FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

# PEAT & SPOIL MANAGEMENT PLAN

## GLENORA WIND FARM

Prepared for: **MKO Ltd**

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# GLENORA WIND FARM

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**Abstract:** Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan (MKO) to compile a Peat and Spoil Management Plan (PSMP) for Glenora 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.

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# 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.100 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.

This Report was written by Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering) and Alan Whelan (FT Project Engineer, BEng (Hons) Civil Engineering). Ian is a Principal Geotechnical Engineer with Fehily Timoney and has 25 years' experience in geotechnical engineering. Alan is a Project Engineer with Fehily Timoney and has two years' experience in geotechnical engineering.

## 1.2 Project Description

Fehily Timoney and Company (FT) was engaged in March 2021 by MKO on behalf of Glenora Wind Farm DAC to compile a Peat and Spoil Management Plan for the Proposed Development.

The Proposed Development will be located at a site approximately 6km southwest of Ballycastle in County Mayo.

The Proposed Development site comprises predominantly commercial forestry underlain by blanket peat with a mainly man-made drainage network.

## 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. Such peat and spoil management measures have been successfully implemented on numerous wind farms over the past 15 years.

This peat and 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 will be carried out by the appointed construction stage designer prior to any construction work commencing on site. This will take account of the consented project details and any conditions imposed by that consent. This will include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

As work is carried out on site the contents of the peat and spoil management plan and peat stability monitoring programme will be implemented in full and updated (if required to comply with any planning conditions or requirements of the planning authority) in the Construction & Environmental Management Plan (CEMP) for the construction phase.

This 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 site is outlined in detail in the relevant chapter of 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 will 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.

# 2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

## 2.1 Construction Activities

For the construction phase of the Proposed Development the activities that will generate peat and spoil are as follows:

(1) Upgrade of existing access tracks (excavate and replace, and floating tracks) including temporary widening of local road to facilitate deliver of turbine components

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (will not generate peat and spoil but the methodology for construction is included for completeness)

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

(1) Buildability considerations

(2) Maximising use of existing infrastructure

(3) Minimising excavation arisings

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

(5) Requirement to minimise disruption to peat hydrology

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

The proposed 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 Proposed Development. 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 proposed methodology is presented however a detailed design will be carried out prior to construction commencing on site. These measures are based on available guidance, including 'Constructed Tracks in the Scottish Uplands (Scottish Natural Heritage, 2nd Edition ,2015), Floating Roads on Peat (Scottish Natural Heritage/Forestry Commission Scotland, 2010) and 'Dealing with Bearing Capacity Problems on Low Volume Roads Constructed on Peat (ROADEX II, 2004).

**Table 2.1: General Road Construction Techniques**

| Construction Method | Site Conditions | | | Comment |
|---|---|---|---|---|
| | Construction Type | Peat Depth (m) | Slope Inclination (degs) | |
| Upgrade of existing access roads | Type A | - | Varies | Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – Drawing P20-312-0600-GLEN-0005 |
| Construction of new excavated roads through peat | Type B | Normally proposed where less than 1.5m, locally up to 3.0m | Varies | New access road construction technique envisaged for various locations on site – Drawing P20-312-0600-GLEN-0005 |
| Construction of new floating roads over peat | Type C | >2.0 | <3 | New access road construction technique envisaged for various locations on site – Drawing P20-312-0600-GLEN-0005 |

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

# 3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A

Up to 15km of existing access roads requiring upgrade are present across the Proposed Development site and have been in operation for a significant number of years. The existing access roads were constructed using both floating and excavate and replace construction techniques. Based on the site walkover carried out by FT the existing access roads were noted as being in relatively good condition. Upgrade works will involve both widening and resurfacing of the existing access road. The proposed locations for upgrade of the existing access roads on site are shown in Drawing P20-312-0600-GLEN-0005 and details are shown in Drawing P20-312-0600-GLEN-0006.

## 3.1 Upgrading Existing Access Tracks Construction Methodology

This methodology includes procedures that will be included in the construction methodology 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 assessed in Chapter 4 and 9 of the EIAR.

(1) Access road construction will be to the line and level requirements as per design.

(2) For upgrading of existing excavated access roads (Type A) the following guidelines will be implemented in full:

  (a) Excavation of the widened section of access road will 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 where the depth of excavation required exceeds 500mm.

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

  (d) Access roads will 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 (to be confirmed by the designer).

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

(3) The finished road width will have a running width of 5m, with wider sections on bends and corners.

(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 10 to 20m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded to accommodate wind turbine construction and delivery traffic.

# 4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE B

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 drawing P20-312-0600-GLEN-0005 and details are shown in drawing P20-312-0600-GLEN-0007.

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 will 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 assessed in Chapter 4 and 9 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 of roads swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.

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

(5) Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All peat placement areas will be upslope of founded roads/hardstands and will be inspected by the Project Geotechnical Engineer before material is stored in the area.

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

  (a) Where Acrotelm (to about 0.3 to 0.4m of peat) is required for landscaping it 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 will 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) will be transported immediately on excavation to the designated placement areas.

(7) Excavation side slopes in peat will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. 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) End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.

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

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

(11) A layer of geogrid/geotextile may be required at the surface of the competent stratum where cohesive material is present to prevent mixing of the underlying material with the granular fill.

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

(13) Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e., greater than 2m) 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.

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

(15) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/Ecological Clerk of Works/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

# 5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE C

The use of new floated access tracks will be limited on site to areas of flatter terrain, i.e., less than a 3 degree slope. The proposed locations for floating roads across the are shown in drawing P20-312-0600-GLEN-0005 and details shown in drawing P20-312-0600-GLEN-0008. Floating roads are not proposed on areas of sidelong ground.

A confirmatory stability analysis will 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 will 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 assessed in Chapter 4 and 9 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 will be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(3) Construction of road will be in accordance with appropriate design from the designer.

(4) The make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (drawing P20-312-0600-GLEN-0008).

(5) Granular fill will be placed and compacted in layers in accordance with the TII Specification for Road Works.

(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 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.

(7) The finished road width will be 5m, with wider sections on bends and corners.

(8) Stone delivered to the floating road construction will be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat will 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 will 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 will 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 bulldozer will be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface layer will 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.

## 6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines will be implemented 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. The ditch will be filled with suitable drainage stone. As applicable, a perforated pipe will 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) will 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 will be excavated in short lengths and backfilled as soon as practicable.

(4) Floating roads will not be constructed on areas of sidelong ground.

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

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

(7) 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 2m). These survey points will be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.

(8) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(9) In the event of excessive vertical displacement of the road during/following construction then mitigation measures will be required to ensure the stability of the road. This will 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 willow then excavate peat and replace with suitable fill.

  (c) Slowing the rate of construction.

(10) 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 will 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, the road will be re-levelled using crushed stone.

# 7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

## 7.1 Excavation and Storage of Arisings Methodology

This methodology includes procedures that will 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 assessed in Chapter 4 of the EIAR.

(1) All excavated peat and spoil will be transported immediately on excavation to one of the 3 no. borrow pits (see drawing P20-312-0600-GLEN-0005) or to one of the designated peat placement areas around turbine locations.

(2) Further details on the construction and reinstatement of the 3 no. borrow pits are given in Section 7.4.

(3) Further details on the placement of excavated material to designated peat placement areas close to turbines 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 Development site is given in Table 7-1.

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

| Infrastructure Element [1] | Proposed Dimensions | Peat Volume ($m^3$) [2] | Spoil (non-peat) Volume ($m^3$) [2] and [3] | Comment |
|---|---|---|---|---|
| 22 no. Turbines and Hardstands | 28m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area. | 309,000 | 135,000 | Hardstanding area and foundation footprint |
| Access Roads | Assumed 5m running surface with 6m wide development footprint. | 212,000 | 30,500 | |
| Temporary Construction Compounds | Hardstanding area of 90 x 70m. | 29,000 | 5,200 | Hardstanding areas |
| Substation | Hardstanding area of 130 x 180m | 44,300 | 7,900 | |
| Met Mast | 10 x 10m foundation footprint and 30 x 30m hardstanding area (met mast). | 900 | 200 | |
| Borrow Pits | 3 no. borrow pits. | 60,200 | 25,800 | Borrow pit footprint |
| | | | | |
| | **Total =** | **655,400$m^3$** | **204,600$m^3$** | **Total = 860,000$m^3$ (peat and spoil volume) [4]** |

Note (1) The location of the infrastructure elements on site are shown on Drawing P20-312—0600-GLEN-0005.

Note (2) A factor of 10% (bulking factor of 10%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.

Note (3) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see Section 13 of this report for further details.

Note (4) It should be noted that the excavated rock volume from the borrow pits is not included in the total volume quoted above in Table 7-1, see the cut-fill assessment in Section 13 of this report for further details. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on 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 Proposed Development site is 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 |
|---|---|---|
| Peat placement within clear fell areas around turbines | 134,000 | 1.3m in height across specific areas shown in Drawing P20-312-0600-GLEN-0005. See Section 7.5 of the report and Drawing P20-312-0600-GLEN-0012 for further details. |
| Borrow Pits | 744,000 | See Drawing P20-312-0600-GLEN-0009 to 0011 for further details |
| Landscaping (2) | 44,000 | It is estimated that approximately 2,000$m^3$ of peat will be required for landscaping purposes at each of the 22 no. turbine locations. |
| | | |
| **Total =** | **922,000$m^3$** | |

Note (1) The location of the proposed borrow pits at the site are shown on Drawing P20-312-0600-GLEN-0005.

