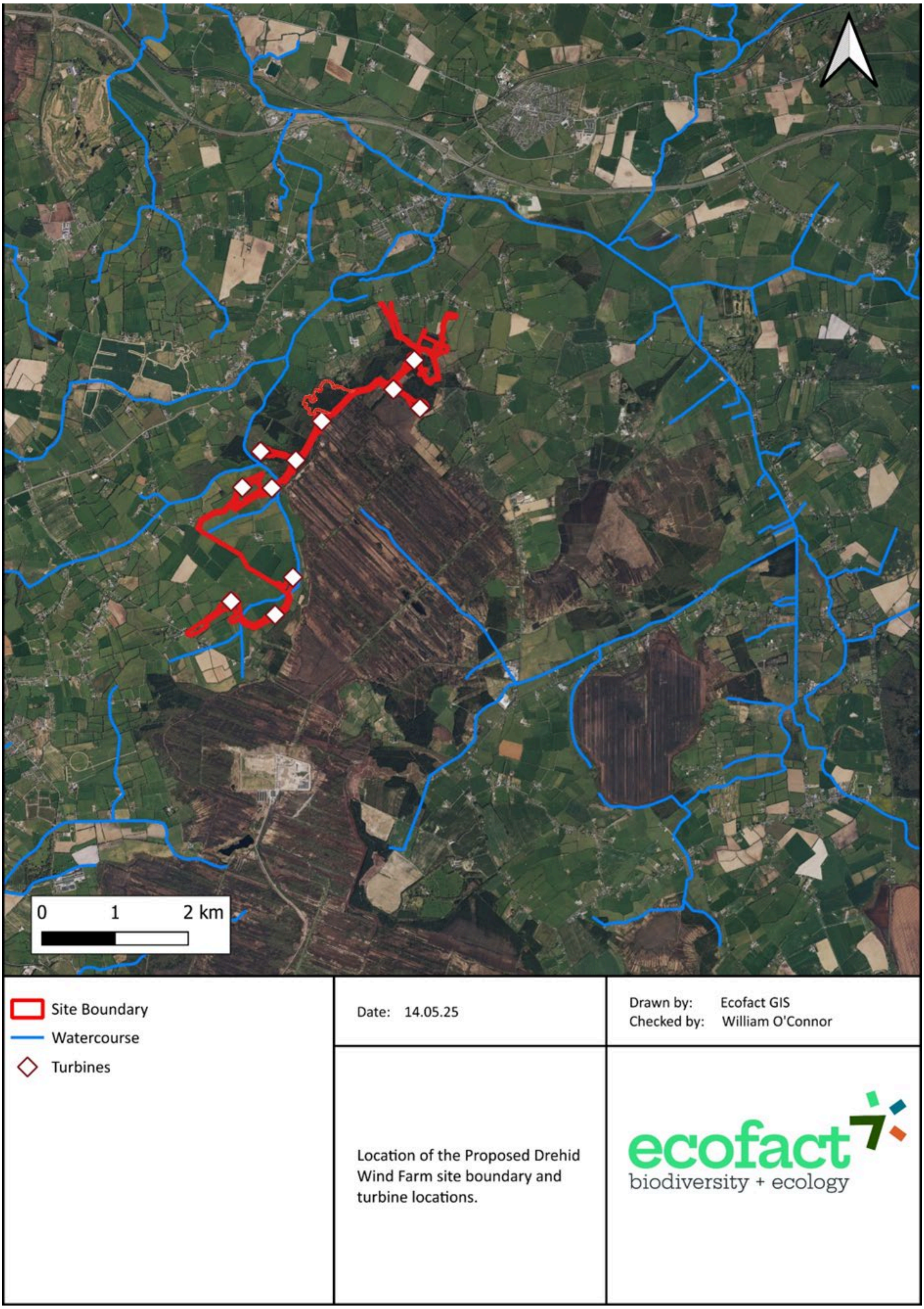

Figure 1 Location of the proposed Drehid Wind Farm site boundary and turbine locations.

2. METHODOLOGY

2.1 Introduction

This report provides a baseline description of the aquatic ecology receiving environment for the proposed Drehid wind farm. The results of a new updated survey completed in December 2023 are included. The watercourses have previously been surveyed in detail in 2018, 2019, 2021. This assessment was based on a desk study and a baseline aquatic ecological survey of 10 sites, completed in 2018, 2019, and 2021 along with a updated walkover survey completed in December 2023. The location of the aquatic ecology survey sites are indicated in Figures 2 and 3. The conducted surveys encompassed aquatic habitat evaluations, fish population studies via electrofishing, and biological water quality assessments using kick sampling techniques. The selection of survey sites was made in agreement with the client and also with the approval of Inland Fisheries Ireland and the Department of the Environment, Climate, and Communications. This approval was granted under Section 14 of the Fisheries (Consolidation) Act of 1959.

2.2 Desk Study

A desktop study was undertaken to describe the aquatic ecology of the study area of the proposed Drehid wind farm. The purpose of this desk study was to identify previous records of aquatic species. This involved accessing the National Biodiversity Data Centre (NBDC) (www.biodiversityireland.ie). The National Parks and Wildlife Service (www.npws.ie) website was also accessed in relation to designated areas, qualifying interests, and site synopses on relevant Special Areas of Conservation. The Environmental Protection Agency (www.gis.epa.ie/EPAMaps/) websites including (including www.catchments.ie) were accessed to identify watercourse in study area. Similarly, any relevant information on the website of Inland Fisheries Ireland (www.fisheriesireland.ie) was reviewed. All documents reviewed are included in the bibliography section of the current report.

2.3 Field Surveys

2.3.1 Selection of Watercourses for Assessment

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. drain areas close to the site) were considered as part of the current appraisal. Aquatic habitat surveys were completed on all watercourses draining the proposed wind farm site and a total of 10 sites were selected for detailed assessment. The purpose of these sites is to provide baseline information and can also be used for monitoring during the construction of the proposed wind farm. The location of the 10 survey sites is given in Table 1 and shown in Figure 2. This is considered to be a very high-resolution survey for the study area in question. 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. All watercourses on the site were viewed during the 2018, 2019, 2021, and 2023 walkover surveys.

During the December 2023 survey five new sites were also visited – Sites A,B, C, D, and E. The location of these sites is shown in Figure 3, and they are also listed in Table 3. These areas were already considered and evaluated in the previous surveys but were considered in further detail during the December 2023 surveys. In the previous surveys in 2018, 2019, and 2021 sites located both downstream and upstream of these areas were surveyed and evaluated. Site A is located on the Ballynamullagh Stream downstream of Sites 9 and 10. Sites B and C are also located on the Ballynamullagh Stream further downstream again. Site D is also located on the Ballynamullagh Stream, downstream of sites A, B, and C but upstream of the confluence with the Coolree 07 River. Site 8 is located on the Coolree 07 River upstream of the Ballynamullagh Stream confluence. Site 6 is located on the Coolree 07 River upstream of the Ballynamullagh Stream confluence. The December 2023 survey therefore was a survey of areas already extensively survey and evaluation. However, it provides an updated description and more detailed description of these channels.

Site E was located on an unregistered watercourse in Coillte lands. This artificial /highly modified stream flows into the Gorteen 07 stream, which is a minor tributary of the Coolree 07 River. This minor sub catchment was also already captured in the previous surveys; Site 5 is located downstream, and Site 6 is located upstream of this site.

2.3.2 Licensing and personnel

The 2021 electrofishing survey was completed under authorisation from the Department of the Environment, Climate and Communications under Section 14 of the Fisheries (Consolidation) Act (1959). Licenses were not required for the 2023 survey which involved visual observation, and kick/sweep net sampling only. The surveys and assessments were completed by Dr William O' Connor with the assistance of a number of ecologists including Grace Walsh, Eoin McMahon, and Dr Lucy Harding.

2.3.3 Biosecurity

Strict biosecurity measures were employed during the survey. This included disinfecting gear between sites and working at the upstream sites first. The IFI (2010) '*Biosecurity Protocol for Field Survey Work'* was followed during all survey work.

2.3.4 Aquatic Habitat Surveys

The habitat surveys were completed with regard to the Environment Agency's manual "*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*" (EA, 2003) and "*A Guide to Habitats in Ireland*" by Fossitt (2000). Fish habitat was evaluated with reference the Department of Agriculture for Northern Irelands Fisheries Division document, the '*Evaluation of habitat for Salmon and Trout'* (DANI, 1995), the English Nature manuals 'Ecology of the Atlantic Salmon' by Hendry K & Cragg-Hine D (2003), and '*Ecology of the River Brook and Sea Lamprey'* by Maitland (2013). River habitat types characterised at each survey site. The status of the watercourses surveyed was categorised on a scale of High-Good-Moderate-Poor-Bad.

2.3.5 Biological Water Quality

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at all survey sites using kick-sampling (Toner *et al*., 2005). This sampling was completed in 2018, 2019, 2021 and an additional walkover/visual survey was completed during December 2023.

A biological water quality rating was assigned at each site following the methodology given in Toner *et al*., (2005). For the smaller streams the a "risk level" was given as described in the 'Small Stream Risk Score Method Manual' Anon (2005). This was a rapid assessment and estimated water quality ratings were assigned for each of the aquatic survey sites. The SSRS categories are "Probably not at risk", "Probably at risk", and "At risk" of not meeting the Good Status requirements of the Water Framework Directive.

2.3.6 Electrofishing Surveys

Electrical fishing surveys were undertaken at the 10 selected aquatic survey sites during September 2019 and 2021. The sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive-Electric fishing in wadable reaches*" and had regard to Matson *et al*, (2018). A portable electrical fishing unit (Smith Root-LR 24backpack) was used to carry out the survey. The sites were fished continuously for 5 minutes each. Juvenile Lamprey surveys were completed following the methodology for ammocoete surveys given in the manual *'Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri* and *Petromyzon marinus'* by Harvey & Cowx (2003). Captured fish were collected into a container of river water using dip nets. The fish were released alive and spread evenly over the sampling area.

2.3.7 Rare species surveys

During the course of the survey the possible presence of rare/notable species, including White-clawed crayfish (*Austropotamobius pallipes*), was fully considered. Crayfish, if present, will be detected during electrofishing surveys, and kick/sweep sampling was also conducted at each site. The potential of any other important species, including Otters and Kingfishers, was also considered at each site.

Table 1 Location of the aquatic ecology sites assessed for the proposed Drehid Wind Farm site (2018, 2019, 2021, and 2023).

Site No.	Catchment	Sub-catchment	Watercourse Name	Watercourse Order	EPA Segment Code
1	Boyne	Blackwater (Longwood)	Blackwater (Longwood)	3	07_1059
2	Boyne	Blackwater (Longwood)	Blackwater (Longwood)	3	07_2240
3	Boyne	Blackwater (Longwood)	Mulgeeth	2	07_1720
4	Boyne	Blackwater (Longwood)	Mulgeeth	2	07_1320
5	Boyne	Blackwater (Longwood)	Blackwater (Longwood)	4	07_350
6	Boyne	Blackwater (Longwood)	Coolree 07	3	07_1848
7	Boyne	Blackwater (Longwood)	Clonkeeran	1	07_1287
8	Boyne	Blackwater (Longwood)	Coolree 07	1	07_1230
9	Boyne	Blackwater (Longwood)	Ballynamullagh	1	07_801
10	Boyne	Blackwater (Longwood)	Drehid	1	07_800

Table 2 Location of the additional aquatic ecology sites considered during the 2023 survey.

Site No.	Catchment	Sub-catchment	Watercourse Name	Watercourse Order	EPA Segment Code
A	Boyne	Blackwater (Longwood)	Ballynamullagh	1	07_864
B	Boyne	Blackwater (Longwood)	Ballynamullagh	1	07_864
C	Boyne	Blackwater (Longwood)	Ballynamullagh	1	07_864
D	Boyne	Blackwater (Longwood)	Ballynamullagh	1	07_864
E	Boyne	Blackwater (Longwood)	Unnamed	n/a	n/a

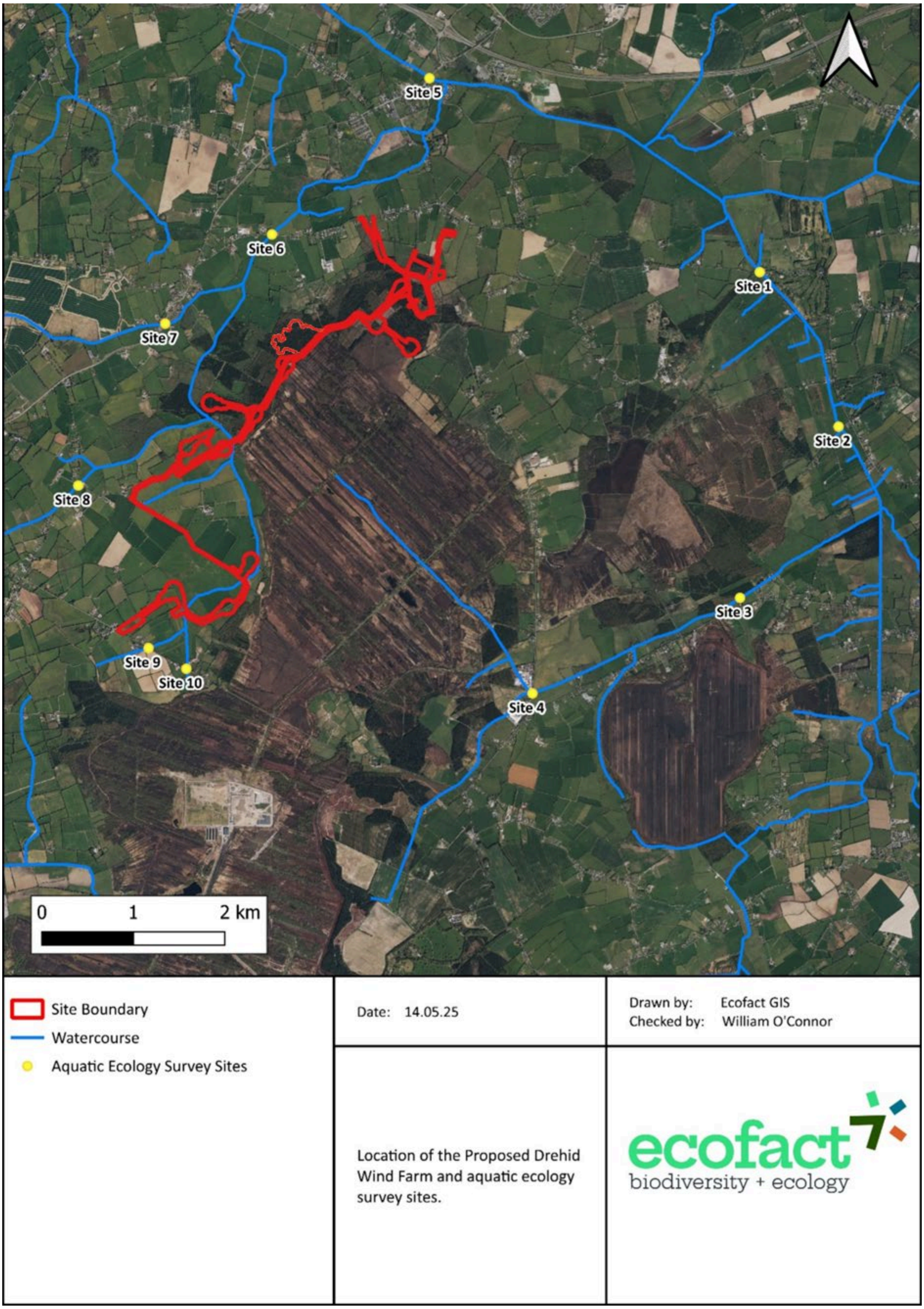

Figure 2 Location of the proposed Drehid Wind Farm and aquatic ecology survey sites.

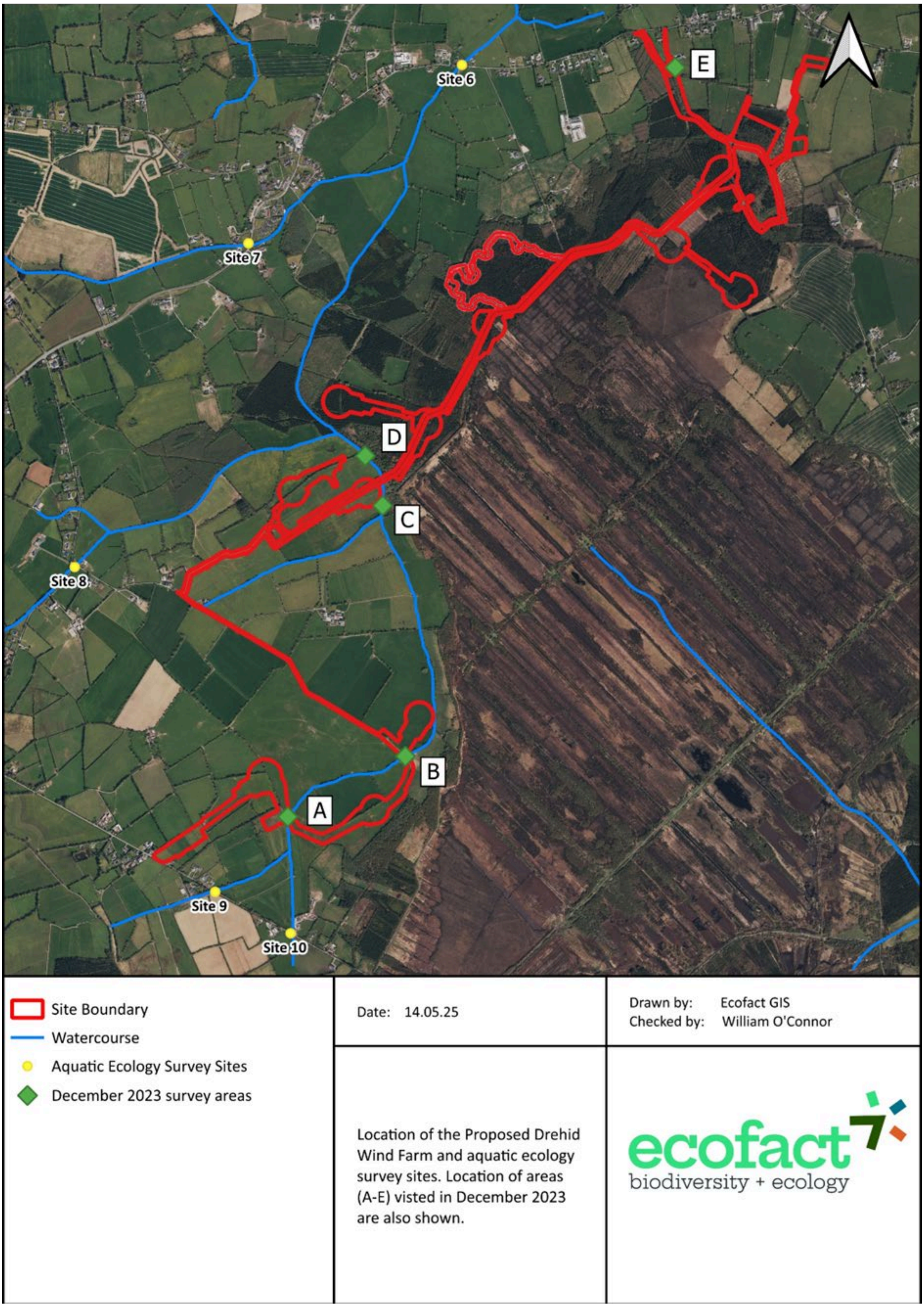

Figure 3 Location of the proposed Drehid Wind Farm and additional areas visited during December 2023.

3. RECEIVING ENVIRONMENT

3.1 Desk Study

3.1.2 SACs designated for aquatic interests

The only Natura 2000 river system in the study area with a downstream hydrological connection to the proposed Drehid wind farm site is the River Boyne and River Blackwater SAC (Site Code: 002299). The River Boyne and the River Blackwater SAC comprises the freshwater element of the River Boyne as far as the Boyne Aqueduct, the Kells Blackwater as far as Lough Ramor and the Boyne tributaries including the Deel, Stoneyford and Tremblestown Rivers. This site is a SAC selected for Alkaline fens [7230] and Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0], both listed on Annex I of the E.U. Habitats Directive. The site is also listed for the following Annex II species; River lamprey (*Lampetra fluviatilis*) [1099], Atlantic salmon (*Salmo salar*) [1106] and Otter (*Lutra lutra*) [1355]. The shortest hydrological pathway between the proposed development and the River Boyne and the River Blackwater SAC is approximately 19.5rkm via the Blackwater (Longwood) River.

