PEAT AND SPOIL MANAGEMENT PLAN

DERRINLOUGH WIND FARM, COUNTY OFFALY

JANUARY 2020

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FEHILY TIMONEY
30 YEARS

PEAT AND SPOIL MANAGEMENT PLAN

DERRINLOUGH WIND FARM, COUNTY OFFALY

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Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan to compile a Peat and Spoil Management Plan (PSMP) for Derrinlough wind farm. The purpose of this report is to provide a Peat and Spoil Management Plan for the construction phase of the wind farm. The report describes how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat and spoil placement measures which will be developed at the site.

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1 INTRODUCTION

1.1 Background and Experience

Fehily Timoney and Company (FT) formerly Applied Ground Engineering Consultants Ltd (AGEC) was engaged in March 2018 by McCarthy Keville O'Sullivan on behalf of Bord na Móna Powergen Ltd to compile a Peat and Spoil Management Plan for the proposed Derrinlough wind farm.

The relevant geotechnical project team along with their relevant experience are outlined below.

- Gerry Kane (BEng, PGradDip, CEng, MIEI) is a Chartered Civil/Geotechnical Engineer with over 10 years geotechnical consultancy experience in Ireland and the UK. Gerry has completed numerous geotechnical & geological impact assessments for wind farm developments in Ireland. In addition, he has significant experience in the geotechnical/civil design of wind energy projects at construction stage.
- Ian Higgins (BSc, MSc, FGS, MIEI) is a Geotechnical Engineer with over 20 years geotechnical consultancy experience in Ireland and the UK. Ian has completed numerous geotechnical & geological impact assessments for wind farm developments in Ireland. In addition, he has significant experience in the geotechnical/civil design of wind energy projects at construction stage.
- Paul Jennings (PhD, BEng, DipArb, CEng, MIEI) is a Chartered Geotechnical Engineer with over 30 years geotechnical consultancy experience in Ireland, the UK and Hong Kong. Paul has completed numerous geotechnical & geological impact assessments for wind farm developments in Ireland. In addition, he has attended and represented developers and consultants at numerous oral hearings for wind energy developments.

1.2 Description of Works

The proposed Derrinlough wind farm is at a site located approximately 2.5km south of Cloghan in Co. Offaly.

The site is relatively flat-lying with drainage channels running typically southeast to northwest. The site is split into two areas, Drinagh to the east of the N62 national road and Clongawny to the west. The land uses and types within the proposed development site are a mixture of bare cutover and cutaway peat, re-vegetation of bare peat, commercial forestry, telecommunications (a 30m Mast) and wind measurement (a single 100m anemometry mast on Clongawny Bog). There are also a number of Bord na Móna rail lines that pass through the bogs facilitating the transportation of milled peat to Derrinlough Briquette Factory which is located in the most western part of Drinagh bog.

Bord na Móna has considerable experience in the handling of peat in these circumstances, both during peat production operations and during wind farm construction projects. This experience has shown that the most environmentally sensitive and stable way of handling and moving of peat is its placement across the site and at locations as close as possible to the excavation areas.

The proposed development comprises the following:

(1) 21 No. wind turbines with an overall blade tip height of up to 185 metres and all associated hard-standing areas.

(2) 2 No. permanent Anemometry Masts up to a height of 120 metres.

(3) Provision of new and upgraded internal site access roads, passing bays, amenity pathways, amenity carpark and associated drainage.

(4) 2 No. permanent underpasses in the townland of Derrinlough. One underpass will be located beneath the N62 and one will be located beneath an existing Bord na Móna rail line.

(5) 1 No. 110 kV electrical substation, which will be constructed in the townland of Cortullagh or Grove. The electrical substation will have 2 No. control buildings, associated electrical plant and equipment and a wastewater holding tank.

(6) 5 No. temporary construction compounds, in the townlands of Clongawny More, Derrinlough, Derrinlough/Crancreagh, Drinagh and Cortullagh or Grove.

(7) All associated underground electrical and communications cabling connecting the turbines to the proposed electrical substation.

(8) 2 No. temporary security cabins at the main construction site entrances in the townland of Derrinlough.

(9) All works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Dallow/Portlaoise/Shannonbridge 110 kV line.

(10) Removal of existing meteorological mast.

(11) Upgrade of existing access and temporary improvements and modifications to existing public road infrastructure to facilitate delivery of abnormal loads including locations on the N52 and N62; construction access for delivery of construction materials at locations on the N62 and R357; operational access onto L7009 in the townland of Cortullagh or Grove and amenity access off R357 and L7005.

(12) All associated site works and ancillary development including signage.

