APPENDIX 4-2

PEAT AND SPOIL MANAGEMENT PLAN

PEAT AND SPOIL MANAGEMENT PLAN
BALLIVOR WIND FARM

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT
User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Draft for Comment	AW/IH	IH	BDH	03.12.2021
1	Updated following Comment	AW/IH	IH	TC	03.03.2023

Client: MKO Ltd

Keywords: **Peat, Spoil, Management, Excavation, Borrow Pits**

Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan (MKO) to compile a Peat and Spoil Management Plan (PSMP) for Ballivor 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/reinstatement areas which will be developed at the site.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.95 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged in February 2020 by McCarthy Keville O'Sullivan (MKO) on behalf of Bord na Mona to compile a Peat and Spoil Management Plan for the Ballivor wind farm site.

The proposed Ballivor wind farm is at a site located approximately 4km west of Ballivor, on the border between Co. Meath and Co. Westmeath.

The site is relatively flat-lying with drainage channels running typically northwest to southeast. The site is split into three areas, two areas to the north of the R156 regional road and one to the south. The land uses and types within the proposed development site are a mixture of bare cutover and cutaway peat, re-vegetation of bare peat and commercial Bord na Móna operated bog land. Several Bord na Mona rail lines also pass through the site.

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 development comprises of the following:

(1) 26 no. wind turbines with a maximum overall blade tip height of up to 190-200 metres and all associated hard-standing areas

(2) 2 no. borrow pits located in Carranstown Bog, and in third party land in the townland of Craddanstown

(3) 2 no. permanent Anemometry Mast up to a height of 115m

(4) Provision of new site access roads(30km) and associated drainage

(5) Temporary construction compounds

(6) All associated underground electrical and communications cabling connecting the turbines to the proposed substation in Grange More.

(7) All works associated with the connection of the proposed wind farm to the national electricity grid.

(8) All associated site development works

The peat depth data was recorded by FT during the site walkovers from the 8th to the 10th June 2021 and the 22nd to the 24th June 2021 and has been used in the assessment of peat stability for the proposed wind farm site.

Ground investigation in the form of trial pits and boreholes were carried out by FT and Irish Drilling ltd. (IDL) during the following dates:

- 17th – 21st August 2020
- 1st – 16th February 2021
- 19th July 2021
- 5th -11th August 2021

Trial pitting was also carried out by Bord na Mona on 18th and 19th March 2021.

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. The intention of the report is to describe 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 in an appropriate manner.

The report also provides construction details for the types of roads which will be put in place at the site and associated proposed peat and spoil placement/reinstatement areas which will be developed at the site.

This peat & spoil management plan 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.

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent.

The contents of the peat and spoil management plan and peat stability monitoring programme will be updated in the Construction & Environmental management Plan (CEMP) for the construction phase in line with any planning conditions that may apply.

The peat and spoil management plan contains drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in Chapter 4 and Chapter 9 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 below a floating access road, creep movement or localised erosion type events.

Adherence to the peat and spoil management plan should reasonably 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.

PLAN
Scale 1:20000

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

Road Type Legend:

Type A - Upgrade of Existing Excavated Access Tracks

Type B - Upgrade of Existing Floated Access Tracks

Type C - New Excavate & Replace Access Road

Type D - New Floated Access Road

T22 T23 T24 T25 T26 T21 T20 T19 J08 J07 T15 T14 T16 J03 T18 J04 J02 T13 J05 T17 J06 MM2 J01

Proposed Turbine & Hardstanding

Proposed New Access Road

Proposed Permanent Amenity Car Park

Proposed Temporary Construction Compound

Site Boundary

Proposed Met Mast 2

Proposed Temporary Access Track

Borrow Pit 2

Proposed Site Offices

Access for delivery and Removal of Machinery to Borrow Pit

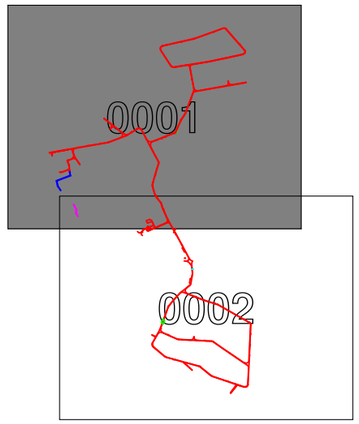
Proposed Substation

Corduff - Mullingar 110kv OHL

Borrow Pit 1B

0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m

Scale 1:20000



KEYPLAN

Scale (@ A3) 1:20000

Date - 24.02.23

FIGURE 1-1 : ROAD CONSTRUCTION TYPES PLAN SHEET 1 OF 2

Drawn - POR

Checked - IH

Rev - B

O:\ACAD\2020\P2318\P2318-0600-0012

Friday 24 February 2023

PLAN

Scale 1:20000

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Road Type Legend:

Type A -
Upgrade of Existing
Excavated Access Tracks

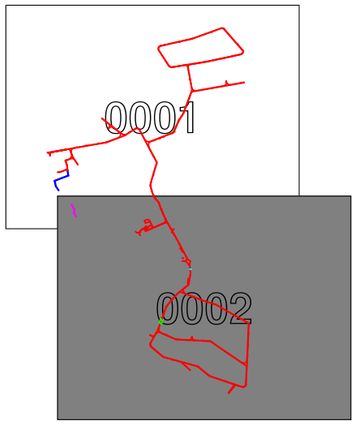
Type B -
Upgrade of Existing
Floated Access Tracks

Type C -
New Excavate &
Replace Access Road

Type D -
New Floated Access Road

Access for delivery and Removal of Machinery to Borrow Pit
Proposed Substation
Corduff - Mullingar 110kv OHL
Borrow Pit 1B
J01
ENT01
ENT02
Proposed Drain
Borrow Pit 1A
Proposed Site Offices
J09
T12
T01
T02
Site Boundary
Proposed Met Mast 1
T11
J13
J12
MM1
T06
T03
Proposed Turbine & Hardstanding
T05
T04
Proposed New Access Road
T10
J11
T09
T08
J10
T07

0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m
Scale 1:20000



KEYPLAN

Scale (@ A3)
1:20000

Date - 24.02.23

FIGURE 1-1 : ROAD CONSTRUCTION TYPES PLAN SHEET 2 OF 2

Drawn - POR
Checked - IH
Rev - B

O:\ACAD\2020\P2318\P2318-0600-0013

Friday 24 February 2023

2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the Ballivor wind farm the activities that will generate peat and spoil are as follows:

(1) Upgrade of existing access tracks (excavate and replace tracks)

(2) Construction of new excavated roads through peat

(3) Excavation and placement of arisings

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

(5) 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 existing tracks will need to be upgraded and new access roads will need to be constructed. The road construction preliminary design has taken into account the following key factors:

(1) Buildability considerations

(2) Minimising excavation arisings

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

(4) Requirement to minimise disruption to peat hydrology

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 by the prevailing ground conditions encountered along that length of road.