3.1.3 Boyne Catchment

The proposed Drehid wind farm is located within the Boyne catchment. The River Boyne main channel rises near Edenderry on the borders of Counties Offaly and Kildare and flows in a north-easterly direction for 112 km before entering the Irish Sea at Drogheda. Together with its tributaries, it drains a catchment of approximately 2,500 km^2. The River Boyne corridor, together with its tributary the Kells Blackwater River, is designated as a Special Area of Conservation (SAC) (Site Code: 002299). In addition, the River Boyne main channel is also a designated salmonid river under the EU Freshwater Fish Directive (78/659/EEC).

An arterial drainage programme was undertaken throughout the Boyne catchment between 1969 and 1985 (O'Grady 1998). The only major section of this catchment which was not drained was the lower reaches of the main Boyne channel - from Navan downstream, and a section of the Kells Blackwater. The river channels affected by the proposed development were all dredged and channelised at this time and are subjected on ongoing drainage maintenance.

3.1.4 Water Quality

3.1.4.1 Blackwater (Longwood) River

The Blackwater [Longwood] River (07B02) rises south west of Enfield, Co. Meath. The total channel length is approximately 24km. From the source, the river flows north as far as survey Site 1. From here it flows north-east past Enfield and north to its confluence with the River Boyne (Segment Code: 07B04). There are six EPA biological water quality monitoring stations on the River Blackwater [Longwood] that were recently monitored. The furthest upstream (Station Code: 07B02 0060) was rated Q3 in 2020; This station was located at Site 2. Another EPA station is located where the R402 crosses the Blackwater (Longwood) river. This station (Station Code: 07B02 0100) was rated Q3-4 in 2020. There is another monitoring site (Station Code: 07B02 0200) approximately 4km downstream that was rated Q3 in 2009.

The next EPA monitoring station (Station Code: 07B02 0300) is approximately 8km downstream from here. This site was rated Q3-4 in 2020. In 2003 another site 2km from here (Station Code: 07B02 0400) was rated Q3-4. The last EPA monitoring station (Station Code: 07B02 0600) is located where the R161 crosses the river approximately 200m upstream of the confluence with the Boyne. This site was rated Q3-4 in 2020.

The EPAs most recent assessment of the Blackwater [Longwood] River is as follows: *" The dominance of pollution tolerant and paucity of pollution sensitive macroinvertebrate taxa indicated unsatisfactory ecological conditions at all sites surveyed on the Blackwater (Longwood) River in 2020. Enriched conditions were evident with enhanced algal growth noted at all sites".*

All waterbodies in the Blackwater [Longwood] SC_010 sub catchment, except one are considered to be at risk. The majority of the survey sites are on waterbodies with a Water Framework Directive status of 'Poor'.

3.1.4.2 Mulgeeth River

The Mulgeeth River (EPA Code: 07M54) is a tributary of the Blackwater [Longwood] River]. The river rises in the Dunfierth Bog which is located just east of the proposed Drehid wind farm site. From here it flows south-east before turning sharply north-east to its confluence with the Blackwater [Longwood] River. The entire channel length is approximately 8rkm (river kilometres). There are no EPA biological monitoring stations on this watercourse.

3.1.4.3 Coolree 07 River

The Coolree River (EPA Code: 07C23) is a tributary of the Blackwater [Longwood] River. The entire channel length is approximately 10rkm. It rises to the south-west of Enfield and flows predominantly north-west until it's confluence with the Blackwater [Longwood] River. There are no EPA biological monitoring stations on this river. A section of this river and one of its tributaries, the Ballynamullagh River (EPA code: 07B19) flows along the proposed wind farm site.

The Coolree 07 River is also known as the Fear English River. The "Fear" part is locally pronounced "Fair" and it understood that the name relates to the word "meadow".

3.1.4.4 Ballynamullagh Stream

The Ballynamullagh Stream (EPA Code: 07B19) is also a tributary of the Blackwater [Longwood] River. The entire channel length is approximately 4rkm. This stream is also known as the Fear English River locally. The Ballynamullagh Stream rises ca. 1.2rkm south of the wind farm site. Immediately upstream of the boundary of the wind farm site the 1st order Drehid stream (EPA Code: 07D13) joins this watercourse. From here the Ballynamullagh stream flows north-east through the proposed wind farm site, before flowing north through the wind farm site. Seven of the proposed turbines are located near this watercourse, and it is proposed that access roads will cross this stream at three different points. Just before the proposed Turbine 6 the Ballynamullagh Stream flows into the Coolree 07 River.

The EPA do not carry out biological monitoring on the Ballynamullagh Stream, presumably due to its small size.

3.2.4 Previous aquatic ecology surveys

The Coolree 07 and Blackwater (Longwood) Rivers were surveyed by Ecofact during 2005 as part of a baseline survey of lamprey populations in the in the River Boyne catchment. This survey is presented in the report '*A survey of juvenile lamprey populations in the Boyne Catchment'* by O'Connor (2006). These watercourses were again surveyed by Ecofact during 2013 as part of an assessment of a different proposed wind farm (Ecofact. 2013). These historical surveys were again reviewed as part of the current assessment.

A total of five sites were investigated on the Longwood Blackwater including its tributary - the Fear English (Coolree 07 River) during the Boyne baseline juvenile lamprey survey completed by O'Connor 2005. A total area of 30 m^2 was fished and the mean density of Brook/River lampreys (*Lampetra* spp.) recorded was 4.62 per m^2 (0.20-15.00 per m^2). Minnow (*Phoxinus Phoxinus*), Three-spined sticklebacks (*Gasterosteous aculeatus),* and Brown trout (Salmon trutta) were also recorded.

No lampreys were recorded on the Fear English stream (Coolree 07 River), which was visibly polluted at the time of the survey in 2005.

It was considered by O'Connor (2005) that only one species of lamprey occurs in the Longwood Blackwater catchment – the resident Brook Lamprey (*Lampetra planeri*). Although the anadromous river lamprey (*Lampetra fluviatilis*) is indistinguishable from brook lamprey at the larval stage, a number of lamprey migration barriers are present on the main channel of the River Boyne. Sea lamprey (*Petromyzon marinus*), also an anadromous species, is distinguishable from *Lampetra* spp. at the larval stage but this species was not encountered in the O'Connor (2005) survey. Overall it was considered that lampreys were present at an unsatisfactory conservation status level. It was stated that "*as in other tributaries of the Boyne, lamprey populations here are currently threatened by pollution and drainage maintenance*".

There are limited other records from the study area. There is a previous record of White-clawed crayfish from the Longwood Blackwater at Johnstown Bridge in 2018. It is noted that crayfish were also recorded here during the Ecofact surveys for Drehid wind farm, most recently in September 2021. There are no other relevant records from the study area, apart from a record of Duck Mussel (*Anodonta anatina*) from Johnstown Bridge (in 2003).

The current 10 sites were surveyed in 2018 and 2019 as part of the baseline survey for the current proposed Drehid wind farm development (Ecofact, 2019). In September 2018 aquatic habitat surveys, and kick sampling surveys, were conducted at the 10 baseline sites. In September 2019 updated aquatic surveys were again conducted at the 10 baseline sites. In September 2021 an electrofishing survey of these 10 sites was also completed. The results of these surveys are presented in the field results section. The latest and most up-to-date results is presented for each site. The most recent survey was completed in December 2023.

3.2 Baseline Aquatic Ecology Surveys

3.2.1 Introduction

The survey sites are located on watercourses that both drain – or run close to - the proposed Drehid wind farm site. The watercourses surveyed are the Blackwater (Longwood) River, the Mulgeeth River, the Ballynamullagh Stream, the Drehid Stream and the Coolree 07 River. All of the sites are located within the Boyne catchment, and the Blackwater (Longwood) sub catchment. The survey sites are discussed in detail below with additional results provided in Appendix 1.

3.2.2 Site 1

Site 1 is located on the 3rd order Blackwater [Longwood] River (EPA segment code: 07_925). The site is located approximately 4km south-east of Enfield, Co. Meath just off the L1004 road. The EPA do not monitor water quality this part of the river. There are three EPA stations upstream from here but they have not been monitored in recent years,

The section of river this site is located on is classified by the Water Framework Directive (WFD) as an "at risk" waterbody. The watercourse also has a WFD (2016-2021) Ecological Status or Potential status of `Poor'. This survey site is located to the north-east of the proposed wind farm,

This site is located on a low gradient section of the 3rd order Blackwater (Longwood) River. This stretch of the river has been deepened and channelised in the past. The site was previously well shaded by riparian trees which overhung the watercourse along high banks. During the December 2023 survey it was apparent that extensive maintenance works had been undertaken along the channel at this site and the overhanging trees has been removed. There is no instream vegetation in the river at this location. The water is silted and slow flowing at this site. It was considered that the maintenance works had been completed recently.

This stretch of the river does not have any suitable spawning or nursery habitats for salmonids. There is potential lamprey nursery habitats and trout rearing and foraging habitats present. This channel has been further degraded by the recent maintenance works.

Brown Trout, Brook Lamprey, Three-spined Stickleback, Minnow (*Phoxinus Phoxinus*), and Stone Loach (*Barbatula barbatula*) were recorded during the 2019-2021 electro fishing surveys. These species are all still likely to be present. However, the removal of the overhanging trees will have negatively affected fish habitats and has caused further siltation in the river. Although White-clawed Crayfish have been recorded in this river previously, none found to be present at the site during the 2021 survey. Habitats for crayfish are very limited at this site due to the general absence of suitable refuges.

The estimated current Q-rating for this site is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Moderate'. This stretch of the river has been further degraded by recent arterial drainage maintenance works.

3.2.3 Site 2

Site 2 is located 2km upstream of Site 1 on the Blackwater (Longwood) River (EPA segment code: 07_2240). The Blackwater [Longwood] River rises approximately 4km upstream of Site 2. The EPA carry out biological monitoring at this site (Station Code: 07B020060). It was rated as Q3 in 2020, which corresponds to WFD 'Poor' status. The site is classified by the WFD as an "at risk" waterbody and has a Water Framework Directive (2016-21) waterbody status of "Poor". The proposed Drehid wind farm site is located to the west this site.

The water channel at this site is very narrow and channelised, flowing through agricultural land. It is evident that this section of the river has been well maintained in the past, and further channel maintenance works had recently been completed at the site. There was evidence of recent bank works and tree clearance, and a tracked machine was still present at the site when it was visited in December 2023. The gradient at this site was very low and siltation levels were high. This is a relatively featureless channel with no pool, riffle, glide sequences. This is an artifact of the arterial drainage scheme. The river is lined by high spoil heaps of material that was previously dredged from the river.

Brown Trout, Brook Lamprey, Minnow, Three-spined Stickleback, and Stone Loach were recorded during the 2021 electro fishing survey. The results were very similar to the previous 2019 survey and the numbers of all species recorded was low. These species are all still likely to be present – but this is a very degraded stretch of river and is subject to regular disturbance by maintenance activities. White-clawed Crayfish were recorded here in low numbers during the 2021 survey. Habitats for crayfish are very limited at this site due to the low instream physical diversity, and regular disturbance. They could still be present in very low numbers.

The estimated current Q-rating for this site is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent / ongoing arterial drainage maintenance works.

3.2.4 Site 3

Site 3 is located on the 2nd order Mulgeeth River (EPA segment code: 07_1720). This watercourse rises in the Dunfierth Bog. This site is located approximately 3km upstream of Site 2. There is no EPA water quality monitoring station on this river. The section of river this site is located on is assessed by the WFD as an "at risk" waterbody. The watercourse has a Water Framework Directive (2016-2021) waterbody status of "Poor". The site is located to the south-east of the proposed Drehid wind farm.

The Mulgeeth River channel at Site 3 is also subject to regular arterial drainage maintenance, and impacts and disturbance was apparent again in the December 2023 survey. The banks are hight and the gradient is low. The site is heavily silted, as was similarly noted in previous surveys.

The only species that was recorded at this site in the 2021 electrofishing survey were Three-spined Stickleback and Minnow which were recorded in small numbers. Lampreys and crayfish were never recorded at this site. It is unlikely that this has changed and the landowner at this site informed as that there were no fish at this site.

The estimated current Q-rating for this site is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. There have not been any significant changes at this site since the 2021 survey.

3.2.5 Site 4

Site 4 was located on the 2nd order Mulgeeth River (EPA segment code: 07_1320). This site is approximately 2.5km upstream of Site 3. There are no EPA monitoring stations on this stretch of river. The site is assessed by the WFD as being an "at risk" waterbody. The watercourse has a Water Framework Directive (2016-2021) waterbody status of "Poor". This site is located to the south-east of the proposed Drehid wind farm site.

This channel has been dredged and channelised in the past, and is well maintained. The condition of this site is much the same as it was during the 2021 survey. The only species recorded at this site during the 2021 electrofishing survey was Three-spined Stickleback. This species was common at this location. This site is considered to be unsuitable for lampreys, salmonids, and crayfish.

The estimated current Q-rating for this site is ‘Q3 – Moderately Polluted’. The overall status of this channel is rated as ‘Poor’. There have not been any significant changes at this site since the 2021 survey.

3.2.6 Site 5

Site 5 is located in Johnstown bridge on the 4th order Blackwater [Longwood] River (EPA segment code: 07_350). It is located downstream of an existing bridge where the R402 road crosses this watercourse. The EPA carries out biological monitoring at this site (Station Code: 07B020100). It was rated Q3 in 2020, corresponding to WFD status ‘Poor’. The section of river this site is located on is classified by the WFD as an “at risk” waterbody. The watercourse also has a Water Framework Directive (2016-2021) waterbody status of “Poor Ecological Status (or Potential)”. The site is located to the north of the proposed Drehid wind farm.

The river at the site has been drained and channelised in the past, and water quality has declined since 2018. There were construction works underway with the building of a new sewage treatment works downstream of the site. There was evidence that machinery had crossed the river at the 2021 electrofishing site with tracks on both sides of the river leading to the waterline. This location was heavily impacted by cattle accessing the river for drinking in September 2021. The site is heavily silted.

During the 2021 electrofishing survey Salmon and Brook Lampreys were recorded in small numbers. This was the only site Salmon were recorded during the baseline surveys for the proposed wind farm site. Brown Trout, Three-spined stickleback, and Minnow were also recorded in small numbers. White-clawed Crayfish were recorded at this site in 2021, but not in 2019 and 2018. The numbers present are very low.

The estimated current Q-rating for this site is ‘Q3 – Moderately Polluted’. The overall status of this channel is rated as ‘Poor’. There have not been any significant changes at this site since the 2021 survey, apart from the localised impacts of machines tracking across the river.

3.2.7 Site 6

Site 6 is located on the 3rd order Coolree 07 River (EPA segment code: 07_1848). It is located approximately 3 km upstream of Site 5. This site is assessed as an “at risk” waterbody by the WFD. The watercourse has a Water Framework Directive (2016-2021) waterbody status of “Poor”. This site is located to the north-east of the proposed Drehid wind farm.

This site is heavily silted and was recently subjected to arterial drainage maintenance. Dredging and removal of vegetation has occurred since the last survey. There is cattle access to the river which was also evident during previous surveys. Indeed, cattle were recorded in the river during both the 2019 and 2021 surveys. The heavy siltation at this site is due to livestock entering the river, and the upstream maintenance works.

Brown Trout, Minnow, Three-spined Stickleback and Stone Loach were recorded in low numbers during the September 2021 electrofishing survey. Nominal numbers of Brook lampreys were recorded at this site in 2018, but not in the subsequent surveys. This site was first surveyed by Ecofact in 2005 when it was considered to be “*visibly polluted at the time of the survey*”.

The estimated current Q-rating for this site is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent maintenance works.

3.2.8 Site 7

Site 7 was located on the 1st order Clonkeeran River (EPA segment code: 07_1287). There are no EPA monitoring stations on this river. The section of river this site is located on is classified as an "at risk" waterbody. The watercourse has a waterbody status of 'Poor'. This site is located to the west of the proposed wind farm. The site is highly modified.

This site on the 1st order Clonkeeran River does not provide optimal aquatic habitat. The Clonkeeran River is also known locally as the "Sweep River". The origins of this name are unknown and it is a very small and low gradient stream, and does not have a significant flow. Indeed during the 2018 survey the site was dry. In 2019 there was a very small flow in the river, but not enough to provide substantial aquatic habitat. In 2021 the site was again dry and overgrown with briars and overhanging vegetation. In December 2023 there was a moderate flow in the river. It was obvious that recent maintenance works had been completed - vegetation cleared from the banks and some dredging had been undertaken. The channel was heavily silted.

The estimated current rating for this site is "at risk". It is not suitable for applying a Q rating. The overall status of this channel is rated as 'Poor'. This stretch of the river has been further degraded by recent maintenance works.

3.2.9 Site 8

Site 8 is located a further c. 4km upstream from Site 6 on the first order Coolree 07 River (EPA segment code: 07_1230). There are no EPA biological water quality monitoring stations here. This section of the river is classified as an "at-risk" waterbody by the EPA and has a 'Poor' status. This site is located to the west of the proposed Drehid wind farm.

The banks of the river at this site are high and overgrown with heavy vegetation. There is significant siltation at this site, and it is accessible to cattle, which are trampling through the watercourse and exacerbating the sediment issue. The only fish species recorded at this site during the 2019 and 2021 electrofishing surveys were Three-spined Sticklebacks.

During December 2023, water levels at this site were higher than in the previous year. There are a few areas of the channel in the upper Coolree 07 River catchment where there is at least some gradient and some run-type habitat present. It cannot be fully excluded that some trout might move upstream into a channel like this in wet years (like 2023). However, this would provide temporary habitat only in a wet year, and the trout present would be expected to leave or perish when more normal conditions return. Brown trout were not recorded in the two previous electrofishing surveys. The summer and autumn of 2023 were record wet periods, and it is to be expected that all watercourses were higher as a result. Obviously, a stream with more water provides better potential habitat. However, at best this watercourse could provide a marginal habitat for trout, and considering more typical water levels and water quality it would be a temporary one only.

The estimated current Q-rating for this site is 'Q3 – Moderately Polluted'. The overall status of this channel is rated as 'Poor'. Water levels in this stretch were higher than what was observed in previous surveys. However, the overall evaluation of the channel/site remains the same.

3.2.10 Site 9

Site 9 was located on the 1st order Ballynamullagh Stream (EPA Segment Code: 07_801) approximately 590rm upstream of the proposed Drehid wind farm site. There are no EPA monitoring stations on this watercourse. The EPA classifies this watercourse as being 'At Risk'. The Ballynamullagh Stream flows through the proposed wind farm site and approximately 7 of the proposed 11 turbines are located in the lands surrounding this watercourse. Proposed access roads also cross the Ballynamullagh Stream at three different points.

The stream is very small at this site with overgrown banks. It does not provide suitable habitat for aquatic species. No fish were recorded during the electrofishing surveys completed in 2019 and 2021. The stream was slightly higher in December 2023 than in the previous surveys – but it was still very obvious that it could not provide a suitable habitat for fish.

The estimated current rating for this site is "at risk". It is not suitable for applying a Q rating. The overall status of this channel is rated as 'Poor'. There have not been any significant changes at this site since the 2021 survey.

3.2.11 Site 10

Site 10 was located on the 2nd order Drehid River (EPA segment code: 07_800) approximately 570rm upstream of the proposed Drehid wind farm site boundary. There are no EPA monitoring stations on this watercourse. The section of river this site is located on is classified as an 'at risk' waterbody and has a Water Framework Directive (2016-2021) waterbody status of 'Poor'.

The Drehid River watercourse is largely concealed under heavy vegetation overhanging from high banks at both sides of the river. The site was dry during the 2021 current survey. In 2019 there was very little water and it was heavily silted. No fish were recorded and it was concluded that this stream does not provide any suitable habitat for any fish species. During the December 2023 survey the stream was higher than we had seen before, and there was a flow.

The estimated current rating for this site is "at risk". It is not suitable for applying a Q rating. The overall status of this channel is rated as 'Poor'. This channel was dry during the 2021 survey, and there was a flow during December 2023. However, the site remains in a poor condition and does not provide a sufficient aquatic habitat to support any fish or other important aquatic organisms.

3.2.12 Sites A-D

Sites A-D were additional sites considered during the December 2023 survey at the request of the client. In the previous surveys in 2018, 2019, and 2021 sites located both downstream and upstream of these points were surveyed.

Site 6 is located downstream of Sites A-D on the 3rd order Coolree 07 River. Sites 8, 9, and 10 are located upstream of Sites A-D on the Coolree 07 stream, Ballynamullagh stream, and Drehid stream respectively. Sites A-D are all located on the Ballynamullagh stream between Sites 6 and 8-10. It is considered that this stretch of river has already been fully assessed and evaluated. However, the current December 2023 updated survey provides an updated and a higher level of resolution survey. Sites A-D are all located on the same EPA river segment (07_864).