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

## 7.4 Summary of Construction Phasing

The Proposed Development will be constructed in phases, which each phase comprising 5-7 turbines and associated hardstands and access roads. This will allow for the borrow pits to be developed and backfilled in stages. An outline of the Phasing is provided below:

a. Phase 1: Construction of link road, widening of public road, upgrade of private access road between the local road and the on-site substation and the substation and primary construction compound (100,000$m^3$ of peat and spoil).
   i. All fill material will come from BP3
   ii. All excavated material will be transferred to BP3 once cells have been created

b. Phase 2: Upgrade of all existing roads within the main wind farm site and construction of all other construction compounds (180,000$m^3$ of peat and spoil).
   i. Fill material to be taken from BP1 and BP2.
   ii. All excavated material to be transferred to BP3 until cells open up in BP1

c. Phase 3: Construction of new access roads, hardstands and foundation bases for Turbines 1, 2, 3, 4, 6 (150,000$m^3$ of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1 and peat placement areas around those turbines

d. Phase 4: Construction of new access roads, hardstands and foundation bases for Turbines 7, 8, 9, 11, 12, 15, 18 (170,000m$^3$ of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1 and the peat placement areas around T8 and T12

e. Phase 5: Construction of new access roads, hardstands and foundation bases for Turbines 5, 16, 19, 20, 21, 22 (130,000m$^3$ of peat and spoil).
   i. Fill material to be taken from BP2
   ii. Excavated material to be transferred to BP 2 until full and then to BP1

f. Phase 6: Construction of new access roads, hardstands and foundation bases for Turbines 10, 13, 14, 17 and met mast (130,000m$^3$ of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1

The above phasing works are estimated to take 16-18 months in total.

## 7.5 Guidelines for the Construction and Reinstatement of Borrow Pits

Three number locations have been identified as borrow pits and are shown on Drawing P20-312-0600-GLEN-0005. The peat depth within the development footprint of the borrow pits is less than 1.5m. The borrow pit locations were selected based on the shallow depth of peat and overburden and accessibility from the existing forestry tracks. Bedrock within the borrow pits will be a mixture of sandstone and siltstone, based on GSI mapping, site observations and trial pit findings. Appendix B contains an example of a completed borrow pit from Galway Wind Park with a perimeter buttress.

Upon removal of the rock from the borrow pits, it is proposed to reinstate the borrow pits using excavated peat and spoil. The excavated rock 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 rock 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. The text below provides design and construction guidelines for the borrow pits.

It should be noted that there are significant excavation works required in order to develop the borrow pits at the site. Excavation works will be undertaken and supervised by experienced contractor and suitably qualified personnel. The text below provides some design and construction guidelines for the borrow pit.

Drawings P20-312-0600-GLEN-0009 to 0011 show proposed construction details for the borrow pits.

The borrow pits will be constructed as follows:

(1) The rock within the proposed borrow pit footprints will be removed by either breaking or blasting depending on its excavatability, which will be determined from a confirmatory ground investigation carried out at the proposed borrow pits. The ground investigation will comprise rotary core drilling with associated engineering logging including rock quality designation and strength and durability testing. From site observations of rock exposures breaking is most likely to be suitable to remove the rock, however at depth some blasting may also be required.

(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.

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

(4) The stability of the rock faces within the borrow pits will be inspected by the Project Geotechnical Engineer upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock, in line with best practice guidelines.

(5) It will be necessary to construct rock buttresses founded on in-situ rock within the borrow pits to create individual cells (up to 6 no. depending on the borrow pit). The cells will be opened in sequence and filled as needed. The rock buttresses will be constructed of rock fill from the borrow pit excavation, placed and compacted in layers. The founding stratum for each rock buttress will be inspected and approved by the Project Geotechnical Engineer.

(6) The rock buttresses will be constructed in stages to allow infilling of peat and spoil within cells. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil.

(7) Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress, allowing the borrow pit to be developed and infilled in cells. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be reinstated safely.

(8) A number of rock buttresses to form cells within the borrow pits will be required to ensure access for trucks and excavators can be achieved. See Drawings P20-312-0600-GLEN-0009 to 0011 for the location of the rock buttresses. The locations of the rock buttresses shown on Drawings P20-312-0600-GLEN-0009 to 0011 for the borrow pit are indicative only and may change subject to local conditions encountered on site during construction, or as a result of the confirmatory ground investigation.

(9) The rock buttresses will be wide enough (up to 4m) to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The permanent side slopes of the rock buttress will be constructed at between 40 to 60 degrees.

(10) A rock buttress will be required on the downslope side of the borrow pits to safely retain the infilled peat and spoil. The height of the berm constructed will be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. A berm of up to 8m in height will be constructed, depending on the borrow pit. The berm height for each borrow pit is provided on the drawings.

(11) The rock buttress will be founded on mineral soil or bedrock i.e., competent strata. Either material will be suitable provided a minimum shear strength of 75kPa is achieved (if the overburden material is cohesive). The founding stratum for the rock buttress will be inspected and approved by the Project Geotechnical Engineer. The stability of the proposed berms has been checked as Part of the Peat Stability Assessment, see Section 7.4 of that report.

(12) A level surface in the underlying mineral soil or bedrock will be prepared before placing and compacting the rock fill used to construct the perimeter berms.

(13) 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 rock fill of 100mm up to 500mm in size. In addition, drains will be placed through the buttresses to allow excess water to drain.

(14) A layer of geotextile will be placed on the inside face of the perimeter berm to act as a separator layer between the berm and the placed peat/spoil, to prevent the placed peat/spoil infilling any voids on the inside face of the berm, maintaining the permeability of the berm.

(15) The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil will be required.

(16) The surface of the placed peat and spoil will be shaped following backfill using excavators to allow efficient run-off of surface water from the placed arisings towards the perimeter of the borrow pit.

(17) As the berms are slightly higher than the retained peat, drains will be provided at regular intervals through the berms, at the same level as the top of the peat surface, to prevent ponding of water around the edges of the repositories. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.

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

(19) An interceptor drain will also be installed upslope of the borrow pit. 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.

(20) Temporary control of groundwater within the borrow pits will be required and exact measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations will be required during construction.

(21) Settlement ponds will be constructed at the lower side/outfall location of the borrow pits.

(22) The acrotelm will 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.

(23) Supervision by the Project Geotechnical Engineer will be carried out for the development of the borrow pits.

(24) All the above-mentioned general guidelines and requirements will be implemented by the Contractor during construction.

## 7.6 Designated Peat Placement Areas within Turbine Clearfell Areas

The following commitments for the placement of peat within permanent clearfell areas around 9 no. turbines will be implemented during construction. These areas have been selected based on a combination of the depth of peat, the recorded peat strength in the area and the slope angle. A check of peat stability in each area was also undertaken, allowing for the additional loading from 1m of stored peat, and these results are included on the Peat Stability Assessment Report (FT, 2023). All of the proposed peat placement areas have an acceptable factor of safety against failure.

(1) Excavated peat will be placed/spread across the clearfell areas around 9 no. of the proposed turbines. These locations are shown in Drawing P20-312-0600-GLEN-0005.

(2) The peat placed within the areas shown on Drawing P20-312-0600-GLEN-0005 will be restricted to a maximum height of 1.3m. Weak/liquified peat will be placed within the proposed borrow pits and not stored within these areas.

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

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

(5) It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat placement area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat.

(6) Finished/shaped side slopes in the placed peat will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.

(7) The acrotelm will be placed on the finished surface 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 and spoil within the placement areas.

(8) Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site.

(9) Supervision by the Project Geotechnical Engineer will be carried out for the works.

(10) 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 ensure stability of the placed peat and reduce the likelihood of debris run-off.

(11) All the above mentioned general guidelines and requirements will be undertaken by the Contractor during construction.

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

The turbine bases will be founded on competent founding strata which will require excavation through peat and soft overburden. Some turbine bases may require a piled solution following confirmatory ground investigations by the Contractor.

Similarly, crane hardstandings, construction compound, substation platforms and met mast foundations are to be founded on competent mineral soil and/or rock which will require excavation through peat and spoil. Excavations for the borrow pits will also remove the peat and non-peat spoil overlying the rock.

## 8.1 Methodology

This methodology includes procedures that will 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 assessed in Chapters 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavations the commitments given in Section 7 will be followed.

(2) All excavations within peat will 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 provided.

(3) Excavations will be kept reasonably free from water at all times. Water will 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, as described in Chapter 4 of the EIAR.

# 9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Glenora Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Glenora Wind Farm will connect to the national grid via an existing substation (Tawnaghmore) located in Killala to the west of the proposed wind farm development. The proposed grid connection is 26.1km in length and will follow existing and proposed tracks and the public road corridor.

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 within the footprint of the access roads and TDR. The grid connection route will encounter peat and till derived from Devonian and Carboniferous sandstones and will be constructed on solid ground to Eirgird specifications.

## 9.1 Methodology

This methodology includes procedures that will 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 assessed in Chapters 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavations the guidelines given in Section 8 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes will 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) 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.

(4) Excavations will be kept reasonably free from water at all times.

(5) Any overburden excavated from the cable trench will be transported to the borrow pits for storage. Any pavement materials containing tar will be transported to an authorised waste facility.

## 10. GENERAL MEASURES FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS) for the project will also implement (as a minimum), the general measures below together with the specific measures above.

