Oweninny Wind Farm Phase 3

Environmental Impact Assessment Report

Appendix 9.3 Peat Management Plan

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BUILT ON KNOWLEDGE

Bord na Móna

OWENINNY WIND FARM
Phase 3

Peat Management Plan

OWENINNY WIND FARM – Phase 3

PEAT MANAGEMENT PLAN

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TOBIN Consulting Engineers

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1.0 INTRODUCTION

The proposed Oweninny Wind Farm Phase 3 development is located on Bord na Móna lands at Bellacorick, in North County Mayo, located north of the N59 national road (see Figure 1-1)

In 1992, Bord na Móna Energy Limited established Ireland's first commercial wind farm on the cutover blanket bog at Bellacorick. In the past, the main activity in the surrounding area was peat harvesting (Bord na Móna), however peat extraction has ceased since 2003. The peat-burning power station at Bellacorick burned milled peat from the surrounding bogland from 1962 until it was decommissioned in 2004 (the cooling tower was demolished in 2007).

Peat is defined as the partially decomposed remains of plants and soil organisms which have accumulated at the surface of the soil profile. Active peatlands are traditionally described using a simple 2-layer model; the acrotelm including active peat vegetation and catotelm. Sections of the proposed development are located in areas of cutaway bog with much of the peat on site being predominantly drained catotelm on flat or gently sloping lands. It is proposed to manage peat within the site boundaries. There are limited areas of peat instability identified on the Phase 3 site and these will be appropriately monitored and avoided for development where possible.

1.1 OBJECTIVE

The role of the Spoil/Peat Management Plan (SPMP) is to demonstrate that the management of peat excavated during construction of the proposed project has been considered and will be treated appropriately during the construction process.

This SPMP also includes a monitoring programme which will be implemented during the construction phase of the wind farm and a contingency plan should peat instability/failure occur at the site. The SPMP acts as a live document arising from information presented during the consenting process, planning conditions and the content of which will be updated as work is carried out on site.

The SPMP contains some 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 9 (Hydrology and Hydrogeology) of the EIAR and within the Construction and Environmental Management Plan (CEMP) Appendix 3.1 of the EIAR.

The SPMP outlines the overall design approach that has been applied to the proposed project to minimise peatland disruption and aims to ensure that all opportunities to minimise peat disturbance and extraction during construction will be taken. The SMP identifies appropriate and industry proven methods for the reuse of excess peat to restore the effects of construction activities, without significant environmental or health and safety implications, to reduce the release of carbon and minimise risk in terms of human health.

The proposed development will comprise:

- 18 no. wind turbines;
- Decommissioning and removal of 21 no. existing Bellacorick Wind Farm wind turbines;
- New internal site access roads, passing bays, car parking and associated drainage;
- An amenity route through the site to the existing Visitors Centre with access from a local road off the N59 near Dooleeg;
- Two. borrow pits;

- Five peat deposition areas;
- Construction compounds;
- 110kV electrical substation compound;
- All associated underground electrical and communications cabling;
- All related site works and ancillary development including (but not limited to):
    - Earthworks;
    - Peat management works;
    - Site security;
    - Groundwater and surface water management;
    - Overburden (soils/peat) storage and management; and
    - Site reinstatement, landscaping and erosion control.
- A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

In addition, there will be a requirement for improvements and temporary modifications to public road infrastructure to facilitate the delivery of abnormal loads.

1.2 GUIDANCE

The legislation and guidance regarding the management of peat includes:

- Scottish Environment Protection Agency (SEPA), Regulatory Position Statement – Developments on Peat (2010);
- Scottish Government, Guidance on Developments on Peatland – Site Surveys (2014);
- Floating Roads on Peat, Scottish Natural Heritage (2011); and
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Scottish Renewables and SEPA (2014).

The following guidance specifically relates to wind farm construction and peatland:

- Investigating the impacts of wind farm development on peatlands in England: Part 1 Final Report (2011);
- Best Practice Guidance to Planning Policy Statement 'Renewable Energy' (2009);
- Wind Farm Developments on Peat Land fact sheet. Scottish Government (2011); and
- Good practice during wind farm construction, A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland. (2019).

Many of the publications listed above have been developed by the Scottish Government. The Scottish documents are considered to be best practice in Ireland and are therefore appropriate for use within this SPMP.

The guidance identifies three main stages in the development process and describes what data should be gathered and assessed at each to inform a site specific SPMP:

- Stage 1: Environmental Impact Assessment (EIA);
- Stage 2: Post-consent / pre-construction; and
- Stage 3: Construction.

This SPMP has been prepared in accordance with the principles in the guidance for Stage 1 and proposes that prevention and re-use are the most appropriate means of managing peat excavated during construction at this site. This report details the methodologies required to assess all potential surplus materials and presents the expected volume of excavated materials and required reuse volumes for reinstatement and restoration purposes.

1.3 PEAT DESCRIPTION

Organic material less than 0.5m depth is not defined as peat. This is in accordance with guidance from:

- Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland states that *'Peat soil is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness'*; and
- The James Hutton Institute define shallow peat as having *'a prescribed depth of organic matter of 50 – 100 cm*[1]*'*

Also, The Forestry Commission use 45 cm as the critical depth for peat to occur (*Understanding the greenhouse gas (GHG) implications of forestry on peat soils in Scotland*, 2010[2]);

- Peat can therefore be classified as organic material over 0.5m in depth.

Peat can be separated into three main layers: acrotelm (the upper living layer), catotelm (the middle to lower layer) and occasionally amorphous (lower layer) peat:

- Acrotelm peat is the living layer of the peat including the peat turf or turve being a thin, floating vegetation mat layer. The acrotelm is found within the top layer of peat (often less than 0.5m) depending on the degree of decomposition and fibrous nature of the peat (H1 to H6 on the von post classification scale). The acrotelm is generally of high permeability, decreasing with depth. The water table fluctuates in this layer and conditions vary from aerobic to anaerobic. Material may be fibrous or pseudofibrous (plant remains recognisable), spongy, and when excavated strength is lost but retains integral structure and can stand unsupported when stockpiled >1m.
- Catotelm peat is the dead layer of peat found deeper than acrotelm peat which has some remnant plant structures. Material has high water content and is permanently below the water table (saturated) therefore organic matter decomposes anaerobically. Some plant structures may be recognisable but are highly humified losing most of their characteristics (approximately H6 to H9 on the von post classification scale) and strength. Water flow in the catotelm is slow unless peat structures such as sink holes or peat pipes are present.

The best management option to minimise potential surplus peat is to prevent its production. Therefore, the design of the project has aimed to minimise peat excavation where possible. Discussion of design considerations to avoid deeper areas of peat is included in Appendix 9-4: Peat Stability Risk Assessment and Chapter 3: Consideration of Alternatives of this EIAR.

[1] https://www.hutton.ac.uk/learning/exploringscotland/soils/organicsoils

[2] https://www.forestresearch.gov.uk/publications/understanding-the-greenhouse-gas-ghg-implications-of-forestry-on-peat-soils-in-scotland/

SEPA has provided a hierarchy of management approaches in which the effectiveness of the approach to peat management is optimised at development sites as summarised below (SEPA 2010, SEPA 2012):

1. prevention: avoiding generating excess peat during construction (e.g., by avoiding peat areas or by using construction methods that do not require excavation such as floating tracks);
2. re-use: use peat produced on site in habitat restoration of hardstanding or landscaping;
3. recycling/recovery/treatment: modify peat produced on site for use as fuel, or as a compost/soil conditioner, or dewater peat to improve its mechanical properties in support of re-use; and
4. storage: temporarily store peat on-site (for example, during short periods in the construction phase) and then re-use.

In relation to the SEPA guidance the following has been applied to the design and construction of the proposed project:

1. Floating tracks are proposed along access tracks with suitable gradients;
2. Reuse of material is proposed for landscaping and restoration of borrow pits;
3. Recycling/recovery is not appropriate on this site; and
4. Temporary storage and reuse are proposed (outside of borrow pits).