Site 6 is located downstream on the 3rd order Coolree 07 River (EPA segment code: 07_1848), and is downstream of Sites A-D. The Coolree 07 River has been surveyed on a number of occasions and is a small and physically degraded aquatic habitat. It is considered that Site 6 is the upper limit of where salmonids would be regularly found. During the previous surveys nominal numbers of Brown Trout were found on this site, but it is considered to be a marginal and suboptimal habitat for salmonids. Upstream of Kilshanroe bridge the river is very modified, has low gradient, is dominated by silt and mud substrates. There are ongoing agricultural, forestry, and river maintenance impacts. During the original 2018 survey, Site 6 was selected as a receptor site due to the reason that this was the closest potentially suitable salmonid habitat to the proposed wind farm site on this watercourse. Sites 8, 9, and 10 are located upstream from here and no salmonids were found. The only fish species thought to regularly occur in the Coolree 07 River catchment upstream of Site 6 is Three-spined stickleback. This is a highly modified catchment and subject to regular instream maintenance works. During the current survey it was clear that dredging and vegetation removal had occurred in the stretch upstream of Site 6. This was also concluded in previous surveys and is clearly an ongoing impact.

During December 2023 the channels between Sites 6, 8,9, and 10 were investigated, including Sites A-D. Water levels in this channel were higher than during the previous surveys. This was due to the current survey being completed in the winter when rainfall levels are generally higher. Moreover, the preceding 6 months had also been very wet and this resulted in most watercourses in the study area being much higher than during the previous visits. This was the case even though the current survey was preceded by a relatively dry two-week period. Therefore these channels were viewed at their best, with higher base flows and die back of algae/instream vegetation. However, they were still rated as being marginal habitats for salmonids, and unsuitable for species such as lampreys and crayfish.

There are a few areas of channel in the upper Coolree 07 River catchment where there is at least some gradient; for example, downstream of Site 8 on the Clonkeeran stream. It can't be fully excluded that some trout could move upstream into these areas in wet years. However, this would provide temporary habitat only and the trout present would be expected to leave or perish when more normal conditions occur. The Clonkeeran stream runs very slow in the summer and had obvious agricultural impacts when previously visited. Streams often look their best in the winter months when there is more water, but this stream is still, at best, a marginal salmonid habitat. Moreover, Sites A,B,C,D are located upstream of where the Clonkeeran stream joins the Ballynamullagh Stream. There is no salmonid habitat present at Sites A, B, C, D, or E. The Ballynamullagh Stream itself is very unlikely to be ever used by salmonids and the areas at Sites A,B,C, and D are not of any potential value to fish or other sensitive aquatic organisms. This is because of the small size of the stream, its degraded physical status, and unsatisfactory water quality. Even when viewed in the winter months this the same conclusion has been reached.

The Coolree 07 River at Site 6 is a salmonid nursery channel (albeit a very marginal one) so the overall evaluation and assessment of this aquatic area does not change. Water quality in the Ballynamullagh Stream will of course influence water quality in the Coolree 07 River. Similarly, the water quality in the downstream River Boyne is ultimately strongly influenced by the water quality in the smaller catchment feeder streams. Therefore, despite its degraded status it was already accepted that the upper reaches of the Coolree 07 River would need to be fully protected during the construction of the proposed wind farm.
Overall, the conclusion of the current updated survey of the upper Coolree 07 River is that the evaluation is the same. There are really no suitable salmonid habitats upstream of Kilshanroe bridge. Similarly, lampreys and crayfish have been confirmed absent from this area. The character of the river changes above Site 6 to a channelised drain-like watercourse with a mud substrate, and it becomes smaller and of less value to aquatic ecology as you move further upstream. In a wet year and in the winter months

it can't be fully ruled out that some Brown Trout may move upstream. But this would be into degraded, marginal, and temporary habitats only.

The estimated quality rating for EPA river segment (07_864) where sites A-D are all located is "at risk". None of the sites are suitable for applying a Q rating. The overall status of this channel is rated as 'Poor'. There have not been any significant changes on this section of river since the 2021 survey, when sites both upstream and downstream of this river segment were surveyed using electrofishing.

3.2.13 Site E

This site was located on an unregistered watercourse. This means that it is not included in the EPA watercourse maps. Very small, ephemeral, watercourses are sometimes not included in the EPA maps. This is often the case for very small artificially created watercourses (e.g. drains) also. This site was visited during December 2023 and a watercourse is present at the site. This is a very small watercourse that is heavily modified and more like a drain than a stream. Even during December 2023 there was a minimal flow and this 'watercourse' can be expected to dry up.

This 'drain' is within the catchment of the Kilmurray 07 stream (EPA segment 07_1820) which is a minor tributary of the Coolree 07 river. Site E is located approximately 300m upstream from the Kilmurray 07 stream. The confluence with the Coolree 07 river is then a further c. 400m downstream. The confluence of the Coolree 07 river and the Longwood Blackwater is a further c. 2km downstream. The Kilmurray 07 stream itself is not of any aquatic ecological importance, and the 'watercourse' at Site E is of less importance. There is also very little risk of conveying any pollutants downstream due to the low flow, low gradient, and a high level of in channel vegetation growth.

This site can't really be rated under any biological monitoring scheme as it does not qualify as a watercourse. But by any measures this would not meet anything higher than 'Poor Status'. This site does not provide any habitat that could support fish or other important aquatic organisms.

4. CONCLUSIONS

This report presents the findings from a comprehensive survey conducted on various watercourses within the vicinity of the proposed Drehid wind farm site. The surveys were completed in 2018, 2019, 2021, and 2023. A total of 10 sites were surveyed in detail during the 2018-2021 surveys (Sites 1-10). These sites were visited again in December 2023 to document any changes at the sites. In additional a further 5 sites were considered in the December 2023 visit (Sites A-E). The surveys completed were located at sites on the Blackwater (Longwood) River, the Mulgeeth River, the Ballynamullagh Stream, the Drehid Stream, and the Coolree 07 River, all located within the Boyne catchment and the Blackwater (Longwood) sub-catchment. The baseline survey sites in this survey were chosen to reflect reference and receptor areas for the proposed Drehid Wind Farm. In addition to the field surveys completed, detailed desk studies were also completed, and these were updated as part of the current assessment.

None of the river channels in the study area are meeting “Good Ecological Status”. The common issues identified across these sites include high levels of siltation, degraded hydromorphology, limited instream vegetation, and the absence of optimal habitats for key species such as salmonids, lampreys, and crayfish. Recent arterial drainage maintenance works have further degraded the river channels, exacerbating siltation and disturbing aquatic habitats. These works have resulted in the removal of overhanging trees and vegetation, which previously provided shade and habitat for fish species. There are three sites on the Blackwater (Longwood) River included in the current assessment two of them had been subjected to recent arterial drainage works (Sites 1 and 2) when visited in December 2023. There was evidence that track machines has recently crossed the third site (Site 5). Additional maintenance works were also recorded at Sites 6 and 7 during the current survey. Evidence of agricultural impacts was recorded at every one of the baseline survey sites investigated. This included cattle accessing the watercourses and banks.

The surveys identified the presence of various fish species including Brown Trout, Brook Lamprey, Three-spined Stickleback, Minnow, and Stone Loach in the overall study area. However, the abundance of these species is low, and their habitats have been negatively impacted by the overall poor condition of the watercourses. The current water quality ratings for the sites generally indicate "Moderately Polluted" conditions. The overall status of these channels is "Poor" reflecting the degraded state of the watercourses and their unsuitability to support a healthy aquatic ecosystem.

The most important watercourses in the study area is the main channel of the Blackwater (Longwood) River. Salmon, Brown trout, and White-clawed crayfish occur in this river. It is a tributary of the River Boyne, and associated Natura 2000 sites. This watercourse is a significant distance downstream from the proposed wind farm boundary and can be easily protected during the development of the proposed wind farm site. The Blackwater (Longwood) River is also a highly modified watercourse that was severely dredged and channelized during the Boyne arterial drainage scheme. It is also has a ‘Poor-Moderate’ water quality rating. The Ballynamullagh Stream which flows through the proposed wind farm site is very unlikely to be ever used by salmonids and the areas at Sites A,B,C, and D investigated in December 2023 are not of significant value to fish or other sensitive aquatic organisms. This is because of the small size of the stream, its degraded physical status, and unsatisfactory water quality. It was also concluded that the new Site E in the Kilmurray 07 stream catchment is not of any aquatic ecological importance. It is an unregistered watercourse and is just a highly modified drain.

Overall, the conclusion of the current updated survey is that the previous evaluation of the watercourses has not changed. Indeed, conditions have deteriorated at some sites due to arterial drainage maintenance works and a background decline in water quality. All the sites visited in the current survey had evidence of agricultural impacts and have been drained or channelised in the past. Most of the areas have been subjected to recent maintenance or other physical impacts.

The impact of developing a wind farm in the Coolree 07 / Ballynamullagh Stream sub-catchment is not considered to be a significant cumulative pressure. The Ballynamullagh Stream which flows through the proposed wind farm site is very unlikely to be ever used by salmonids, and is of limited/no aquatic ecological significance. The receiving watercourses can be easily protected with industry standard 'best practice' mitigation. The proposed wind farm site is also not in an upland area so controlling and treating runoff from the proposed works area can be easily achieved. None of the aquatic areas affected are particularly sensitive. As concluded in O'Connor (2017), most potential issues arising between wind farms and the aquatic environment can be avoided or mitigated through careful project design and management. This is the case for the current site and changes in land use as a result of the development of the proposed wind farm could actually bring positive benefits to water quality and the receiving watercourses.

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PLATES

Plate 1 Site 1 on the Blackwater (Longwood) River in 2021. This site had high banks, overhanging riparian trees and a sluggish flow.

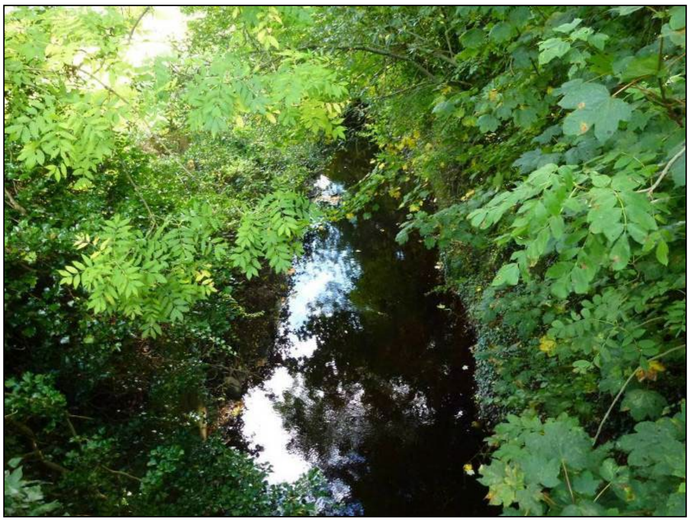

Plate 2 Site 1 on the Blackwater (Longwood) River in 2013. These watercourses are very well known to the project aquatic ecologists.

Plate 3 Recently completed riparian tree removal and maintenance at Site 1 on the Blackwater (Longwood) River in December 2023. Arterial drainage maintenance is a major pressure on this river.

Plate 4 Brown trout from Site 1 on the Blackwater (Longwood) River, September 2021.

Plate 5 Three-spined Stickleback from Site 1 on the Blackwater (Longwood) River in September 2019. This was the most common fish species recorded in the 2019 and 2021 electrofishing surveys.

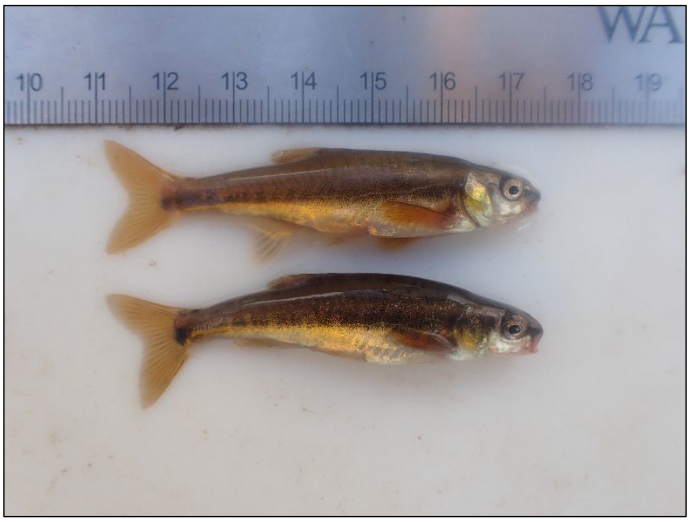

Plate 6 Minnows from Site 1 on the Blackwater (Longwood) River, September 2021.

Plate 7 Site 2 on the Blackwater (Longwood) River, September 2021.

Plate 8 Site 2 on the Blackwater (Longwood) River, December 2023.

Plate 9 Bank clearance and maintenance works at Site 2 on the Blackwater (Longwood) River, December 2023.

Plate 10 Electrofishing at Site 2 on the Blackwater (Longwood) River, September 2021.

Plate 11 Brown trout with unusual coloration from the peat-stained Blackwater River at Site 2. September 2021.

Plate 12 Brook lampreys from Site 2 on the Blackwater (Longwood) River, September 2021.

Plate 13 Stone Loach were present at Site 2 on the Blackwater (Longwood) River.

Plate 14 Site 3 on the Mulgeeth River in 2018 – this channel had been recently maintained at this time.

Plate 15 Electrical fishing survey at Site 3 on the Mulgeeth River during September 2019.

Plate 16 Site 3 on the Mulgeeth River in September 2021.

Plate 17 Site 3 on the Mulgeeth River in December 2023.

Plate 18 Site 4 on the Mulgeeth River during September 2021.

Plate 19 Site 4 on the Mulgeeth River during December 2023.

Plate 20 Site 5 on the Blackwater (Longwood) River, September 2021.

Plate 21 Lamprey survey at Site 5 on the Blackwater (Longwood) River, September 2021.

Plate 22 Site 5 on the Blackwater (Longwood) River, September 2021, showing agricultural imapcts.

Plate 23 Site 5 on the Blackwater (Longwood) River, December 2023. There was evidence that construction machinery had recently tracked across the river at this point.

Plate 24 Salmon (top) and Brown Trout from Site 5 on the Blackwater (Longwood) River, September 2021.

Plate 25 Juvemile Atlantic salmon from Site 5 on the Blackwater (Longwood) River, September 2021.

Plate 26 White-clawed crayfish from Site 5 on the Blackwater (Longwood) River, September 2021. Only nominal numbers were indicated to be present.

Plate 27 White clawed crayfish were also recorded at Site 5 on the Blackwater (Longwood) River during September 2019.

Plate 28 Adult Brown Trout from Site 5 on the Blackwater (Longwood) River during September 2019.

Plate 29 Minnows were common at Site 5 on the Blackwater (Longwood) River during September 2019.

Plate 30 Site 6 on the Coolree 07 River during September 2021.

Plate 31 Site 6 on the Coolree 07 River during December 2023.

Plate 32 Site 6 on the Coolree 07 River during September 2019. Cattle were also in the river here during the 2016 and 2021 surveys.

Plate 33 Site 6 on the Coolree 07 River during December 2023. Cattle were again accessing this site.

Plate 34 Site 7 – the Clonkeeran stream during September 2019. This stream was dry during the September 2021 survey.

Plate 35 Site 7 – the Clonkeeran stream during December 2023.

Plate 36 Site 8 on the Coolree 07 River during December 2024. Water levels river were higher than previously recorded, due to the very wet conditions in 2023.

Plate 37 Site 8 on the Coolree 07 River during September 2018 showing more typical conditions. This is not salmonid habitat.

Plate 38 Water levels on the upper Coolree 07 river were higher than previously recorded, due to the very wet conditions in 2023.

Plate 39 Site 9 on the Ballynamullagh Stream during September 2021.

Plate 40 Site 9 on the Ballynamullagh Stream during December 2024.

Plate 41 Three spined sticklebacks are the most common fish species in the upper Coolree 07 river.

Plate 42 Site 10 on the Drehid Stream during September 2021.


Plate 43 Site 10 on the Drehid Stream during December 2024.


Plate 44 Additional Site A on the Ballynamullagh Stream in December 2023 (this is at a livestock drink).


Plate 45 Site B on the Ballynamullagh Stream in December 2023. Note the agricultural impacts (sheep).

Plate 46 Site C on the Ballynamullagh Stream in December 2023. Note the agricultural impacts (sheep).

Plate 47 Whooper Swans near the Ballynamullagh Stream, December 2023.

Plate 48 Site E is on an unregistered watercourse/drain of no aquatic ecological importance and was visited during December 2023.

APPENDIX 1 RESULTS

Table A1.1 Summary and evaluation of the aquatic ecology survey of 15 sites (updated 2023 survey).

Site No.	Watercourse name	Biological Water quality	Aquatic habitat	Fish population	Rare / notable species	Overall evaluation
1	Blackwater (Longwood)	Q3	Drained and channelized river with fine substrate and high banks. Recent arterial drainage maintenance work completed.	Brown Trout, Brook lamprey, Minnow, Three-spined stickleback, and Stone Loach recorded during 2019 and 2021 electrofishing surveys.	Brown Trout Brook Lamprey (nominal numbers)	Moderate status
2	Blackwater (Longwood)	Q3	Drained and channelized river with excessive macrophyte growth, mixed substrate and high banks. Recent arterial drainage maintenance work completed.	Brown Trout, Brook lamprey, Three-spined stickleback and Stone Loach recorded during 2019 and 2021 electrofishing surveys.	Brown Trout Brook Lamprey White-clawed crayfish (nominal numbers)	Poor status
3	Mulgeeth	Q3	Drained and channelized river with fine substrate and high banks	Minnows and sticklebacks only.	None	Poor status
4	Mulgeeth	Q3	Drained and channelized river with fine substrate and high banks	Three-spined sticklebacks	None	Poor status
5	Blackwater (Longwood)	Q3-4	Drained and channelized river with excessive macrophyte growth, mixed substrate and high banks. Recent tracking of machines across river.	Salmon, Brown Trout, Brook lamprey, Minnow, Three-spined stickleback, and Stone Loach recorded during 2019 and 2021 electrofishing surveys.	Salmon Brown Trout Brook Lamprey White-clawed crayfish	Poor status
6	Coolree 07	Q3	Drained, highly modified. Cattle accessing the river. Fine/gravel substrate. Recent arterial drainage maintenance work completed.	Minnows, stone loach, and three-spined sticklebacks recorded in very low numbers during 2019 and 2021 electrofishing surveys.	None	Poor status
7	Clonkeeran	At risk	Dry in previous years, low flow in 2023 survey. Recent maintenance work completed.	No fish present	None	Poor status
8	Coolree 07	Q3	Highly modified tiny stream, higher water levels in 2023 survey.	Three spined sticklebacks, possibly provides temporary habitat for trout.	None	Poor status

Site No.	Watercourse name	Biological Water quality	Aquatic habitat	Fish population	Rare / notable species	Overall evaluation
9	Ballynamullagh	At risk	Drain like stream	No fish present	None	Poor status
10	Drehid	At risk	Drain like stream	No fish present	None	Poor status
A	Ballynamullagh	At risk	Tiny, modified stream	No fish present	None	Poor status
B	Ballynamullagh	At risk	Tiny, modified stream	No fish present	None	Poor status
C	Ballynamullagh	At risk	Tiny, modified stream	Three spined sticklebacks may be present.	None	Poor status
D	Ballynamullagh	At risk	Tiny, modified stream	Three spined sticklebacks may be present	None	Poor status
E	Unnamed	n/a	Drain	No fish present	None	Poor status

Table A1.2 Results of the River Corridor Survey (RHS) Assessments of survey sites at the proposed Drehid wind farm site, September 2021.

Site	Watercourse Name	EPA Segment	Drained (Y/N)	Wetted Width (m)	Gradient (Low/Med/High)	Siltation (Heavy/Moderate/Normal/Free)	Filamentous algae (Y/N)	Eroding Banks (Y/N)	Braided Channel (Y/N)	Artificial Features (Y/N)
1	Blackwater (Longwood)	07_1059	Y	2.8	L	H	N	N	N	Y
2	Blackwater (Longwood)	07_2240	Y	2.5	L	H	N	N	N	Y
3	Mulgeeth	07_1720	Y	2.5	L	H	N	N	N	Y
4	Mulgeeth	07_1320	Y	1.2	L	H	N	N	N	Y
5	Blackwater (Longwood)	07_350	Y	2.8	L	M	N	N	N	Y
6	Coolree 07	07_1848	Y	2	L	H	N	N	N	Y
7	Clonkeeran	07_1287	Y	<1	L	H	N	N	N	Y
8	Coolree 07	07_1230	Y	1.5	L	H	Y	N	N	Y
9	Ballynamullagh	07_801	Y	0.9	L	H	N	N	N	Y
10	Drehid	07_800	Y	<1	L	H	N	N	N	Y
A	Ballynamullagh	07_864	Y	<1	L	H	N	N	N	Y
B	Ballynamullagh	07_864	Y	<1	L	H	N	N	N	Y
C	Ballynamullagh	07_864	Y	<1	L	H	N	N	N	N
D	Ballynamullagh	07_864	Y	<1	L	H	N	N	N	N
E	Unnamed	n/a	Y	<1	L	H	N	N	N	Y

Table A1.3 Results of the fisheries habitat assessments of survey sites at the proposed Drehid wind farm site, updated December 2023.