(13) A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

1.3 Purpose

The purpose of this report is to provide a peat and spoil management plan with particular reference to peat stability for the construction phase of the project.

This peat and spoil management plan also includes a monitoring programme which should be implemented during the construction phase of the wind farm and a contingency plan should peat instability/failure occur at the site.

As work is carried out on site the contents of the peat and spoil management plan and peat stability monitoring programme should be updated, as appropriate.

The peat and spoil management plan 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 the site is outlined in detail in Chapter 9 Hydrology and Hydrogeology of the Environmental Impact Assessment Report (EIAR).

1.4 Peat Instability Definition

Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur (for example) below a floating access road, creep movement or localised erosion type events.

Adherence to the peat and spoil management plan will minimise the potential for all such peat movements. However it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid localised peat movement.

2 CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the proposed Derrinlough wind farm the following activities that are considered to have potential for possible peat stability issues:

(1) Upgrade of existing access tracks

(2) Construction of new excavated roads through peat

(3) Construction of new floating roads over peat

(4) Excavation and placement of arisings

(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations

(6) Excavations in peat for underground cables

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

2.2 Road Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure new roads will need to be constructed. The road construction preliminary design has taken into account the following key factors:

(1) Requirement to minimise disruption to peat hydrology

(2) Minimise excavation arisings

(3) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(4) Buildability considerations

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

The general road construction techniques to be considered are given in Table 2-1.

Table 2-1: General Road Construction Techniques

Construction Method	Typical Site Conditions			Comment
	Description	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access tracks – **Type A and B**	Flat slopes with relatively shallow peat	-	-	Upgrade existing excavated access track to the required width and finished with a layer of selected granular fill (to be confirmed by designer) – Figure 1-1
Construction of new excavated roads through peat – **Type C**	Flat slopes with relatively shallow peat	<1.0	Varies	New excavated roads are proposed for areas where the peat depth is less than 1m
Construction of new floating roads over peat – **Type D**	Flat slopes with shallow and deep peat	>1.0	<5	New floating access roads are proposed where the peat depth is greater than 1m

It should be noted that Table 2-1 summarises the general road construction techniques only. Prior to the construction of any floating access roads on site a detailed design will need to be carried out.

Figure 1-1 shows the proposed road construction types for site.

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Temporary Construction Compound 5

Proposed Substation

Proposed Amenity Links

T21

New Proposed Access Track

T18

Temporary Construction Compound 4

Proposed Turbine

T20

T17

Temporary Construction Compound 2

Temporary Construction Compound 3

T19

T12

T8

T1

T7

T6

T2

T16

T10

Proposed Underpass

Existing Excavated Access Track

T13

T15

T9

T14

T11

Temporary Construction Compound 1

Proposed Met Mast 2

T3

T4

T5

Proposed Met Mast 1

Road Type Legend:

Type A -
Upgrade of Existing Excavated Access Tracks

Type C -
New Excavate & Replace Access Road

Type D -
New Floated Access Road

Scale 1:28000

0m 140m 280m 420m 560m 700m 840m 980m 1120m 1260m 1400m

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FIGURE 1-1 : PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE

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3 UPGRADE OF EXISTING ACCESS TRACKS – TYPE A AND B

Minimal, localised sections of existing tracks are present on site. Upgrading works are likely to involve both widening and resurfacing of the existing access track. The proposed locations for upgrading of the existing access tracks on site are shown in Figure 1-1 and details are shown in Figures 3-1 and 3-2.

3.1 Upgrading Existing Access Tracks Construction Methodology

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

(1) Access road construction shall be to the line and level requirements as per design/planning conditions.

(2) For upgrading of existing excavated access tracks (Figure 3-1) the following guidelines apply:

(a) Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.

(b) Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.

(c) The surface of the existing access track should be overlaid with up to 500mm of selected granular fill.

(d) A layer of geogrid/geotextile may be required at the surface of the existing access track and at the base of the widened section of access road (to be confirmed by the designer).

(e) For excavations in peat, side slopes shall be not greater than 1 (v): 2 or 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.

(3) For upgrading of existing access tracks constructed using a floated construction technique (Figure 3-2) the following guidelines apply:

(a) The surface of the existing access track should be graded/tidied up prior to the placement any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).

(b) Where granular fill has been used in the existing access track make-up, a layer of geogrid should be placed on top of the existing access track.