(1) Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) All excavations will 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 during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions will be assessed by a 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 the Contractor and Project Geotechnical Engineer will be undertaken and will 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 2m. Additional monitoring locations will be provided at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

(1) A line of sighting posts will comprise:

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

(b) The sighting line will comprise 6 no. posts at 5m centres that is a line some 25m long.

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

(2) Lines of sighting posts will 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 2.0m). Where there are relatively steeper slopes or softer ground a sighting line will be placed down the slope, or at any location where monitoring is deemed useful by the Project Geotechnical Engineer.

(3) Each line of sighting posts will be uniquely referenced with each post in the line given a reference. The post reference will 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 will be monitored at the beginning of each working day, and during the day were considered appropriate (e.g., when working activity is concentrated at a specific location).

(5) Monitoring of the posts will 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 will be increased.

(7) A monitoring record will be kept of the date, time and relative movement of each post, if any. This record will 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 will be carried out.

(1) All activities (if any) will cease within the affected area.

(2) Increased monitoring at the location will be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities will only start following a cessation of movement and agreement with all parties (Contractor/Engineer/Designer).

## 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 will be carried out.

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

(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 will 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 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 will comprise well-graded coarse rock pieces from about 300mm up to 1000mm.

The rock fill for the check barrage will be sourced from locally won granular fill material on site.

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.

The check barrage will fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of at least 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 will 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 will 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 will be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

# 13. CUT & FILL EARTHWORKS ASSESSMENT

FT carried out an assessment for the site which quantifies the total volume of cut and fill earthworks required for the construction of the wind farm. The cut & fill assessment is graphically presented in Drawing P20-312-0600-GLEN-0013.

The outputs from the cut & fill earthworks assessment includes the following:

- Plan drawings of the entire site showing an outline of cut & fill earthworks at all infrastructure elements (Drawing P20-312-0600-GLEN-0013)
- Preliminary cut & fill earthwork volumes (see Table 13-1 of this report)

A summary of the basis for the cut & fill earthworks assessment is included in Appendix A of this report.

A summary of the cut & fill earthwork volumes is given in Table 13-1.

## 13.1 Commentary on Earthworks Volumes

It will be noted that the earthwork volumes given in Table 13-1 are estimates and subject to detailed design. This section of the report should be read in conjunction with Sections 7.2 and 7.3 of the report which summarises the peat and spoil volumes for site and the placement/reinstatement areas on site.

In summary the following points are given,

1) The total volume of spoil (peat and non-peat superficial deposits) requiring placement/reinstatement on site is estimated at 860,000m$^3$. This material will be excavated and placed/reinstated to the borrow pits, with 134,000m$^3$ stored across clearfell areas near turbines and 22,000m$^3$ used for landscaping around the turbines.

2) The estimated quantity of available rock within the borrow pit is 805,000m$^3$. Note that limited ground investigation is available at the borrow pits to define rockhead level. Conservative assumptions were made in estimating the quantity of rock available in the borrow pits.

3) Note a number of assumptions were made during the cut & fill assessment, see Appendix A. A bulking factor of 10% has been applied to the excavation volumes.

**Table 13.1: Summary of Cut & Fill Earthworks Volumes**

| Infrastructure Element | Description | Total Earthwork Volume (1) & (2) – Peat | Earthwork Volume (3) – Estimated non-peat overburden material | Earthwork Volume (4) - Estimated rock volume only | Stone Volume Requirements | Comment |
|---|---|---|---|---|---|---|
| | | Cut ($m^3$) | Cut ($m^3$) (3) | Cut ($m^3$) | ($m^3$) | |
| 22 no. Turbines and Hardstands | 25m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area | 309,000 | 135,000 | - | 330,000 | Hardstanding area and turbine foundation footprint |
| Access Roads | Proposed 5m running surface with 6m wide development footprint | 212,000 | 30,500 | - | 395,000 | Excludes proposed floating sections of access road where no excavation of peat will take place (see Drawing P20-312-0600-GLEN-0005). |
| Various Infrastructure Locations | Includes substation, 5 no. construction compounds and met mast | 74,200 | 13,300 | - | 70,000 | - |
| | | | | | | |
| Borrow Pits | 3 no. Borrow Pits | 60,200 | 25,800 | 805,000 | 15,000 | Estimated potential rock volume from borrow pits is **805,000$m^3$**. Note limited ground investigation in area of borrow pits to define rockhead level. |
| | **Total =** | **655,400** | **204,600** | **805,000** | **810,000** | |

**Notes**

Note (1) The total earthwork volumes includes peat, non-peat superficial deposits and rock from the borrow pit.
Note (2) The earthwork volumes quoted for the non-peat material were calculated based on the total earthwork volume (peat & non-peat material) minus the peat volumes calculated and presented in Table 7-1 within Section 7.2 of this report.
Note (3) The in-situ rock volume from the borrow pits was estimated based on available ground investigation data to define rockhead level.
Note (4) It should be noted that the earthwork volumes given in Table 13-1 are subject to confirmatory design.

## 14. REFERENCES

Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery.

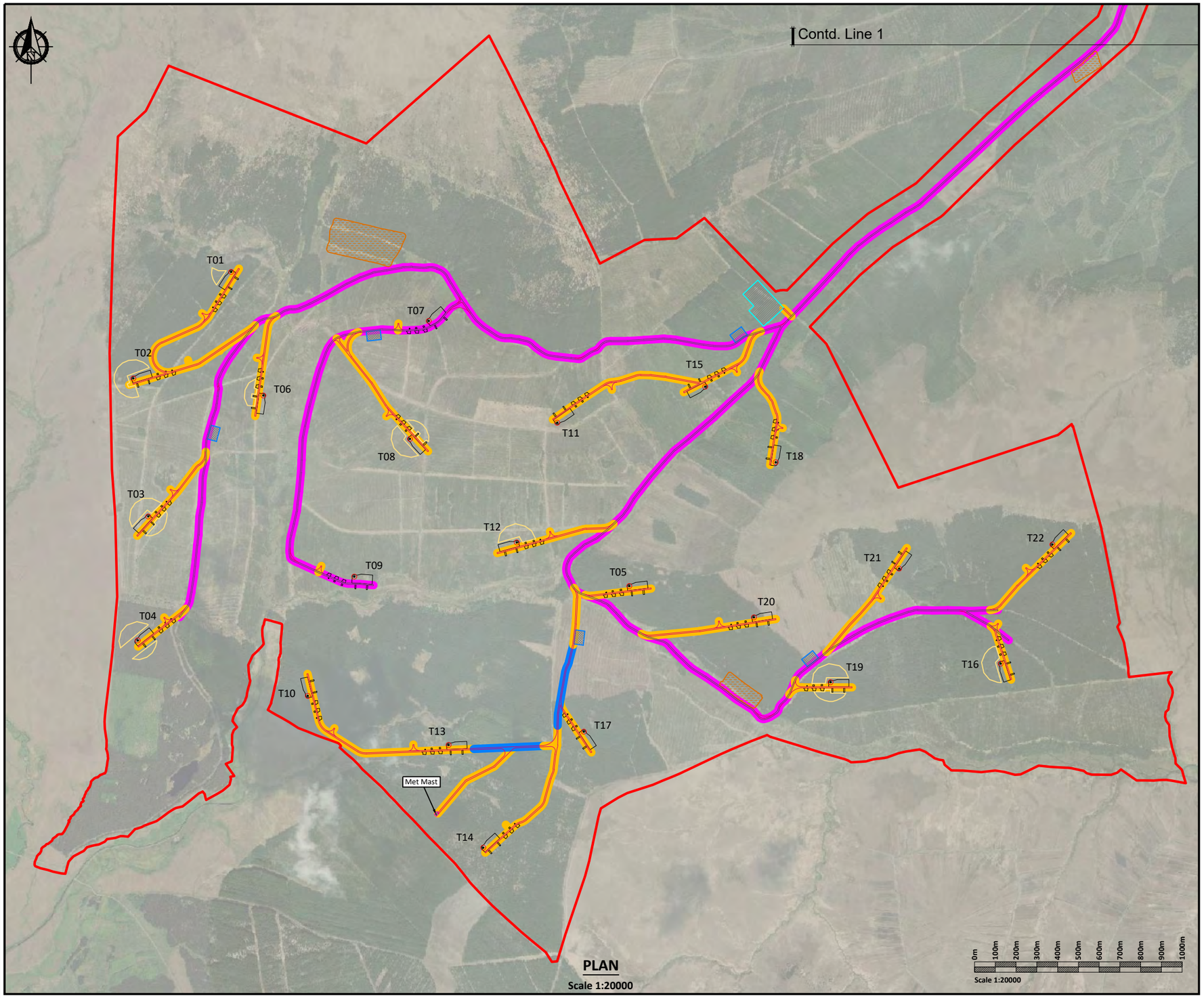
Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat.