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)	Coarse Fish (P/A)	Eel (P/A)	Lamprey Habitat (P/A)	Lamprey (Y/N)	Crayfish (P/A)	FWPM (P/A)
1	Blackwater (Longwood)	N	N	N	N	A	P	P	L	P	Y	L	A
2	Blackwater (Longwood)	N	N	N	N	A	L	L	L	P	Y	L	A
3	Mulgeeth	N	N	N	N	A	L	L	A	P	L	A	A
4	Mulgeeth	N	N	N	N	A	A	A	A	P	L	A	A
5	Blackwater (Longwood)	Y	N	N	N	P	P	A	L	P	Y	P	A
6	Coolree 07	N	N	N	N	A	P	A	A	P	L	A	A
7	Clonkeeran	N	N	N	N	A	A	A	A	A	N	A	A
8	Coolree 07	N	N	N	N	A	A	A	A	A	N	A	A
9	Ballynamullagh	N	N	N	N	A	A	A	A	A	N	A	A
10	Drehid	N	N	N	N	A	A	A	A	A	N	A	A
A	Ballynamullagh	N	N	N	N	A	A	A	A	A	N	A	A
B	Ballynamullagh	N	N	N	N	A	A	A	A	A	N	A	A
C	Ballynamullagh	N	N	N	N	A	A	A	A	A	N	A	A
D	Ballynamullagh	N	N	N	N	A	A	A	A	A	N	A	A
E	Unnamed	N	N	N	N	A	A	A	A	A	N	A	A

Y = Yes, N= No, P = Present, A = Absent, L = not recorded but likely to occur in the waterbody

Table A1.4 Biological water quality and WFD status at the aquatic survey sites at the proposed Drehid wind farm.

Site	Watercourse Name	EPA Code	EPA Q Value	Ecofact Q Value	WFD Status
1	Blackwater (Longwood)	07_1059	N/A	Q3	Moderate
2	Blackwater (Longwood)	07_2240	Q3	Q3	Poor
3	Mulgeeth	07_1720	N/A	Q3	Poor
4	Mulgeeth	07_1320	N/A	Q3	Poor
5	Blackwater (Longwood)	07_350	Q3-4	Q3-4	Poor
6	Coolree 07	07_1848	N/A	Q3	Poor
7	Clonkeeran	07_1287	N/A	n/a	Poor
8	Coolree 07	07_1230	N/A	Q3	Poor
9	Ballynamullagh	07_801	N/A	n/a	Poor
10	Drehid	07_800	N/A	n/a	Poor
A	Ballynamullagh	07_864	N/A	n/a	Poor
B	Ballynamullagh	07_864	N/A	n/a	Poor
C	Ballynamullagh	07_864	N/A	n/a	Poor
D	Ballynamullagh	07_864	N/A	n/a	Poor
E	Unnamed	n/a	N/A	n/a	Poor

Table A1.5 Summary results of the electrical fishing surveys undertaken at the 10 survey sites during September 2021. Each site was fished for 5 minutes and an additional 3 minutes was spent surveying for juvenile lampreys.

Site	Watercourse Name	Brown Trout	Salmon	Brook Lamprey	Minnow	Three-spined stickleback	Stone Loach	White-clawed crayfish
1	Blackwater (Longwood)	*		*	*	***	*	
2	Blackwater (Longwood)	**		**		**	*	*
3	Mulgeeth				**	**		
4	Mulgeeth					***		
5	Blackwater (Longwood)	***	**	*	***	**		*
6	Coolree 07	*			*	*	*	
7	Clonkeeran							
8	Coolree 07					*		
9	Ballynamullagh							
10	Drehid							

*Present, **Small Numbers, ***Common, ****Numerous

Table A1.6 Results of the 5-minute electrical fishing surveys at the 10 survey sites (CPUE fish/min) during September 2021.

Site	Watercourse Name	Brown Trout	Minnow	Three-spined stickleback	Stone Loach
1	Blackwater (Longwood)	0.4	0.4	0.8	1.2
2	Blackwater (Longwood)	0.6	0.6	0	0.8
3	Mulgeeth	0	0	1	1.4
4	Mulgeeth	0	0	0	2
5	Blackwater (Longwood)	1.2	0.4	2	1.8
6	Coolree 07	0.2	0	0.4	0.6
7	Clonkeeran	0	0	0	0
8	Coolree 07	0	0	0	0.8
9	Ballynamullagh	0	0	0	0
10	Drehid	0	0	0	0

Table A1.7 Results of the 3-minute lamprey surveys at the 10 survey sites (CPUE fish/min) during September 2021.

Site	Watercourse Name	Potential lamprey habitat present (Y/N)	Brook Lamprey	CPUE
1	Blackwater (Longwood)	Y	2	0.67
2	Blackwater (Longwood)	Y	1	0.33
3	Mulgeeth	Y	n/a	
4	Mulgeeth	N	n/a	
5	Blackwater (Longwood)	Y	4	1.33
6	Coolree 07	Y	n/a	
7	Clonkeeran	N	n/a	
8	Coolree 07	N	n/a	
9	Ballynamullagh	N	n/a	
10	Drehid	N	n/a	

FEHILY TIMONEY

DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

APPENDIX 7

Otter Report

Otter (*Lutra lutra*) survey of Drehid Wind Farm, Co. Kildare (2022-2023)

Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

October 2023

Please cite as:

Triturus (2023). Otter (*Lutra lutra*) survey of Drehid wind farm, Co. Kildare (2022-2023). Report prepared by Triturus Environmental Ltd. for Fehily Timoney & Company. October 2023.

Table of contents

1. Introduction

1.1 Project background

Triturus Environmental Ltd. were commissioned by Fehily Timoney & Company to undertake an otter (*Lutra lutra*) survey of the watercourses in the vicinity of the proposed Drehid wind farm project, located near the Kildare/Meath border south of Enfield, Co. Meath (**Figure 2.1**).

Site surveys completed as part of the Environmental Impact Assessment Report (EIAR) for the proposed development in 2018 identified two otter signs (including a potential holt) along the Fear English River within the study area and concluded that "*otters are likely to utilise the Fear English River which bisects the proposed development site*" (FT, 2018). Subject to a further information request on the 19th February 2019 from Kildare County Council (Planning Ref 18/1534), and in order to ensure the EIAR and AA Screening/NIS had sufficient scientific data to support its assessment, findings and conclusions, a dedicated otter survey within the development footprint was undertaken within the development footprint in May 2019. The survey recorded a low number of otter signs along the Fear English River, including two potential holts (Triturus, 2019).

The current baseline surveys, undertaken in October 2022 and October 2023, aimed to update previous otter surveys of the site (Triturus, 2019) to provide more contemporary records of otter distribution by identifying otter field signs (i.e. holts, spraints, couches, prints & other signs). The distribution of these signs acted as an indicator of the most important areas of aquatic and riparian habitat used by otters, inclusive of potential breeding and resting areas (i.e. holts and couches). This data would also help to further inform mitigation for the proposed development and minimise potential direct and indirect impacts to otter.

1.2 Legislative protection & conservation status

The Eurasian otter (*Lutra lutra*) is a species of conservation concern and high priority having suffered major declines in its range and population throughout Europe since the 1950s. It is classified as 'near threatened' by the IUCN Red List with a decreasing population trend and, as such, is listed in Appendix I of CITES, Appendix II of the Bern Convention (Council of Europe, 1979) and Annexes II and IV of the EC Habitats Directive (92/43/EEC).

Otters, along with their breeding and resting places, are also protected under provisions of the Irish Wildlife Acts 1976-2023. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive 92/43/EEC, which is transposed into Irish law by the European Union (Birds and Natural Habitats) Regulations 2011-2021.

The protection of otters is outlined in Article 51(1) and (2):

Protection of fauna referred to in the First Schedule;

51.(1) *The Minister shall take the requisite measures to establish a system of strict protection for the fauna consisting of the species referred to in Part 1 of the First Schedule.*

51.(2) *Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a license granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule (listed below). Items (b) and (d) may be considered most relevant to developments.*

(a) *deliberately captures or kills any specimen of these species in the wild,*

(b) *deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,*

(c) *deliberately takes or destroys eggs of those species from the wild,*

(d) *damages or destroys a breeding site or resting place of such an animal, or*

(e) *keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive, shall be guilty of an offence.*

According to the NPWS (2021), '*it should also be noted that in the case of Regulation 51(d) any action resulting in damage to, or destruction of, a breeding or resting place of an animal may constitute an offence unless a derogation licence has been granted and this action does not need to be deliberate*'. Furthermore, '*breeding and resting places are protected even when the animals are not using them, once there is a high probability that they will return*' (CJEU Case C-477/19) (NPWS, 2021). Regulation 51(d) therefore places a strict responsibility of due diligence on anyone proposing to carry out an 'action or project' that can 'damage or destroy' the breeding place of Annex IV species.

In an Irish context, according to the most recent Article 17 reporting (NPWS, 2019), otter conservation status has improved, with the species now evaluated as being of 'Favourable' conservation status. Otters were considered to be previously 'Near Threatened' (Marnell, 2009) based on a 20-25% decline between 1980 and 2005 (Bailey & Rochford, 2006). However, the current conservation status is now of 'Least Concern' (Marnell et al., 2019).

1.3 Study area description

The c. 393ha landholding in which the Proposed Wind Farm and Substation are located is composed primarily by agricultural pasture (GA1; Fossitt, 2000) to the north and south, with more central areas dominated by coniferous afforestation and associated clear-fell (WS5) over peat soils. To the east of the site boundary sits Timahoe North Bog, a large area of cutaway bog (PB4). Small areas of degraded raised bog (PB1), scrub (WS1), bog woodland (WN7) and mixed broad-leaved woodland (WD1) are also scattered throughout the wider site.

The site is bisected by the Fear English River (aka Ballynamullagh/Coolree River), a tributary of the (Longwood) River Blackwater which has indirect connectivity with the River Boyne and River Blackwater SAC (site code: 002299) site approximately 15km downstream. Both the Kilcooney River (aka Coolree Stream) and Sweep River (aka Clonkeeran Stream), as well as several unnamed adjoining drainage channels, adjoin the Fear English River within the proposed landholding boundary (**Figure 2.1**). A small, c. 0.16 ha dystrophic lake (FL1 habitat) is situated in recolonising cutover bog (PB4) and wet heath (HH3) habitat adjoining the proposed development boundary near turbine T8. To the south of the site, the Fear English River channel flows through an agricultural landscape bordered to the east by cutaway bog. The channel has been extensively straightened and deepened historically, with a largely trapezoidal profile of poor hydromorphology (i.e. steep more V-shaped sloping banks with flat uniform bed). Much of the upper and lower survey reaches are heavily scrubbed over by bramble (*Rubus fruticosus* agg.) and hawthorn (*Crataegus monogyna*), with intermittent treelines largely composed of mature ash (*Fraxinus excelsior*). More open areas are often dominated by instream growth of fool's watercress (*Apium nodiflorum*), branched bur reed (*Sparganium erectum*) and common duckweed (*Lemna minor*). Riparian shading is invariably high throughout, particularly in the middle reaches of the survey area where particularly steep banks (up to 4m in height) have promoted arboreal tunnelling of the channel. Basal flow rates are typically slow (glide habitat), with the substrata dominated by silt throughout. Some shallow, higher energy areas of coarse gravels, cobble and limited boulder are present but these are invariably bedded and silted. The lower reaches of the Kilcooney and Sweep rivers, which are also heavily scrubbed, historically straightened and situated in agricultural landscapes, also suffer from hydromorphological and siltation pressures.

2. Methodology

2.1 Desktop review of otter records

A desktop review of the available otter data for the Drehid wind farm site and surrounding areas was undertaken. Data records held by the National Parks & Wildlife Service (NPWS) and National Biodiversity Data Centre (NBDC) were also reviewed. Otter data collated during previous ecological surveys of the site (Triturus, 2019; FT, 2018) was also reviewed. Grey literature in the form of consultancy reports for other nearby habitats (e.g. Timahoe North Bog) were also consulted.

2.2 Otter sign surveys

Walkover otter surveys of the aquatic habitats in the vicinity of the proposed development were undertaken on the 15th and 16th October 2022 and the 10th October 2023. Mirroring previous efforts (Triturus, 2019), the survey area encompassed sections of the Fear English River (aka Ballynamullagh or Coolree River), Kilcooney River (aka Coolree Stream) and Sweep River (aka Clonkeeran Stream), as well as several unnamed adjoining drainage channels (**Figure 2.1**). This equated to a total linear channel survey distance of 6.9km (**Table 2.1).** A small bog pool (covering c.1ha surface area), located near proposed turbine T8, was also surveyed.

The surveys were completed during dry, mild, bright and settled conditions, which ensured that a good representation of habitat marked by otter could be recorded in the field, including territorial marking or marking of feeding areas. Each otter sign was logged by type, location (handheld GPS), condition and approximate age for later interpretation to distinguish differences in habitat use and activity. Spraints were subjectively assessed as either fresh (recent), mixed-age (recent and older spraints, typically indicative of a regular sprainting site) or old (spraint degrading and not recently deposited). Furthermore, indicative counts of spraint (i.e. number of individual spraints) and the number of sprainting sites (often separate clusters in one area) were noted. This helped indicate the frequency of otter marking, which can clarify levels of activity in particular areas, inclusive of breeding (holt) and resting (couch) areas.

Table 2.1 Watercourses surveyed for otter in the footprint of the proposed Drehid wind farm site, Co. Kildare, October 2022 & October 2023

Watercourse	EPA code	Alternative name (EPA)	Length of channel surveyed (nearest 0.1km)
Fear English River	07B19, 07C23	Ballynamullagh River, Coolree River	5.7
Fear English River	n/a	n/a	0.2
Fear English River	07C23	Coolree River	0.5
Fear English River	07C26	Clonkeeran Stream	0.5
Total channel length surveyed			**6.9**

2.3 Total corridor otter survey (TCOS) methodology

The survey broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003) and Bailey & Rochford (2006). However, methodology differed in that the entire waterline was surveyed rather than the standard 500-600m sections from accessible points (e.g. bridges). The novel survey technique, known as a total corridor otter survey (TCOS) (Macklin et al., 2019), encompassed the entire riparian zone (both banks) within the survey area.

Total corridor survey methodology typically involves the use of two (or more) surveyors working independently (in tandem) along each respective bank of an individual watercourse (where practical). This also facilitates one to work from a more elevated position (e.g. bank top) with one surveying (with appropriate PPE such as a dry suit or chest waders) from within the channel, thus greatly increasing the likelihood of otter sign detection. This is especially true of more cryptic signs such as holts, which can be located in undercut banks, under tree root systems etc. out of the view of traditional surveys. Surveyors can alternate between the channel and each bank depending on surveyor knowledge and experience of preferential areas of habitat likely to be used by otter.

2.4 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. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

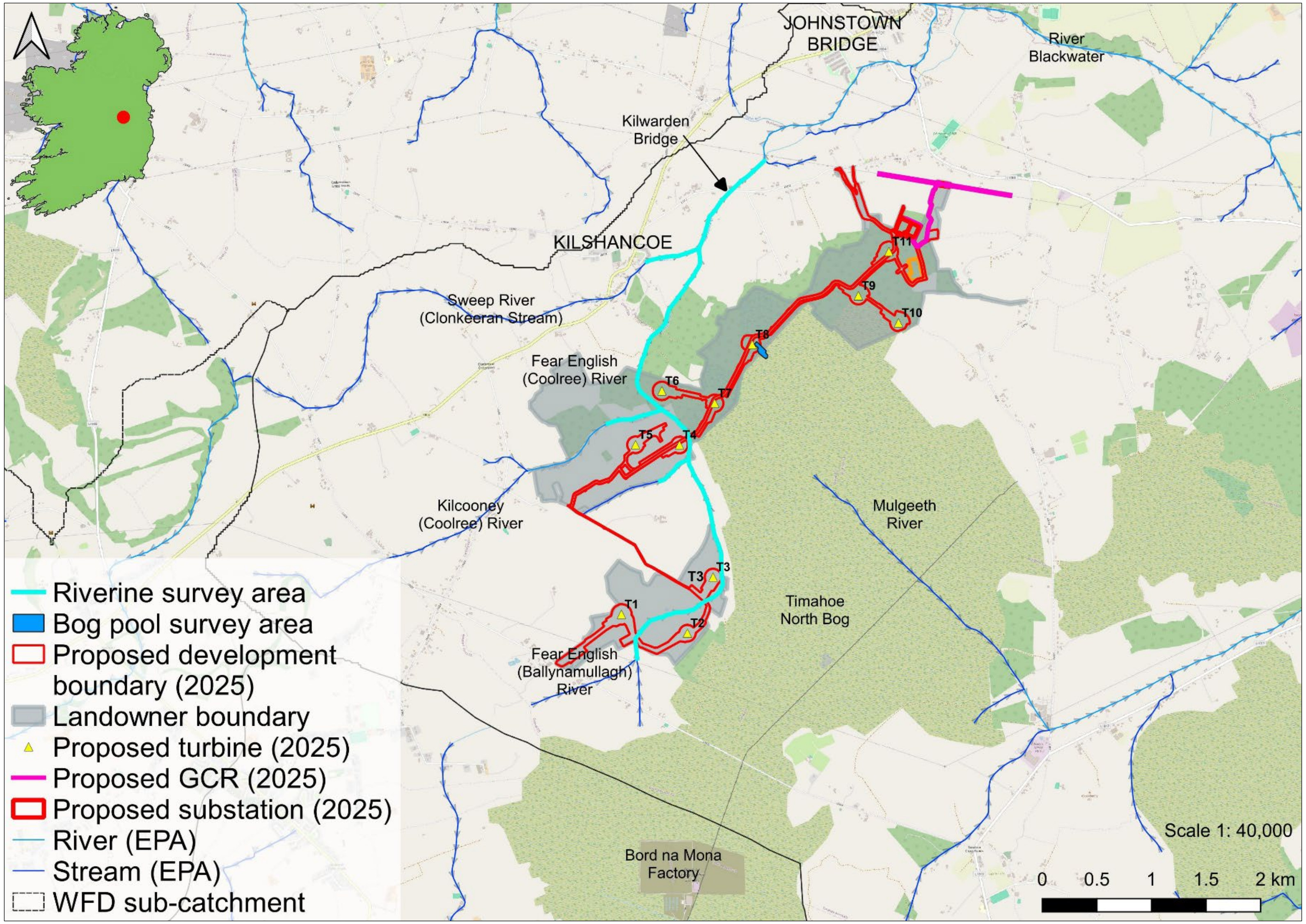

Figure 2.1 Overview of the otter survey area in the vicinity of the proposed Drehid wind farm, October 2022 & October 2023

3. Results

3.1 Desktop review of otter records

A desktop review revealed a low number of otter records within and in the vicinity of the survey area. Otter signs (spraint) were recorded in the 2012-2013 period along bog drainage channels to the south-east of turbine 7 and 8 of the proposed wind farm (FT, 2018). During 2018 surveys, two otter signs were observed within the study area; one outside of the proposed development and one within. An otter slide was observed just outside the proposed development along the Fear English (Ballynamullagh) River; approximately 93m from proposed turbine T3 hardstanding area. An otter holt[1] was observed within the proposed development boundary along the Fear English River, approximately 27m from a new access track and 16m from felling activities (FT, 2018).

A low number of contemporary otter records were also available for the Fear English River (2015, NBDC data) and adjacent Timahoe North Bog (Triturus, 2019b; NBDC data).

Previous otter surveys of the proposed wind farm site revealed a low number of spraint sites, prints and two holt areas (Triturus, 2019). Apart from prints near a bog pool adjacent to turbine T8 , all signs were recorded along the Fear English River channel.

3.2 Otter records [2]

A total of *n*=8 otter signs were recorded within the survey area during the October 2022 survey, with *n*=6 signs recorded in October 2023 (**Table 3.1; Figures 3.1**).

Considering data compiled over the two years of surveys, spraint sites (*n*=7) accounted for the majority of all signs recorded, with 3 no. set of prints and 2 no. holts (H1 and H2) also recorded (**Table 3.1**). Based on the 2023 survey data holt H2 was considered active while holt H1 was considered inactive.