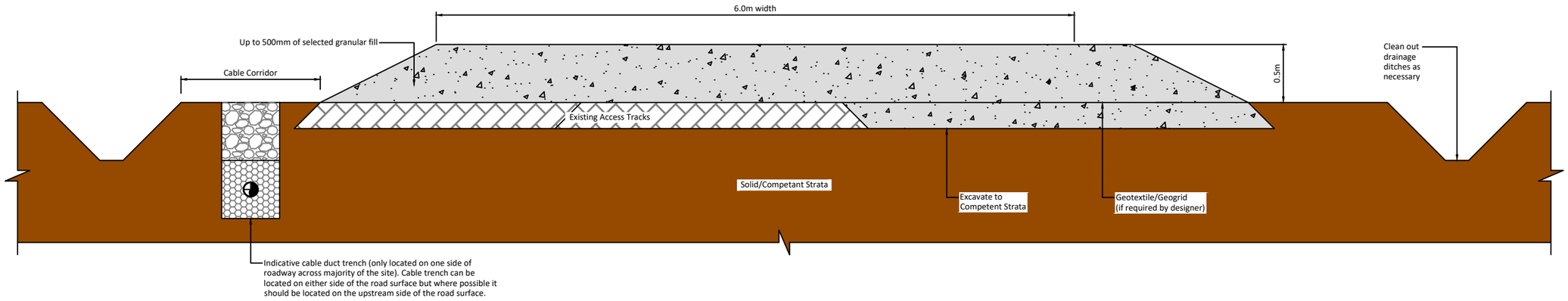
(c) The geogrid may be overlaid with up to 500mm of selected granular fill.

(d) Additional geogrid and granular fill may be required in certain sections of the works (to be confirmed by the designer).

(4) Where the ground is sloping across a section of access road (side long ground) any road widening works required should be done on the upslope side of the existing access road, where possible.

(5) At transitions between floating and existing excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road (Figure 5-2).

(6) A final surface layer shall be placed over the existing access track, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.



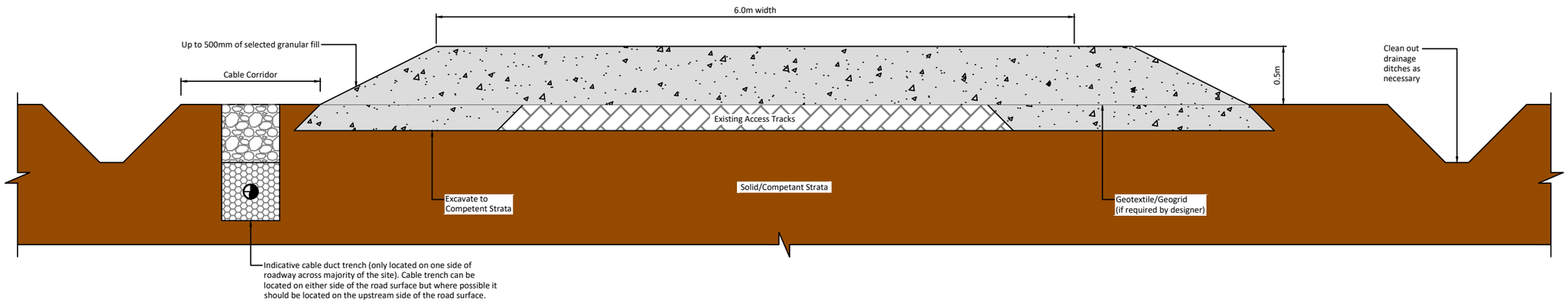


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FIGURE 3-1 : TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS

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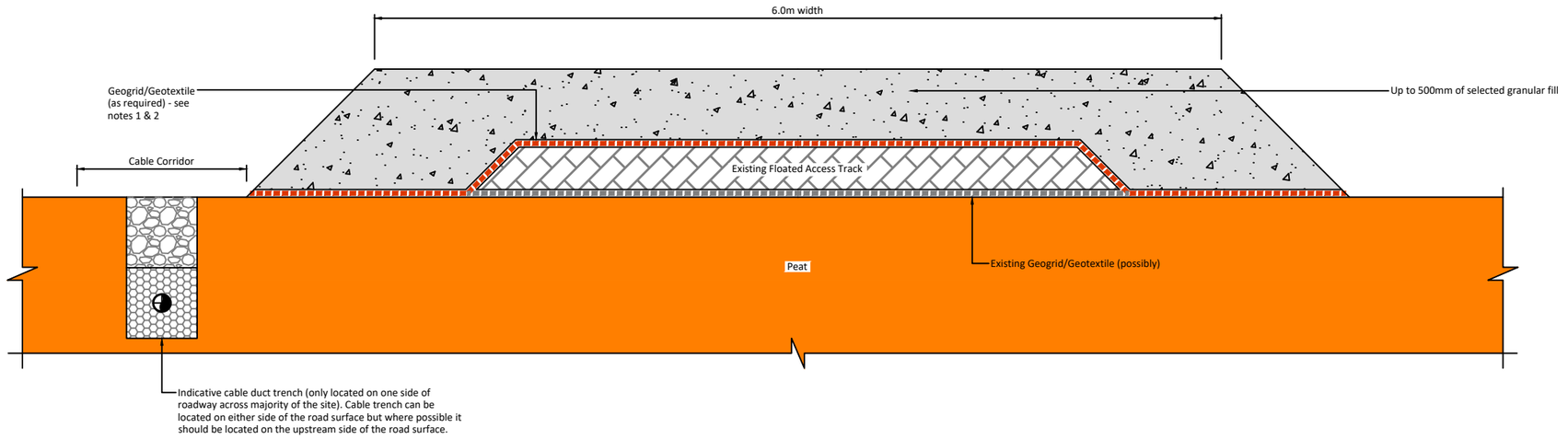