Scottish Natural Heritage, 2015. Constructed Tracks in the Scottish Uplands. Scottish Natural Heritage.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

# DRAWINGS




**PLAN**

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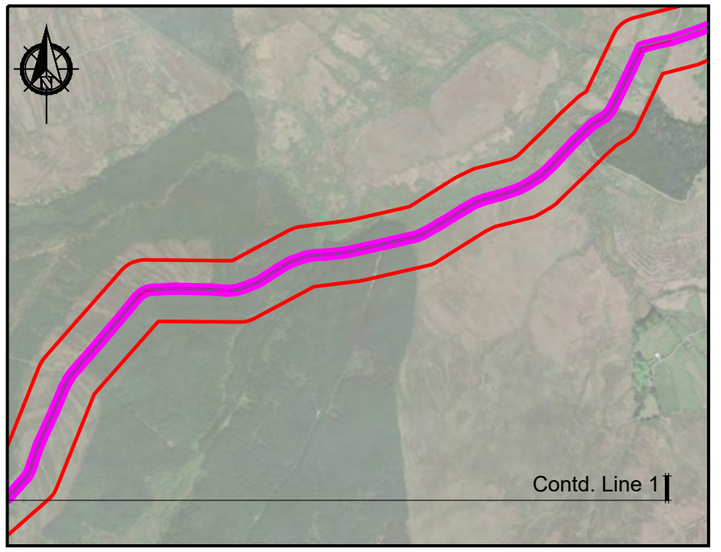


**PLAN**

**Scale 1:20000**

Road Type Legend:

Type A -
Upgrade of Existing
Excavated Access Tracks

Type B -
New Excavate &
Replace Access Road

Type C -
New Floated Access Road

Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement



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| Rev. | Description | App By | Date |
|---|---|---|---|
| A | FOR INFORMATION | BDH | 12.05.23 |
| B | FOR INFORMATION | BDH | 30.11.23 |
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PROJECT: **GLENORA WINDFARM**

CLIENT: **MKO**

SHEET: **PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE**

Date: 30.11.23

Project number: P20-213

Scale (@ A3 ): As Shown

Drawn by: POR

Checked by: IH

Drawing Number: **P20-312-0600-GLEN-0005**

Rev: **B**

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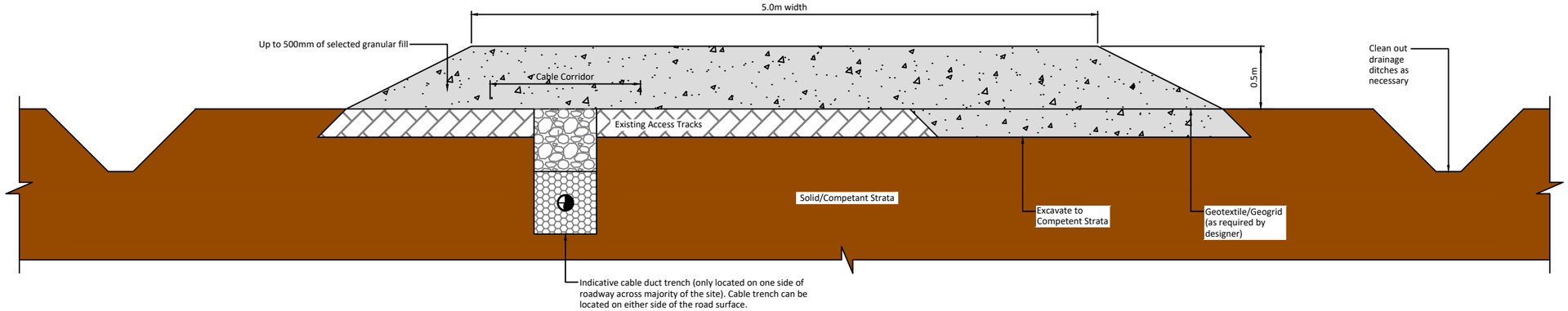
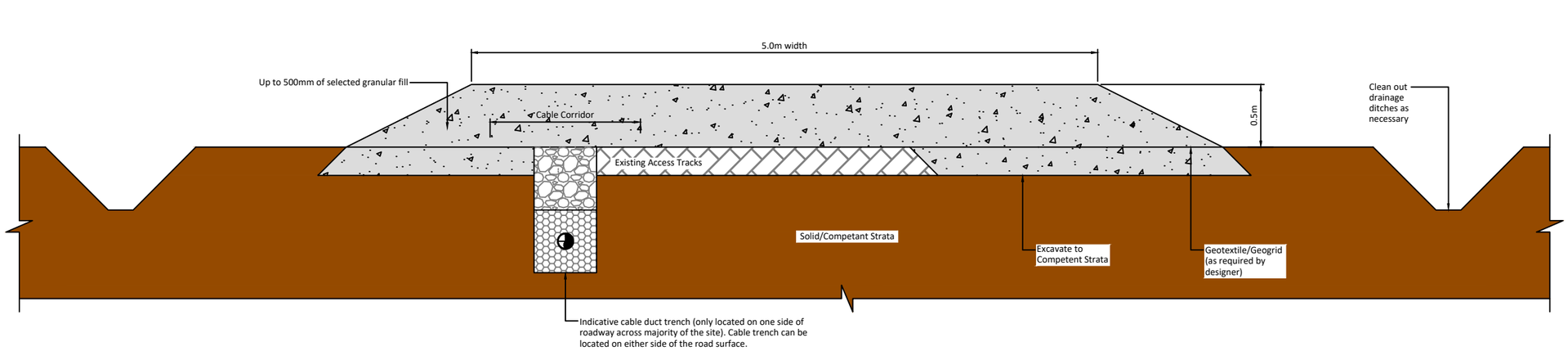
30 November 2023

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|---|---|
| PROJECT | GLENORA WINDFARM |
| CLIENT | MKO |
| SHEET | TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS |
| Date | 12.05.23 |
| Project number | P20-213 |
| Scale (@ A3 ) | As Shown |
| Drawn by | POR |
| Drawing Number | P20-312-0600-GLEN-0006 |
| Rev | A |
| Checked by | IH |

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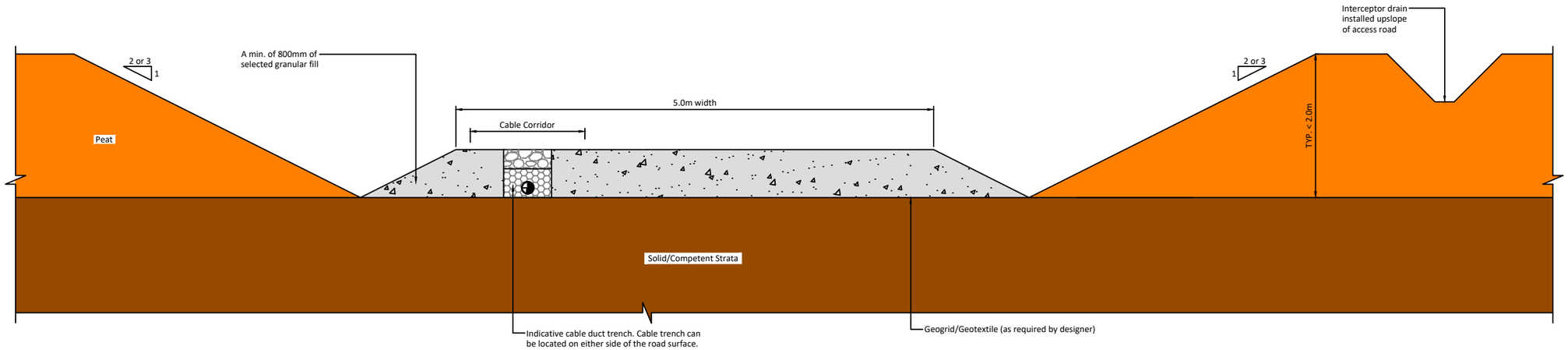
12 May 2023

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| A | FOR INFORMATION | BDH | 12.05.23 |
| B | FOR INFORMATION | BDH | 05.12.23 |
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|---|---|
| PROJECT | GLENORA WINDFARM |
| CLIENT | MKO |
| SHEET | TYPE B - NEW EXCAVATE AND REPLACE ACCESS ROAD |
| Date | 05.12.23 |
| Project number | P20-213 |
| Scale (@ A3 ) | As Shown |
| Drawn by | POR |
| Drawing Number | P20-312-0600-GLEN-0007 |
| Rev | B |
| Checked by | IH |

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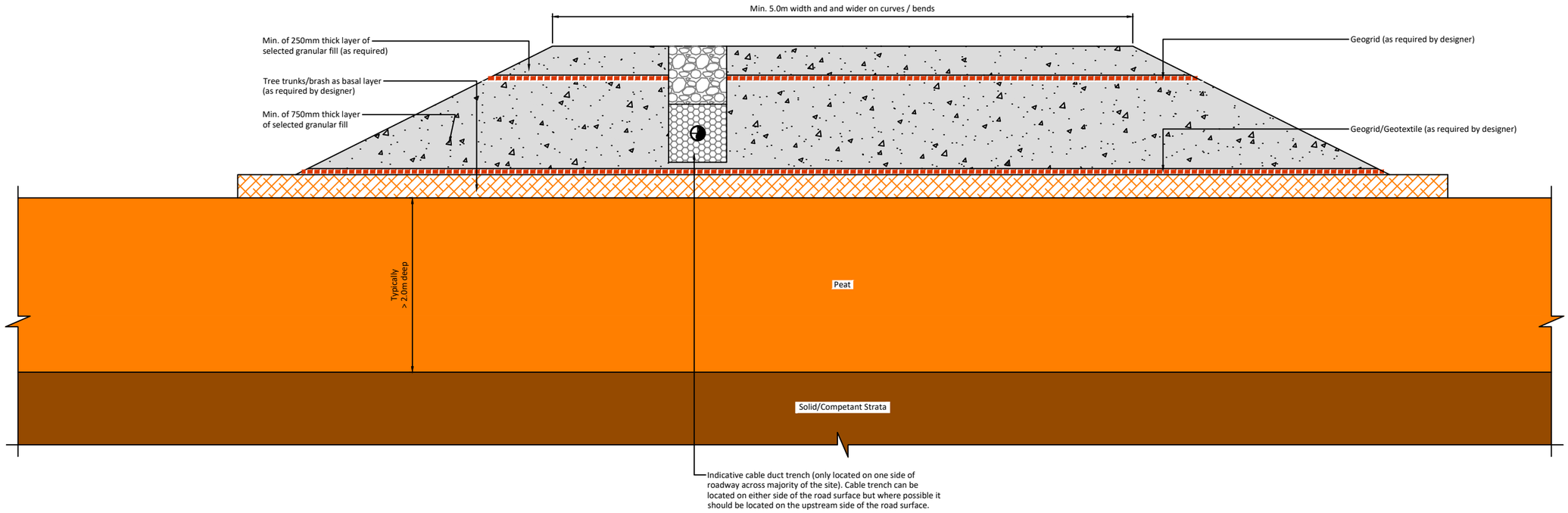
5 December 2023