Apart from fresh prints (and associated slide) in the soft littoral mud of the bog pool adjacent to turbine T9 and prints recorded in the lowermost reaches of the Kilcooney (Coolree) River during October 2022, all signs were recorded along the Fear English River channel.

[1] This is the same location as the current holt H2 (see Table 3.1 and Results section)
[2] Please note that, to protect the location of sensitive potential otter breeding and resting areas, a redacted version of this report is required should the data be made publicly available

Table 3.1 Summary of the otter signs recorded in the vicinity of the proposed Drehid wind farm, October 2022 & October 2023

Otter sign	Watercourse	Within landholding boundary	Nearest turbine	Notes	ITM X	ITM Y
October 2022						
Spraint	Fear English River	Yes	T3	Regular sprainting site on marginal rock. Mixed age.	674759	734819
Holt (H1)	**Fear English River**	**Yes**	**T4 (0.14km approximately)**	**Located downstream of adjoining drainage channel. Inactive at time of survey with root growing across entrance.**	**674461**	**735787**
Holt (H2)	**Fear English River**	**Yes**	**T4 (0.22km approximately)**	**Potentially active holt along Fear English River channel. Two entrances. Previously identified in November 2018(FT, 2018).**	**674363**	**736122**
Spraint	Fear English River	Yes	T4 (0.22km approximately)	Regular sprainting site on marginal rock adjacent to holt. Mixed age.	674348	736122
Spraint	Fear English River	Yes	T4 (0.25km approximately)	Single old spraint on marginal rock adjacent to holt. Mixed age.	674321	736146
Prints	Kilcooney (Coolree) River	Yes	T6 (0.18km approximately)	Recent prints on muddy littoral at confluence of Kilcooney & Fear English channels	674196	736221
Spraint	Fear English River	No	n/a	Regular sprainting site on ledge & cross-channel pole under Kilwarden Bridge. Mixed age.	674846	738231
Prints	Bog pool	Yes	T8 (0.08km approximately)	Fresh prints with associated slide in muddy littoral of bog pool	675116	736776
October 2023						
Spraint	Fear English River	Yes	T6 (0.17km approximately)	Fresh on muddy mound at drainage channel confluence near holt area, north bank	674222	736225
Prints	Fear English River	Yes	T6 (0.19km approximately)	Fresh prints in marginal clay slope, north bank	674244	736206
Holt (H1)	**Fear English River**	**Yes**	**T4 (0.14km approximately)**	**Inactive at time of survey with no access for otter due to bisecting tree root**	**674461**	**735787**

Holt (H2)	**Fear English River**	**Yes**	**T4 (0.22km approximately)**	**Potentially active holt with two entrances. Northern (smaller) entrance had signs of recent mammal activity.**	**674363**	**736122**
Spraint	Fear English River	No	n/a	On old telegraph pole used as sheep drink	674651	737980
Spraint	Fear English River	No	n/a	Regular sprainting site on ledge & cross-channel pole under Kilwarden Bridge. Mixed age.	674846	738231

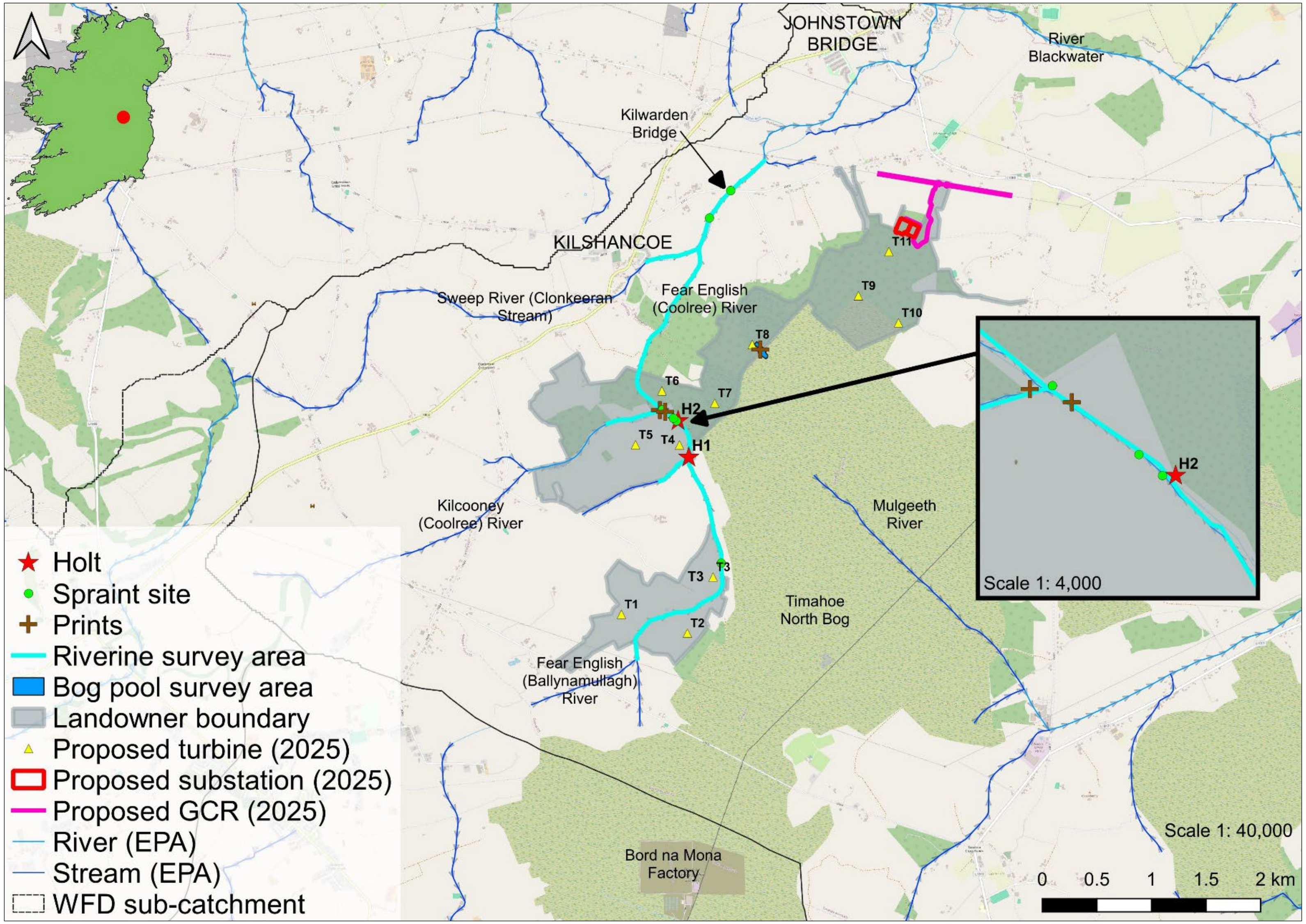

Figure 3.1 Overview of the otter signs recorded within the vicinity of the proposed Drehid wind farm, October 2022 & October 2023

Figure 3.2 Location of otter holts and nearby signs, October 2022 & October 2023

Plate 3.1 Otter spraint and anal jelly deposited on marginal rock on the Fear English River, October 2022

Plate 3.2 Previously identified holt H1 (from 2019) adjacent to the Fear English River with root now restricting access for otter (October 2023)

Plate 3.3 Old otter spraint recorded along the Fear English River channel, October 2022

Plate 3.4 Smaller entrance of holt H2 along the Fear English River channel, October 2023, with signs of recent activity

Plate 3.5 Larger entrance of holt H2 along the Fear English River channel, October 2023, with eroded path indicating signs of recent activity

Plate 3.6 A spraint site was located on top of old pole across the Fear English River, October 2023

Plate 3.7 Example of the historically modified nature (poor hydromorphology) of the Fear English River, October 2023

Plate 3.8 Old otter spraint on cross-channel pole at Kilwarden Bridge on the Fear English River, October 2023

4. Discussion

The current total channel otter survey (TCOS) recorded a total of *n*=8 ad *n*=6 otter signs within the survey area over October 2022 and October 2023, respectively (**Figure 3.1**). This was a comparably low number to previous surveys of the site (Triturus, 2019). Apart from prints located in the margins of a bog pool near the proposed site of turbine T8 and in the lowermost reaches of the Kilcooney (Coolree) River in October 2022, all signs (i.e. spraints, prints, anal jelly & potential holts) between the two survey years were recorded along the Fear English River. This supports previous findings for the site which suggested the Fear English channel to be the primary otter habitat in vicinity of the proposed wind farm. No signs were recorded on the lower reaches of the Clonkeeran (Sweep) River.

The lower number of signs recorded in October 2023 (6) compared with October 2022 (8) likely reflects the higher water levels throughout the survey area due to recent heavy rainfall, which further reduced the already scarce marking opportunities for otter through submersion (e.g. some prominent marginal boulders were underwater). Recent mammal activity was observed at the smaller entrance of holt H2 in October 2023 (**Plate 3.4**) and given the wetted, worn trail leading into the hole, it would suggest usage by otter. No recent activity was observed at the larger of the two entrances at holt H2 (Plate 3.5). Despite previous suitability (Triturus, 2019), holt H1 was not considered accessible to otter in October 2022 or October 2023 due to a bisecting tree root and no recent worn trails (**Plate 3.2**).

The deposition of spraint and other marking behaviour (e.g. scent marking via urination) is known to serve a variety of territorial and communicative functions in otter populations (Sittenthaler et al., 2020; Remonti et al., 2011; Kean et al., 2011; Kruuk, 1992). Sign marking is routinely associated with prominent features such as large instream boulders and riparian tree root systems (Almeida et al., 2012). Historical modifications (drainage) removes the majority of such features (**Plate 3.7**; O'Grady et al., 2017), typically resulting in habitats with poor otter marking opportunities and, consequently, a low number of detectable signs, even where otter utilisation occurs. The paucity of potential marking sites also increases the frequency of intra-annual and inter-annual use (i.e. same sites marked repeatedly over time). This pattern has been repeatedly observed on the Fear English River and tributaries in vicinity of the proposed development.

River hydromorphology is known to be a key driver of otter distribution and habitat utilisation (Couturier et al., 2023; Macklin et al., 2019; Scorpio et al., 2016), primarily through impacts to fish populations, the key prey resource for otter (Krawczyk et al., 2016). Historical straightening and deepening of watercourses removes habitat and hydromorphological heterogeneity, encourages sediment deposition and invariably results in irreparable damage to fisheries potential (O'Grady et al., 2017; O'Grady, 2006). Whilst there is a paucity of contemporary fisheries data for the watercourses in question, the Kilcooney (Coolree) River, a tributary of the Fear English River, is known to support brown trout (*Salmon trutta*), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*), minnow (*Phoxinus phoxinus*) and brook lamprey (*Lampetra planeri*) (Ecofact, 2022, 2018). Walkover surveys of the Fear English River have confirmed the presence of brown trout (at evidently low densities) and three-spined stickleback were recorded previously (Ecofact, 2018). Nonetheless, fish prey resources preferred by foraging otter are appreciably poor within the survey area and would likely support only a small otter population. However, even areas of river channel with lower inherent value for otter are important to enable lateral and longitudinal colonisation, by allowing otters to commute between better quality habitats (Van Looy et al., 2014).

As per 2019, signs of otter activity (i.e. prints and slide through vegetation) were recorded in the vicinity of the bog pool located adjacent to proposed turbine T8 in October 2022 (but not October 2023). Whilst significant fish stocks (the primary component of otter diet) were unlikely to be present given a lack of surface water connectivity (but three-spined stickleback possible), the bog pool did support a range of aquatic species known to form a component of otter diet, such as common frog (*Rana temporaria*) and provides suitable habitat for common waterbird species (Kloskowski et al., 2013; Reid et al., 2013a; Wise et al., 1981). Given its proximity to the Fear English River channel (<1km distance), this pool likely serves as an occasional foraging habitat for otter utilising nearby riverine corridors.

River drainage, together with clearance of riparian vegetation, are the main causes of otter habitat loss in Ireland (Reid et al., 2013b; NPWS, 2009). Suitability for holting was typically low on the watercourses within the survey area given agricultural land use practices (i.e. narrow riparian zones and historical bank modifications (including riparian clearance). Nevertheless, two potential holts (first identified in 2019) were situated in the middle survey reaches of the Fear English River. One of holts (between turbines T4 and T6 **H2, Figure 3.2**) was considered potentially active during the survey period given nearby spraint sites and a wetted trail to the holt as previously described. Otters, along with their breeding and resting places, are protected under provisions of the Irish Wildlife Acts 1976-2023. Therefore, as works may disturb otter breeding/resting areas, a derogation licence may be required from the National Parks and Wildlife Service (NPWS) in advance of any works activity within ≤150m of identified otter holts. Trail camera monitoring at the potentially active holt is recommended to determine whether the sites are utilised by breeding otter or not, in advance of proposed works (under a NPWS Sections 9 & 23(6)b licence to photograph/film wild animals).

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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 8

Kingfisher Report

Kingfisher (*Alcedo atthis*) survey of Drehid Wind Farm, Co. Kildare

Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

October 2023

Please cite as:

Triturus (2023). Kingfisher (*Alcedo atthis*) survey of Drehid Wind Farm, Co. Kildare. Report prepared by Triturus Environmental Ltd. for Fehily Timoney & Company. October 2023.

Triturus

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by Fehily Timoney & Company to undertake a kingfisher (*Alcedo atthis*) survey of the watercourses and habitats within the vicinity of the proposed Drehid wind farm project, located near the Kildare/Meath border south of Enfield, Co. Meath (**Figure 2.1**).

The EIAR for the project (FTCO, 2018) identified kingfisher as a 'key ecological receptor' with high sensitivity for the Drehid site. The report concluded that it was "*near certain that the proposed impact of habitat loss will be a long-term imperceptible impact*" with regards kingfisher, and that indirect impacts resulting from wind farm construction works had a "*low*" probability. Nevertheless, a dedicated pre-construction kingfisher survey within the development footprint was required to inform the wind farm project and minimise potential direct and indirect impacts to the species, particularly in terms of breeding / feeding habitat loss. Kingfishers are considered especially vulnerable to potential construction-related impacts given their reliance on natural fish stocks as their primary food source and sensitivity to disturbance and pollution, in addition to their short life cycle (average 7 years; Libois & Libois, 2013), small clutch sizes, high winter juvenile mortality (7-8 eggs; Morgan & Glue, 1977) and small territory size of 10-15km (Crowe et al., 2008). Due to their specific requirements in terms of bank composition and structure (Heneberg, 2004), nesting sites are vitally important for kingfisher.

The baseline survey aimed to update previous kingfisher surveys of the site (Triturus, 2019), by identifying the current distribution of kingfisher in vicinity of the proposed project and highlighting any potential breeding (nesting) areas. The recorded presence or absence of kingfisher would help inform the necessary mitigation to prevent impacts to kingfisher populations resulting from the proposed project. Surveys following best practice (see methodology section) were carried out during the late kingfisher breeding season, in the mid-April to mid-June 2022 period, as well as an additional bank walkover survey in August 2022.

1.2 Legislative protection

Kingfishers are protected under Annex I of the EU Birds Directive (79/409/EEC as amended 2009/147/EC) and are Amber-listed (medium conservation concern) in Ireland according to the Birds of Conservation Concern of Ireland (BoCCI; Gilbert et al., 2022) due to a depleted European population. However, very few sites in Ireland have been formally designated for kingfishers despite the legal requirements and, thus, the feeding and breeding territory should be preserved on a precautionary basis where the species is at risk from development.

1.3 Study area description

The c. 393ha landholding in which the Proposed Wind Farm and Substation are located is composed primarily of agricultural pasture (GA1; Fossitt, 2000) to the north and south, with more central areas dominated by coniferous afforestation and associated clear-fell (WS5) over peat soils. To the east of the site boundary sits Timahoe North Bog, a large area of cutaway bog (PB4). Small areas of degraded raised bog (PB1), scrub (WS1), bog woodland (WN7) and mixed broad-leaved woodland (WD1) are also scattered throughout the wider site.

The site is bisected by the Fear English River (aka Ballynamullagh/Coolree River), a tributary of the (Longwood) River Blackwater which has indirect connectivity with the River Boyne and River Blackwater (site code: 002299) site approximately 15km downstream. Both the Kilcooney River (aka Coolree Stream) and Sweep River (aka Clonkeeran Stream), as well as several unnamed adjoining drainage channels, adjoin the Fear English River within the proposed site boundary (**Figure 2.1**). A small, c.1ha dystrophic lake (FL1 habitat) is situated in degraded raised bog (PB1) habitat within the centre of the wind farm site. To the south of the site, the Fear English River channel flows through an agriculture landscape bordered to the east by cutaway bog. The channel has been extensively straightened and deepened historically, with a largely trapezoidal profile of poor hydromorphology (i.e. steep more V-shaped sloping banks with flat uniform bed). Much of the upper and lower survey reaches are heavily scrubbed over by bramble (*Rubus fruticosus* agg.) and hawthorn (*Crataegus monogyna*), with intermittent treelines largely composed of mature ash (*Fraxinus excelsior*). More open areas are often dominated by instream growth of fool's watercress (*Apium nodiflorum*), branched bur reed (*Sparganium erectum*) and common duckweed (*Lemna minor*). Riparian shading is invariably high throughout, particularly in the middle reaches of the survey area where particularly steep banks (up to 4m in height) have promoted arboreal tunnelling of the channel. Basal flow rates are typically slow (glide habitat), with the substrata dominated by silt throughout. Some shallow, higher energy areas of coarse gravels, cobble and limited boulder are present but these are invariably bedded and silted. The lower reaches of the Kilcooney and Sweep rivers, which are also heavily scrubbed, historically straightened and situated in agricultural landscapes, also suffer from hydromorphological and siltation pressures.

2. Methodology

2.1 Desktop review

A desktop review of the available kingfisher-related data for the proposed site boundary and surrounding areas was undertaken (within 5km of the site by water). Data records held by the National Biodiversity Data Centre (NBDC) were also referenced, which primarily included data from the Bird Atlas 2007-2011 (Balmer et al., 2013). Kingfisher data collated during previous ecological surveys of the site (i.e. Triturus, 2019; FTCO, 2018) was also reviewed.

2.2 Presence/absence surveys

2.2.1 Vantage point (VP) surveys

To gather data on kingfisher distribution in the vicinity of the proposed project, vantage point (VP) surveys were undertaken along the Fear English River in mid-April to mid-June 2022 in accordance with best practice (e.g. SNH, 2017; NRA, 2009). A total of 4 no. fixed point VP sites were strategically chosen relative to the proposed project (**Figure 2.1**) and corresponded to the same sites surveyed in 2019 (Triturus, 2019). These VP sites were utilised to document passing and/or feeding kingfisher moving through areas of the Fear English River channel with good visibility. A broad site description of the 4 no. VP locations in context of kingfisher is provided in Triturus (2019).

As per best practice, VP sites were located at accessible sites with higher visibility and probability of kingfisher occurrence such as bridge crossings or along straightened sections of channel. Due to natural site characteristics (e.g. riparian shading), the viewshed for kingfisher VP sites did not exceed 180° visibility nor extend to a distance greater than 2km away (as per SNH, 2017 guidelines). Binoculars (8 x 42) were used as required to enhance bird detection. Alarm calls were also listened for as a cue for approaching kingfisher.

Given that kingfishers are typically most active in the early morning, the timing of VP surveys reflected this (i.e. 7-11am period). One hour was spent at each VP location and each VP site was visited on four occasions with optimal weather conditions during the survey period, i.e. 14th April, 25th April, 19th May and 13th June 2022. The surveys deliberately coincided with both the early and late breeding season for kingfisher (March to June period) and was chosen to maximise the chance of recording kingfisher, and to improve the definition of possible kingfisher territories. Survey effort was divided between two surveyors throughout the monitoring period and VP surveys did not coincide with any other field work activity on site to reduce disturbance.

The following activities were recorded to establish the behavioural usage of habitat by kingfisher;

- Direction & time of flight
- Presence of prey in bill
- Activity (perching, foraging, avoidance behaviour, vocalising etc.)

Table 2.1 Summary of vantage point (VP) survey locations for kingfisher with the vicinity of the proposed Drehid wind farm, Co. Kildare surveyed in mid-April to mid-June 2022

VP site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	Fear English River	07C23	Drehid	674681	735166
2	Fear English River	07C23	Drehid	674207	736222
3	Fear English River	07C23	Ballynamullagh	674062	736737
4	Fear English River	07C23	Kilwarden Bridge	674850	738237

2.2.2 Bank walkover transect surveys

Following best practice (i.e. SNH, 2017; Crowe, 2008), in addition to VP surveys, bank walkover transects were undertaken on the 15th August 2022 along the Fear English River and the adjoining lower reaches of the Kilcooney (Coolree) River, Sweep (Clonkeeran) River and unnamed stream (**Figure 2.1)**. Walkover surveys within the vicinity of the proposed site were completed at the same time as the accompanying total corridor otter survey (TCOS) (see Triturus, 2022b), equating to a total linear channel survey distance of 6.9km (**Table 2.2; Figure 2.1**).