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

It should be noted that this report does not include a detailed design for the access roads on the Ballivor wind farm site. This report includes the most suitable type of road construction envisaged for each section of access road based on the ground/site conditions recorded during the site walkovers. Where floating roads are proposed in this report, a typical methodology is presented, and a confirmatory ground investigation will be carried out prior to construction on site.

Table 2.1: General Road Construction Techniques

Construction Method	Typical Site Conditions			Comment
	Construction Type	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access roads	Type A and B	-	Varies	Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – Figure 1-1
Construction of new excavated roads through peat	Type C	<1.0	Varies	New access road construction technique envisaged for various locations on site – Figure 1-1
Construction of new floating roads over peat	Type D	>1.0	<5	New access road construction technique envisaged for various locations on site – Figure 1-1

Further details on access road construction types A to D are given in Sections 3, 4 and 5 of the report.

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

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A AND B

Minimal, localised sections of existing access tracks are present on the site. Upgrading works are likely to involve both widening and resurfacing of the existing access tracks. The proposed locations for upgrade of the existing access roads on site are shown in Figure 1-1 and details are shown in Figure 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, which are discussed in the EIAR.

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

(2) For upgrading of existing excavated access roads (Type A - 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 road should be overlaid with up to 500mm of selected granular fill.

(d) Access roads to be finished with a layer of capping across the full width of the track.

(e) A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road where the existing track shows signs of excessive rutting (to be confirmed by the designer).

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

(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.

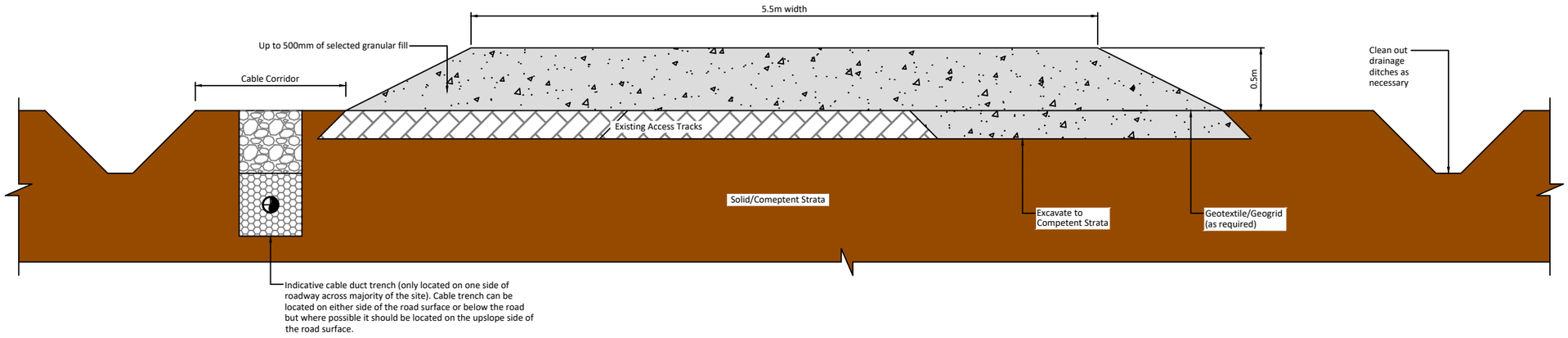
(d) Additional geogrid and granular fill may be required in certain sections of the works, such as where excessive rutting is noted in the existing track (to be confirmed by the designer).

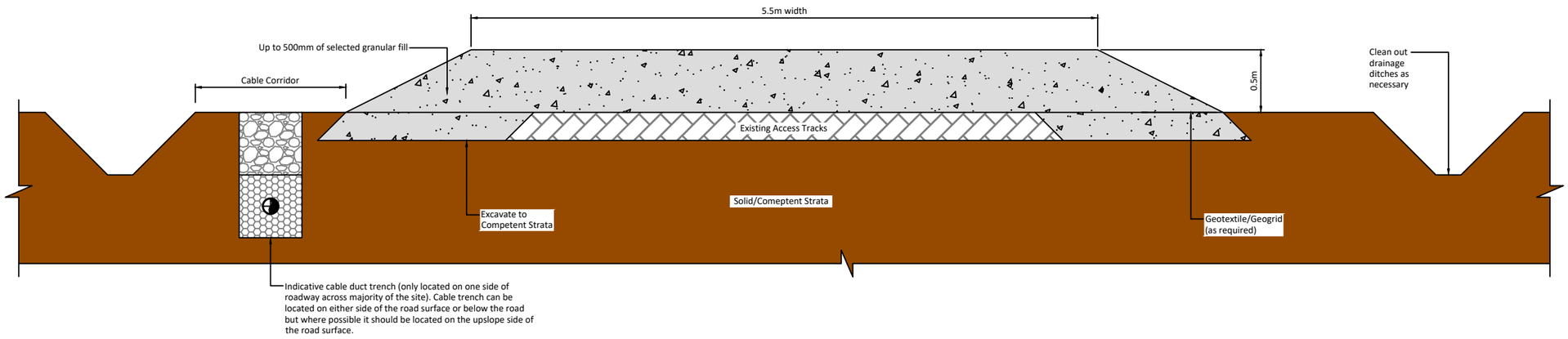
(4) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

(5) At transitions between new floating and existing excavated roads a length of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.

(6) The finished road width will be 5.5m, including a running width of 5m, with wider sections on bends and corners.

(7) 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.