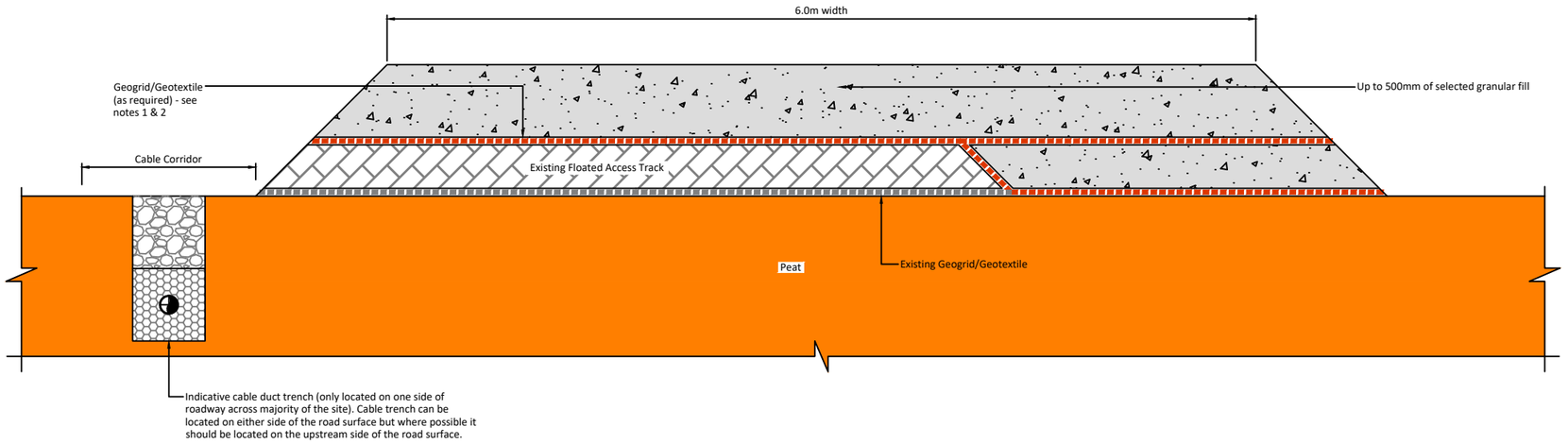

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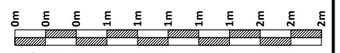

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FIGURE 3-2 : TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS

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4 CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

New excavated roads through peat are proposed for the site, typically in areas where the peat depth is less than 1m. These areas are highlighted on Figure 1-1 with typical cross section details of new excavated roads shown on Figure 4-1.

4.1 Excavated Road Construction Methodology

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

(1) Prior to commencing the construction of the excavated roads movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.

(2) Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.

(3) Excavation of roads shall be to the line and level given in the design requirements. Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer).

(4) Road construction should be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill unless otherwise agreed with the site designer or resident engineer on site.

(5) All excavated peat shall be placed/spread alongside the excavations. Further guidelines are given in Section 6.0 of this report.

(6) 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 should be carried out as the excavation progresses.

(7) The surface of the finished excavated access road will be 1.2m above existing ground level.

(8) A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer).

(9) At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road (Figure 5-2).

(10) Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site.