1.3.1 Peat Conditions on Site

The site was assessed for peat vegetation in desktop review of maps and plans, previous SI data, site walkovers by ecologists and hydrologists in 2020 to 2023; and in intrusive site investigation in terms of peat depth probing and coring across the proposed wind farm site and access track routes.

The proposed wind farm site area concerned covers approximately 2282 ha. It ranges in altitude between just over 75 and 130 mOD. The site is characterised by drained peatland with streams, ponds and lakes in topographical depressions.

The land cover for the site comprises of cutover peatland with coniferous forestry and intact peat in the surrounding area. The peatland areas are drained blanket peat mostly with some marginally areas. Forestry is absent from the development area. The peat overlies sandy till and sand/gravel. Areas of gravel and sandy till are evident as shown in Photo 1 below.

Photo 1 View southwest to Oweninny Phase 1 and Furnought hill

1.3.2 Peat Survey Methodology

To obtain a detailed understanding of the spatial and depth distribution of peat and its properties, a series of tasks have been completed which include:

- Habitat mapping detailed within the Chapter 6 - Biodiversity).
- Collection of peat samples for laboratory analysis incl moisture content;
- Development of a peat depth map to indicate the maximum depth ofprobe penetration at all investigated points across the proposed development;
- Calculation of the maximum potential peat volumes that will be removed due to excavation for infrastructure based on the depth penetration probing results; and,
- Examination of areas where peat is re-used to allow calculation volumes.

Depth penetration probing (see Appendix 9-2) at turbines and crane hardstanding, construction compounds and the substation;

- at borrow pit areas;
- at construction compounds and the substation, and
- along the access tracks.

Site investigation locations are included below on Figure 1-2 to 1-4.