Primarily, the walkover survey was completed to assess the potential for such areas as kingfisher nesting (breeding) and foraging habitat. Areas were also assessed in terms of potentially suitable riparian resting perches and prey availability (i.e. small fish). Bank transect surveys facilitated greater kingfisher detection rates compared to VP surveys in isolation. The surveys were carried out under dry and settled conditions. GPS coordinates (ITM) were recorded where a kingfisher was observed (perching, flying, foraging), heard (vocalising) or where nesting sites were identified. If detected, nests were classed as active based on the presence of recent kingfisher droppings at the entrance rather than observed bird arrivals/departures (which may not be routinely observed even when nests are active). Nest sites were recorded whether considered currently active or not. With further regard to nesting sites, the extent of suitable nesting bank and its general physical characteristics were noted in context of the wider survey area. Photographs were taken at each site of interest to aid relocation. Aquatic and terrestrial habitat characteristics in the vicinity of kingfisher sites (nests, flying/foraging observations) were noted.

Table 2.2 Watercourses surveyed for kingfisher via bank transects in the vicinity of the proposed Drehid wind farm site, Co. Kildare, August 2022

Watercourse	EPA code	Alternative name (EPA)	Length of channel surveyed (nearest 0.1km)
Fear English River	07B19, 07C23	Ballynamullagh River, Coolree River	5.7
Fear English River	n/a	n/a	0.2
Fear English River	07C23	Coolree River	0.5
Fear English River	07C26	Clonkeeran Stream	0.5
Total channel length surveyed			**6.9**

2.3 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 of pathogens and invasive species. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

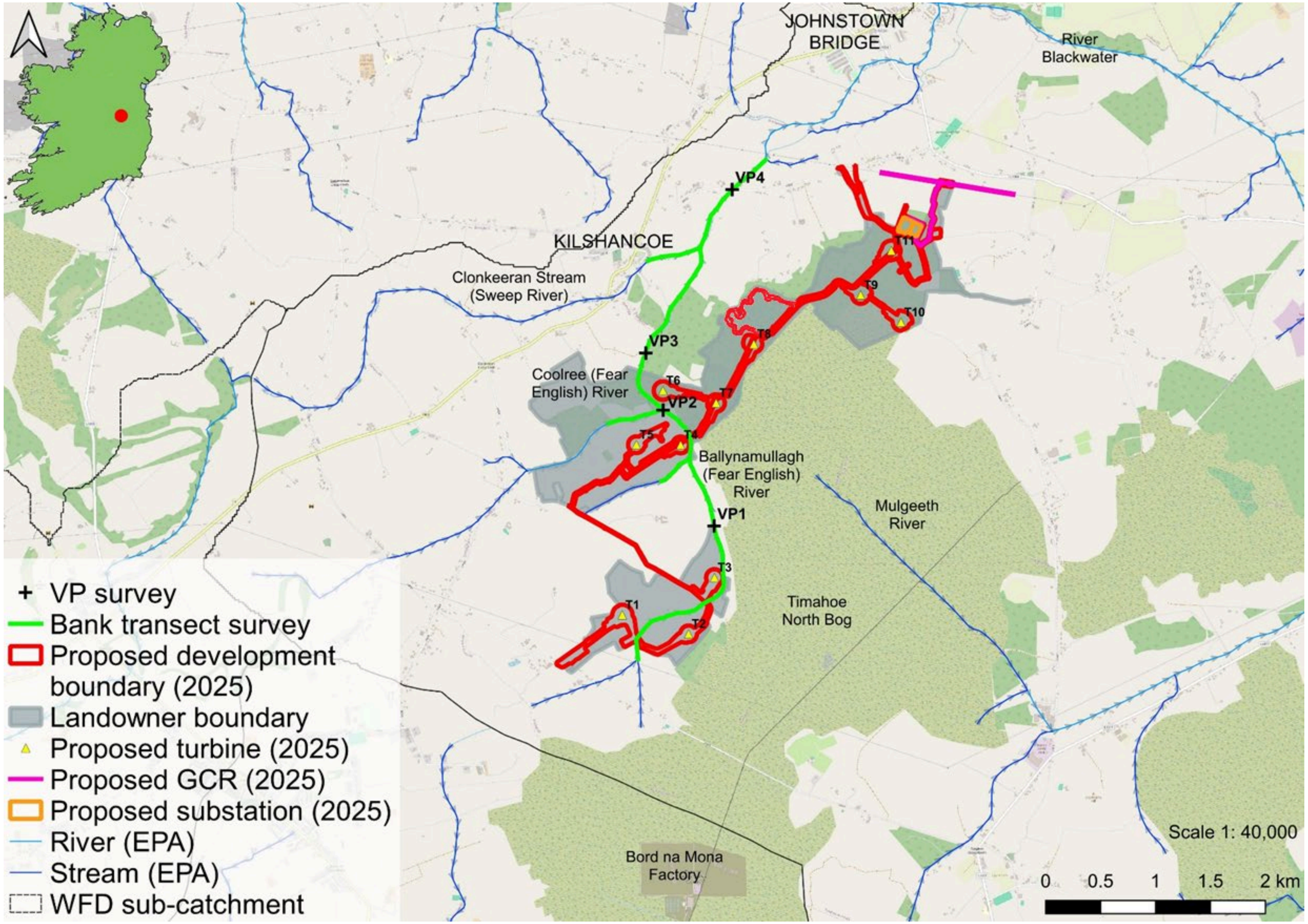

Figure 2.1 Overview of the kingfisher vantage point (VP) and bank transect survey areas in the vicinity of the proposed Drehid Wind Farm, 2022

3. Results

3.1 Desktop review

A desktop review revealed a low number of kingfisher records in the vicinity of the proposed project (contained within 10km grid square N73). Multiple long-term records (*n*=16) existed for grid square N73 (through which the Fear English River channel flows) over the 1981-2022 period (Bird Atlas data via the NBDC). Most of the records were concentrated in 2km grid square N73U near Johnstown Bridge, downstream of VP4 (Kilwarden Bridge).

Avifauna surveys for the Drehid wind farm development also recorded low numbers of kingfisher observations during the December 2012 to 2018 monitoring period (FTCO, 2018). Of these observations, one was recorded during breeding wader surveys in June 2017 and one during winter surveys in December 2017. These observations were made along the Fear English River (north-east of proposed turbine T9, outside of the proposed site boundary) and along drainage channels outside of the site boundary at Hortland, near the downstream-connecting River Blackwater.

A dedicated kingfisher survey undertaken in April-June 2019 recorded a total of 3 no. observations via VP surveys at four sites, in addition to 2 no. records during bank walkover surveys (Triturus, 2019).

No kingfisher breeding or nesting have been identified during previous avifauna surveys of the site.

3.2 Vantage point surveys

A total of 2 no. kingfisher observations were recorded during vantage point (VP) surveys on the Fear English River throughout the monitoring period and are summarised in **Table 3.1** and **Figure 3.1** below. VP surveys resulted in single observations on the 25th April (flying & perching) and 19th May 2022 visits (flying), at VP2 and VP4, respectively (**Table 3.1**). Birds were also recorded at these locations in October and May 2019, respectively (Triturus, 2019; **Figure 3.2**). No kingfishers were observed during the VP surveys in mid-April or mid-June.

3.3 Bank transect surveys

Bank transect surveys undertaken in August 2022 along approximately 6.9km length of riverine channel resulted in a total of 1 no. additional kingfisher observation (**Table 3.2, Figure 3.1**). An adult bird was recorded in flight along the Fear English River channel near the confluence of the Kilcooney River (aka Clonkeeran Stream) on the 15th August 2022.

No kingfisher nesting sites (active or inactive) were located during bank transect surveys in 2022 (this survey) or the 2019 surveys (Triturus, 2019).

Plate 3.1 Representative image of the Fear English River near VP1, August 2022

Plate 3.2 Representative image of the Fear English River at VP2, April 2022

Plate 3.3 Representative image of the Fear English River at VP3, April 2022 (heavily overgrown channel)

Plate 3.4 Representative image of the Fear English River at Kilwarden Bridge (VP4), April 2022 (upstream of road facing downstream from bridge)

Table 3.1 Kingfisher observations recorded during vantage point (VP) surveys on the Fear English River in the vicinity of Drehid wind farm, April-June 2022

VP site	Location	Date	Observation	Time	Notes
VP1	North of T3, Drehid	14th April 2022	No observations	n/a	
		25th April 2022	No observations	n/a	
		19th May 2022	No observations	n/a	
		13th June 2022	No observations	n/a	
VP2	South of T6, Drehid	14th April 2022	No observations	n/a	
		25th April 2022	**Sighting & perching**	**09:50**	**Single adult observed in flight, heading downstream; then perching on riparian branch (no foraging activity observed)**
		19th May 2022	No observations	n/a	
		13th June 2022	No observations	n/a	
VP3	Farm access bridge, Ballynamullagh	14th April 2022	No observations	n/a	
		25th April 2022	No observations	n/a	
		19th May 2022	No observations	n/a	
		13th June 2022	No observations	n/a	
VP4	Kilwarden Bridge	14th April 2022	No observations	n/a	
		25th April 2022	No observations	n/a	
		19th May 2022	**Sighting**	**08:05**	**Single adult observed in flight, heading upstream**
		13th June 2022	No observations	n/a	

Table 3.2 Kingfisher observations recorded during bank walkover surveys on watercourses in the vicinity of Drehid wind farm, August 2022

Location	Date	Observation	ITM x	ITM y	Notes
Kilcooney-Fear English River confluence	14th August 2022	Sighting	674559	737646	Bird in flight, heading downstream whilst vocalising. 50m south of Kilcooney-Fer English River confluence

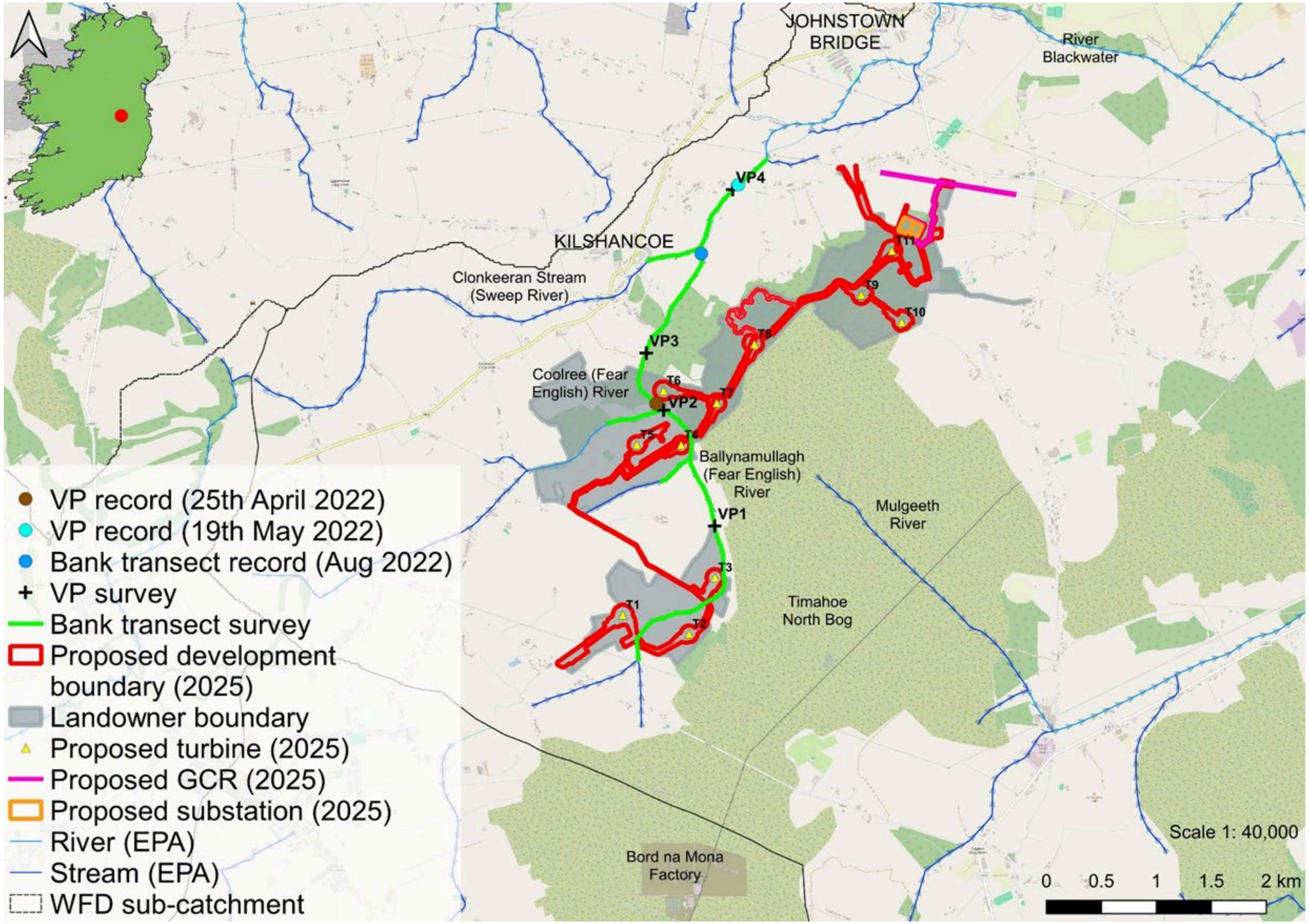

Figure 3.1 Kingfisher observations recorded during vantage point (VP) and bank transect surveys, April-August 2022

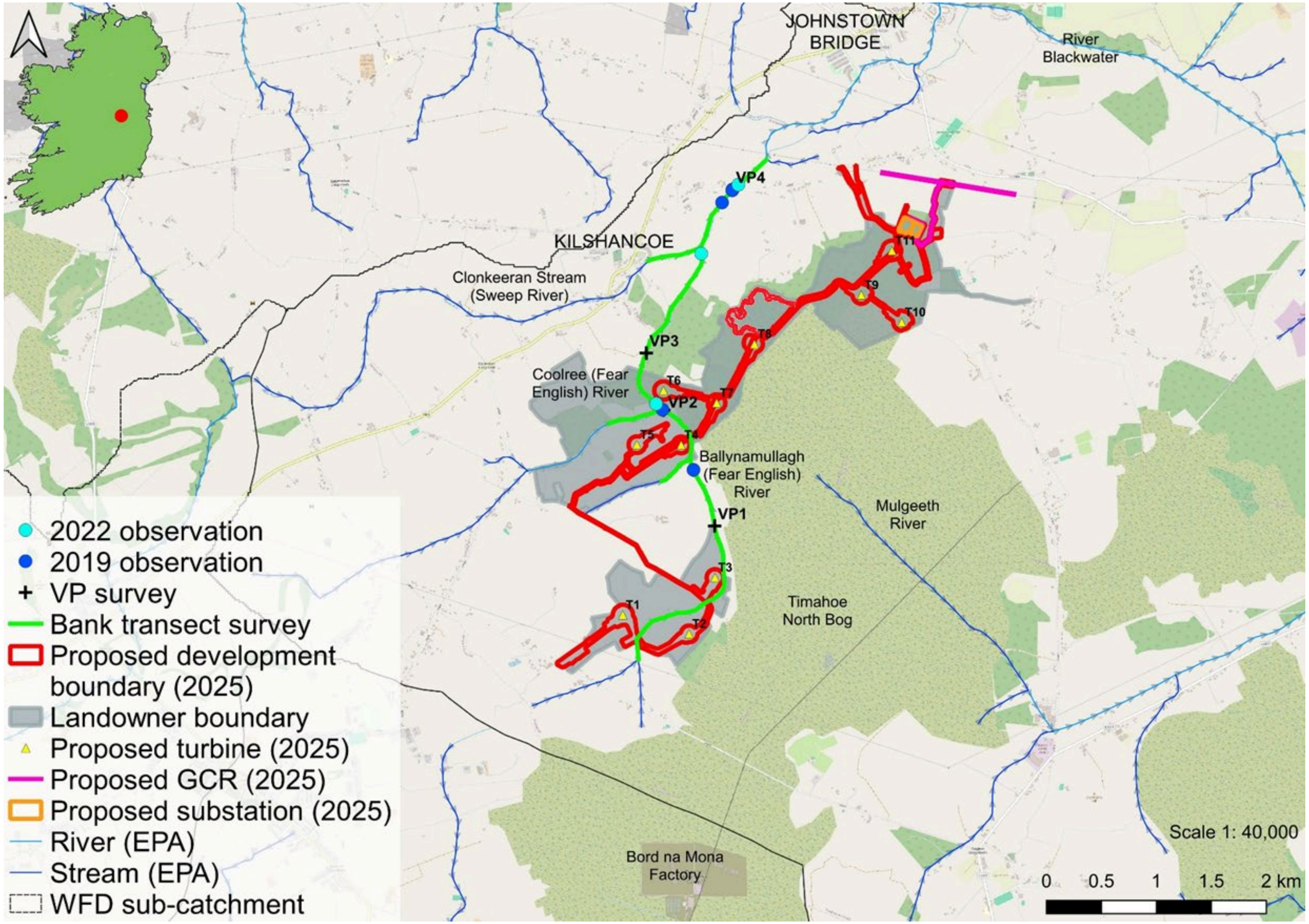

Figure 3.2 Comparison of kingfisher observations recorded during vantage point (VP) and bank transect surveys in 2019 and 2022

4. Discussion

In keeping with previous surveys of the site, a low number of kingfisher observations (3 no.) were made in the mid-April to August 2022 survey period in the vicinity of the proposed Drehid wind farm, through a combination of vantage point (VP) surveys and bank transects (the latter along 6.9km of channel). None of the 3 no. kingfisher observations recorded were within the proposed development boundary; the closest observation was of a perching adult bird near VP2, located approximately 130m south of proposed hardstanding area of turbine T6 (**Figure 3.1**).

Birds were recorded in April, May and August 2022 along the Fear English River[1] near VP2, VP4 (Kilwarden Bridge) and the confluence with the Kilcooney (Clonkeeran) River, respectively (**Figure 3.1**). The number of kingfisher observations in 2022 was slightly less than the 5 no. total recorded in 2019 (Triturus, 2019) but showed a similar distribution (**Figure 3.2**).

No bird sightings or kingfisher activity was recorded on the other adjoining, surveyed watercourses (as per previous surveys; Triturus, 2019; FTCO, 2018). As noted during previous surveys (Triturus, 2019), the Fear English River tributaries in vicinity of the proposed wind farm site, namely an unnamed stream, the Kilcooney River (Coolree Stream) or the Sweep River (Clonkeeran Stream), suffered from low summer flows during the survey period and provided relatively poor quality foraging habitat for kingfisher. Historical drainage (poor hydromorphology) and evident siltation pressures further reduced the suitability and value of these watercourses for kingfisher.

Water quality, availability of suitable perches and adequate fish populations are important in the overall suitability of river corridors for kingfishers (Cummins et al., 2010). There remains a paucity of fisheries data for the Fear English River and tributaries in the vicinity of the proposed site. The Kilcooney River (Coolree Stream), a tributary of the Fear English River, is known to support brown trout (*Salmon trutta*), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*), minnow (*Phoxinus phoxinus*) and brook lamprey (*Lampetra planeri*) (Ecofact, 2022, 2018). Walkover surveys in 2019 and 2022 confirmed the presence of brown trout in the Fear English River (at evidently low densities) and three-spined stickleback were recorded previously (Ecofact, 2018). Brook lamprey are likely present (given some localised suitability), along with minnow (pers. obs.).

Whilst kingfishers are opportunistic and typically predate on fish of 4cm to <10cm fork-length (Nessi et al., 2021; Vilches et al., 2019; Čech & Čech, 2011, 2015; Reynolds & Hinge, 1996), smaller species such as stickleback, stone loach and minnow are known to form major components of kingfisher diet (Raven, 1986), with smaller size classes (<5cm) particularly important for newly hatched chicks. A suitable prey resource would, therefore, appear to exist on the Fear English River in the vicinity of the proposed development, although foraging habitat is sub-optimal given the often heavily overgrown nature of the channel (reduces fisheries value and foraging ability of kingfisher), in addition to evident siltation pressures likely impacting fish recruitment (including salmonids and lamprey). The quality of fisheries habitat, and therefore kingfisher foraging habitat, is superior in the downstream connecting (Longwood) River Blackwater (approximately 3km downstream of site VP4).

