



CONSULTANTS IN ENGINEERING,  
ENVIRONMENTAL SCIENCE &  
PLANNING

# LYRENACARRIGA WIND FARM

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## GEOTECHNICAL ASSESSMENT REPORT

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Prepared for: MKO



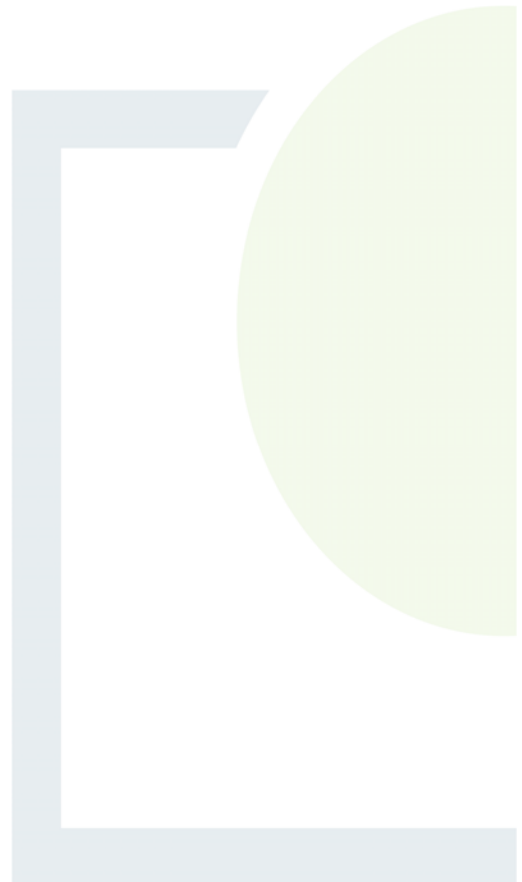
**Date:** December 2020

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## GEOTECHNICAL ASSESSMENT REPORT

### MKO

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

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Draft for Comment	GK/IH	IH	B. de Hora	28.04.2020
1	Final	GK/IH	IH	B. de Hora	23.07.2020
2	Revised following Client Comments	IH	PJ	B. de Hora	09.11.2020
3	Minor revisions to layout	IH	PJ	B. de Hora	21.12.2020

**Client:** MKO

**Keywords:** Inspection, Site visit, Geotechnical

**Abstract:** Fehily Timoney and Company (FT) was engaged by McCarthy Keville O’Sullivan (MKO) to undertake a geotechnical assessment of the Lyrenacarriga Wind Farm site.

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## 1 INTRODUCTION

### 1.1 Background and Experience

Fehily Timoney and Company (FT), formerly Applied Ground Engineering Consultants Ltd (AGEC) was engaged in August 2018 by McCarthy Keville O'Sullivan to undertake a geotechnical assessment of the proposed Lyrenacarriga wind farm.

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 stability assessments, geohazard mapping, investigation of peat and non-peat failures and site assessments.

The proposed Lyrenacarriga wind farm site consists of 2 no. clusters of turbines and is located approximately 5km south east of Tallow, Co. Waterford. The wind farm is located east and west of the R634 (regional road) which links Tallow to the town of Youghal in County Cork.

The proposed development comprises:

- i. Up to 17 no. wind turbines with a tip height of up to 150m and all associated foundations and hardstanding areas,
- ii. 1 no. on-site electrical substation,
- iii. 2 no. temporary construction compounds,
- iv. Upgrading of existing access tracks and provision of new site access tracks required and associated drainage,
- v. Excavation of 3 no. borrow pit areas,
- vi. All associated site development works (including tree felling and permanent met mast).

### 1.2 Contents of Report

The report includes the following:

- (1) Desk study
- (2) Site reconnaissance
- (3) Summary of ground conditions
- (4) Geotechnical considerations for infrastructural elements
- (5) Management of excavated spoil
- (6) Recommendations



## 2 SITE DESCRIPTION

The main proposed wind farm is split into 2 no. clusters of turbines which are located within the townlands of Kilcalfmountain and Lyrenacarriga, and adjacent townlands, in Co. Waterford and Co. Cork. The proposed site is predominantly located in Coillte owned forestry, with the remaining areas made up of privately-owned forestry and farmland used for pasture and tillage (Figure 1). The agricultural tillage and pasture lands are predominantly located in the south of the Kilcalfmountain cluster (the western cluster), centrally and within the north of the Lyrenacarriga cluster (the eastern cluster). From a review of the OSI maps the elevation at the proposed site varies approximately between 150 and 200m OD.