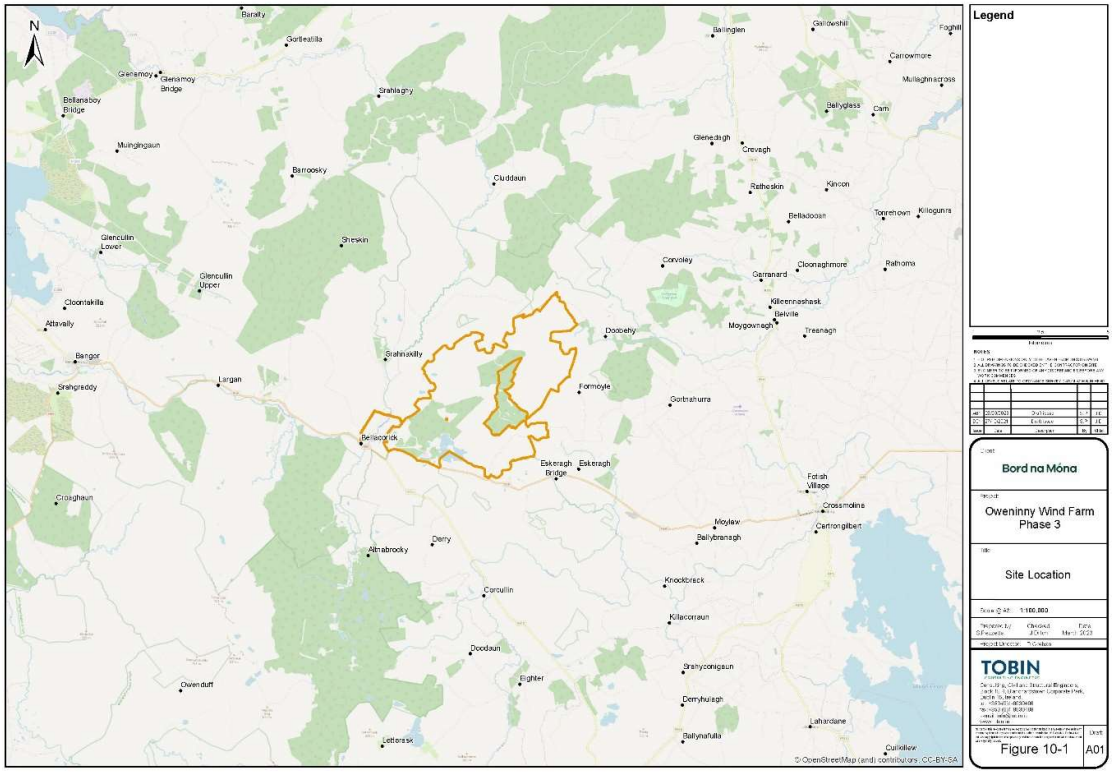


Figure 1-1: Oweninny Wind Farm Site Location Map

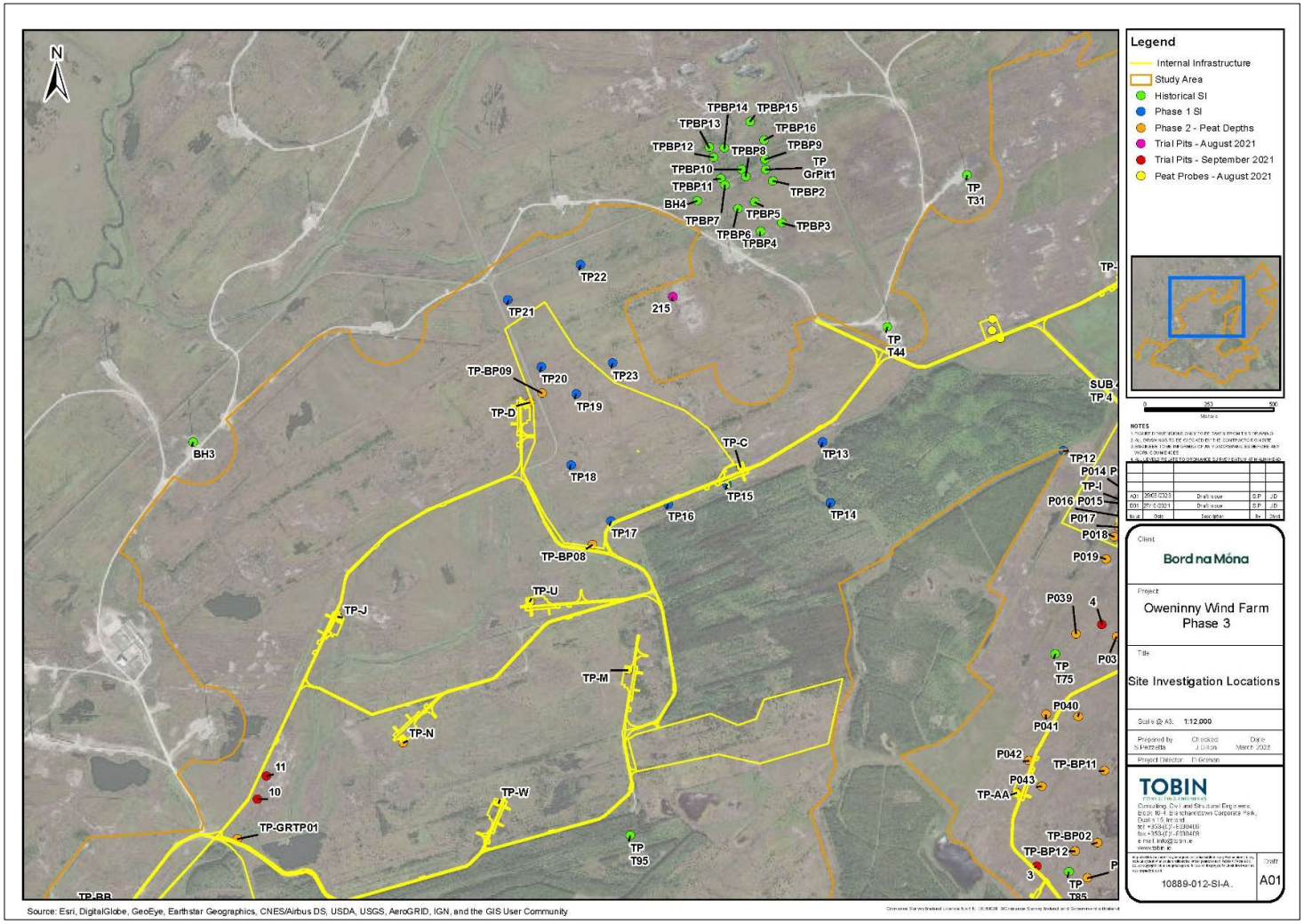


Figure 1-2: Site Investigation Locations - A

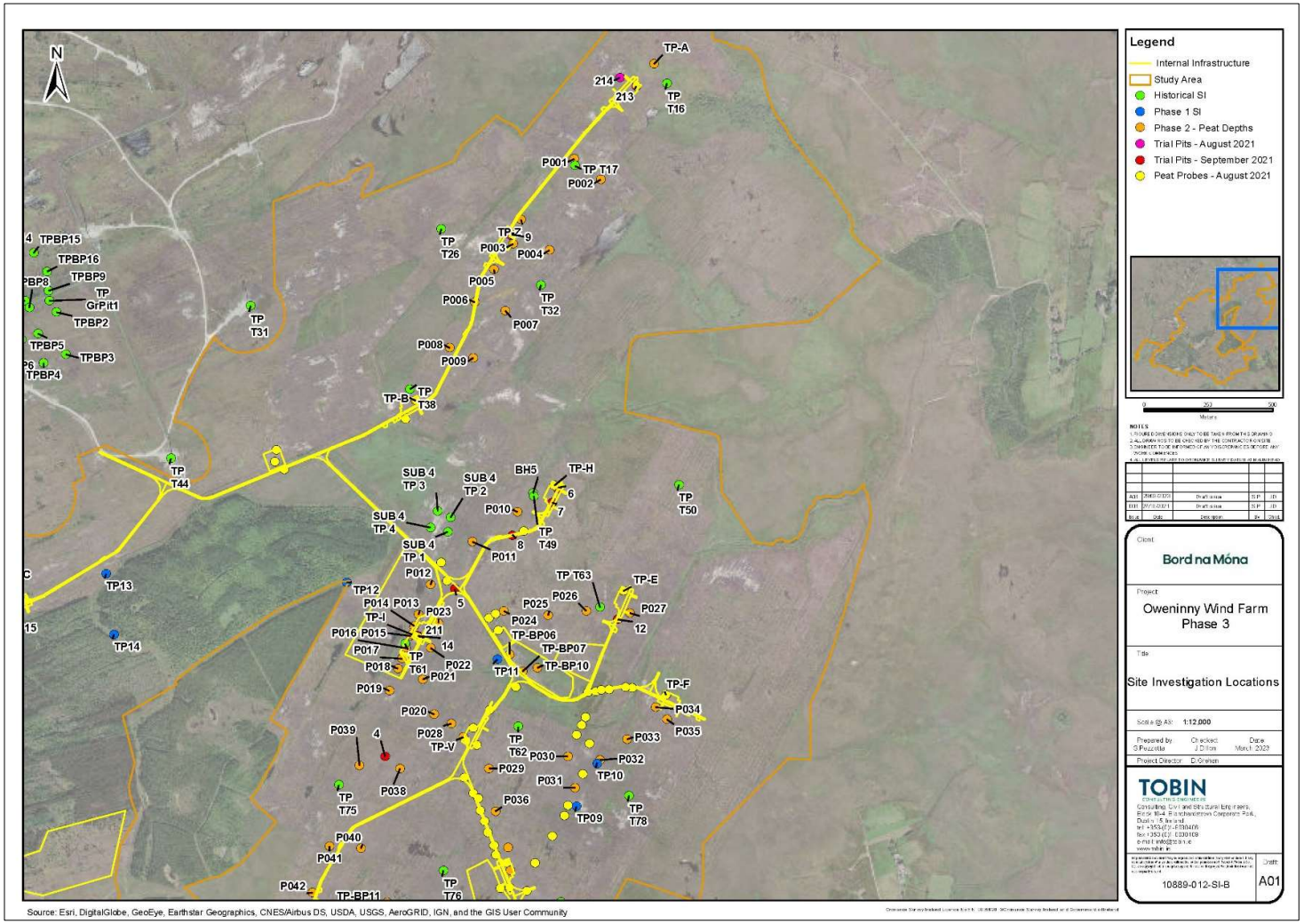


Figure 1-3: Site Investigation Locations - B

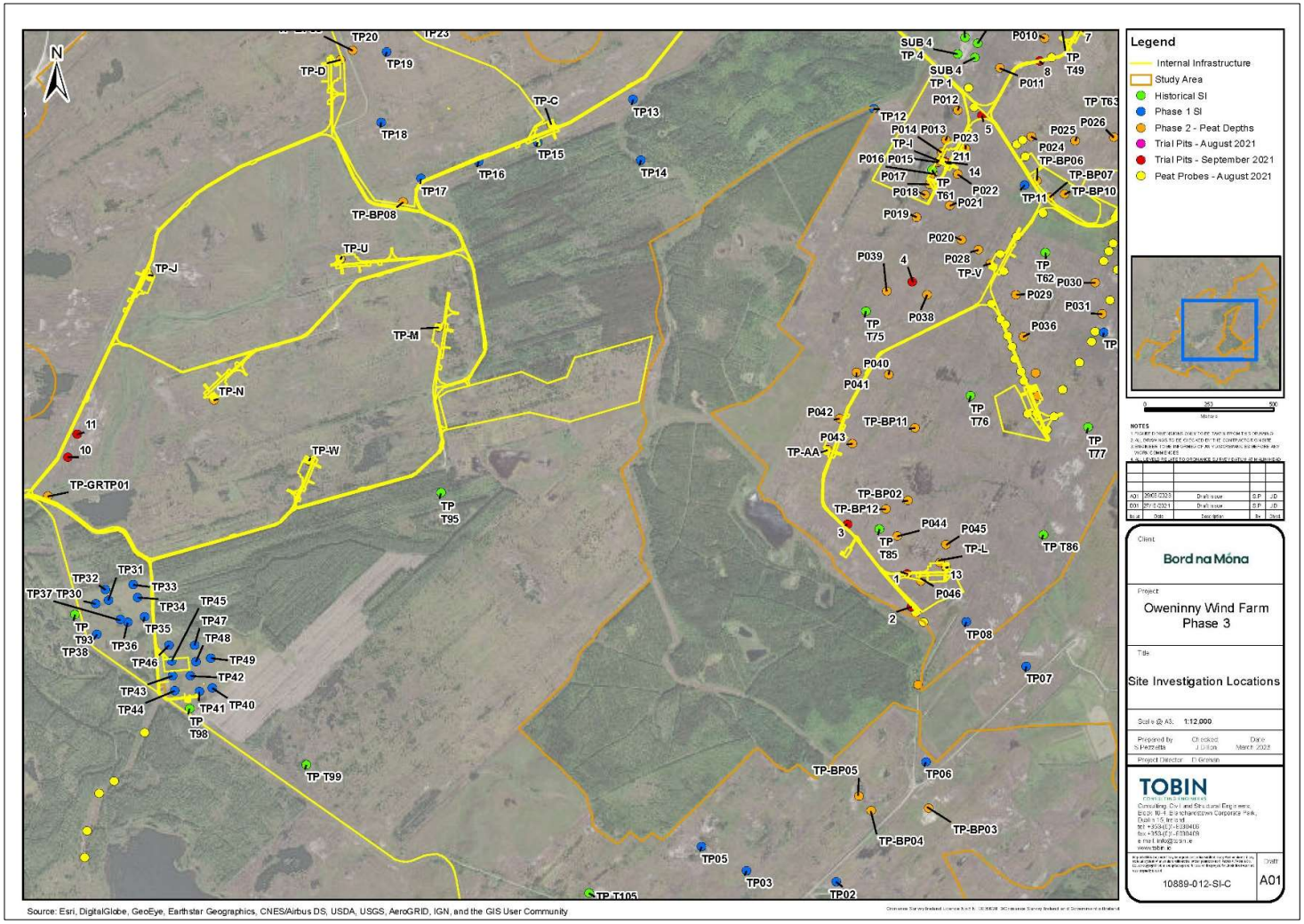


Figure 1-4: Site Investigation Locations -C

A comparison of the peat depth with the site infrastructure footprint. These data indicate that peat (>1.0m depth) is present across >50% of the proposed project infrastructure.