Scale 1:40

0m 0m 0m 1m 1m 1m 1m 1m 2m 2m 2m
Scale 1:40

Scale (@ A3)

Date - 21.10.21

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

Drawn - POR

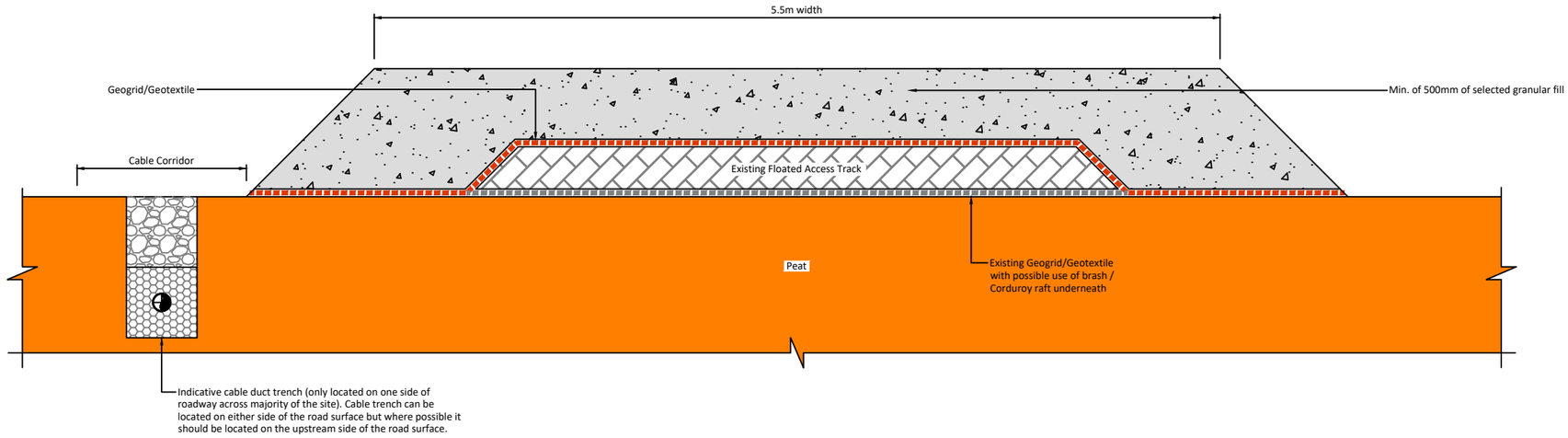
Checked - IH

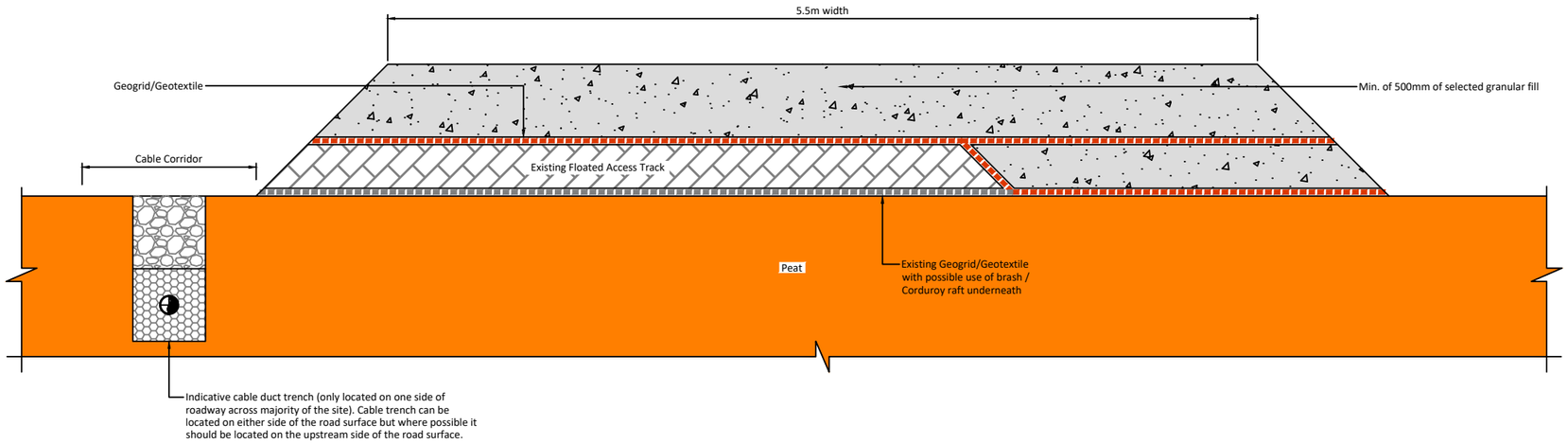
Rev - B

O:\ACAD\2020\P2318\P2318-0600-0014

Friday 24 February 2023

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie





Scale 1:40

0m 0m 0m 1m 1m 1m 1m 1m 2m 2m 2m
Scale 1:40

Scale (@ A3)

Date - 21.10.21

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

Drawn - POR

Checked - IH

Rev - B

O:\ACAD\2020\P2318\P2318-0600-0017

Friday 24 February 2023

####

4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. The proposed locations for new excavated access roads on site are shown in Figure 1-1 and details are shown in Figure 4-1.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

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, which are discussed in the relevant Chapter of the EIAR.

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

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

(3) Excavation will take place to a competent stratum beneath the peat.

(4) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.

(5) Once excavated, peat will be placed within the borrow pit or be side-cast local to the excavation.

(6) Excavation of materials with respect to control of peat stability:

  (a) Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.

  (b) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.

  (c) All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas.

(7) Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.

(8) The excavated access road will be constructed with a minimum of 800mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.

(9) Access roads to be finished with a layer of capping across the full width of the road.

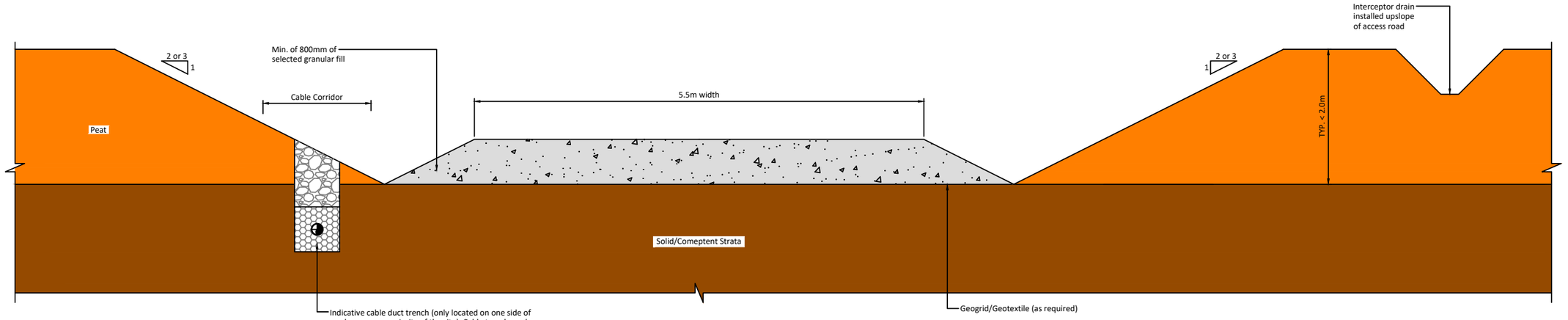
(10) A layer of geogrid/geotextile may be required at the surface of the competent stratum.