(11) A final surface layer shall be placed over the excavated road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

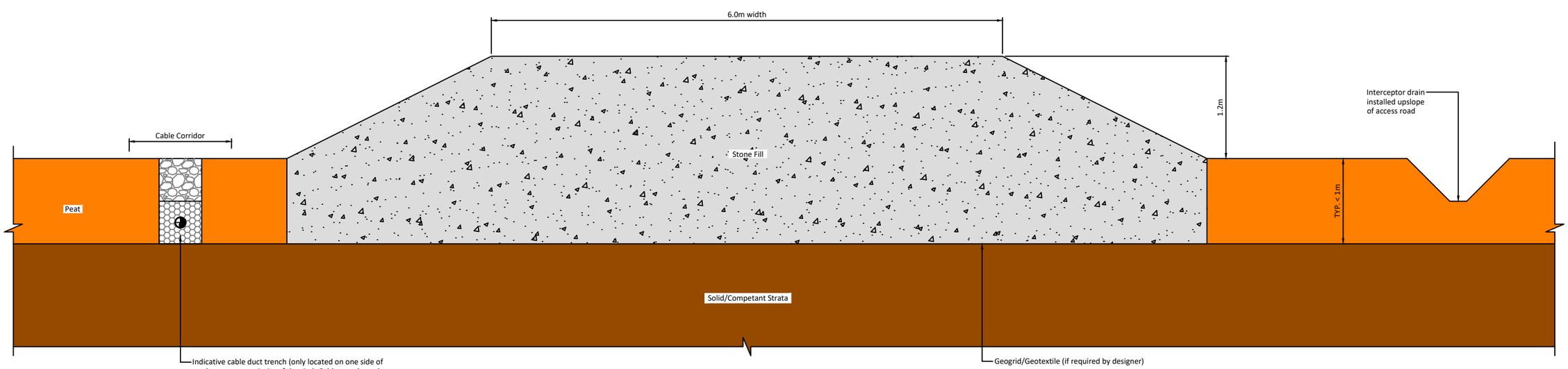

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FIGURE 4-1 : TYPE C - NEW EXCAVATE AND REPLACE ROAD

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5 CONSTRUCTION OF NEW FLOATING ROADS OVER PEAT – TYPE D

Floating access roads are the predominant road construction type proposed for the site and will be used in areas where the peat depth is in excess of 1m. The use of new floated access tracks will be limited on site to areas of flatter terrain i.e. typically less than 5 degree slope. An overview of typical site conditions are presented in Photos 1 and 2 of Appendix A. The proposed locations for the new floating access roads on site are shown in Figure 1-1 and details are shown in Figure 5-1.

A detailed stability analysis should be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road may be more suitable (see section 6). Based on peat strength recordings during the walkovers, floating road construction is deemed suitable for conditions on site.

5.1 Floating Road Construction Methodology

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

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.

(2) Floating road construction shall be to the line and level requirements as per design/planning conditions.

(3) Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(4) Construction of road to be in accordance with appropriate design from the designer.

(5) The typical make-up of the new floated access road is up to 1,200mm 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.

(6) Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 5m wide pressure berm (typically 1m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

(7) The finished road surface width will be approximately 6m (to be confirmed by the designer).

(8) Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.

(9) To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.

(10) Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.

(11) Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

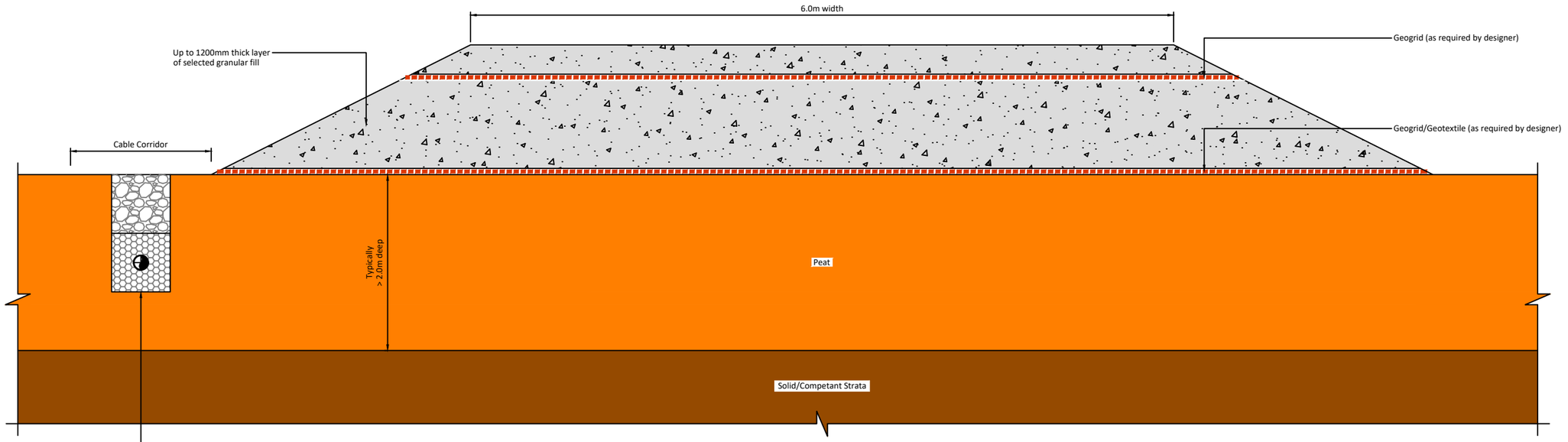

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FIGURE 5-1 : TYPE D - NEW FLOATED ACCESS ROAD

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Notes:

1) Floated access road detail may comprise up to 1200mm stone fill, layer of geotextile & 1 to 2 layers of geogrid.
2) Excavated access road detail may comprise up to 500mm stone & layer of geotextile (depending on ground conditions encountered).