Peat Characteristics

No clear basal layer of amorphous peat (H9/H10) was observed. Tree roots were frequently encountered on the site at the peat-subsoil boundary. The peat characterisation studies concluded that the site comprises drained peatland across much of the site. These values have been used in calculations of volumes of peat across the site where the peat contour map indicates that peat is present (e.g., >0.5m probe depth).

Habitat Conditions

Habitat mapping was undertaken by Project Ecologists and is detailed within Chapter 7 Biodiversity of the EIAR.

The majority of the site is mainly occupied by cutover peat (PB4) habitat, artificial surfaces (BL3), wet grassland (GS4), areas of exposed gravel and stone (ED1) and lowland blanket bog (PB3) Small areas and narrow strips of open habitats occur along forest roads, rides, stream corridors and in small clearings. Areas of wet heath were avoided in the proposed project.

1.3.3 Construction Activities Covered by Spoil/Peat Management Plan

The overall layout of the proposed project is shown in Figure 1-1 of the EIAR. This figure shows the proposed locations of the wind turbines and associated hardstanding areas, substation, meteorological mast, temporary construction compounds, peat deposition areas, borrow pits, internal access roads and the main site entrance. Site layout drawings of the proposed project are included as Appendix 1-1 of this EIAR. A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm is being sought.

Given the recent advances in turbine technology, and the anticipated lifespan of wind turbines, this is considered to be the optimal operational life for the proposed project. The duration of this operational life allows the proposed turbines to be used to generate clean renewable energy until they have reached the end of their life, rather than being removed prematurely.

1.3.4 Construction Activities covered by Peat Management Plan

The proposed development is characterised by the following civil engineering works to provide the necessary infrastructure to complete the wind farm as described in Chapter 3, Description of the Proposed Development:

2.0 PROPOSED MEASURES

This methodology includes procedures that are to be included in the construction phase to minimise peat excavations. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

The Principal Contractor will produce a detailed Method Statement identifying where and how excavated peat will be used in reinstatement or landscaping works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in this Method Statement. The Principal Contractor will consider potential impacts on downstream receptors and the potential for instability issues with the excavated material.

Some of the requirements to be contained within this are outlined below. The majority of the site comprises drained peatland and rock. For founded roads, areas of peat within the footprint of excavation will have the top layer of vegetation stripped prior to construction by an experienced specialist contractor. Underlying peat or bare peat will then be removed.

Classification of excavated materials will depend on their identified re-use in reinstatement works. At this site it is anticipated that the material to be excavated will comprise peat and mineral subsoil.

A total of 28km of access tracks are proposed at the site.

For the construction phase of the Oweninny Wind Farm (Phase 3), the activities that are considered to have potential for possible peat stability problems are as follows:

- Excavations in peat for:
    - turbine foundations;
    - hardstanding foundations;
    - substation foundation;
    - met masts;
    - construction compound;
    - underground cables
- Construction of:
    - new permanent excavated access tracks in peat; and
    - new permanent/temporary floating access tracks over peat.
- Excavation of borrow pits; and
- Excavation and placement of arisings in PDAs.

Peat management of the above construction activities are covered individually in this report.

The site is covered with thick glacial deposits resulting in local variations in topography. Post glacial peat and alluvial deposits overly the quaternary deposits. The peat across the area was previously drained for extensive peat harvesting by Bord na Móna. The bog has undergone a rehabilitation phase and is currently showing good signs of recovery.

The topography of the proposed windfarm site ranges from c.75 to 130 mAOD, with the majority of the site located on the lower and relatively flat-lying areas, currently overlain by blanket peat bog. The proposed turbines are located between 80mOD and 100mOD. Localised anthropogenic changes to the topography in the form areas of shallow excavation are also present due to the historic peat cutting in the area as well as from farming activities.

2.1 EXCAVATIONS IN PEAT FOR TURBINE FOUNDATIONS

As a part of the Ground Investigations, the material encountered at the trial pit locations generally consisted soft to firm sandy tills and silty gravelly SANDS. The soft peat conditions, require removal for the wind turbine foundations. Deeper excavations to more competent material may be required to construct the turbine foundations. Based on the ground investigation the proposed foundations will be piled.

Under the peat and soft soil stability assessment within the PSRA, the results were found to be the same for most turbines as soft ground was encountered in all of these trial pits without confirmation of depth of a competent layer. The risk rating relates to a depth of Peat or Soft sediments identified in these areas. While in the absence of mitigation, several areas are rated as *"low"* risk rating is achieved by the implementation of suitable and common-place mitigation measures (see Appendix 9-2, Chapter 9).

Volume calculations provide an estimation of fill required for all the turbine foundations on the assumption piling of the turbine locations are required. Material for the construction works will be sourced from borrow pits on-site and from locally approved quarries.

Full excavation of peat (where present) to substrate and replacement with rock is required to provide a suitably stable surface for turbine placement. Once excavated, peat will be re-used to batter the edges grading the bases into the local topography.

A summary of the ground conditions encountered during the ground investigation carried out as part of this report are given in the tables below. Locations of peat probe investigation works and recorded depths are presented in Figure 2-1.

Table 2-1: Ground Profile for each turbine location - Peat

Trial Pit ID	Turbine	Horizon top	Horizon top	Peat Description
TP-J	1	0	1.9	Soft dark brown slightly sandy slightly gravelly fibrous **PEAT** with a strong organic odour, rootlets and tree trunk fragments
TP-W	2	0	0.2	Soft dark brown slightly sandy slightly gravelly pseudo fibrous **PEAT** with moss.
TP-M	3	0	0.1	Soft dark brown slightly sandy slightly gravelly **PEAT** with grass and rootlets.
		0.1	0.9	Soft dark brown slightly sandy slightly gravelly fibrous **PEAT** with tree trunk fragments.
TP-U	4	0	0.9	Soft brown slightly sandy slightly gravelly fibrous **PEAT** with tree trunk fragments.

Trial Pit ID	Turbine	Horizon top	Horizon top	Peat Description
TP-N	5	0	0.8	Soft dark brown slightly sandy slightly gravelly fibrous **PEAT** with rootlets.
TP-D	6	0	0.1	Soft dark brown slightly sandy slightly gravelly **PEAT** with grass and rootlets.
		0.1	0.9	Soft brown slightly sandy slightly gravelly **PEAT**
TP-C	7	0	0.2	Soft dark brown slightly sandy slightly gravelly **PEAT** with grass and rootlets
TP-B	8	0	1.8	Soft slightly sandy slightly gravelly **PEAT** with a strong organic odour.
TP-Z	9	0	1.2	Soft dark brown slightly sandy slightly gravelly fibrous **PEAT**.
TP-A	10	0	0.4	Soft dark brown slightly sandy slightly gravelly pseudo fibrous **PEAT** with an organic odour.
TP-I	11	0	1.8	Soft brown slightly sandy slightly gravelly fibrous **PEAT** with a strong organic odour.
TP-AA	12	0	0.2	Soft dark brown slightly sandy slightly gravelly Peat TOPSOIL.
		0.2	2.7	Soft brown slightly sandy slightly gravelly fibrous **PEAT** with an organic odour and tree trunk fragments.
TP-L	13	0	0.8	Soft brown slightly sandy slightly gravelly pseudo fibrous **PEAT**.
		0.8	1.1	Soft light brown sandy gravelly SILT with rare cobbles.
TP-V	14	0	1.5	Soft brown slightly sandy slightly gravelly pseudo fibrous **PEAT**.

Trial Pit ID	Turbine	Horizon top	Horizon top	Peat Description
		1.5	3.1	Soft brown slightly sandy slightly gravelly fibrous **PEAT** with tree trunk fragments.
TP-G	15	0	0.4	Soft dark brown slightly sandy slightly gravelly pseudo fibrous **PEAT**
TP-F	16	0	0.6	Soft dark brown slightly sandy slightly gravelly pseudo fibrous **PEAT**.
TP-E	17	0	1.6	Soft brown slightly sandy slightly gravelly fibrous **PEAT**.
TP-H	18	0	3	Soft brown slightly sandy slightly gravelly fibrous **PEAT** with a strong organic odour.