The cluster of turbines around the townland of Lyrenacarriga, which borders the R634 (regional road) to the east, has 11 no. proposed turbines labelled T1 to T11. The cluster is typically made up of Coillte forestry to the north and south, with privately owned forestry and agricultural pasture/tillage lands located centrally within the cluster of turbines. The area is generally a mixture of juvenile, mature forestry and deforested areas with some agricultural pasture and tillage land located centrally and to the east of the cluster of turbines. A number of watercourses run through the cluster of turbines which flow into the Glendine River to the south and Blackwater River to the east.

The cluster of turbines around the townland of Kilcalfmountain has 6 no. proposed turbines labelled T12 to T17. From a review of the OSI mapping, the site slopes gently from the north and west towards the south and south east. The topography of the cluster is comprised of generally flat to gently sloping terrain with a mixture of pasture/tillage land, juvenile and mature forestry. The northern portion of the site is drained by a local tributary of the Glenaboy River, while the south portion of the site is drained by a tributary of the Tourig River.



## 3 DESK STUDY

### 3.1 Desk Study

The main relevant sources of interest with respect to the site include:

- Geological (soils & bedrock) plans
- Ordnance survey plans
- Literature review of peat and non-peat failures/landslides
- Previous ground investigation
- Hydrogeology/Groundwater
- Geological heritage

The Geological Survey of Ireland published mapping (GSI 1995) and on-line database (GSI 2019) was used to verify the soil and bedrock conditions.

The Ordnance Surveys of Ireland (OSI 2019) aerial imagery was reviewed to determine if any notable features or areas of particular interest (from a geotechnical point of view) are present on the site.

The desk study also included a review of both published literature and the GSI online dataset viewer on peat and non-peat failures/landslides in the vicinity of the site.

Other information from the GSI (2019) online database included a review of previous ground investigation information, hydrogeology/groundwater and geological heritage sites.

### 3.2 Soils, Subsoils & Geology

A review of the online database (GSI 2019) and published data (GSI 1995) indicates that the site is underlain by the Ballytrasna formation (Figure 3). This formation consists of up to 90% red mudstone with the remaining consisting of pale red fine to medium grained sandstone. Thickness of the formation ranges between 360m to 1500m, with the maximum thickness in the Monavullagh Mountains to the north east in county Waterford. The formation is of Devonian age and is sometimes referred to as "Old Red Sandstone". The member contains significant quartz pebbly sandstone at Ballyvoyle Head and Helvic Head.

The superficial geology consists of predominantly deep well drained mineral soil, with localised areas of shallow well drained mineral soil and alluvial mineral soil (Figure 2).

From the online data there are no fault lines running across the site.

As expected, given the type of rock present, there are no karst features within the site boundary. There are a number of recorded karst features, including an enclosed depression, a cave and a spring, approximately 10km to the north and northeast of the site.



### 3.3 Ordnance Survey Data

The online ordnance survey imagery (OSI 2019) was reviewed as part of the desk study. Analysis of aerial imagery dating back to 2000 found there has been little change in the proposed wind farm location apart from a localised increase in the forested area with some corresponding localised felling.

A review of the historical mapping for the area identified no notable features from a geotechnical point of view.

### 3.4 Previous Failures

From a review of the recorded online database (GSI 2019), there are no recorded slope failures at the proposed Lyrenacarriga wind farm site.

The nearest recorded slope failure is located approximately 11km north of the study area. This failure occurred at Lismore Castle, near the Blackwater River in April 2016 and was described as a small landslide on the cliff of the river Blackwater. The cause of the slope failure in this area was recorded as an exceptional rainfall event.

Based on the review carried out, no other slope failures occurred within a 15km radius of the site.