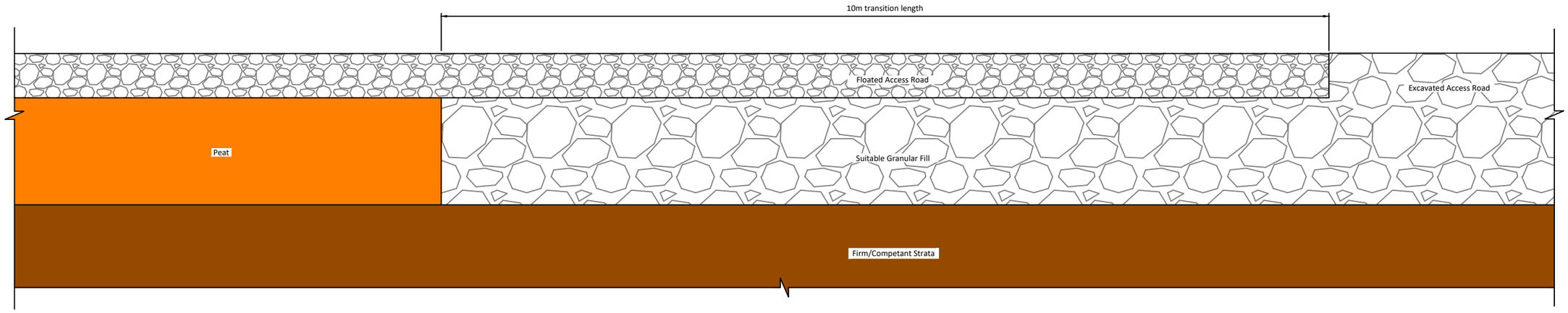

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FIGURE 5-2 : TRANSITION DETAIL FOR FLOATED & EXCAVATED ACCESS ROADS

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6 GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines are given for the access roads on site.

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch may need to be filled prior to upgrading/constructing the access track. It should be noted that the stability of a floating access road is notably reduced by the presence of adjacent ditches/excavations. The ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a ditch prior to filling so as to maintain water flow within the ditch.

(2) Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Recommended remedial works in this instance could include the placement (in the line of the existing drain crossing) of flexible perforated pipes within a permeable stone fill surround.

(3) No excavations (e.g. drainage, peat cuttings) shall be carried out within 2m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations, where required, should be excavated in short lengths and backfilled as soon as practicable.

(4) End-tipping of stone onto the road during the construction/upgrading of the access road should be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(5) Due to the nature of floating road construction it is necessary to monitor the settlement/movement of the road. It is recommended that survey points are located along the road at 10m intervals in areas of deep peat (say greater than 3m). These survey points shall be surveyed on a weekly basis, possibly more frequently depending on construction activities in the area.

(6) It is recommended that the construction and upgrading of access roads in areas of deep peat (say greater than 3m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(7) Where there is excessive vertical displacement of the road during/following construction then mitigation measures may be required to ensure the stability of the road. This may include:

   (a) Introduction of pressure berms either side of the road (that is 2 to 5m wide by 1m deep stone layer).

   (b) Where peat is relatively shallow then excavate peat and replace with suitable fill.

   (c) Slowing the rate of construction.

(8) Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it may be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works it is recommended that measures are taken to re-level the road, as necessary.

7 EXCAVATION AND MANAGEMENT OF PEAT AND SPOIL

The site has been extensively harvested by Bord na Móna using mechanical cutting resulting in well drained and extensively trafficked peat. Bord na Móna has considerable experience in the handling of peat in these circumstances, both during peat production operations and during the rehabilitation processes associated with its cutaway bogs. This experience has shown that when the handling and moving of such peat is appropriately managed, stability or environmental issues are not expected to arise.

7.1 Excavation and Management of Arisings Methodology

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

All excavated peat and overburden will be placed/spread alongside the excavations for the infrastructure elements. As an example, Figure 7-1 shows a typical cross section with placed/spread excavated spoil either side of an access road. Further details are given in section 7.4 of this report.