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| B | FOR INFORMATION | BDH | 07.12.23 |
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| PROJECT | GLENORA WINDFARM |
| CLIENT | MKO |
| SHEET | TYPE C - NEW FLOATED ACCESS TRACK |
| Date | 07.12.23 |
| Project number | P20-213 |
| Scale (@ A3 ) | As Shown |
| Drawn by | POR |
| Drawing Number | P20-312-0600-GLEN-0008 |
| Rev | B |
| Checked by | IH |

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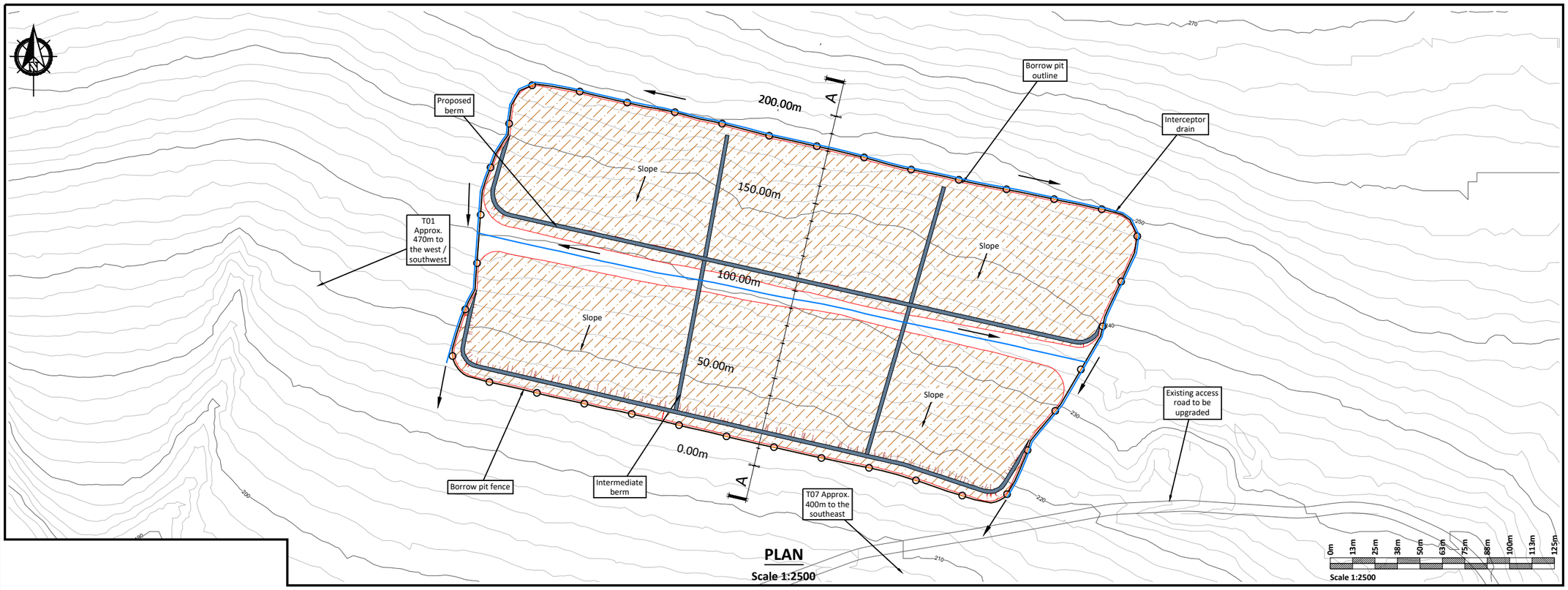
7 December 2023




## PLAN

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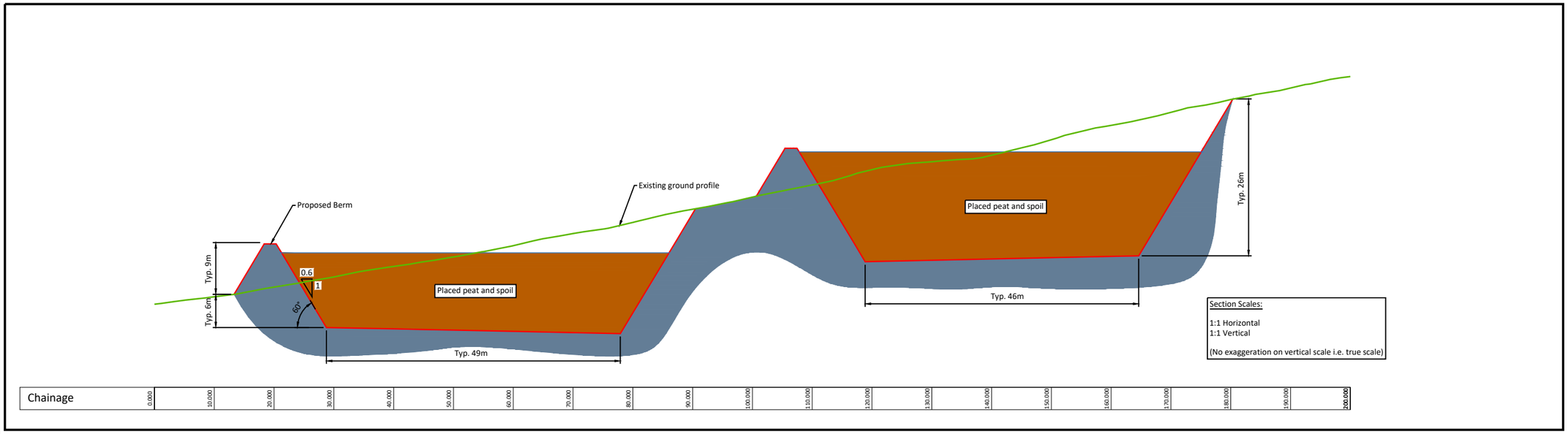


## SECTION A - A

**Scale 1:750**



Borrow Pit Construction Notes:

(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 rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 9m (approx.) in height is likely to be required.

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

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

(7) The surface of the placed peat & spoil will 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 will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan

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| D | FOR INFORMATION | BDH | 30.11.23 |
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PROJECT: **GLENORA WINDFARM**

CLIENT: **MKO**

SHEET: **BORROW PIT 1 PLAN AND SECTION**

Date: 30.11.23
Drawn by: POR
Checked by: IH
Project number: P20-213
Scale (@ A3 ): As Shown
Drawing Number: **P20-312-0600-GLEN-0009**
Rev: **D**

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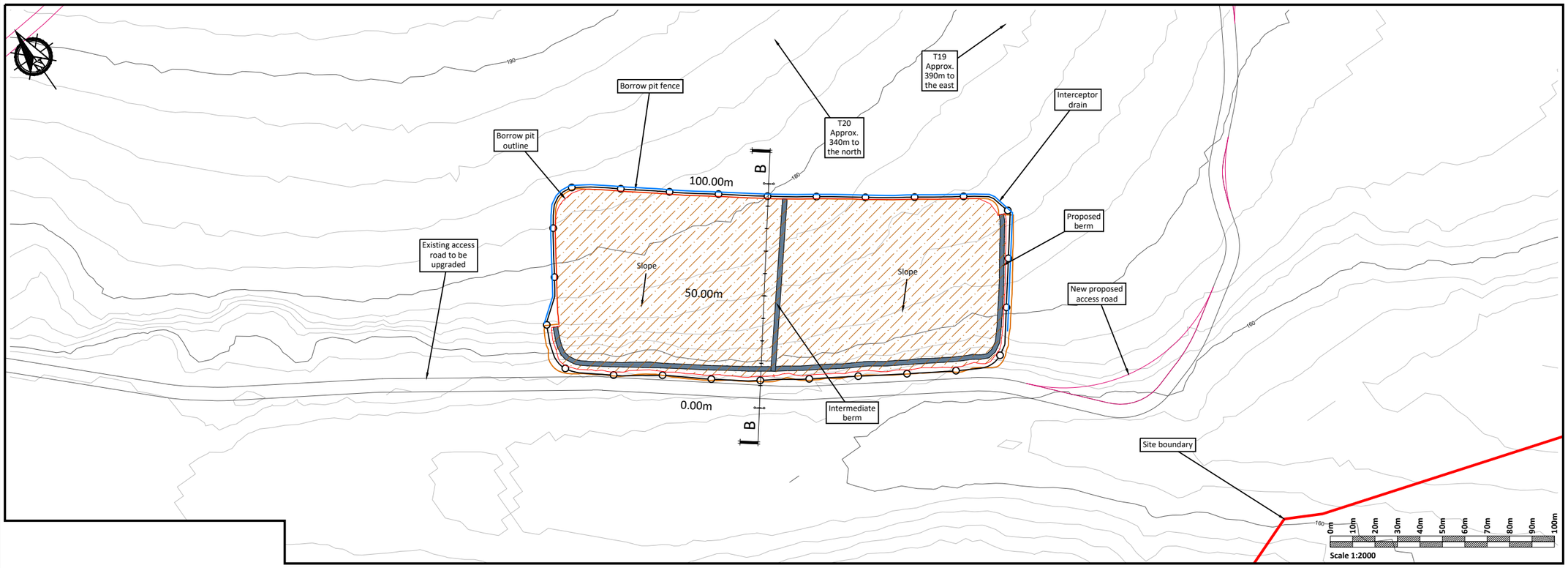
7 December 2023