### 3.5 Previous Ground Investigation Data

Based on a review of the information available (GSI 2019), there are no publicly available intrusive investigation points within a 5km radius of the proposed site boundary.

### 3.6 Hydrogeology/Groundwater

From a review of the available information (OSI 1997 and GSI 2019), a number of watercourses originate and flow through areas of the proposed wind farm. These watercourse form tributaries of the Glendine River, Glenaboy River and Blackwater River.

A review of the mapping for the area identified no notable features from a geotechnical point of view.

### 3.7 Geological Heritage

Reviewing the available information (GSI 2019), there are no geological heritage features that are within or bordering the proposed wind farm site. There are a number of geological heritage sites a considerable distance from the proposed site.

Approximately 7.5km southeast from the study area, a heritage site is located just outside the town of Youghal. It is not clear what the feature is but is described as road cuts near Youghal Bridge and was identified as part of the National Heritage Plan in 2002.





In the townland of Bewley, approximately 8.5km northeast from the study area, there are several small caves in low limestone cliffs, alongside the Finisk River. This feature is identified as the Bewley caves.

From the review of the GSI database there are no other geological features within a 10km radius of the proposed site.



## 4 SITE RECONNAISSANCE

As part of the assessment of potential geotechnical issues at the site, FT carried out a site reconnaissance. This comprised walk-over inspections of the site to record any areas of instability with respect to the proposed wind farm development and to provide a preliminary assessment of the ground conditions.

The following salient geomorphological features were considered:

- Any active, incipient or relict areas of instability
- Presence of shallow valley or drainage lines
- Wet areas
- Any notable change in vegetation
- Inspection of ground conditions
- Slope inclination and break in slope

The survey covered the proposed locations for the turbine bases and associated infrastructure.

The method adopted for carrying out the site reconnaissance relied on practitioners carrying out a visual assessment of the site supplemented with measurement of slope inclinations.

### 4.1 Findings of Site Reconnaissance

The site reconnaissance comprised a walk-over inspection of the site between 4<sup>th</sup> and 5<sup>th</sup> September 2018. Weather conditions for the site visit were dry with sunny spells.

The main findings of the site reconnaissance are as follows:

- (1) The proposed site is predominantly located in Coillte owned forestry, with the remaining areas made up of privately owned forestry and farmland used for pasture and tillage (Appendix A – Photos 1 to 3). The proposed wind farm is split into 2 no. clusters of wind turbines which are located in the townlands of Kilcalfmountain and Lyrenacarriga.
- (2) The site typically comprised flat to gently sloping forested areas and agricultural lands, with localised steeply inclined terrain.
- (3) The forested areas have been planted predominantly with conifers with some deciduous plantations.
- (4) Based on the site reconnaissance, no peat was recorded on the site.
- (5) Ground conditions at the site typically comprise topsoil over mineral soil, which was occasionally exposed at the ground surface in the deforested and forested areas. In the pasture/tillage areas, exposures showed dark brown mineral soil.
- (6) From site observations bedrock is estimated to be between 1.5 and 2.0m below ground level. This estimation is based on inspection of a limited number of exposures.



- (7) The mineral soil was typically described as firm to stiff gravelly Clay with occasional cobbles. The upper 1.0 to 1.5m of bedrock was noted as weathered with more intact bedrock present at depth. The bedrock was noted as Sandstone/Mudstone which is consistent with the desk study findings.
- (8) All existing Coillte access tracks on site have been constructed using a founded i.e. excavate & replace technique (Photos 1 & 2). The access tracks for the wind farm will comprise upgrading of existing founded access tracks and construction of new proposed access tracks using excavate and replace construction techniques.
- (9) Slope angles at the turbine locations and other infrastructural elements typically range from 0 to 8 degrees. The slope angle readings are based on site recordings.
- (10) The location of the proposed borrow pits are shown on Figure 1A. The borrow pits will be used to provide suitable granular material during construction of the wind farm infrastructure. Following removal of the rock from a borrow pit, it is proposed to partially restore the borrow pit by storing excavated spoil generated from construction activities.
- (11) No evidence of past failures or any signs of instability were noted on site.
- (12) The conclusions from the site reconnaissance are as follows:
  - (a) The ground conditions recorded on site from a limited number of exposures indicate that typically the site consists of topsoil over mainly cohesive overburden over bedrock.
  - (b) Based on visual inspection of a limited number of exposed ground conditions on site, the bedrock is likely to be suitable for re-use within the lower layers of access roads, crane hardstands, lay down areas, etc.
  - (c) All proposed access tracks for the wind farm will comprise upgrading of existing founded access tracks and construction of new proposed access tracks using excavate and replace construction techniques.
  - (d) No evidence of past failures or any signs of instability were noted on site.