7.2 Summary of Excavated Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the proposed Derrinlough wind farm site are given in Table 7-1.

Table 7-1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2)	Comment
21 no. Turbines and Hardstands	22m diameter excavation footprint for turbine foundation with hardstand area	152,535	57,700	Hardstanding area and foundation footprint
Access Roads including entrances	Assumed 6m wide finished road surface	57,150	29,465	Excludes proposed floating sections of access road where no excavation of peat will take place (see Figure 1-1)
Substation	17,564m^2 footprint	18,963	6,326	Hardstanding area and foundation footprint
2 no. Meteorological Masts	10 x 10m foundation footprint and 600m^2 hardstanding area	3,490	780	Hardstanding area and foundation footprint. Met Mast 1 likely a piled foundation
5 no. Temporary Construction Compounds and 2 no. Construction Phase Security Hut Platforms	Hardstanding areas – 5,000m^2	37,800	8,570	Hardstanding areas
2 no. Underpasses	Precast concrete box culverts	1,440	4,200	May be piled structures however excavation works will be required
Proposed Amenity Links	3m wide footpath	0	0	Floated construction hence no excavation works
Cable route and grid connection		7,345		Includes the internal network cabling works
N52/N62 Junction			6,920	
	Total =	**278,723m^3**	**113,961m^3**	**Total = 392,684m^3 (peat and spoil volume)**

Note (1) The location of the infrastructure elements on site are shown on Figure 1-1.

Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

7.3 Summary of Peat and Spoil Placement Areas on Site

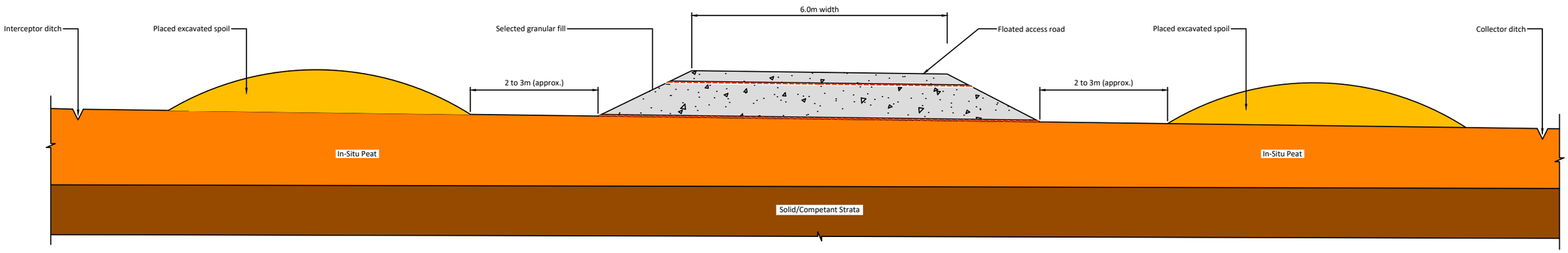
A summary of the potential peat and spoil placement areas at the Derrinlough site are given in Table 7-2.

Table 7-2: Summary of Peat and Spoil Placement Areas on Site

Location	Peat and Spoil Volume (m^3)	Comment
Peat and spoil placement alongside infrastructure elements	352,000	1m in height and 14m wide corridor on both sides of proposed infrastructure elements on site. For example 7m wide corridor on both sides of proposed access roads, see Section 7.4 of the report for further details and Figure 7-1. The placement of peat and spoil alongside infrastructure elements also includes around hardstanding areas, either side of cable trenches, etc.
Landscaping (1)	42,000	It is estimated that approximately 2,000m^3 of peat will be required for landscaping purposes at each of the 21 no. turbine locations
Total =	**394,000m^3**	

Notes:

1) Spoil material will spread to a depth not exceeding 1m in height.
2) See section 7.4 of the Peat & Spoil Management Plan.
3) Indicative locations are given for drainage measures such as drainage ditches.



Scale 1:100

0m 1m 1m 2m 2m 3m 3m 4m 4m 5m 5m
Scale 1:100

Scale (@ A3)
1:100

Date - 16.01.20

FIGURE 7-1 : PEAT & SPOIL PLACEMENT ALONGSIDE INFRASTRUCTURE ELEMENTS - TYPICAL DETAILS

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7.4 Designated Peat and Spoil Placement Areas alongside Infrastructure Elements

The following recommendations/best practice guidelines for the placement of peat and non-peat spoil alongside the proposed infrastructure elements should be considered and taken into account during construction.

(1) All excavated peat and non-peat will be placed/spread alongside the proposed infrastructure elements on site, where possible. A typical example is given in Figure 7-1 which shows a cross section with placed spoil either side of an access road.