Table 2-2: Ground Profile for each turbine location - Soil

Trial Pit ID	Turbine	Horizon top	Horizon top	Soil Description
TP-J	1	1.9	3.2	Firm grey very sandy slightly gravelly SILT with some subrounded cobbles. Gravel is subangular to subrounded fine to coarse
TP-W	2	0.2	0.6	Firm brownish grey sandy gravelly SILT with some organic matter. Gravel is subangular to subrounded fine to coarse
TP-W	2	0.6	2.2	Soft grey sandy slightly gravelly SILT with organic matter and some subrounded cobbles. Gravel is angular to subrounded fine to coarse
TP-M	3	0.9	2.2	Firm grey sandy gravelly SILT with occasional subrounded cobbles and rare subrounded boulders. Gravel is angular to subrounded fine to coarse
TP-M	3	2.2	2.6	Stiff grey sandy gravelly SILT with occasional subrounded cobbles and rare subrounded boulders. Gravel is angular to subrounded fine to coarse
TP-M	3	2.6	2.9	Grey sandy gravelly SILT with occasional subrounded cobbles and rare boulders. Gravel is angular to subrounded fine to coarse. High groundwater content

Trial Pit ID	Turbine	Horizon top	Horizon top	Soil Description
TP-U	4	0.9	1.2	Soft grey sandy gravelly SILT with some laminations and occasional subrounded cobbles and rare subrounded boulders. Gravel is subangular to subrounded fine to coarse
TP-U	4	1.2	2.6	Grey sandy gravelly SILT with occasional subangular to subrounded cobbles. Gravel is angular to subrounded fine to coarse. High groundwater content
TP-N	5	0.8	0.9	Soft brownish grey sandy gravelly SILT with occasional subangular to subrounded cobbles. Gravel is angular to subrounded fine to coarse
TP-N	5	0.9	2.8	Grey sandy gravelly SILT with some organic matter and sand lenses. High groundwater content
TP-D	6	0.9	1.3	Greyish light brown slightly silty gravelly fine to medium SAND with occasional subrounded cobbles. Gravel is subangular to rounded fine to coarse
TP-D	6	1.3	2.5	Grey silty gravelly fine to medium SAND with occasional subangular to rounded cobbles. Gravel is subangular to rounded fine to coarse
TP-C	7	0.2	1.1	Soft grey sandy gravelly SILT with occasional subrounded cobbles. Gravel is angular to subrounded fine to coarse
TP-C	7	1.1	3	Firm grey sandy gravelly SILT with occasional angular to subrounded cobbles and some subangular to rounded boulders. Gravel is angular to subrounded fine to coarse
TP-B	8	1.8	2.5	Firm brownish grey sandy gravelly SILT with some laminations and occasional subangular to rounded cobbles. Gravel is subangular to rounded fine to coarse.
TP-B	8	2.5	3.2	Grey sandy gravelly SILT with some gravel lenses. Gravel is subangular to rounded fine to coarse. High groundwater content
TP-Z	9	1.2	2.7	Firm grey sandy gravelly SILT with some laminations and occasional subangular to rounded cobbles. Gravel is subangular to rounded fine to coarse
TP-Z	9	2.7	3.4	Firm to stiff grey sandy gravelly SILT with some laminations and occasional subangular to rounded cobbles. Gravel is subangular to rounded fine to coarse

Trial Pit ID	Turbine	Horizon top	Horizon top	Soil Description
TP-A	10	0.4	1.2	Firm brownish grey sandy gravelly SILT with some laminations. Gravel is subangular to subrounded fine to coarse
TP-A	10	1.2	2	Stiff grey sandy gravelly SILT with occasional subrounded to rounded cobbles and some subrounded to rounded boulders. Gravel is subangular to rounded fine to coarse
TP-A	10	2	3	Grey sandy gravelly SILT with occasional subangular to rounded cobbles and rare subrounded boulders. High groundwater content
TP-I	11	1.8	2.8	Grey silty slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse
TP-I	11	2.8	3.9	Soft bluish grey sandy gravelly SILT with occasional subrounded cobbles and rare subrounded boulders. Gravel is subangular to subrounded fine to coarse
TP-AA	12	2.7	3.8	Greyish brown silty gravelly fine to medium SAND with some subrounded cobbles. Gravel is angular to subrounded fine to coarse
TP-AA	12	3.8	4.3	Grey sandy gravelly SILT with some subrounded cobbles. Gravel is subangular to rounded fine to coarse. High groundwater content
TP-L	13	0.8	1.1	Soft light brown sandy gravelly SILT with rare cobbles. Gravel is subangular to subrounded fine to coarse
TP-L	13	1.1	2.1	Firm brownish grey sandy slightly gravelly SILT with some subrounded cobbles and some laminations. Gravel is subangular to subrounded fine to coarse
TP-L	13	2.1	2.8	Grey sandy gravelly SILT with occasional subrounded cobbles and some black gravel lenses. Gravel is subangular to subrounded fine to coarse. High groundwater content
TP-V	14	3.1	4.3	Firm grey sandy slightly gravelly SILT with occasional subrounded cobbles. Gravel is subangular to rounded fine to coarse
TP-G	15	0.4	0.6	Firm greyish brown sandy gravelly SILT with occasional subangular to rounded cobbles. Gravel is subangular to subrounded fine to coarse
TP-G	15	0.6	1.8	Soft grey sandy slightly gravelly SILT with occasional subrounded cobbles. Gravel is subangular to rounded fie to coarse

Trial Pit ID	Turbine	Horizon top	Horizon top	Soil Description
TP-G	15	1.8	2.2	Grey with blue lenses sandy gravelly SILT with occasional subrounded cobbles. Gravel is subangular to rounded fine to coarse. High groundwater content
TP-F	16	0.6	0.9	Soft grey sandy slightly gravelly SILT. Gravel is subangular to rounded fine to medium
TP-F	16	0.9	1.5	Orangey light brown slightly silty gravelly fine to medium SAND with some subrounded cobbles
TP-F	16	1.5	3.8	Light whitish brown slightly gravelly slightly silty fine to medium SAND with some subrounded cobbles. Gravel is subangular to rounded fine to coarse
TP-E	17	1.6	2.5	Soft grey sandy slightly gravelly SILT with some subrounded cobbles. Gravel is subangular to subrounded fine to coarse
TP-E	17	2.5	3.2	Blueish grey sandy gravelly SILT with occasional subrounded cobbles. Gravel is subangular to subrounded fine to coarse. High groundwater content
TP-H	18	3	3.1	Soft greyish brown sandy gravelly SILT . Gravel is subangular to subrounded fine to medium