**PLAN**

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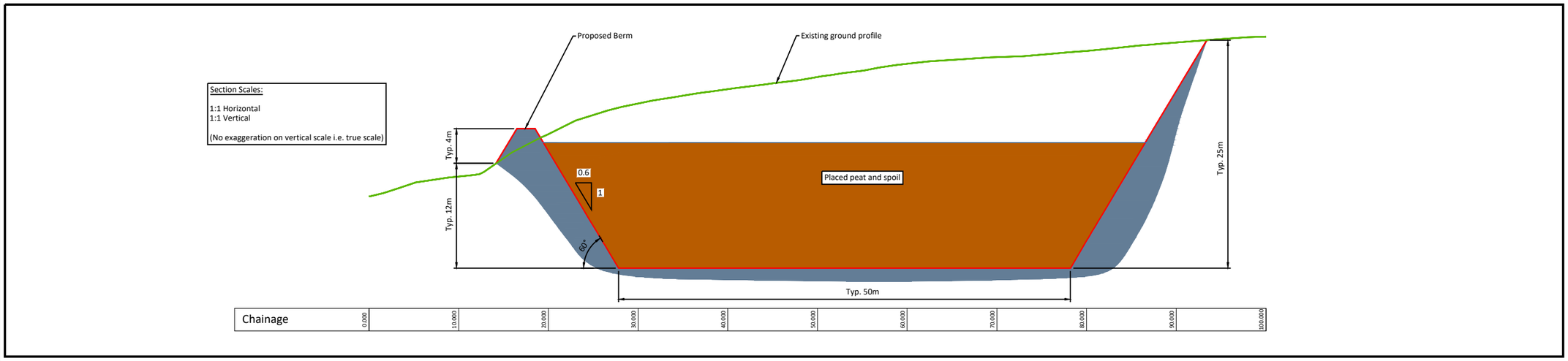


**SECTION**

**Scale 1:500**

Borrow Pit Construction Notes:

(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 rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 5m (approx.) in height is likely to be required.

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

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

(7) The surface of the placed peat & spoil will 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 will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan



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PROJECT: **GLENORA WINDFARM**

CLIENT: **MKO**

SHEET: **BORROW PIT 2 PLAN AND SECTION**

Date: 30.11.23 | Project number: P20-213 | Scale (@ A3 ): | Drawn by: POR | Checked by: IH | Drawing Number: P20-312-0600-GLEN-0010 | Rev: D

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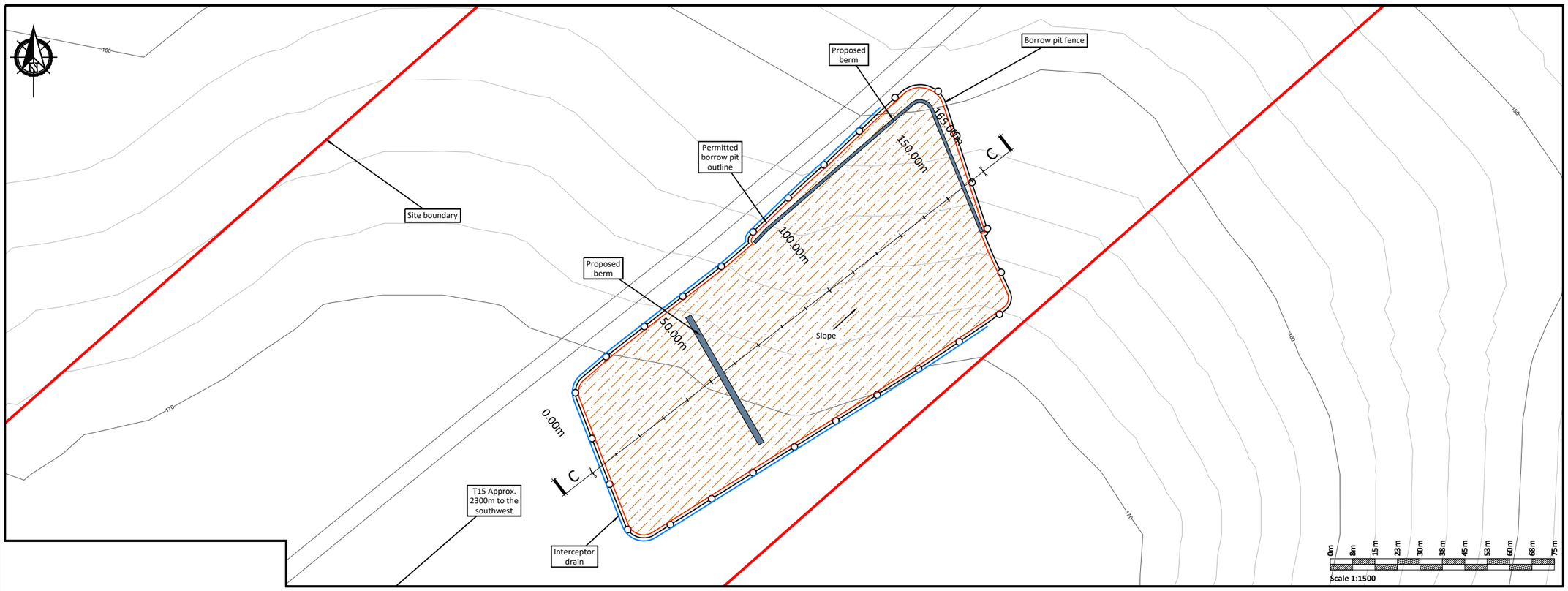


## PLAN

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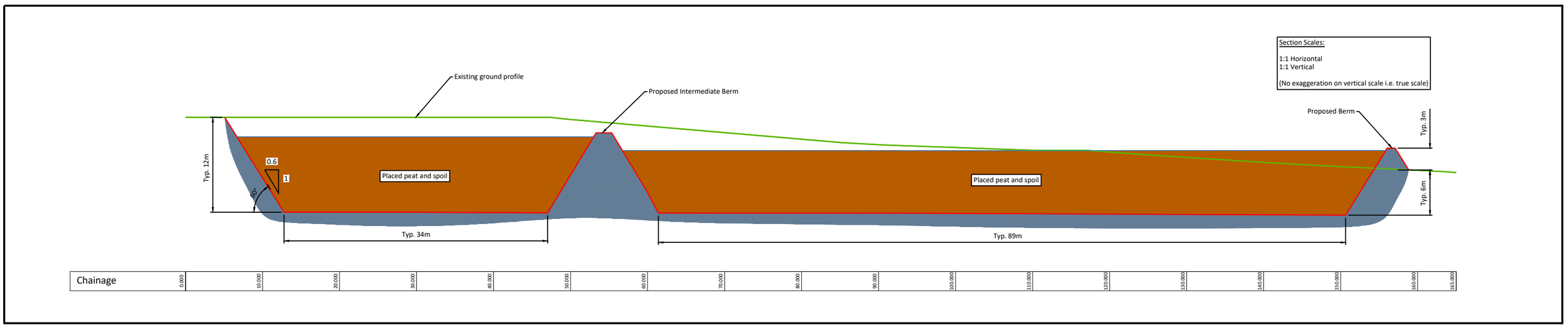


## SECTION

**Scale 1:500**



**Borrow Pit Construction Notes:**

(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 rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 3m (approx.) in height is likely to be required.