(11) 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).

(12) 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.

(13) A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

FEHILY TIMONEY Cork | Dublin | Carlow
www.fehilytimoney.ie



Scale 1:50

0m 0m 1m 1m 1m 1m 2m 2m 2m 2m 3m

Scale 1:50

Scale (@ A3)

Date - 21.10.21

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

Drawn - POR

Checked - IH

Rev - B

Friday 24 February 2023

O:\ACAD\2020\P2318\P2318-0600-0016

5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE D

Floating roads will be the predominant road construction type across 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., less than a 5 degree slope. The proposed locations for floating roads across the are shown in Figure 1-1 and details shown in Figure 5-1.

A confirmatory 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), although this is not anticipated at the location of the floated roads.

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, which are considered in the relevant chapter of the EIAR.

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

(1) Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

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

(3) The typical make-up of the new floated access road is a minimum of 800mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (Figure 5-1).

(4) Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works, Series 600 (2013).

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

(6) The finished road width will be approximately 5.5m (5.0m running width), with wider sections on bends and corners.

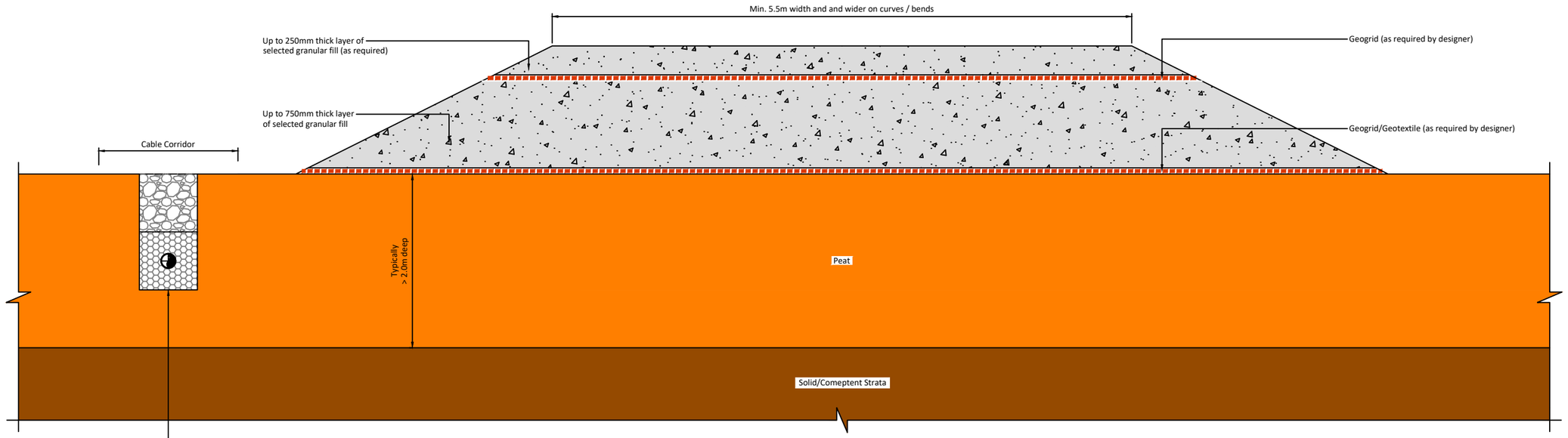
(7) Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.

(8) 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.

(9) 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.

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

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



Scale 1:40

0m 0m 0m 1m 1m 1m 1m 1m 2m 2m 2m
Scale 1:40

Scale (@ A3)
1:40

Date - 24.02.23

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

Drawn - POR
Checked - IH
Rev - A

O:\ACAD\2020\P2318\P2318-0600-0015

Friday 24 February 2023

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 will 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. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.

(3) No excavations (e.g. drainage, peat cuttings) shall be carried out within 5m 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 should be excavated in short lengths and backfilled as soon as practicable.

(4) No excessive stockpiling of materials shall take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(5) 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.

(6) Due to the nature of floating road construction it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2.5m). These survey points shall be surveyed on a weekly basis, possibly more frequently when construction activities are ongoing in the area.

(7) It is recommended that the construction and upgrading of access roads in areas of deep peat (greater than 2.5m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(8) In the event of 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 are 2 to 5m wide by 0.5m deep stone layer).

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

  (c) Slowing the rate of construction.

(9) 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 STORAGE 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 Storage 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 or, if required, transported to the two on-site borrow pits. 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.

(1) All excavated peat and spoil shall be transported immediately on excavation to one of the on-site borrow pits (see Figure 1-1) or to designated peat storage areas alongside the access roads.

(2) Further details on the construction and reinstatement of the borrow pits are given in Section 7.4.

(3) Further details on the placement of excavated peat to designated peat storage areas alongside the access roads are given in Section 7.5.

(4) Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes.

7.2 Summary of Peat and Spoil Volumes on Site

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

Table 7.1: Summary of Excvated Peat and Spoil Volumes on Site

Infrastructure Element [1]	Typical Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3) [2] and [3]	Comment
26 no. Turbines and Hardstands	27m diameter excavation footprint for turbine foundation with 25 x 65m hardstand area.	376,900	95,000	
Access Roads	Assumed 5m running surface with 6m wide development footprint.	2,600	5,100	Excludes proposed floating sections of access road where no excavation of peat will take place (see Figure 1-1)
Meteorological Masts	10 x 10m foundation footprint and 30 x 30m hardstanding area.	3,500	504	
Temporary Construction Compounds	Hardstanding areas vary.	20,000	8,000	
Substation		50,000	5,500	
Borrow pits	On-site and off-site borrow pits	98,400	53,880	Peat and spoil generated from the off-site borrow pit will be backfilled into this borrow pit upon completion.
Cable route and grid connection		12,500		
	Total =	**564,000m^3**	**168,000m^3**	**Total = 732,000m^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/Reinstatement Areas on Site