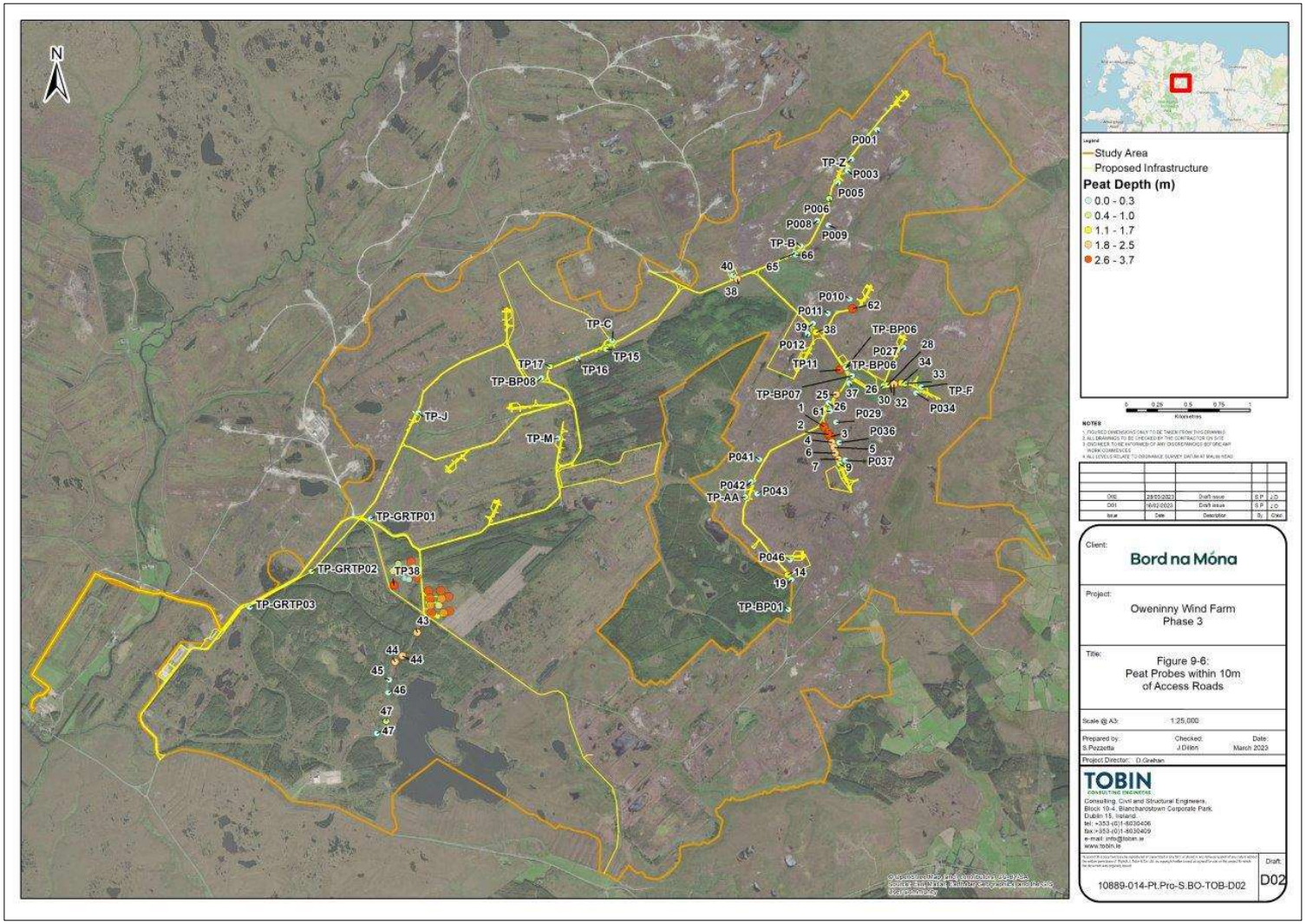


Figure 2-1: GI locations with peat probe depths in metres

2.2 EXCAVATIONS IN PEAT FOR HARDSTANDING FOUNDATIONS

Hardstanding for cranes and other infrastructure foundations on site are to be founded on material underlying peat deposits which will also require excavation in peat. A crane hardstanding is required adjacent to each turbine for the purpose of turbine installation and maintenance. Each crane pad will require the full excavation of peat (where present) to substrate and replacement with rock is required to provide a suitably stable surface for turbine component handling. Once excavated, peat will be re-used to batter the edges of platforms grading the bases into the local topography.

The environmental effects of the construction of the hardstanding foundations are similar to that of the founded access tracks. Ground investigation in the form of trial pitting has been carried out along the proposed hardstanding locations to inform the depth of excavation and upfill required. Volume calculations provide an approximate estimation of fill required for all of the hardstanding foundations. It is calculated as 139,000m^3 of peat and spoil material to be generated as part of the development. This material will be reused on site.

2.3 EXCAVATIONS IN PEAT FOR MET MASTS

The construction of met masts will require removal of topsoil and subsoil to a competent founding layer and upfilling with concrete or structural fill to the required foundation formation level. A crane hardstanding will also be required to install the met mast. This will be similar but smaller than those constructed at the turbines. Ground investigations at potential locations have only been undertaken for the purposes of the EIAR and have been used to inform the depth of excavation and upfill required.

Volume calculations provide an estimation of fill required for the foundations and crane pad for the met mast, assuming spread foundations are used where it is founded on competent material. The volume of material excavated for the met mast is 2,300m^3 material).

2.4 EXCAVATIONS IN PEAT FOR CONSTRUCTION COMPOUND AND SUBSTATION

At the commencement of the construction phase a construction compound will be constructed to provide office space, welfare facilities, concrete wash out areas, hardstands for storing materials and hazardous materials. The hardstanding shall be constructed to average heights of 0.5 m above existing ground level.

Volume calculations provide an estimation of fill required for the temporary compound area. It is likely that this material volume will be sourced one and imported from locally approved quarries.

The construction of the substation foundation will require removal of peat and soil to a competent founding layer and upfilling with concrete or structural fill to the required finished floor level. Ground investigations at the substation location have been undertaken and have been used to inform the depth of excavation and upfill required. Peat/peaty soil is present on the site (2m on average).

Volume calculations provide an estimation of fill required for the foundations for the substation assuming spread foundations are used where they are founded on competent material.

During construction, peat will be excavated to the substrate to make room for concrete foundations, and for a small working area surrounding the foundation footprint. Once excavated, peat will be re-used to batter the edges of platforms grading the bases into the local topography.

2.5 EXCAVATIONS IN PEAT FOR UNDERGROUND CABLES

Each turbine will connect by underground cable to the onsite substation and from there to the planned EirGrid Bellacorick 110kV Substation. To a large extent, underground cable routes will align with the on-site access tracks and public road network routes. The location of the proposed substation and the associated grid connection within the proposed windfarm are presented in Figure 2-1.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or overburden material. The trenches will typically be 1.2m wide and 1.2m deep.

2.5.1 Cable Trench Construction Methodology

This methodology includes procedures that are to be included during the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

With respect to placement of arisings from excavation, the guidelines below are to be followed.

- All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate;
- Where areas of weaker peat are encountered then slacker slopes will be required;
- Excavations shall always be kept reasonably free from water; and
- Backfill requirements for the cable trench will be decided as part of the detailed design/construction.

All cable laying works will be carried out as per ESBN requirements, but it is assumed that initially the contractor will excavate cable trenches and then lay high density polyethylene (HDPE) ducting in the trench in a surround of CBM (cement bound material). A rope will be inserted into the ducts to facilitate cable-pulling later. The as-constructed detail of the cable duct locations will be carefully recorded. Cable marker strips will be placed 75mm above the ducts with two communication ducts also laid.

An additional layer of cable marker strips will be laid above the communication ducts and the trench backfilled. Back-filling and reinstatement in public roads will be to a specification to be agreed with the road authority.

A similar construction methodology will apply for cable trenches laid within site access tracks. In this case the cable-ducts will generally be laid after the track has been constructed and will be within the site access tracks. The trenches within these locations will generally be backfilled using the excavated material.

2.6 CONSTRUCTION OF NEW TRACKS IN PEAT

Access tracks will be needed to accommodate the construction works and provide access to turbine locations for the whole life cycle of the wind farm. Approximately 29km of access tracks

are to be constructed which will provide access to necessary locations within the site e.g., wind turbines and substation.

The access tracks will be constructed as founded or floating roads. Founded roads are excavated down to and constructed up from a competent geological stratum, whereas floated roads are built directly on top of the peat and soft soils.

Ground investigation in the form of trial pitting and peat probing have been carried out along the proposed access routes to inform the depth of excavation and upfill required for the access tracks. It is calculated as 210,000 m^3 of peat material, to be excavated and reused on site.

Track Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure new tracks will need to be constructed. The identification of the access track layout is an iterative procedure. While the majority of tracks onsite will be constructed on mineral soil, there are some locations where construction on peat will be required.

The track construction preliminary design has considered the following key factors:

- Requirement to minimise disruption to peat hydrology;
- Minimise excavation arisings;
- Serviceability requirements for construction and wind turbine delivery and maintenance vehicles; and
- Buildability considerations.

Whilst the above key factors are used to determine the track design the actual construction technique employed for a particular length of track will be determined on the prevailing ground conditions encountered along that length of track.