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

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

(7) The surface of the placed peat & spoil will 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 will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan

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| PROJECT: GLENORA WINDFARM | | CLIENT: MKO | |
| SHEET: BORROW PIT 3 PLAN AND SECTION (OFFSITE BORROW PIT) | Date: 30.11.23 | Project number: P20-213 | Scale (@ A3 ): |
| | Drawn by: POR | Drawing Number: P20-312-0600-GLEN-0011 | Rev: D |
| | Checked by: IH | | |

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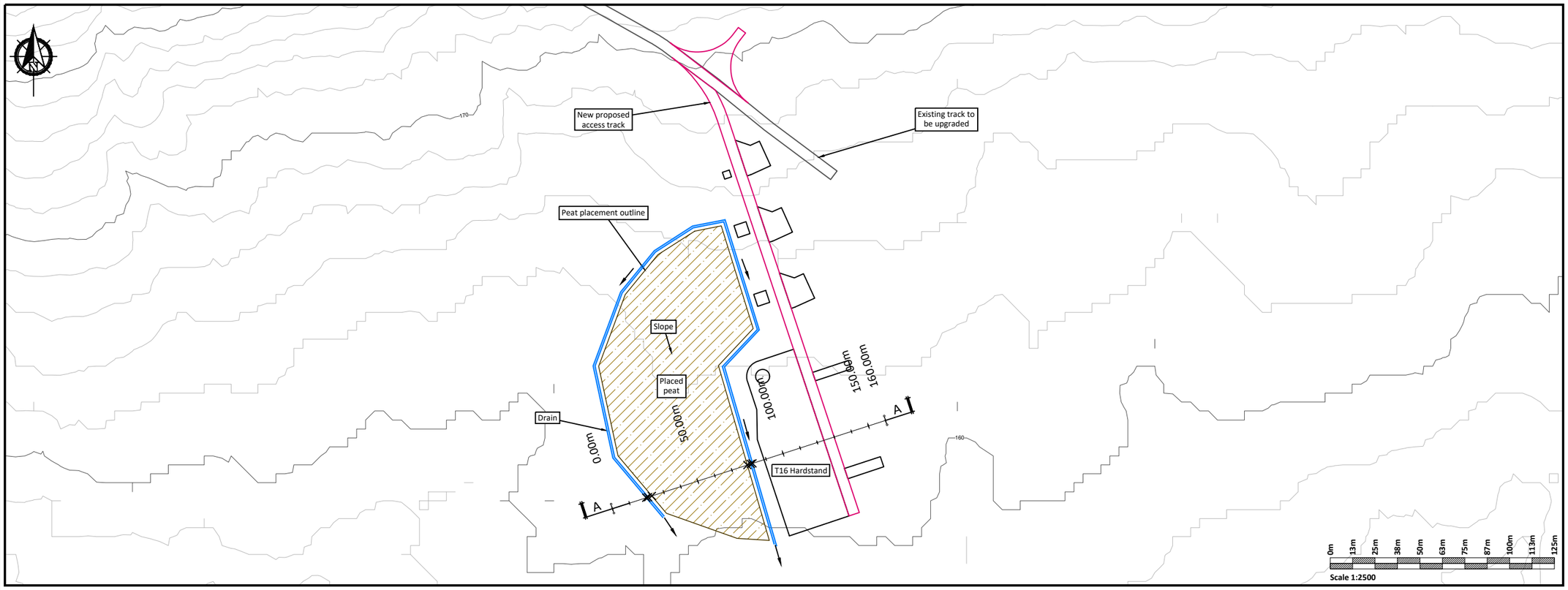


## PLAN

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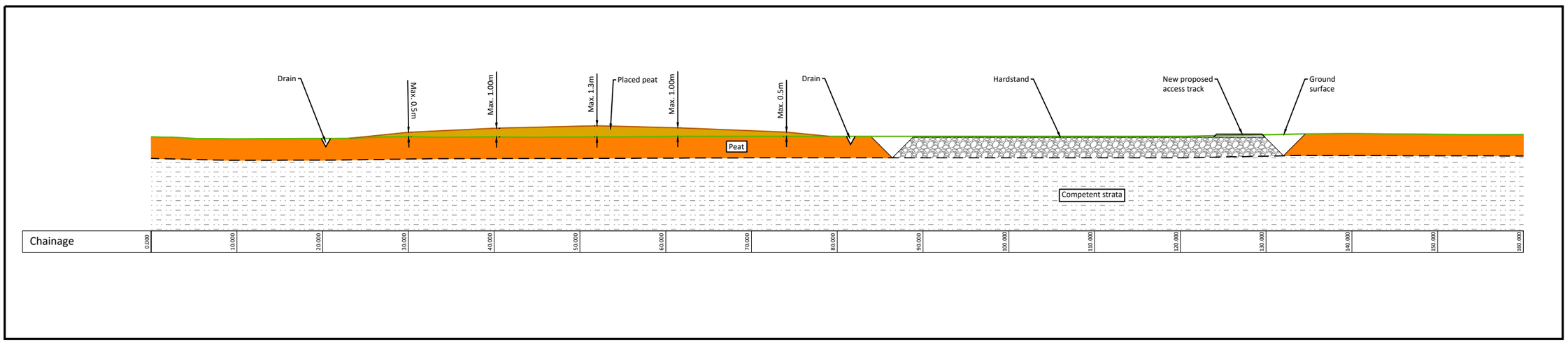


## SECTION A - A

**Scale 1:500**

## Construction Notes Peat Storage Areas:

(1) An interceptor drain will also be installed upslope of the repository areas.

(2) A silting pond will be required at the lower side of the peat storage areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat storage area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 7.5 of the Peat & Spoil Management Plan.



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| PROJECT | GLENORA WINDFARM |
| CLIENT | MKO |
| SHEET | PEAT PLACEMENT WITHIN CLEAR FELL AREAS – TYPICAL DETAILS |
| Date | 12.05.23 |
| Project number | P20-213 |
| Scale (@ A3 ) | As Shown |
| Drawn by | POR |
| Drawing Number | P20-312-0600-GLEN-0012 |
| Rev | A |
| Checked by | IH |

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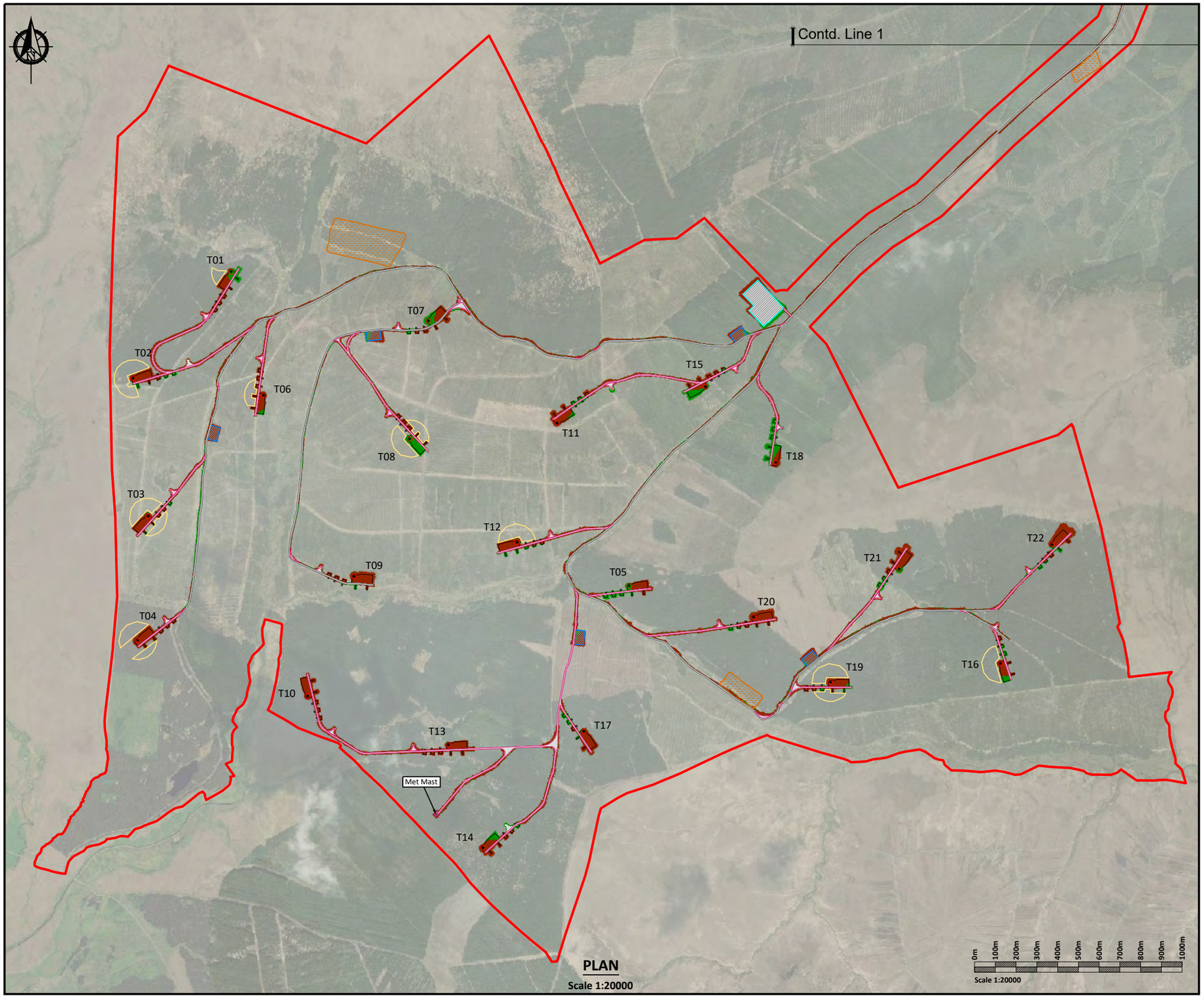
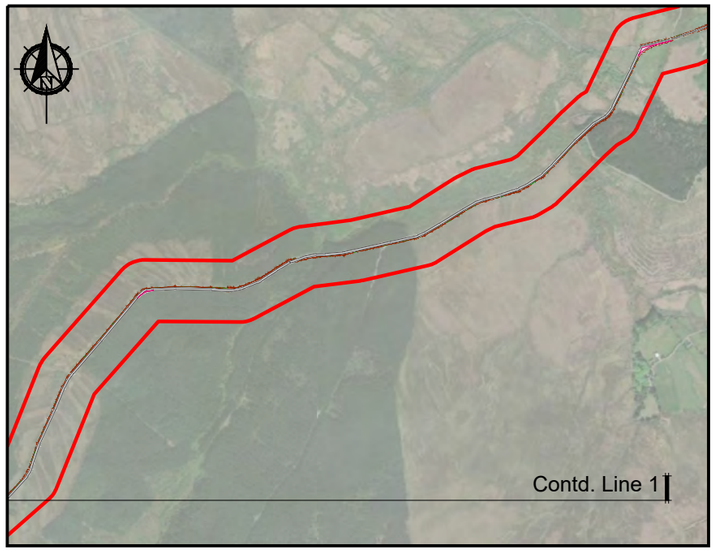
12 May 2023