## 5 GROUND CONDITIONS

### 5.1 Soils & Subsoils

Based on the site reconnaissance the superficial deposits are typically topsoil overlying mineral soil overlying bedrock in the forestry areas. While in the agricultural pastures and tillage areas the ground conditions comprised of deeper deposits of mineral soil.

Based on inspections of exposures on site, the mineral soil was typically described as firm to stiff gravelly Clay with occasional cobbles.

A review of the GSI subsoils database indicates that the site is mainly underlain by deep well drained mineral soil with localised shallow mineral soil and alluvial soils. Figure 2 shows the dispersion of soils and subsoils throughout the proposed site.

### 5.2 Bedrock

The underlying bedrock was described by the Geological Survey of Ireland (GSI 2018) and shown on sheet 22 Geology of East Cork – Waterford (GSI 1995). In the area of the site, one dominant bedrock formation is present.

The site is underlain by the Ballytrasna formation which is described as purple mudstone and sandstone, see Figure 3. There were no rock outcrops recorded across the site. However, from site observations of an existing borrow pit located near to proposed borrow pit no. 3, bedrock is estimated to be between 1.5 and 2.0m below ground level. It should be noted that this estimation is based on inspection of a limited number of exposures.

### 5.3 Ground Investigation

A ground investigation comprising 27 trial pits was undertaken by HES during May 2020. The trial pit logs are included in Appendix B.

Ground conditions across the site comprise a stiff to very stiff, occasionally soft, slightly gravelly sandy Silt/Clay, typically overlying a medium dense slightly clayey, sandy Gravel. This gravel deposit may represent a weathered bedrock layer.



## 6 SUMMARY OF SITE CONDITIONS AT INFRASTRUCTURE LOCATIONS

As part of the site reconnaissance, details of any soft ground and slope angles were recorded throughout the site. Inspections were completed at the proposed turbine locations, access tracks, constructions compounds, substations and borrow pits.

A summary of the site conditions at the proposed infrastructure locations is given in Table 6.1. The slope angles presented in Table 6.1 were recorded on site using a hand-held Silva Clino Master.

**Table 6.1: Terrain Type/Land Use & Slope Angle at Proposed Infrastructure Locations**

<b>Turbine</b>	<b>Easting</b>	<b>Northing</b>	<b>Terrain/Land Use Type</b>	<b>Slope Angle (°) <sup>(1)</sup></b>
<b>T1</b>	603993	587718	Juvenile forestry	3 - 4
<b>T2</b>	603110	587386	Mature forestry	0 - 1
<b>T3</b>	603576	587412	Agricultural/grassland	2 - 3
<b>T4</b>	603877	587091	Agricultural/grassland	1 - 2
<b>T5</b>	603177	586974	Mature forestry	0 - 1
<b>T6</b>	604338	586514	Agricultural/tillage	2 - 3
<b>T7</b>	603959	586377	Agricultural/tillage	3 - 4
<b>T8</b>	603868	585916	Mature forestry	2 - 3
<b>T9</b>	603487	585581	Mature forestry	1 - 2
<b>T10</b>	603623	585230	Juvenile forestry	7 - 8
<b>T11</b>	603482	586139	Mature forestry	0 - 1
<b>T12</b>	599804	588402	Deforested	0 - 2
<b>T13</b>	599365	588088	Agricultural/grassland	1 - 2
<b>T14</b>	599703	587808	Mature forestry	0 - 1
<b>T15</b>	600078	587585	Agricultural/tillage	1 - 2
<b>T16</b>	599590	587320	Planted forestry	2 - 3
<b>T17</b>	600260	587156	Mature forestry	2 - 3
<b>Substation</b>	604079	586896	Agricultural/grassland	1 - 2
<b>Temporary Construction Compound 1</b>	599170	588066	Felled/planted forestry	0 - 1