(2) The placement of excavated spoil should be restricted to areas where the peat depth is less than 2m. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.

(3) The peat and spoil placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1m over a 7m wide corridor on both sides of the proposed infrastructure elements. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat and spoil.

(4) The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas may require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

(5) Where there is any doubt as to the stability of the peat surface then no excavated spoil shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.

(6) Where practical, it should be ensured that the surface of the placed peat and spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat and spoil should be carried out as placement of peat and spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat and spoil.

(7) Finished/shaped side slopes in the placed peat and spoil 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 and spoil are encountered then slacker slopes will be required.

(8) All placed spoil will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively and possibly in addition, seeding of the placed spoil could be carried out which would aid in stabilising the placed spoil in the long term.

(9) Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer on site.

(10) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.

(11) An interceptor drain should be installed upslope of the designated spoil placement areas to divert any surface water away from these areas. This will help ensure stability of the placed spoil and reduce the likelihood of debris run-off.

(12) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

8 EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

Based on the ground investigation information available, it is estimated that all 21 no. turbine bases are likely to require piled foundations hence arisings from these types of foundations will be minimal. Following the installation and trimming of the piles for the foundations some excavation works are likely to be required. Should gravity foundations be employed the volume of peat and spoil will increase from that quoted in Table 7-1. This will be confirmed at detailed design stage following additional ground investigation.

Similarly, hardstandings for cranes, precast concrete underpasses and other infrastructure foundations on site are to be founded on material underlying peat deposits which will also require excavation through peat.

8.1 Methodology

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

(1) With respect to placement of arisings from excavations the guidelines given in Section 6 are to be followed.

(2) 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.

(3) Excavations shall be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.

(4) Where water is channelled or pumped from an excavation then this water is to be fed into an established watercourse or drainage ditch following suitable treatment.

(5) Excavations shall be kept reasonably free from water at all times.

9 EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Derrinlough wind farm and the national electricity grid will be necessary to export electricity.

It is proposed that the Derrinlough wind farm will connect to the national grid via a proposed substation located in Cortullagh or Grove townland in the northeast of the proposed wind farm development. See Figure 1-1 for the general layout of the proposed substation and its associated grid connection.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in the EIAR.

Should underground cabling be chosen for connection to the national grid, it is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 600mm wide and 1200mm deep.

The cable trench route is envisaged to encounter peat, lacustrine soil and locally till derived from limestone rock.

9.1 Methodology

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

(1) With respect to placement of arisings from excavation the guidelines given in Section 6 are to be followed.

(2) It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material.

(3) 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.

(4) Similarly all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.

(5) Excavations shall be kept reasonably free from water at all times.

(6) Any spoil excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.

(7) Any excavated spoil not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

(8) Backfill requirements for the cable trench will be as per Eirgrid specifications.

10 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMS's) for the project should also take into account, but not be limited, to the general recommendations below together with the specific recommendations above. Some of the general recommendations are already included in more detail within the specific recommendations.

(1) Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.

(2) Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.

(3) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(4) Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits (see section 10).

(5) Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).

11 INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements it is proposed to install sighting posts upslope and downslope of the access road at staggered intervals at locations where the peat depth is greater than 3m. Details of sighting posts are given below.

(1) A line of sighting posts shall comprise:

(a) A line of wooden stakes (typically 1 to 1.5m long) placed vertically into the peat to form a straight line.

(b) The sighting line shall comprise 6 nos. posts at (say) 5m centres that is a line some 25m long.

(c) A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.

(2) Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the road at 10m intervals in areas of deep peat (say greater than 3m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.

(3) Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).

(4) The sighting lines shall be monitored at the beginning of each working day, and during the day where considered appropriate (e.g. when working activity is concentrated at a specific location).

(5) Monitoring of the posts shall comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring shall be increased.

(7) A monitoring record shall be kept of the date, time and relative movement of each post, if any. This record shall be updated and stored as a spreadsheet.

12 CONTINGENCY MEASURES

12.1 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 agreement with all parties.

12.2 Onset of Peat Slide

In the unlikely event of a peat slide, where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area should cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Where considered possible, action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain 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.

(3) All relevant authorities should be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrage

Whilst it is not anticipated that a peat slide will occur on site as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The rock fill for the check barrage will be imported onto site from a local quarry/supplier.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

Typically the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location shall be along public roads or onsite access tracks, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures may be required and would be assessed by all parties and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties.

Appendix A

Photos from Site Walkover

Photo 1 Overview of site conditions (close to turbine T5 looking in a north-eastern direction)

Photo 2 Overview of site conditions (close to temporary construction compound 2 looking in a south-western direction)