**PLAN**

**Scale 1:20000**




**PLAN**

**Scale 1:20000**

Cut / Fill Legend:

- Areas of Cut
- Areas of Fill

Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement



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PROJECT: **GLENORA WINDFARM**

CLIENT: **MKO**

SHEET: **PLAN DRAWING OF CUT FILL EARTHWORKS FOR SITE**

Date: 30.11.23

Project number: P20-213

Scale (@ A3 ): As Shown

Drawn by: POR

Checked by: IH

Drawing Number: **P20-312-0600-GLEN-0013**

Rev: **B**

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30 November 2023

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# APPENDIX A

## Assumptions for Cut & Fill Earthworks Assessment

## Assumptions for Cut/Fill Earthwork Assessment

### Main Infrastructure Locations

Appendix A provides a summary of the main assumptions for the cut/fill earthworks assessment.

Table A1 provides a summary of the assumptions regarding the dig depths adopted for the cut/fill assessment for the main infrastructure elements at Glenora wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 25m plus 1m working room all around the base i.e., 27m.

**Table A1: Summary of the dig depths at the main infrastructure locations**

| Turbine | Easting | Northing | Average Peat Depth for Turbines (m) | Dig depth for Turbine Foundation (m) [1] | Average Peat Depth for Crane Hardstands (m) | Max Dig depth for Associated Crane Hardstand (m) [2] |
|---|---|---|---|---|---|---|
| **T1** | 502518 | 834923 | 2.12 | 4.0 | 2.12 | 2.4 |
| **T2** | 502047 | 834410 | 2.30 | 4.0 | 2.30 | 2.6 |
| **T3** | 502119 | 833745 | 2.38 | 4.0 | 2.38 | 2.7 |
| **T4** | 502069 | 833148 | 2.96 | 4.0 | 2.96 | 3.3 |
| **T5** | 504436 | 833410 | 2.50 | 4.0 | 2.50 | 2.8 |
| **T6** | 502673 | 834328 | 2.00 | 3.0 | 2.00 | 2.3 |
| **T7** | 503470 | 834687 | 1.12 | 3.0 | 1.12 | 1.5 |
| **T8** | 503379 | 834119 | 2.56 | 4.0 | 2.56 | 2.9 |
| **T9** | 503111 | 833456 | 1.54 | 3.0 | 1.54 | 1.9 |
| **T10** | 502887 | 832881 | 1.36 | 3.0 | 1.36 | 1.7 |
| **T11** | 504089 | 834197 | 1.82 | 3.0 | 1.82 | 2.1 |
| **T12** | 503894 | 833620 | 1.46 | 3.0 | 1.46 | 1.8 |
| **T13** | 503565 | 832645 | 1.58 | 3.0 | 1.58 | 1.9 |
| **T14** | 503732 | 832150 | 1.92 | 4.0 | 1.92 | 2.3 |
| **T15** | 504802 | 834370 | 0.72 | 3.0 | 0.72 | 1.0 |
| **T16** | 506225 | 833037 | 2.22 | 4.0 | 2.22 | 2.5 |
| **T17** | 504216 | 832709 | 1.92 | 4.0 | 1.92 | 2.4 |
| **T18** | 505141 | 834006 | 0.96 | 3.0 | 0.96 | 1.3 |
| **T19** | 505406 | 832947 | 2.36 | 4.0 | 2.36 | 2.7 |
| **T20** | 505036 | 833259 | 2.14 | 4.0 | 2.14 | 2.4 |

| Turbine | Easting | Northing | Average Peat Depth for Turbines (m) | Dig depth for Turbine Foundation (m) [1] | Average Peat Depth for Crane Hardstands (m) | Max Dig depth for Associated Crane Hardstand (m) [2] |
|---|---|---|---|---|---|---|
| **T21** | 505736 | 833494 | 1.86 | 3.0 | 1.86 | 2.2 |
| **T22** | 506474 | 833610 | 0.94 | 3.0 | 0.94 | 1.3 |
| | | | | | | |
| **Infrastructure Element** | **Easting** | **Northing** | **Average Peat Depth (m)** | **Max Dig depth for Infrastructure Element (m) [3] & [4]** | | |
| **Substation** | 505146 | 834797 | 0.9 | 1.2 | | |
| **Construction Compound 1** | 502430 | 834183 | 1.4 | 1.7 | | |
| **Construction Compound 2** | 503395 | 834636 | 1.8 | 2.1 | | |
| **Construction Compound 3** | 504987 | 834672 | 1.0 | 1.3 | | |
| **Construction Compound 4** | 504180 | 833199 | 2.5 | 2.8 | | |
| **Construction Compound 5** | 505128 | 833102 | 2.8 | 3.1 | | |
| **Met Mast** | 503515 | 832315 | 2.1 | 2.4 | | |

**Notes**

(1) Founding depths for the turbines was assumed to be the average peat depth + 1m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. A minimum dig depth of 3m is assumed for each turbine foundation. For the purpose of this assessment, it is assumed that all turbine foundations will be gravity type founded bases i.e., no piled foundations.

(2) Founding depths for the crane hardstands was assumed to be the average peat depth + 0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the crane hardstandings and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the hardstands, where possible.

(3) For the construction compounds and substation, the founding depth was assumed to be the average peat depth +0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the compounds and substation platform and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the platforms, where possible.

(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation.

(5) Note the maximum dig depths stated in the Table above are indicative and for information purposes only and are subject to confirmation at detailed design stage following a confirmatory ground investigation.

### Access Roads

The following assumptions for the cut/fill assessment are given in relation to the access roads.

- Typical gradient requirements from turbine suppliers were assumed for the cut & fill assessment i.e., maximum gradients of 10 to 12%. A maximum gradient of 12% has been assumed for straight sections of access road on site.
- For the purpose of the assessment, it is assumed that the existing access tracks on site are 4m in width.
- There are 3 types of access tracks/roads proposed/present on site, which include:

- Existing excavated and replace type access tracks - some excavation works as a result of localised widening will be required. It is assumed that widening will typically take place on both sides of the road. In areas of side long ground/steeper terrain (say greater than 5% gradient), widening of existing tracks will take place on the upslope side of the road. Assumed dig depth to competent strata for both cases are 0.3m below the base of the peat.
- New proposed excavate & replace type access roads – excavation work will be required. Assumed dig depth to competent strata was 0.3m below the base of the peat.
- New proposed floating roads – no excavation will be required.

### Borrow Pits

The cut/fill assessment for the borrow pits is based on the cross-section drawings (Drawings P20-312-0600-GLEN-0009 to 0011) included in this report. The borrow pits were sized to allow for the reinstatement of the excavated peat volume generated on site and to accommodate the estimated site-won stone fill requirements.

### General Assumptions

A 1(v): 1(h) configuration for all excavation faces was assumed for the cut & fill earthworks assessment, except for excavations in rock at the borrow pit where a configuration of 1(v): 0.7(h) i.e., 60 degrees was assumed.

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# APPENDIX B

Borrow Pit Example

**Example of Borrow Pit backfill.**

Construction of Seecon Wind Farm (part of Galway Wind Park) commenced construction in 2015. The majority of crushed stone required for the construction of the development was obtained from on-site borrow pits. The borrow pits, following the extraction of the necessary volume of rock, then became peat repositories. As per the proposed methodology for the restoration of the borrow pits within the Proposed Development, rock buttresses were constructed on the downslope edge of the borrow pits to safely retain the infilled peat and spoil. The buttresses were up to 6m in height when complete.

Peat and spoil material, excavated as part of the Seecon Wind Farm development, was placed within the borrow pits up to 1m below the top of the buttress. Plate 1 below shows one of the Seecon Wind Farm borrow pits following extraction of all of the required rock and the downslope edge buttress under construction (c. 2016). Plate 2 then shows the same borrow pit in November 2023. Over the intervening 7 years, the peat and spoil within the borrow pit has significantly reduced in volume as the water within the infilled material has gradually drained away. The surface of the infilled material is now approximately 3-4m below the top of the buttress. Significant revegetation of all of the surface of the infilled material and the rock buttress has also occurred. Both the drainage and revegetation will significantly increase the stability of the infilled material. This has occurred due to the implementation of the correct buttress construction methodology and drainage measures, as will be implemented as part of the Proposed Development.

This example is evidence of the suitability of borrow pits, with downslope buttresses, as permanent peat and spoil repositories.

**Plate 1**: Borrow Pit prior to backfilling (c.2016).

**Plate 2**: Borrow Pit following backfilling (image taken in 2023).

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