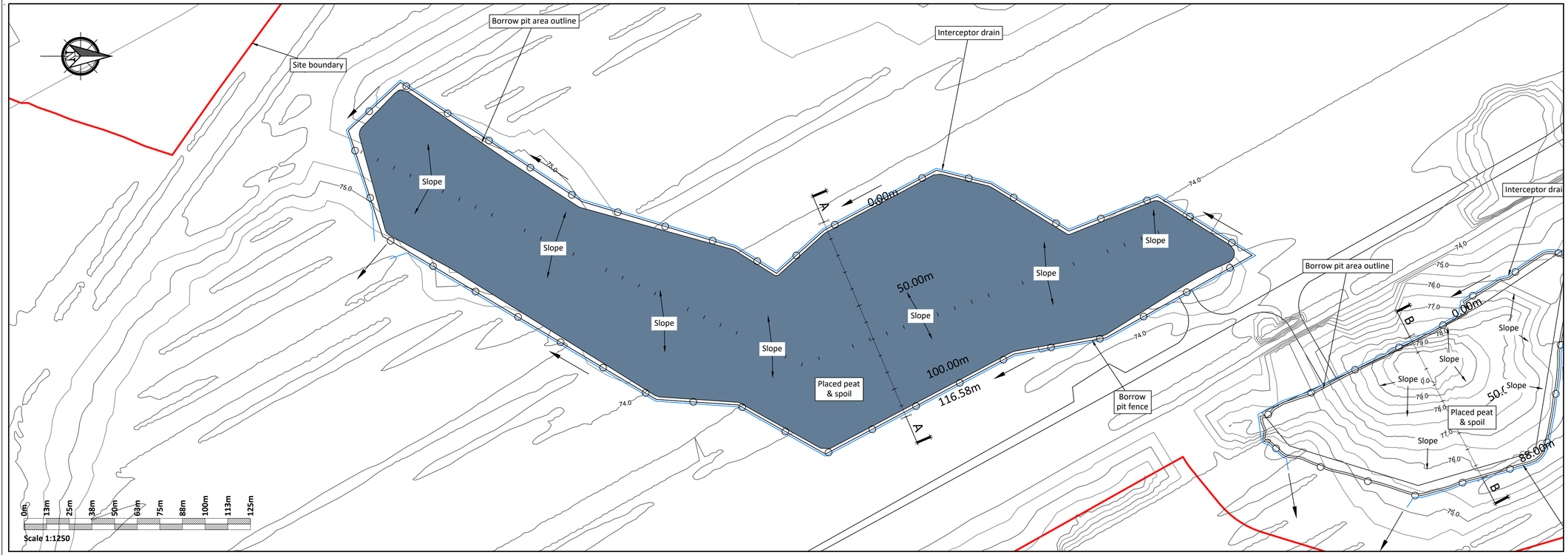
A summary of the potential peat and spoil placement/reinstatement areas at the Ballivor wind farm site are given in Table 7-2.

Table 7.2: Summary of Peat and Spoil Placement/Reinstatement Areas on Site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Borrow Pits	290,000	See Figure 7-1 to 7-3 for details. Peat and spoil generated from offsite borrow pit to be backfilled into pit upon completion.
Peat placement alongside designated access roads	405,000	1.3m in height and 10m wide corridor on both sides of proposed infrastructure elements on site. For example, 10m wide corridor on both sides of proposed access roads, see Section 7.4 of the report for further details and Figure 7-5. The placement of peat alongside infrastructure elements also includes around hardstanding areas, either side of cable trenches, etc.
Landscaping (2)	52,000	It is estimated that approximately 2,000m^3 of peat will be required for landscaping purposes at each of the 26 no. turbine locations.
Total =	**747,000m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Figure 1-1.

Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.



PLAN

Scale 1:1250

FEHILY TIMONEY Cork | Dublin | Carlow
www.fehilytimoney.ie

Construction Notes Borrow Pit:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ conditions.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/buttress. Leaving in place upstands/segments of intact ground which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) A buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 2m (approx.) in height is likely to be required.

(5) The buttress will be founded on competent strata. The founding stratum for the buttress should be inspected and approved by the project geotechnical engineer.

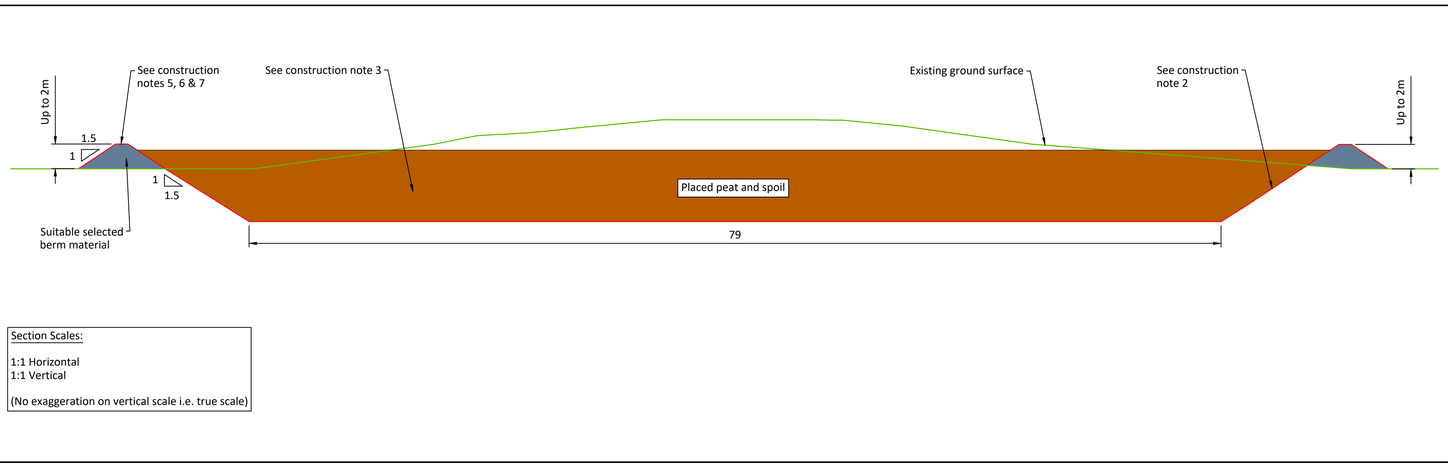
(6) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(7) The surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

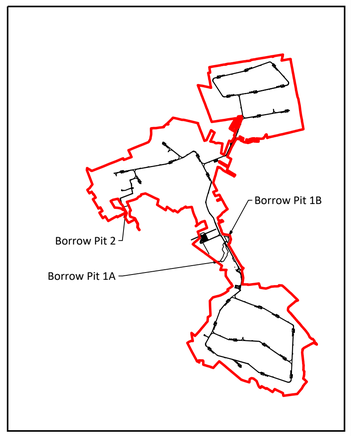
(9) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan



SECTION A - A

Scale 1:250



KEYPLAN

Scale 1:80000

Scale (@ A1) 1:1250

Date - 06.03.23

FIGURE 7-1 : BORROW PIT 1A PLAN AND CROSS SECTION

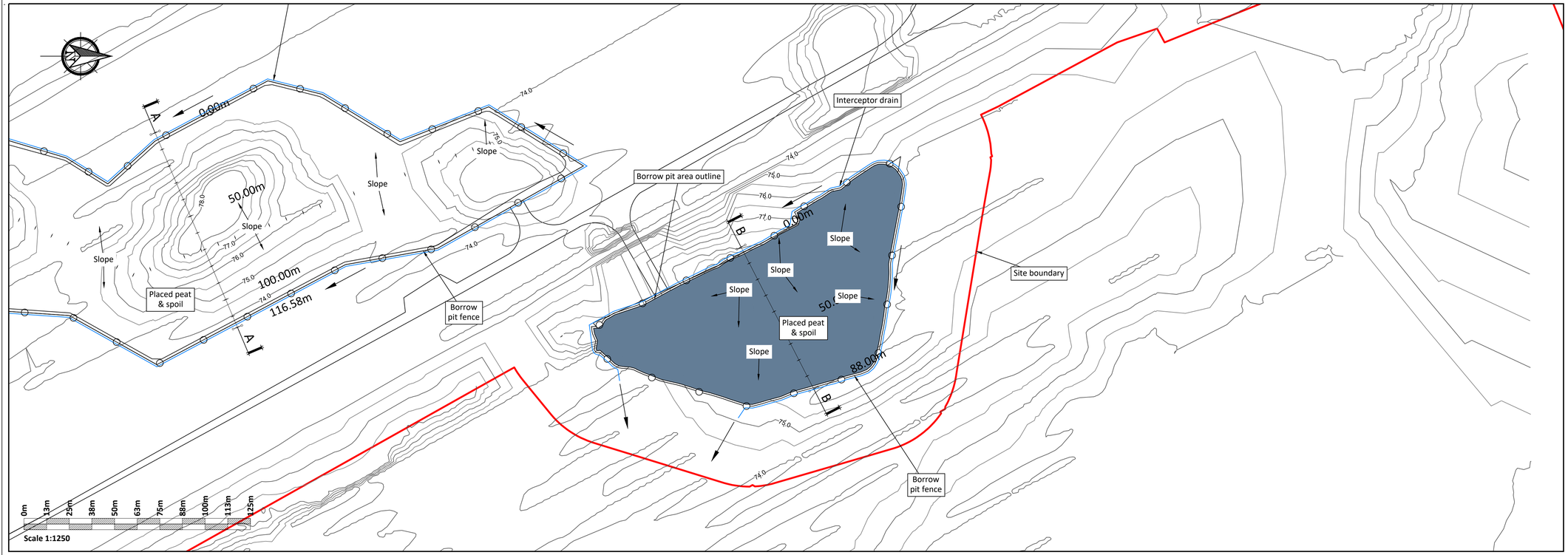
Drawn - POR

Checked - IH

Rev - C

O:\ACAD\2020\P2318\P2318-0600-0008

06 March 2023



PLAN

Scale 1:1250

FEHILY TIMONEY Cork | Dublin | Carlow
www.fehilytimoney.ie

Construction Notes Borrow Pit:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ conditions.

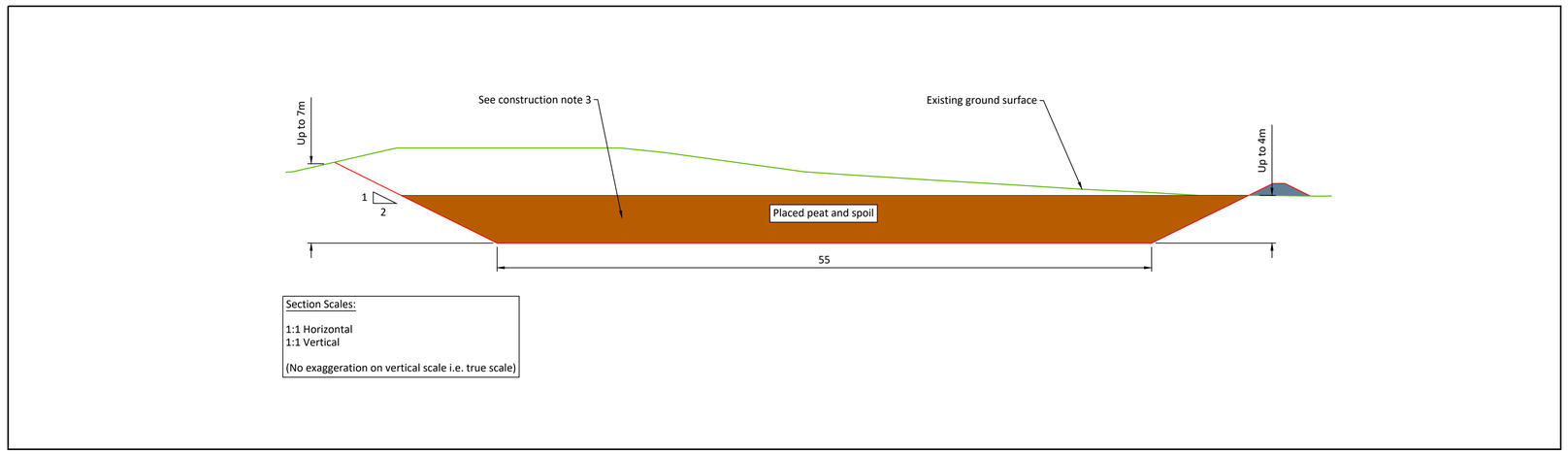
(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/buttress. Leaving in place upstands/segments of intact ground which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(5) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

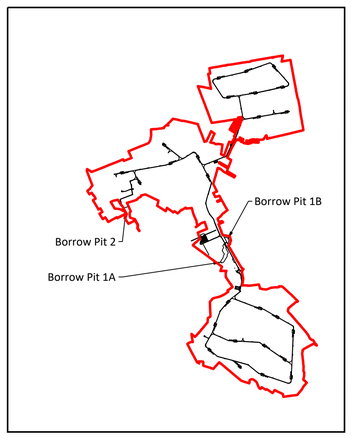
(6) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(7) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan



SECTION B - B

Scale 1:250



KEYPLAN

Scale 1:80000

Scale (@ A1) 1:1250

Date - 06.03.23

FIGURE 7-2 : BORROW PIT 1B PLAN AND CROSS SECTION

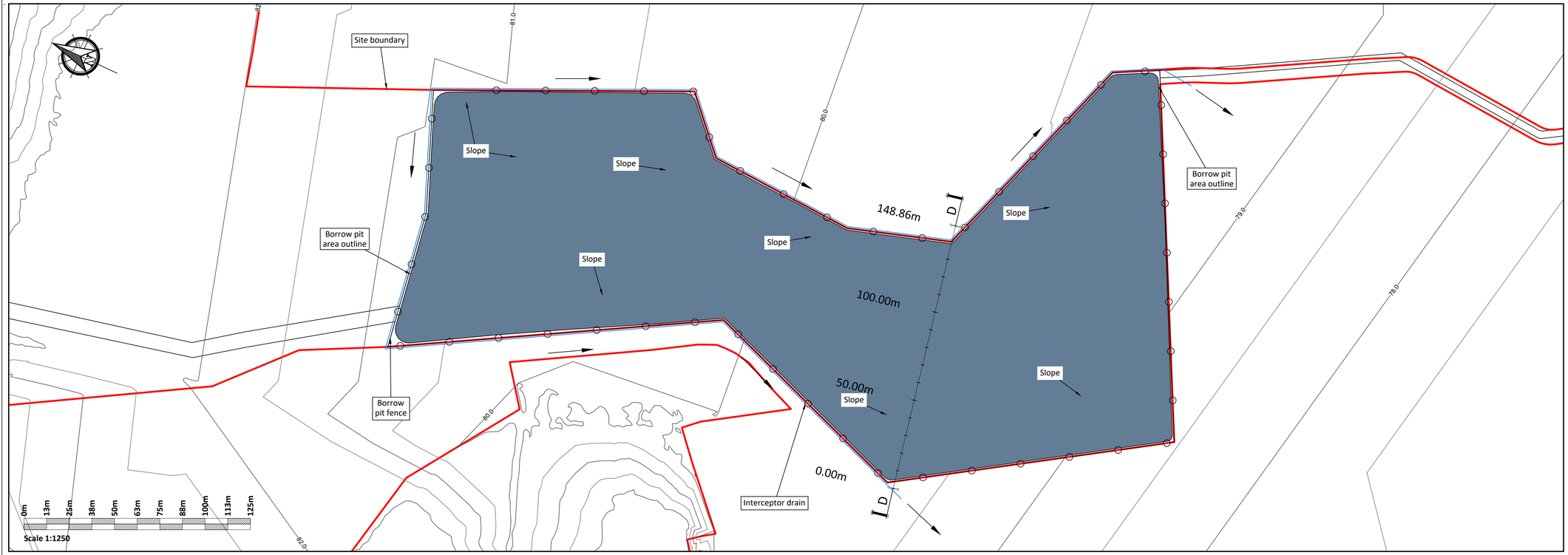
Drawn - POR

Checked - IH

Rev - C

O:\ACAD\2020\P2318\P2318-0600-0009

06 March 2023



PLAN

Scale 1:1250

FEHILY TIMONEY Cork | Dublin | Carlow
www.fehilytimoney.ie

Construction Notes Borrow Pit:

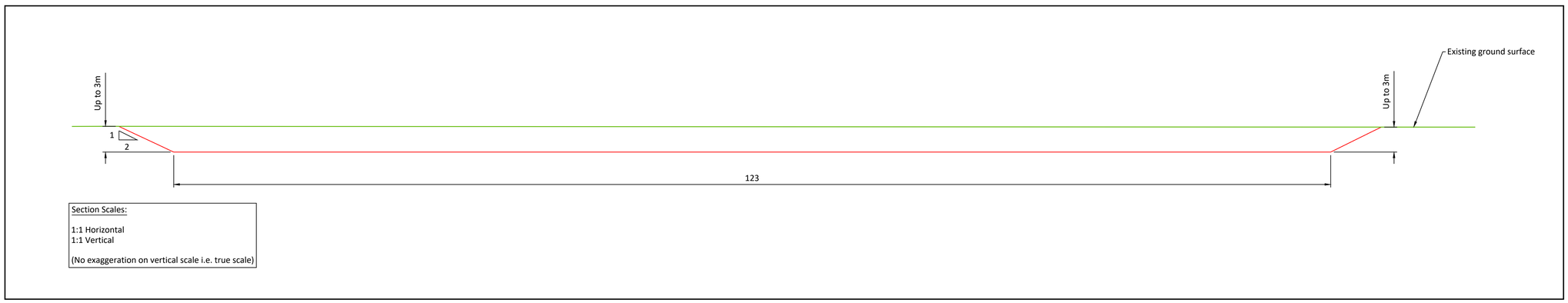
(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ conditions.

(3) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

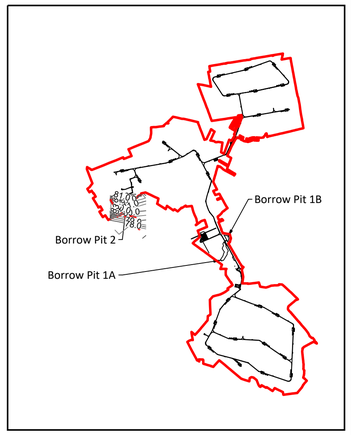
(4) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(5) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan



SECTION D - D

Scale 1:250



KEYPLAN

Scale 1:80000

Scale (@ A1) 1:1250

Date - 06.03.23

FIGURE 7-3 : BORROW PIT 2 PLAN AND CROSS SECTION

Drawn - POR

Checked - IH

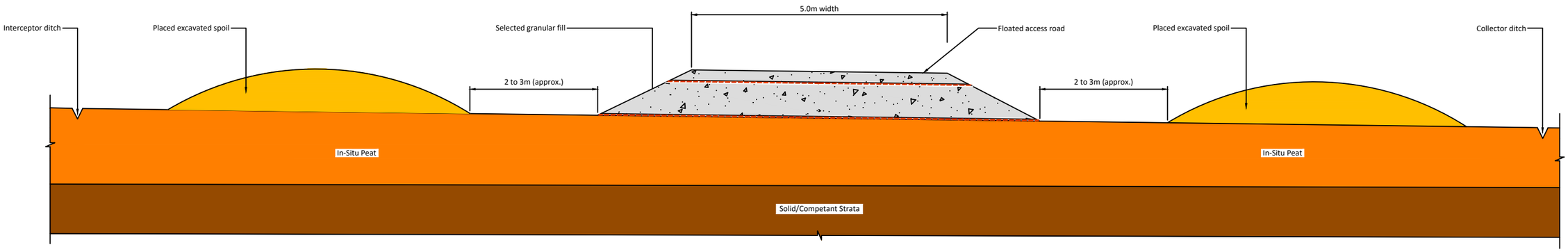
Rev - C

O:\ACAD\2020\P2318\P2318-0600-0011

06 March 2023

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

Scale (@ A3)
1:100

Date - 02.11.21

FIGURE 7-4 - PEAT & SPOIL PLACEMENT ALONGSIDE INFRASTRUCTURE ELEMENTS - TYPICAL DETAILS

Drawn - POR
Checked - IH
Rev - A

O:\ACAD\2019\P2192\P2192-0600-0015

Wednesday 3 November 2021

7.4 Guidelines for the Construction and Reinstatement of Borrow Pits

Three number locations have been identified as potential borrow pits and are shown on Figure 1-1. The peat depth within the development footprint of the borrow pits is around 0.5-1.5m.

Upon removal of the granular material from the borrow pits, it is proposed to reinstate the on-site borrow pits using excavated peat and spoil. The excavated granular material from the borrow pits will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. The contractor excavating the granular material will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators. It also eliminates the need to construct above ground retaining structures which may have an unnecessary visual impact and increase the development footprint of the proposed wind farm. The text below provides design and construction guidelines for the borrow pits.

Figures 7-1 to 7-4 show typical construction details for the borrow pits.

The borrow pits shall be constructed as follows:

(1) The granular material within the proposed borrow pit footprints will be removed by excavation.

(2) It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of access road. As excavation progresses into the back edge of the borrow pits, the base of the borrow pits may be raised to suit local conditions. Localised deepening of the borrow pit floors may be required depending on extraction operations.

(3) Depending on the depth and type of granular material present in the borrow pits it may be possible to excavate the granular material from the borrow pits whilst leaving in place upstands/segments of granular material which will help to retain the placed peat and spoil. The upstands/segments of granular material will essentially act as engineered buttresses within the borrow pits.

(4) Slopes within the excavated granular material formed around the perimeter of the borrow pits will be formed at stable inclinations to suit local in-situ conditions. Exposed sections of the excavation slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(5) The stability of the excavation faces within the borrow pits will be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable conditions to be identified and suitable mitigation measures to be applied.

(6) Where it is not possible to leave upstands/segments of intact granular material in place it may be necessary to construct buttresses within the borrow pits. The buttresses should be constructed of granular fill from the borrow pit excavation. The founding stratum for each buttress should be inspected and approved by a competent person.

(7) It may be necessary to construct the buttresses within the borrow pits in stages as infilling of peat and spoil behind the buttresses progress. The buttress should be constructed of granular fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil, as necessary.

(8) Infilling of the peat and spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/buttress. The contractor excavating the granular material will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be reinstated safely.

(9) A number of buttresses to form cells with the borrow pits may be required to ensure access for trucks and excavators can be achieved. See Figures 7-1 to 7-4 for the location of the buttresses. The locations of the buttresses shown on Figures 7-1 to 7-4 for the borrow pit are indicative only and may change subject to local conditions encountered on site during construction.

(10) In order to prevent water retention occurring behind the buttresses, the buttress will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.

(11) Any buttresses should be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The side slopes of the buttress should be constructed between 30 to 45 degrees.

(12) The height of the buttresses constructed should be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. Buttresses up to 2m in height are likely to be required.

(13) The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil is likely to be required.

(14) The surface of the placed peat and spoil should be shaped to allow efficient run-off of surface water from the placed arisings.

(15) A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pits may be required.

(16) An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.

(17) Control of groundwater within the borrow pits may be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.

(18) A silting pond will be required at the lower side/outfall location of the borrow pits.

(19) The acrotelm (upper fibrous layer) layer of peat shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the peat and spoil within the borrow pits.

(20) All the above mentioned general guidelines and requirements will be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pits should be compiled prior to construction.

7.5 Designated Peat Placement Areas alongside Infrastructure Elements

The following best practice guidelines for the placement of peat alongside the proposed infrastructure elements will be adhered to during construction.

(1) All excavated peat will be placed/spread alongside the proposed infrastructure elements on site, where possible. A typical example is given in Figure 7-5 which shows a cross section with placed peat either side of an access road.

(2) The peat placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1m over a 10m 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.

(3) 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 within the placement areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

(4) Where a peat stability analysis following the confirmatory ground investigation reveals areas with an unacceptable risk of peat instability, then no material shall be placed on to the peat surface.

(5) The surface of the placed peat will be shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat should be carried out as placement of peat within the placement area progresses. This will reduce the likelihood of debris run-off.

(6) Finished/shaped side slopes in the placed peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.

(7) The acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat within the placement areas.

(8) 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.

(9) An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help reduce the likelihood of debris run-off.

(10) 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

From the available ground investigation data, it is estimated that all 26 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. This will be confirmed at detailed design stage following confirmatory ground investigation.

Similarly, crane hardstandings, construction compound, substation platforms and met mast foundations are to be founded on competent overburden which will also require excavation through peat and spoil. Excavations for the borrow pits will also require the removal of 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 7 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): 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.

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Ballivor Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Ballivor Wind Farm will connect to the national grid via a new substation located in Grange More townland on the western side of the proposed wind farm development.

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

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 900mm wide and 1200mm deep.

The cable trench route is envisaged to encounter peat.

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 excavations the guidelines given in Section 7 are to be followed.

(2) It is proposed to excavate the trenches for the underground cable at a uniform depth 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): 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 material 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 material not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

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) for the project will also take into account, but not be limited, to the general recommendations below together with the specific recommendations above.

(1) Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge. All water discharged form excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) Avoidance of unstable excavations. All excavations shall be suitably supported or battered to stable slopes 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 11).

(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 2.5m. Additional monitoring locations may be required at infrastructure locations with deeper peat deposits. 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 no. posts at 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 (greater than 2.5m). 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 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) 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 a Geotechnical Engineer and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken 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 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 the existing access roads on the wind farm site and/or along public roads, 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, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer 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.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE and PLANNING

www.fehilytimoney.ie

CORK OFFICE
Core House
Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6
Bagenalstown Industrial Park,
Bagenalstown, Co. Carlow,
R21 XW81, Ireland
+353 59 972 3800