[1] also known as the Ballynamullagh River and (further downstream) the Coolree River according to EPA nomenclature

No kingfisher nesting sites were identified within the study area during vantage point surveys or bank walkover surveys along 6.9km of riverine channel. The banks of the lower reaches of the Kilcooney and Sweep Rivers were typically steep (historically deepened) and heavily scrubbed-over. Some localised, largely-unvegetated areas of bank were recorded along the Fear English River, particularly along a straightened section near site VP2. However, no nests (active or inactive) were observed, despite kingfisher activity in the area.

Kingfishers usually require soft, loamy banks into which to dig their burrows (Heneberg, 2013; Cummins et al., 2010; Crowe et al., 2008; Boag, 1982) and typically choose fine-particulate banks of at least 1-2 metres high with near-vertical banks for nesting, with a slight preference for some emergent and or fringing vegetation (Heneberg, 2004, 2009). Soil compaction and particle composition are key drivers of kingfisher nest locations (Heneberg, 2004), in addition to bank slope angle (Ward et al., 1994). In general, although superficially suitable areas were present along the middle survey reaches of the Fear English channel, the soils of the historically excavated, sloping banks would appear to be too compacted for kingfisher. Indeed, no active kingfisher nests (breeding areas) have been identified in the vicinity of the proposed wind farm to date (this survey; Triturus, 2019; FTCO, 2018). In support of previous findings, the survey area is largely unsuitable for kingfisher nesting. Although kingfishers can adapt their nest site choice if other suitable conditions (i.e. prey availability, perching sites) are prevalent (Hopkins, 2001; Morgan & Glue, 1977), the watercourses within the vicinity of the proposed Drehid wind farm can be best considered as foraging habitat rather than a breeding area for kingfisher.

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FEHILY TIMONEY

DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

APPENDIX 9

Invasive Species Management Plan

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

DREHID WIND FARM AND SUBSTATION

Invasive Species Management Plan

Prepared for:
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Invasive Species Management Plan

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Final	DF/BOD/KB	BOD	JK	30/05/2025

Client: North Kildare Wind Farm Ltd.

Keywords: Invasive Species, North Kildare Wind Farm Ltd., Drehid Wind Farm and Substation, Sycamore, Cherry Laurel, Rhododendron, Snowberry, Butterfly-bush

Abstract: This document provides an Invasive Species Management Plan to provide guidance and strategies for the management of invasive plant species at the proposed Drehid Wind Farm and Substation, Co. Kildare.

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1. INTRODUCTION

North Kildare Wind Farm Ltd. has commissioned Fehily Timoney & Company (FT) to prepare an Invasive Species Management Plan as part of the proposed Drehid Wind Farm and Substation assessment. Fehily Timoney & Company (FT) has prepared this Invasive Species Management Plan (ISMP) to comply with Regulations 49 and 50, Schedule III of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 (not to cause the spread of non-native invasive plant species listed in the Third Schedule), and to ensure non-native invasive plant species not listed in the Third Schedule are not spread to adjacent lands or Natura 2000 (European) sites. The report details a programme for the monitoring and control of invasive species at and adjacent to the proposed project.

In total, five invasive/non-native species were recorded. Of these, one species (*Rhododendron ponticum*) is listed in the Third Schedule.

1.1 Legislative Context

In Ireland, the spread and propagation of species listed in the Third Schedule of S.I. No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 is an offence. Under Regulation 49 (2) - save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence. Under Regulation 50 it is an offence to transport a vector material listed in Part 3 of the Third Schedule except under licence.

1.2 Site Location and Description

The Proposed Wind Farm is wholly located in County Kildare and includes lands in the townlands of Ballynamullagh, Kilmurry, Killyon, Coolree, Mulgeeth and Drehid. The site is accessed from the M4 motorway until Enfield, then along the R402 for c. 7.7 km and finally along the local road (L5025) to the entrance of the site. The site lies c. 2.8 km south of the motorway M4 at Enfield and 1.2 km southeast of the regional road R402 linking the M4 to the R420 east of Tullamore in County Offaly.

The Proposed Substation, including the loop-in connection to the existing Kinnegad-Rinawade overhead line, is wholly located in County Kildare, within the townland of Coolree.

The site of the Proposed Wind Farm is located in relatively low-lying, relatively flat land with the majority of proposed turbines located beneath the 80 m contour line. The landcover is classified by Tailte Eireann's National Land Cover map as improved grassland, treelines, hedgerows, transitional forest, coniferous forest, broadleaved forest and woodland, mixed forest, scrub, bare peat, bare soil and disturbed ground, and artificial surfaces (forest roads). The east of the site is adjacent to a cutover bog (Timahoe Bog). The Fear English River bisects the site, flowing south to north before it enters the Blackwater River at Johnstown Bridge. The landscape is classified as being of low sensitivity from a landscape perspective.

The site of the Proposed Substation is located in commercial forestry at the northern extent of the wind farm site. The proposed loop-in connection to the existing overhead line is situated in agricultural lands, approximately 500m northeast of the Proposed Substation compound.

The Fear English River bisects the proposed development. This is the traditional local name for the river, however it is noted that the Fear English is comprised of two EPA-named watercourses, namely the Ballynamullagh and Coolree 07. The Fear English is a tributary of the River Blackwater (Longwood). The Blackwater is a main tributary of the River Boyne.

1.3 Relevant Guidance

The methodology and guidance for this management plan has been devised in consideration of the following relevant guidance:

- NRA, (2010) Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads. Revision 1, December 2010. National Roads Authority.
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- AM-SOP-009 Information and Guidance Document on Japanese Knotweed
- RAPID, 2018. Good Practice Management- Japanese Knotweed (*Fallopia japonica*).
- INNSA, 2017. Code of Practice – Managing Japanese Knotweed

A desktop study was carried out to identify existing records of invasive flora species both within and adjacent to the proposed Drehid Wind Farm and Substation assessment, as well as habitat suitability of the footprint of the development for the invasive species. This study allows the surveyor to narrow down the source of the species introduction and its likelihood of spreading. The following open sources of information were consulted:

- Invasive Alien Species in Ireland website (Invasives.ie, 2025)
- OSI Aerial photography and 1:50000 mapping
- National Parks and Wildlife Service (NPWS) web mapping (NPWS, 2025)
- National Biodiversity Data Centre (NBDC) web mapping (National Biodiversity Data Centre, 2025)
- Environmental Protection Agency (EPA) web mapping (EPA, 2025)

1.4 Surveys and Baseline

Detailed botanical surveys and habitat classification for the areas containing the Proposed Wind Farm, Substation , grid connection and TDR were completed. These surveys were completed during 19 - 21 September 2023, with additional follow-up surveys on 3 April and 30 September 2024.

During habitat surveys, a search for non-native invasive plant species was undertaken. The survey focused primarily on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended).

Desktop records

Historical records of invasive species plants from the relevant national datasets were assessed through the National Biodiversity Data Centre (search completed 25th April 2025). The invasive species listed in Table 1-1 have been recorded within the 10km grid square (N73) overlapping the main windfarm and substation site. A total of five invasive plant species have been recorded in this 10km grid square, of which two (Japanese knotweed (*Fallopia japonica*), and Rhododendron (*Rhododendron ponticum*)) are listed in Schedule III under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule.

Invasive species of flora recorded within 1km grid squares that overlap the grid connection route are also detailed in Table 1-1.

Table 1-1: Invasive Species within 10 km grid square N73 which encompasses the proposed Wind Farm site and Substation, and 1 km grid squares overlapping the Turbine Delivery Route (TDR) (Source: NBDC)

Common Name	Scientific Name	Year of Last Record	Location of Record	Legal status	Invasive Impact
Wind Farm/Substation					
Sycamore	*Acer pseudoplatanus*	2020	N765 384 – c. 380m north of Proposed Wind Farm	None	Medium Impact
Cherry Laurel	*Prunus laurocerasus*	2005	N710 345 - c. 2km west of Proposed Wind Farm	None	High Impact
Rhododendron	*Rhododendron ponticum*	2022	c. 100m east of Proposed Wind Farm/c. 170m north-east of T9 In woodland c. 25m from access track south of T8	Schedule III	High Impact
Japanese Knotweed	*Fallopia japonica*	2021	N733 393 - c. 2.8 km north-west of Proposed Wind Farm	Schedule III	High Impact
Butterfly-bush	*Buddleja davidii*	2019	N760 373 - overlapping existing access track north of T9 N766 375 & N766 374 - c. 230m south of proposed substation	None	Medium Impact

Common Name	Scientific Name	Year of Last Record	Location of Record	Legal status	Invasive Impact
TDR					
Cherry Laurel	*Prunus laurocerasus*	2005	N7134	None	High Impact
Sycamore	*Acer pseudoplatanus*	2005	N7134	None	Medium Impact

Invasive Species Recorded During Surveys

An individual Rhododendron bush c. 2m x 3m in extent was recorded in mixed broadleaved/conifer woodland adjacent to a section of proposed access track south of T8. This Schedule III invasive species was also recorded in conifer plantation c. 170m north-east of T9, as indicated by the desktop record.

Sycamore was recorded within mixed broadleaved/conifer woodland within the proposed substation footprint, and was noted to be common in open parts of recently replanted conifer plantation to the south of the proposed substation. It was also recorded in hedgerows at TDR points of interest.

Butterfly Bush was recorded along existing forestry tracks north of T9 and south of the proposed substation.

Cherry Laurel was recorded at two TDR points of interest (POI 1 & 3).

Snowberry (*Symphoricarpos albus*), another invasive species, was identified during ecological survey. This record is c. 15m from the proposed T7 - T8 access track. Snowberry is a medium impact invasive species.

Table 1-2: Invasive Species recorded onsite

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
Sycamore	*Acer pseudoplatanus*	In substation footprint and replanted conifer blocks in north of site TDR POIs: 5, 6, 7 & 14	None	Medium Impact
Cherry Laurel	*Prunus laurocerasus*	Existing Coillte entrance in north (adjacent domestic property boundary) TDR POIs: 1 & 3	None	High Impact
Rhododendron	*Rhododendron ponticum*	c. 100m east of Proposed Wind Farm/c. 170m north-east of T9	Schedule III	High Impact

Common Name	Scientific Name	Location of Record	Legal status	Invasive Impact
		In woodland c. 25m from access track south of T8		
Butterfly-bush	*Buddleja davidii*	N760 373 - overlapping existing access track north of T9 N766 375 & N766 374 - c. 230m south of proposed substation	None	Medium Impact
Snowberry	*Symphoricarpos albus*	ITM 0674913 0736546 - c. 15m from proposed T7 - T8 access track	None	Medium Impact

The locations of invasive species stands relative to proposed infrastructure are shown in Figure 1-1.

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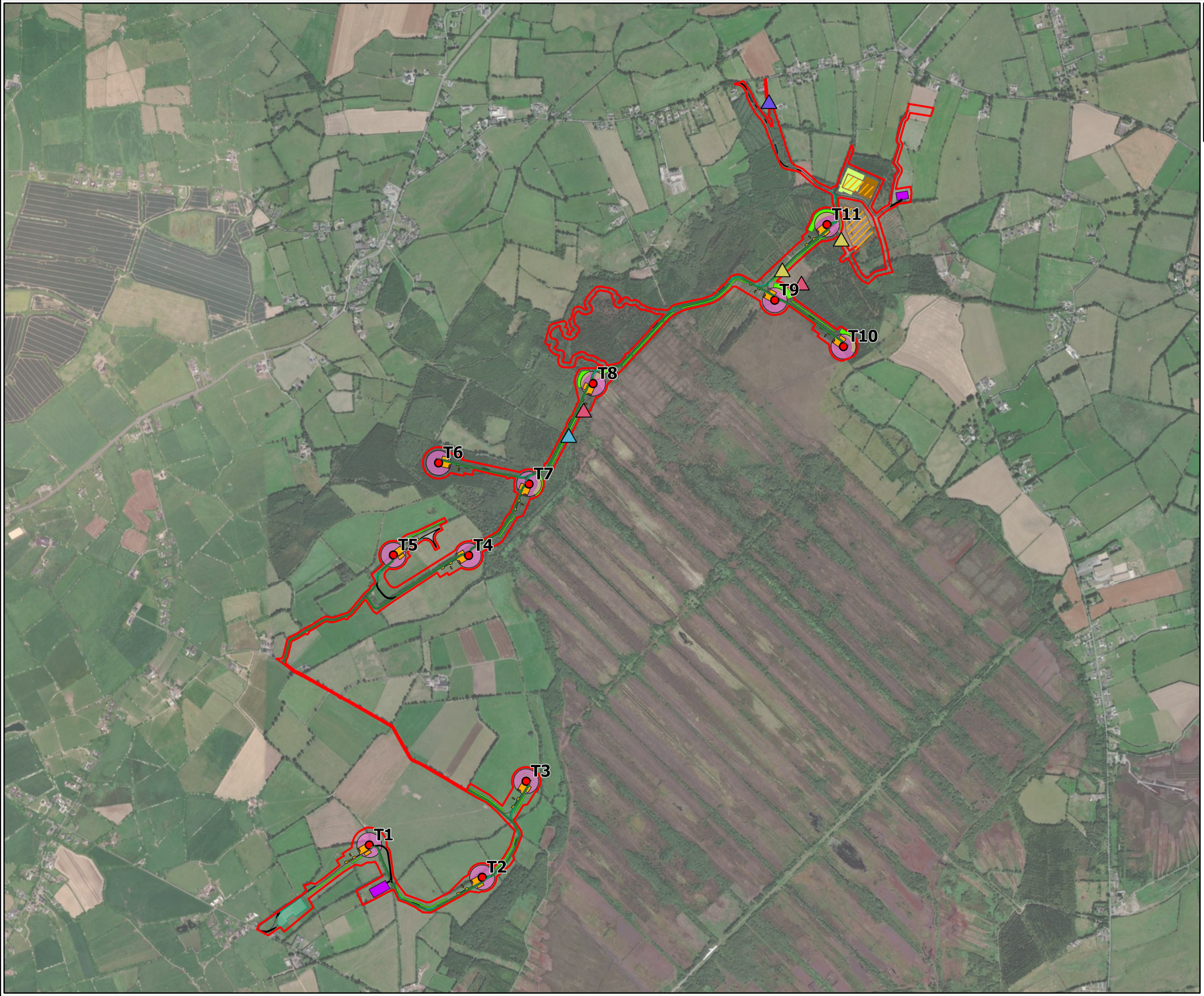

Legend

- Proposed Development Boundary
- Road widening - Access tracks
- Road widening - Temp. Access Tracks
- Access Track
- Temporary Access Track
- Blade Transfer Area
- Construction Compound
- Passing Bays
- Turbine Hardstanding
- Turbine Swept Path
- Berms
- Peat Deposition Area
- Substation
- Cable Route
- Turbines

Invasive Species

- Sycamore indicative extent
- Butterfly-bush
- Cherry Laurel
- Rhododendron ponticum
- Snowberry

TITLE: Invasive Species	
PROJECT: Drehid Wind Farm and Substation	
FIGURE NO: 1.1	
CLIENT: North Kildare Wind Farm Ltd.	
SCALE: 1:20,000	**REVISION:** 0
DATE: 10/06/2025	**PAGE SIZE:** A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

0 0.5 1 2 Kilometers

2. INVASIVE SPECIES ACCOUNTS

The International Union for Conservation of Nature (IUCN) in their 'IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species' 2000 report describes non-native invasive species (referred to as an invasive species) as:

> *"an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity".*

The five invasive/non-native species below were recorded within the proposed site. The species in bold are included in the Third Schedule, the remaining species are identified in Kelly et al., (2008). Accounts of these species, summaries of their ecology, distribution, growth, and management periods are included below.

- Sycamore (*Acer pseudoplatanus*)
- Cherry Laurel (*Prunus lauroceracus*)
- Rhododendron (*Rhododendron ponticum*)
- Butterfly Bush (*Buddleja davidii*)
- Snowberry (*Symphoricarpos albus*)

2.1 Sycamore (*Acer pseudoplatanus*)

2.1.1 Species Ecology

The sycamore tree can grow up to 35m tall and has a distinctive fruit with wings, which are the main mechanism through which this tree spreads. Originally it was thought to be damaging to native woodlands and to support a much narrower range of diversity than native species. However, it has been shown to support a wide range of lichens and other species. The principal concern would be sycamore dominated woodlands, though sycamore seedlings are out competed by ash under sycamore canopy and vice versa, suggesting that there is a pattern of succession in mixed woodlands. Undisturbed woodlands have relatively few trees compared to disturbed sites, even when sycamore trees are present at nearby sites. Poor growth in dry conditions suggests that careful management of forests can mitigate any effects of sycamore invasion. Sycamore is of medium invasive impact when growing in native woodland areas.

	
Bark on a mature tree.	Palmately lobed leaf with blunt teeth showing black spots.
	
Yellow-green flowers hanging in racemes.	Long-winged, hairless fruits hanging in pairs held at right angles.

Figure 2-1: Characteristic features of sycamore (Source: www.wikipedia.org and www.woodlandtrust.org.uk)

2.1.2 Timeframe

Control and disposal of plant material is best carried out in spring before seeds are produced. As is common with invasive species, careful monitoring and follow-up applications of herbicides may be necessary.

2.2 Cherry Laurel (*Prunus lauroceracus*)

2.2.1 Species Ecology

Cherry Laurel is an evergreen shrub can reach heights of 10m and forms dense thickets of either a single stem or multiple stems (especially if it has been trimmed). It has thick, 5-15cm long oblong-ovate leaves; glossy green on top surface and pale underneath. Leaves are arranged alternately on short leaf stalks and leaf edges are toothed with pointed tips. Small white fragrant flowers are held in clusters (racemes) and flowers are comprised of five petals and many yellow stamens. The clustered fruits are purple/black and cherry like and are eaten and dispersed by birds, this plant is also spread vegetatively via layering and suckering. Cherry Laurel is often found growing alongside *Rhododendron ponticum* in woodland and, like rhododendron, forms dark thick stands and local fauna do not eat it. This plant outgrows native species and shades them out. Cherry Laurel was initially planted as an ornamental shrub and has now spread across Ireland. Cherry Laurel has been assessed by the National Biodiversity Data Centre as having a risk of High Impact on native biodiversity.

Clusters of white flowers

This evergreen leaves alternate on stem with short leaf stalks.

Fruit in clusters.

Figure 2-2: Characteristic Features of Cherry Laurel (Source: www.kingcounty.gov)

2.2.2 Timeframe

Cherry Laurel can be cut down at any time of year; the herbicide glyphosate can also be applied throughout the year, however May to October inclusive is a sub-optimal period. Of principle concern when cutting and/or moving vegetation or surrounding soil is the movement of viable seeds. As such the optimal time for cutting is outside the flowering and fruiting period.

2.3 Rhododendron *(Rhododendron ponticum)*

2.3.1 Species Ecology

This densely branched evergreen shrub is widespread across Ireland and can grow to a height of 5m, producing purple flowers May-June. Leaves are 6-20cm long, dark green and shiny, elliptical to oblong in shape, untoothed and held in dense terminal clusters (racemes). It spreads through abundant seed dispersal and vegetative layering. Rhododendron is found on a wide variety of habitats, forming dense stands. It reduces native plant cover through competition for light and by releasing toxic chemicals produced by its roots into the surrounding soil. Also, rhododendron can host fellow invasive species *Phytophthora ramorum* (sudden oak death), which can affect several tree species. It has been assessed by the National Biodiversity Data Centre as having a high risk of impact on native Irish species.

	
Bell-shaped flowers.	Dark green and shiny leaves held in dense terminal racemes.

Figure 2-3: Characteristic features of rhododendron (Source: www.wildflowersofireland.net)

2.3.2 Timeframe

Rhododendron can be cut down at any time of year; the herbicide glyphosate can also be applied throughout the year, however May to October inclusive is a sub-optimal period. Of principle concern when cutting and/or moving vegetation or surrounding soil is the movement of viable seeds. As such the optimal time for cutting is outside the flowering and fruiting period.

2.4 Butterfly Bush (*Buddleja davidii*)

2.4.1 Species Ecology

The Butterfly Bush is a multi-stemmed shrub that can reach 4m in height. From June to September, the arching branches bear conical panicles of lilac flowers, which may occasionally be white, pink, red or purple. Leaves are long and serrated along the edges. In the winter, flower heads and seed capsules remain despite the plant being deciduous. Up to 3 million seeds are produced per plant and can remain dormant in the soil for many years. Butterfly Bush is common throughout Ireland. It spreads through abundant seed dispersal by wind and draught behind vehicles. While being a valuable source of nectar, especially for butterflies, it can cause structural damage to buildings by rooting in cracks in masonry. Butterfly Bush has been assessed as having a risk of Medium Impact to native biodiversity by the National Biodiversity Data Centre.