The majority of site construction will utilise the permanent access track network for access and egress, and this access will be constructed in advance of other ground works in a sequential manner.

It is intended that the access tracks will be constructed using site won material as subbase and unbound crushed aggregates and incorporate drainage to maintain the performance of the pavement during wet weather. The access tracks shall be constructed to average heights of 0.5m above existing ground level.

Ground investigations in the form of peat probing and trial pitting has been carried out along the proposed access routes to inform the depth of excavation and upfill required for the access tracks.

Table 2-3: General Construction of Access Tracks

Construction Method	Typical Site Conditions		
	Description	Typical Peat Depth (m)	Typical Slope Inclination (degs)
Construction of new excavated tracks in peat	Flat slopes with relatively shallow peat	Typically, less than 0.5m, locally up to 1m	Less than 3 degrees
Construction of new floating tracks over peat	Flat slopes with relatively deeper peat	>1m	Less than 3 degrees

2.7 GENERAL ACCESS TRACK CONSTRUCTION TECHNIQUES

It should be noted that Table 2-3 summarises the general track construction techniques only. Prior to the construction of any access tracks on site a detailed design will be carried out.

2.7.1 Excavated Track Construction Methodology

Given the flat topography and relatively shallow peat on site, excavated access tracks are deemed an appropriate construction technique for the majority of the site.

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

- Interceptor drains will be installed upslope of the access track alignment to divert any surface water away from the construction area;
- Excavation of tracks shall be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat (as agreed with the site designer);
- Track construction will be carried out in sections of approximately 50m lengths; i.e. no more than 50m of access track will be excavated without re-placement with stone fill unless otherwise agreed with the resident engineer on site;
- All excavated peat shall be placed/spread alongside the excavations or placed in PDAs;
- Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses;
- The surface of the finished excavated access track will be finished above current ground level;
- A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer);
- At transitions between floating and excavated tracks a length of track of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the track surface transitions smoothly from floating to excavated track;
- Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access track perpendicular to the slope contours it is best practice to start construction at the

bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site; and
- A final surface layer shall be placed over the excavated track, as per design requirements, to provide a track profile and graded to accommodate wind turbine construction and delivery traffic.

Wind farm access tracks require careful monitoring to ensure that there is no significant standing water forming, which would lead to potholes in the surface. If areas of track are causing concern, repairs will be carried out in favourable, preferably dry, conditions, to ensure that there is no saturation of the surface of the track.

2.7.2 Construction of new Floating Tracks over Peat

Floating roads are built directly on top of the peat and soft soils. Where peat is deeper than 1m, floating roads will be used. The access tracks shall be constructed to average heights of 0.5m above existing ground level. It is expected that founded tracks will constitute the majority of the site, however floating tracks will be used over the area where peat is greater than 1m.

Floating track sections will be designed by a geogrid manufacturer, or by a consultant assisted by a geogrid manufacturer. It can also be designed in-house by a contractor with experience in track construction over peat. The design will have a geotechnical input to fully understand the principles at work in the floating track. Design can be by calculation or, more usually by the application of semi-empirical rules based on experience of EN 1997 (Geotechnical Design).

Transitions between the site floating tracks and excavated tracks (or other forms of track not subject to long term settlement) will be gentle (e.g. 1:10 basal transition slope) in order to minimise likelihood of track failure at the boundary between construction types.

2.7.2.1 Floating Access Track Construction Methodology

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations. Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

- Mark out the line of track;
- Install advance drainage ahead of construction where necessary;
- Clear the intended floating track area of major protrusions such as rocks, trees, bushes etc down to ground level leaving any residual stumps and roots in place;
- Leave the local surface vegetation and soils in place if possible;
- Fill any local hollows and depressions with a suitable local lightweight fill such as tree brash, logs, or a combination of lightweight fill and suitable material. (Brash mats and fascines can also be used to form an initial surface on difficult ground.);
- Floating track construction shall be to the line and level requirements as per design/planning conditions;
- Base geogrid to be laid directly onto the existing peat surface along the line of the track in accordance with geogrid provider's requirements; and
- Construction of track to be in accordance with appropriate design from the designer.

The typical make-up of new floating access track is generally between 600mm and 1000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator. This may vary depending on designer requirements.

Following the detailed design of the floating access tracks it may be deemed necessary to include pressure berms either side of the access track in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access track will reduce the likelihood of potential bearing failures beneath the access track.

The finished track width will be approximately 6m (to be confirmed by the designer). Stone delivered to the floating track construction shall be end-tipped onto the constructed floating track. Direct tipping of stone onto the peat shall not be carried out. To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating track shall be tipped over at least a 10m length of constructed floating track. Where it is not possible to end-tip over a 10m length of constructed floating track then dumpers delivering stone to the floating track shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating track.

Following end-tipping suitable machinery shall be employed to spread and place the tipped stone over the base geogrid along the line of the track. A final surface layer shall be placed over the floating track, as per design requirements, to provide a track profile and graded to accommodate wind turbine construction and delivery traffic.

2.8 BORROW PITS

It is proposed to open borrow pits for the construction of the proposed wind farm. Limited in-situ peat will be encountered at the borrow pits. This material will be reused for restoration on completion of the construction phase.

Peat will be reused within borrow pit 1 for the purpose of their restoration provided the method of reuse is consistent with the environmental reinstatement objectives of the site and presents no residual risks from pollution of the environment or harm to human health (SEPA, 2012). Key issues for borrow pit restoration are:

- Prevention of desiccation and carbon losses from peat used in the restoration; and
- Fencing where required to exclude grazing stock and encourage vegetation establishment.

Borrow Pit 2 will contain a mosaic of bare sand/gravel, open water and revegetated soil/peat and will form a biodiversity area for breeding birds. As a consequence, this area will contain areas of bare gravel.

2.9 PEAT DEPOSITION AREA

Peat reuse around and within infrastructure areas is an important aspect of the Proposed Development as it allows an opportunity to maintain the integrity of the excavated peat and enhance habitats. Any landscaping or road batters will be limited to the areas of ground already disturbed.

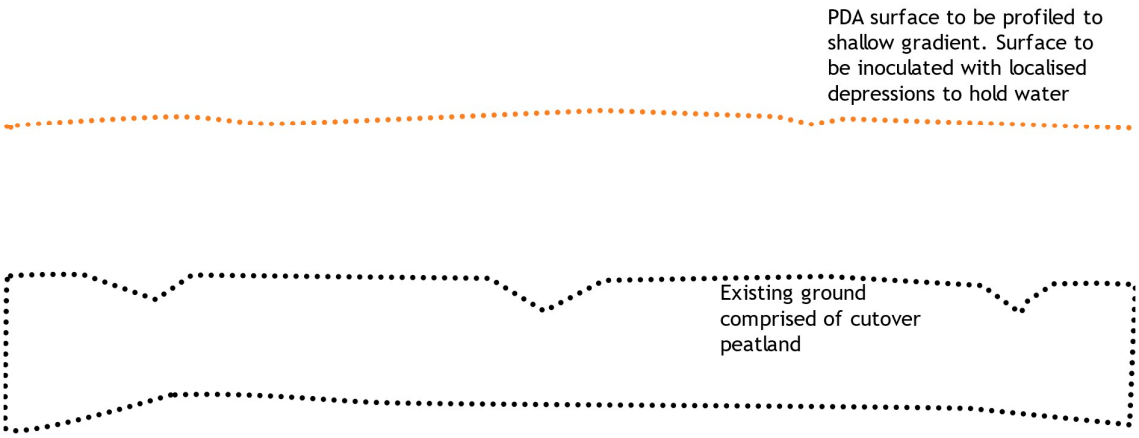
The proposed deposition peat areas (PDAs) will be carried out by an approved contractor, under the management of Bord na Móna, in accordance with the requirements of any planning conditions.

It is proposed to construct internal access route within PDAs, in order to minimise the handling and disturbance of the peat. The road will be constructed by laying a geotextile reinforcing material directly on the native peat and depositing compacted rockfill to form the haul road. Trucks will deliver and unload the peat at the relevant PDA. The peat will then be placed using low ground bearing pressure trailers for dispersal within the deposition.