<b>Turbine</b>	<b>Easting</b>	<b>Northing</b>	<b>Terrain/Land Use Type</b>	<b>Slope Angle (°) <sup>(1)</sup></b>
<b>Temporary Construction Compound 2</b>	602560	588235	Felled/planted forestry	2 - 3
<b>Borrow Pit 1</b>	599500	588320	Juvenile forestry	3 - 5
<b>Borrow Pit 2</b>	599540	587700	Juvenile forestry	1 - 3
<b>Borrow Pit 3</b>	603520	5855330	Juvenile forestry	3 - 5

Note (1) Slope angle obtained during site survey by AGEC using handheld equipment or taken from contour survey. The slope angle quoted reflects the slope immediately around the infrastructure location.



## 7 GEOTECHNICAL CONSIDERATIONS FOR INFRASTRUCTURE ELEMENTS

### 7.1 Turbine Foundations

Based on a review of the GSI information for the area and findings from the site reconnaissance carried out by FT, a preliminary assessment of the likely foundation types found that excavate and replace construction (founded) would be suitable for the turbine foundations.

It should be noted that a confirmatory ground investigation will be carried out at each turbine location prior to construction to confirm the turbine foundation type. The ground investigation will be in the form of a borehole with in-situ SPT testing at 1.0m intervals in the overburden and follow-on rotary core through bedrock.

For gravity type turbine foundations, where the depth of excavation exceeds the minimum required founding depth for the proposed turbine base, up-fill material consisting of granular fill (6N/6P) in accordance with Transport Infrastructure Ireland (TII) requirements shall be used to backfill the excavation to the required founding depth.

### 7.2 Access Tracks

The guidelines for construction of the access tracks at Lyrenacarriga wind farm are outlined in Section 8.

Up to 10.7km of existing access tracks requiring upgrade are present across the site and based on anecdotal information have been in operation for a significant number of years. The existing access tracks were constructed using the excavate and replace construction technique.

Up to 4.1km of new proposed access roads will be constructed as part of the wind farm construction. Due to the ground conditions the access tracks on site will be founded. The typical make-up of the founded access tracks is a minimum stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed prior to construction.

### 7.3 Crane Hardstands

The crane hardstands will be constructed using the founded technique (i.e. not floated technique).

Crane hardstands are generally constructed using compacted Class 1/6F material (in accordance with TII requirements) on a suitable sub-formation to achieve the required bearing resistance. The hardstands will be designed for the most critical loading combinations from the crane.

The founding levels for the hardstands may be variable across the site and will be determined prior to construction.

The typical make-up of the hardstands may include up to 1,000mm of granular stone fill with possibly a layer of geotextile and/or geogrid.



## 7.4 Substation Foundations & Platforms

The substation platforms will be constructed using the founded technique. The substation foundations may comprise strip/raft foundations under the main footprint of the building with possibly a basement/pit for cable connections.

Substation platforms are generally constructed using compacted Class 1/6F material (in accordance with TII requirements) on a suitable sub-formation to achieve the required bearing resistance.

Given the ground conditions present at the proposed substations, it is envisaged that the foundations will require to be founded on mineral soil or bedrock.

The typical make-up of the substation platform may include up to 750mm of granular stone fill with possibly a layer of geotextile and/or geogrid. At the underside of the substation foundations, a layer of structural up-fill (class 6N/6P - in accordance with TII requirements) will likely be required.

## 7.5 Temporary Construction Compound Platforms

The construction compound platforms will be constructed using founded techniques.

The construction compound platforms are generally constructed using compacted Class 1/6F material (in accordance with TII requirements) on a suitable sub-formation to achieve the required bearing resistance.

The typical make-up of the construction compound platform may include up to 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid.

## 7.6 Borrow Pits

The guidelines for construction of the 3 no. borrow pits at Lyrenacarriga wind farm are outlined in Section 9.