"Buddleja davidii Budleja Davida 2015-08-30 01" by Agnieszka Kwiecień, Nova is licensed under CC BY-SA 4.0.(https://commons.wikimedia.org/w/index.php?curid=64364967)

Figure 2-4: Flowers and leaves of Butterfly Bush

2.4.2 Timeframe

Optimal time for treatment and/or movement of material is outside of flowering and seed-bearing periods and treatment should be undertaken in winter and spring.

2.5 Snowberry (*Symphoricarpos albus*)

2.5.1 Species Ecology

Snowberry is a deciduous shrub that can grow up to 2.5m tall, producing small dense clusters of white flowers and white berry-like fruits. It is found in a wide variety of habitat types and spreads mainly by vegetative means through sprouting, but also by rhizomes and potentially by seeds dispersed by birds eating the fruits. Snowberry is found extensively throughout Ireland and impacts habitats and species as it forms dense thickets that outcompete native vegetation. Snowberry is classified by the National Biodiversity Data Centre as having a low risk of impact on native Irish species.

"J20171012-0029—Symphoricarpos albus var laevigatus—RPBG" by John Rusk is licensed under CC BY 2.0. (https://www.flickr.com/photos/12303842@N00/37092360283)

Figure 2-5: Snowberry berries and leaves

2.5.2 Timeframe

Snowberry comes into flower from June to September; their berries are ripe in Autumn. As such, the optimal time for treatment would be outside the flowering and fruiting period.

3. PROPOSED MEASURES FOR MANAGEMENT OF INVASIVE SPECIES

3.1 Recommended Measures

While it is extremely important and more efficient to contain invasive species at the point of infestation, care shall also be taken to ensure the management plan (Section 4) is adhered to ensure that invasive species are not spread outside the works area. Furthermore, none of these invasive species will be planted as part of landscaping the proposed project.

Invasive Species Ireland (ISI) notes that invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

Through prevention, early detection, rapid response, eradication, and control measures, we can reduce the risk of their introduction, establishment, spread, and impact (Invasives.ie, 2025).

Specific consideration will be given to particular locations, due to their potential for disturbance during works. As a general rule, where invasive species are within the footprint of proposed works, they must be contained and disposed of correctly. Where they are outside the proposed footprint, avoidance can be relied on where feasible to prevent their spread. As such, options for avoidance, control and removal are detailed below.

3.1.1 Prevention of spread within the works footprint

Prevention of the spread of invasive species will be achieved by:

- The full implementation of the invasive species management plan (Section 4) in conjunction with a competent and experienced Invasive Species Specialist Contractor.
- Supervision of control measures and treatment works by an appropriately qualified ecologist or invasive species specialist.
- Raising awareness to site workers via toolbox talks given by a suitably qualified person as part of site inductions; informing workers what to look out for and what procedure to follow if they observe an invasive species.
- Only planting or sowing native species within the proposed project lands will be allowed.
- Where invasive species have been physically removed and soil disturbed, this soil will be seeded or replanted (including 5cm deep mulch) with native plant species. This will prevent erosion and the easy colonisation of bare soil by invasive species in the area.
- Unwanted material originating from the site (including soil, rhizomes and other material) will immediately be transported off site by an appropriately licensed waste contractor and disposed of properly at a suitably licenced facility, in accordance with the (NRA, 2010) guidelines, i.e., where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains rhizomes, flower heads or seeds will be disposed to licensed landfill. All disposals will be carried out in accordance with the Waste Management Acts.
- Signs will warn people working within the site that there is invasive species contamination.
- Ensure appropriate biosecurity measure are in place; these will include the Check Clean Dry method, along with those outlined below:
    - Remove the build-up of soil on equipment
    - Keep equipment clean

  - Do not move fouled equipment from one site to another
  - Footwear and clothing of operatives working near invasive species should be checked for seeds, fruits, knotweed rhizomes or other viable material before exiting invasive species control zones and/or the site
  - All vehicles exiting the site will be examined to prevent the transport of rhizomes, seeds and other plant material.
- Follow instructions provided for containment of invasive species (Section 3.2).

3.2 Containment

The three most common ways a site can become infested are:

- Importation of infested soil.
- Contamination on vehicles and equipment.
- Illegal dumping.

Containment of invasive species will be achieved by:

- A pre-construction survey to reconfirm the findings of the baseline survey during the growing season immediately prior to the construction phase. This will mark out the extent of invasive plant species. This survey shall inform the finalised draft of the invasive species management plan prior to the commencement of works. Prior to the construction phase, invasive species are to be treated (Section 3.4 for treatment methods).
- A licensed invasive species contractor shall be engaged to remove invasive plant species prior to development.
- Cordoning of invasive species outside the works footprint shall include a buffer of 1m the area of infestation. When larger buffers are required, this shall be specified in Section 3.4. This will prevent plants with underground rhizomes being transported to other sections of the site and it will also prevent contact with plants which could result in the transport of seed, fruit or vegetation to other parts of the site. No construction works will occur within exclusion zones prior to the eradication of invasive species.
- No contaminated soil (soil containing non-native invasive species material) or vegetation shall be removed from site unless proper biosecurity (Refer to Section 3.1 above) is observed and removal to a suitably licenced facility is carried out by an appropriately licensed waste contractor.
- New sightings of the invasive plant species identified at the proposed site shall be relayed to the contractor for invasive species control. These areas shall follow the same protocol as the current infected areas.
- It is possible, particularly in the first year of control, that new plants will sprout following the initial removal/treatment, either because shade suppression will be reduced or due to soil disturbance. As such, several additional visits will likely be required. Three visits, during May/June, July/August and September/October should be sufficient to catch all regrowth, although a cautionary approach is advisable and pending the outcome of initial visits, further monitoring and control measures may be required.

3.3 Limitation on Herbicide Use

Where a risk of transport of herbicide into the hydrological network exists, prioritisation of physical control over chemical methods must guide management strategies.

It is recommended to avoid spraying as an application method near rivers and drains, instead favouring application using 'weed wipers' or direct injection if herbicides are deemed necessary.

Any herbicides used near rivers or drains must be DAFM approved and also non-toxic to aquatic life.

3.4 Species-specific Measures

3.4.1 Sycamore (*Acer pseudoplatanus*)

Sycamore was recorded within mixed broadleaved/conifer woodland within the proposed substation footprint, and was noted to be common in open parts of recently replanted conifer plantation to the south of the proposed substation. It was also recorded in hedgerows at TDR points of interest (See Figure 1-1).

General site-wide control measures are not required; however, Sycamore should not be planted as part of landscaping. Control will instead focus on the correct disposal of cut material in areas where sycamore felling and trimming is required. Sycamore reproductive plant material is required to be carefully disposed of.

Any machinery used in areas infested by sycamore will be washed down thoroughly before exiting the area to ensure vector material is not transported to other parts of the site. Similarly, footwear and clothing of operatives working in areas of sycamore infestation will be checked and cleaned prior to exiting the area.

The contractor must appropriately dispose of Sycamore plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

3.4.2 Cherry Laurel (*Prunus laurocerasus*)

Cherry Laurel was recorded at two TDR points of interest (POI 1 & 3) (See Figure 1-1).

The following general recommendations will also be adhered to as part of the plan:

- A buffer of 1m will be left around the individual Cherry Laurel plants to prevent damage to the plant which can result in the production of new stems which can make the plant more difficult to treat. Staff shall be made aware of this buffer zone when working within areas of infestation.
- Construction works will only be allowed within exclusion zones once the species has been fully eradicated.
- No treatment measures are to take place in these areas without supervision and agreement by the appointed invasive species specialist.
- Cherry laurel plant contains cyanide and as per good practice will only be handled with gloves. This plant will be disposed of via an appropriately licensed waste facility.
- Equipment, clothing and footwear will be checked following treatment operations or work in the vicinity of the species and cleared of fruits/seeds as necessary.

Four options for the treatment of Cherry Laurel have been proposed. Any one or a combination of these four options can be used to eradicate Cherry Laurel from the site and avoid the spread of the species.

3.4.2.1 Option 1 – Cut to stump and dig out stump

This method involves cutting the main stem of the plant down near ground level and digging out the stump and any visible roots. This option is not usually practical in areas where there are other invasive plants present as the disturbed soil can allow for the setting of seeds or the spread of rhizomes of adjacent species (ISI, 2012b).

3.4.2.2 Option 2 – Cut to stump and treat stump with herbicide

This method involves cutting the main stem of the plant down near ground level and applying herbicide to the freshly cut stump.

The herbicide concentrations used, and timings of applications vary according to which chemical is used. When treating many stems, vegetable dye added to herbicide is useful for highlighting the stems that have and haven't been treated. The use of a brush or other such applicator will provide an accurate application and prevent damaging adjacent non-target plants via spray drift. Please see table below for best treatment time (ISI, 2012b).

3.4.2.3 Option 3 – Cut to main stem and inject stem with glyphosate

This method involves the 'drill and drop' method where the main stem is cut, and a hole drilled into the cut. This provides a targeted application of glyphosate (25% solution). The main drawback to this technique is that the plant is left in place to rot away; which can take a decade or more. Please see table below for best treatment time (ISI, 2012b).

3.4.2.4 Option 4 - Cut back to stump and spray regrowth with chemicals

This application involves cutting a main stem down near ground level and then treating the new stems with herbicide. This method is the least effective as some stems may be missed and not treated. Also, the application of herbicide is generally via spraying which can result in adjacent non-target plants being killed off. Please see table below for best treatment time (ISI, 2012b).

The contractor must appropriately dispose of excavated waste, including soils containing Cherry Laurel plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 2m, or by incineration (having regard to relevant legislation, including: Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; and relevant local authority byelaws) or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

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.

Figure 3-1: Best time for the treatment of Cherry Laurel and Rhododendron (ISI, 2012b)

3.4.3 Rhododendron (*Rhododendron ponticum*)

An individual Rhododendron bush c. 2m x 3m in extent was recorded in mixed broadleaved/conifer woodland adjacent to a section of the proposed hard stand south of T8 (located 8.5m from T8 hardstand felling buffer) (See Figure 1-1). This Schedule III invasive species was also recorded in conifer plantation c. 170m north-east of T9.

It is recommended to eradicate Rhododendron from the area near T8 prior to construction to prevent infestation of the proposed wind farm during the operational phase.

A combined methodology of both physical removal (cutting/uprooting of plants) and chemical control during March, April or October (inject or paint stump with herbicide) can be used for the removal of this species may use. Good hygiene practices such as wheel and bucket washes and inspection of footwear should be undertaken during eradication operations.

The treatment options provided above for Cherry Laurel in section 3.4.2 also to apply Rhododendron. Any one or a combination of these four options can be used to eradicate Rhododendron from the site and avoid the spread of the species.

As per the Schedule of Commitments the contractor must appropriately dispose of excavated rhododendron plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 2m, or by incineration (having regard to relevant legislation, including: Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; and relevant local authority byelaws) or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

It should be noted that Schedule III species plant material cannot be moved offsite without a licence from the NPWS.

3.4.4 Butterfly Bush (*Buddleja davidii*)

Butterfly Bush was recorded along existing forestry tracks north of T9 and south of the proposed substation (See Figure 1-1).

3.4.4.1 Control

This species is likely to spread within the area regardless of potential transport by humans, due to its mode of spread (by wind). Nonetheless, efforts will be taken to prevent the spread of this species as follows:

- This plant is a prolific seeder and can reproduce vegetatively from cut stems. Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.
- Disturbing ripe seed heads will be avoided during the turbine delivery by implementing an exclusion zone;
- Bags will be placed over the flower spikes where required to avoid dislodging and spreading seeds during the turbine delivery;
- Machinery will be checked for the presence of seed to avoid accidental transportation.

- The disturbance of soil provides the ideal circumstances for the seeds of this plant to germinate. Where any invasive species are physically removed from the ground (resulting in disturbance of soil), the soil will be covered with other material, re-seeded or planted (including 5cm high bark mulch) as soon is appropriate.

3.4.4.2 Treatment

Three options for the treatment of Butterfly-bush at the site are proposed. Any one or a combination of these three options may be used to eradicate Butterfly-bush from the site and avoid the spread of the species. However, the following general recommendations will be adhered to as part of the plan:

3.4.4.2.1 Option 1 – digging plant up/grubbing

While uprooting of young plants is possible, soil disturbance should be minimised (bare soil is an optimum environment for seed growth). Digging up of more mature plants is possible, however, it is important to plant the ground and have good groundcover as soon as is possible otherwise the seedlings of this plant will grow. All stems should also be removed as they can root to produce another plant (NRA, 2010).

3.4.4.2.2 Option 2 Cutting stump to near ground level and treating with herbicide

This option entails cutting the main stem of the plant down to near ground level and treating (brush on) the freshly cut stump with herbicide. This should be carried out during the growing season (NRA, 2010).

3.4.4.2.3 Option 3 – Foliar application of herbicide

During the growing season leaves should be sprayed with either triclopyr or glyphosate. This option is ideal for infestations comprised of young pants and treatment should be carried out at 6 monthly intervals. (NRA, 2010)

Herbicide should not be sprayed in or adjacent to rare plant receptor sites.

As per the Schedule of Commitments the contractor must appropriately dispose of butterfly-bush plant material and soil containing plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 0.5m, or by incineration (having regard to relevant legislation, including: Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; and relevant local authority byelaws) or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

3.4.5 Snowberry (*Symphoricarpos albus*)

Snowberry (*Symphoricarpos albus*) was identified c. 15m from the proposed T7 - T8 access track (See Figure 1-1). If the current baseline persists, interaction with works is unlikely. Identification and cordoning of the infested area is required to ensure no construction access occurs.

Due to close proximity, the following recommendations will be adhered to, and one option is proposed for treatment:

- Snowberry is spread both by seed and suckering stems. A buffer area of 1m will be cordoned to alert site staff to their presence and prevent contact with plants, which could cause seeds to fall or become attached to machinery or people. Disturbed seeds may result in the propagation of a new snowberry population elsewhere.

- All staff shall be made aware of nature of threat via toolbox talks as part of site inductions. Toolbox talks shall be undertaken with all personnel accessing the site to ensure that the details of the invasive species management plan are adhered to and to raise awareness of the potential treat of invasive species.
- Areas of infestation will be fenced off from other works areas including a buffering distance of 1m to create exclusion zones.
- Construction works will not be allowed within exclusion zones until the species has been fully removed but may continue outside of these areas.
- No treatment measures to take place in these areas without supervision and agreement by appointed eradication specialist.
- All machinery and vehicles operating within areas of infestation to be thoroughly checked and if necessary, cleaned prior to leaving the area to protect against further spreading of snowberry.
- No material shall be taken from areas of infestation, unless for disposal. All material will be transported by an appropriately licensed waste contractor and received by an appropriately licensed facility.
- If operating within an area of known infestation all machinery, vehicles, equipment, footwear and clothing will need to be cleaned thoroughly (if necessary, using steam cleaners) in a contained area to avoid further contamination.

3.4.5.1 Option 1: Physical control

Excavation of the entire root system is considered to be an effective method of snowberry control. This must be done before the plants' seeds ripen in autumn. Plant matter from this process can be disposed of at a licenced landfill site.

Any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines. Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

4. MANAGEMENT PLAN

The management of any invasive species is achieved by the assessment and mapping of the invasive species, containment once found, continual monitoring and record keeping as well as the safe disposal of invasive species material. It is recommended that surveys be carried out periodically at the site to monitor the extent of invasive flora and the success of the control and management measures. These can be carried out by FT, or a contractor specialised in invasive flora treatment. Monitoring shall continue during the construction period and as part of post construction monitoring to ensure successful control has been achieved. All invasive species which occur within the area utilised by people and machinery during the proposed construction works will be controlled/removed from the works area before commencement of works.

4.1 Containment

For the efficient use of resources, namely financial and physical effort, it is important to prevent the further spread of invasive species. Containment will be achieved using measure outlined in Section 3 and those presented below:

- Landholder to be informed of location of the invasive species and the management plan.
- Ensure anyone treating the infestation is a suitably qualified trained professional who follows the management plan.
- The site will be re-surveyed prior to treatment/construction works to confirm the findings of the original survey.

4.2 Schedule

Periodic re-surveying for all invasive species will be required, to ensure that treatment measures were effective, and to trigger further treatment if necessary. Refer to Table 4-1.

Please note that the schedule may require amendment following any given site visit.

Table 4-1: Schedule for Management of Invasive Species

Time	Details of Measures
Pre-construction (isolation of invasive species)	• A pre-construction survey (to reconfirm the findings of the initial survey) will be undertaken during the growing season to mark out the extent of invasive species within the footprint of the project prior to any works commencing on-site. • All invasive species observed shall include a suitable buffer (see Section 3.4) surrounding the area of infestation. This will prevent plants with underground rhizomes being transported to other sections of the site and it will also prevent contact with plants, which could result in the transport of seed, fruit or vegetation. • Treatment of invasive species using one or more of the treatment options proposed in Section 3. • Only once treatment has been completed and invasive species have been removed from within the area of works will works commence. • Toolbox talks on invasive species shall be given to all personnel accessing the site.

Time	Details of Measures
	• Disposal of all cut and excavated plant matter, if chosen to be processed off-site, must be done so through a licenced waste processor. Adequate licences may also be required for the transportation of Schedule III plant matter.
During Construction	• Following treatment, site to be monitored for signs of regrowth/spread to new areas. • Toolbox talks shall be given to all personnel accessing the site, informing them of the locations of the invasive species and instructing them not to enter these areas (unless they are licensed invasive species contractors or ecologists). • Designated curtailment areas will be demarcated for the transport of invasive species offsite. • Machinery to be used in the control of invasive species will be itemised, and only that specific machinery will be used for excavation/control measures. • The build-up of soil on equipment will be removed and fouled equipment will not be moved between sites, or between the curtailment area (demarcated areas with invasive species and for transport of invasives)/clean down area and the rest of the site. • Footwear and clothing of operatives working near invasive species will be checked for rhizomes, seeds, fruits, or other viable material before exiting the site. Boot brushes will also be utilised. • All vehicles exiting the site will be examined to prevent the transport of seeds/rhizomes/plant material. • If re-growth of invasive species is discovered, further treatment/control will be completed using the treatment methods detailed in Section 3. • Site to be monitored during works for signs of regrowth of all invasive species.
Post Construction	For 5 years following construction, site to be monitored annually for signs of regrowth of invasive species, triggering further control measures as required. Any maintenance work requiring clearance of vegetation will require an invasive species survey and if required control/eradication measures for the area being accessed prior to works.

4.3 Mapping, Evaluation and Record Keeping

During the preconstruction and construction phases the following will take place before control measures:

- Check that the area of infestation is still cordoned off and a warning/information sign is still in place
- Photographs of the area(s) of invasive species infestation
- Map the extent via recording GPS coordinates and measure the length and width of infestation (including above and below ground rhizome growth) and plot on map
- Evaluate the status/condition of the infestation
- Make sure the above steps are recorded

At the end of each site visit the recorded data should be compared with the findings of this report. Preparation of a short report on the progress of treatment following treatment works, and any subsequent monitoring.

4.4 Appropriate Disposal

4.4.1 Storage

All cut and excavated plant matter will be stored securely in line with the relevant treatment methodology. If invasive species vector material is required to be stored on site, it will be stored in a secure designated area with signage within the boundary of the proposed flood relief scheme.

4.4.2 Disposal

Disposal of plant matter and soil off-site will be completed through an appropriately licenced haulier and waste facility.

Disposal of any Schedule III plant material onsite will be completed in accordance with measures to ensure disposal does not lead to further spread of the species (see Section 3.4).

5. DISCUSSION AND CONCLUSION

There is a legal obligation not to spread plants listed on the Third Schedule of Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021; the relevant species at the proposed site and therefore that of principal concern is Rhododendron. The Rhododendron growth near T8 should be eradicated to prevent infestation of the proposed wind farm during the operational phase. The other growth (100m east of Proposed Wind Farm/c. 170m north-east of T9) should be monitored to ensure any potential for infestation of the proposed development from this source is detected in a timely manner.

A competent and experienced invasive species management contractor is required to be appointed to treat and control invasive species. A dedicated invasive species survey will be undertaken by the appointed contractor to re-confirm the findings of the previous survey and to identify any new areas of infestation or invasive species.

Both infested and treated areas will be appropriately demarcated and signed to prevent access by unauthorised personnel. Additionally, appropriate biosecurity measures to prevent spread of invasive species are required, as detailed in Section 3.

As noted in Section 4.2, surveys and if required treatment measures will be required if vegetation clearance or other works are required for maintenance.

5.1 Conclusion

The report details a programme for the mapping and control of invasive species at the proposed Drehid Wind Farm Site, proposed substation and TDR.

The plan will prevent the spread of identified non-native invasive species within and from any works areas and reduce the potential risk for the introduction and/or spread of new invasive species within the site pre, during and post construction.

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