Reinstatement of vegetation will be focused on natural regeneration utilising peat vegetated turfs. To encourage stabilisation and early establishment of vegetation cover, where available or other vegetation turves in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface.

Appropriate drainage will be required where peat is used in reinstatement, so that the peat will be maintained in a saturated condition.

PDA Conceptual Layout



3.0 EXCAVATION AND STORAGE OF ARISINGS

It will be necessary to extract peat and subsoil on site as part of the construction phase. This will largely consist of areas of peat due to the nature of the site. Oweninny Bog is covered with thick glacial deposits, resulting in local variations in topography. The majority of the site is located on the lower and relatively flat-lying areas, currently overlain by cutover blanket peat bog. It is intended that peat and unsuitable founding soils will be side cast, i.e. placed adjacent to works locations with the balance placed in Peat Deposition areas. Considering the topography, it should be appropriate to do this across most of the site subject to geotechnical assessment.

Any surplus excavated material will be reused, either in profiling/landscaping or constructing berms as close to the excavation areas. The site has been drained resulting in extensively trafficked peat.

A project aim is to incorporate sustainability into the design and construction of the project as is practical. Where mineral soils are encountered in the excavation and construction of site roads, bases, etc, this material will be stockpiled for assessment and subsequent re-use. Where

mineral soil is not directly suitable for construction it will be used for reinstatement works and will be geo-engineered as necessary.

3.1 EXCAVATION AND STORAGE OF ARISINGS METHODOLOGY

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

Prior to any excavations, the Principal Contractor will produce a detailed Method Statement identifying where and how excavated peat will be used in reinstatement or landscaping works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in this Method Statement. The Principal Contractor will consider potential impacts on downstream receptors and the potential for instability issues with the excavated material.

Some of the requirements to be contained within this are outlined below. The majority of the site comprises bare peat with some areas where revegetation is occurring. Areas of peat within the footprint of excavation will have the top layer of vegetation stripped prior to construction by an experienced specialist contractor. Underlying peat or bare peat will then be removed.

Classification of excavated materials will depend on their identified re-use in reinstatement works. At this site it is anticipated that the material to be excavated will comprise peat and mineral subsoil.

The handling, management and re-use of excavated materials are of importance during the construction phase of the project. Excavated material will arise from all infrastructure elements of the windfarm (bases, access tracks, hardstanding etc.). Areas where the peat is noted to extend to a depth of 2m bgl or greater have been identified on-site. As such, these areas may not prove suitable for certain aspects of site development due to the large quantities of peat that would require removal to avoid instability issues.

It is intended that unsuitable founding soils and peat will be side casted, bermed and profiled i.e. placed adjacent to works locations. Considering the topography, it should be appropriate to do this across most of the site. It is anticipated that the height of berms and thickness of peat and unsuitably found soils that are side-cast will not be greater than 1m in general, although location specific designs and assessments during the design and construction phase may allow these to reach 2m. Where necessary, some of these soils may be transported elsewhere around the site for landscaping, such as near watercourses (to avoid stockpiling there). For the proposed substation, approximately 18,100 m^3 of peat will be excavated and placed in a peat deposition area. This action is expected to have a not significant, short-term negative effect.

Excess material will be used on the site of the proposed development for landscaping and reinstatement. Where contaminants are found the material will be removed from site and disposed at an appropriately licenced facility. This action is expected to have a not significant, short-term negative effect.

Excavated peat will only be moved short distances from the point of extraction and will be used locally for landscaping. Landscaping areas will be sealed and levelled using the back of an excavator bucket to prevent erosion. Where possible, the upper vegetative layer will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the landscaped peat. These measures will prevent the erosion of peat in the short and long term. Peat, overburden, and rock will be reused where possible on site to reinstate borrow pits and other excavations where appropriate.

Peat soils will be either side cast on to the existing cutover bog or placed in the Peat deposition area. Where side casting occurs, it is anticipated that the existing vegetation extensive area and existing drainage system will remove any risk from generation of silt to surface water bodies. At the large excavation locations, such as turbine bases and substations, silt control measures will be incorporated into work area drainage with the discharge onto cutover bog rather than directly to surface water, which will provide additional silt control.

It is anticipated that peat deposition to a deposition area will be required, which will be designed to be fully stable, it is anticipated that deposited peat thickness will not exceed 1m. The deposition area will be located in a flat area away from sensitive receptors; the deposition area will be designed to be completed in phases and will include specific drainage and silt controls. On completion the peat deposition area surfaces will be stabilised by the establishment of natural peat land vegetation. Peat deposition locations include the borrow pit locations (Area 1, PDA1) and PDA2 to PDA4.

3.2 SUMMARY OF EXCAVATED PEAT VOLUMES ON SITE

A summary is provided below with the combined volumes of calculated peat volumes requiring excavation on site to allow for development.

Table 3-1: Excavated Peat Volume Summary

Area	Peat Volume (m^3)
Hardstanding Foundations	121,000
Turbine Foundations	19,100
Substation and Compounds	27,700
Met Mast	2,700
Underground Cables	12,100
Access Tracks	252,000
Allowance for bulking	70,600
Total	**433,600**

3.3 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE

The recommendations of the PSRA are incorporated into this document and summarised below.

Following application of mitigation measures, including consideration to the siting of infrastructure to minimise the risk, the findings of the planning stage PSRA indicate a "low" hazard ranking for instability related to the requirement for excavations on the site, subject to appropriate mitigation measures. Routine and common place mitigation measures will be put in place during the detailed design and construction of the scheme to reduce the likelihood of a failure. Required mitigation measures include stepping or battering back of excavations to a safe angle (as determined through a detailed slope stability assessment by a competent temporary works designer) or construction of a temporary sheet pile wall or rock fill berm to support the peat during construction. Following mitigation, the hazard ranking of the development is considered to be "low" for all areas. Further the site terrain is rolling and undulating and topographically confined, limiting the potential and scale of peat slide and debris runout distances. It is concluded that the site is suitable for the proposed project.

3.3.1 Construction Phase:

The following outlines an overview of the tasks for the construction phase:

- Client's Geotechnical Engineer to provide a Geotechnical Induction to all contractor supervisory staff.
- Client to appoint a Site Geotechnical Supervisor to carry out supervision of site works as required. The Site Geotechnical Supervisor will be required to inspect that works are carried in accordance with the requirements of the PSRA, identifying new risks and ensuring all method statements for works are in place and certified.
- Retain a Site Geotechnical Folder which contains all the information relevant to the geotechnical aspects of the site including but not limited to GRR, site investigation information, method statements etc.
- Contractor to develop a Method Statement for the works to be carried out in each of the PSRA areas cognisant of the required mitigating measures.
- Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement.
- Contractor to provide tool box talks and on-site supervision prior to and during the works.
- Daily sign off by supervising staff on completed works.
- Implementation of emergency plan and unforeseen event plan by the contractor.

3.3.2 Operation and Maintenance Phase:

The following outlines an overview of the tasks for the operation and maintenance phase:

- Communication of residual peat risk to appropriate site operatives.
- Ongoing monitoring of residual risks and maintenance if required. Such items would consist of regular inspection of drains and culverts to prevent blockages and inspections of specific areas such as settlement ponds and floated access roads after a significant rainfall event.

4.0 SUMMARY

The total volume of excavated peat associated with the infrastructure footprint, associated excavated slopes and drains has been calculated at about 433,600 m^3, predominately drained lowland blanket bog in an cutover bog site. The potential reuse of excavated peat has been calculated and will be reused on site.

Based on the peat depth, characteristics and distribution investigations undertaken across the development area and the wind farm infrastructure layout, a surplus of peat is not expected to be generated by the proposed wind farm site. All estimated excavated peat is planned for re-use for restoration work during the construction, operation and decommissioning phases.

Floating roads and other measures are utilised on site to minimise the volume of excavation. An ECoW will maintain a record of actual peat volumes excavated and the subsequent peat re-use volumes. This record during the construction, operation, decommissioning phases of the proposed wind farm project will be made available for review by regulatory authorities as required.