From the desk study and limited exposures noted during the site reconnaissance, the rock on site is likely to be suitable only for re-use within the lower layers of access roads, crane hardstands, lay down areas, etc.

Imported stone fill is likely to be required to form the upper layers of the infrastructure elements.





## 8 CONSTRUCTION OF ACCESS TRACKS

Up to 10.7km of existing access tracks requiring upgrade are present across the site and have been in operation for a significant number of years. The existing access tracks were constructed using the excavate and replace construction technique.

Up to 4.1km of new proposed access roads will be constructed as part of the wind farm construction. Due to the ground conditions the access tracks on site will be founded. The typical make-up of the founded access tracks is a minimum stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed prior to construction.

### 8.1 Upgrade of Existing Access Tracks

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

- (1) The following guidelines apply:
  - (a) Excavation will be required on one or both sides of the existing access track to a competent stratum.
  - (b) Granular fill to be placed in layers in accordance with the designer's specification.
  - (c) The surface of the existing access track to be overlaid with up to 300mm of selected granular fill.
  - (d) Access roads to be finished with a layer of capping across the full width of the road.
  - (e) A layer of geogrid/geotextile may be required at the surface of the existing access road in areas of excessive rutting (to be confirmed by the site engineer).
  - (f) For excavations in spoil, side slopes shall be not greater than 1 (v): 2. This slope inclination should be reviewed during construction, as appropriate.
- (2) The finished road width will be approximately 5m.
- (3) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
- (4) A final surface layer shall be placed over the existing access track, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.

### 8.2 Construction of New Access Tracks

The excavation of topsoil & spoil and founding of access roads on competent stratum 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-A.



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) Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
- (2) Excavation will take place to a competent stratum beneath the topsoil (as agreed with the site designer and resident engineer).
- (3) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road will be excavated without re-placement with stone fill.
- (4) The surface of the excavated access road will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.
- (5) Access roads to be finished with a layer of capping across the full width of the road.
- (6) A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the Site Engineer).
- (7) A final surface layer shall be placed over the excavated road, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.



## 9 MANAGEMENT OF EXCAVATED SPOIL

### 9.1 Summary of Excavated Spoil & Stone Volumes on Site

A summary of the excavated spoil volumes calculated for the Lyrenacarriga Wind Farm site are given in Table 9.1. These volumes are based on observations recorded by FT (formerly AGEC) during a site walkover.

**Table 9.1: Summary of Excavated Spoil Volumes on Site**

Infrastructure Element	Typical Dimensions	Spoil (non-peat) Volume (m <sup>3</sup> )	Comment
17 no. Turbines & Hardstands	22m diameter excavation footprint for turbine foundation with hardstand area	42,890	Hardstanding area and foundation footprint
Access Roads (includes offsite road upgrade)	Assumed 5m running surface with 6m wide development footprint	35,235	
Substation	Assumed 21,930m <sup>2</sup> footprint	26,320	-
Temporary Construction Compound (2)	Hardstanding area of 1,925m <sup>2</sup>	4,420	Hardstanding areas
Borrow Pit (3)	3 No. borrow pits	90,115	Borrow pit footprint
<b>Total =</b>		<b>198,980</b>	

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

Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated 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) It should be noted that the spoil volumes given in Table 9.1 are indicative and for information purposes only, and subject to detailed design.

Stone volumes required for the construction of access roads, hardstands and turbine bases are summarised in the table below. This stone will be excavated from the proposed borrow pits on the site.



**Table 9.2: Summary of Stone Volumes on Site**

Infrastructure Element	Typical Dimensions	Stone Volume (m <sup>3</sup> )	Average Stone Depth (m)	Comment
17 no. Turbines	22m diameter excavation footprint for turbine foundation	4,040	0.5	Foundation footprint
17 no. Hardstands	Hardstand area (varies)	40,910	1.0	Hardstanding area
Access Roads (includes offsite road upgrade)	Assumed 5m running surface with 6m wide development footprint	64,500	Varies	
Substation	Assumed 9,587m <sup>2</sup> footprint	27,410	1.0	-
Temporary Construction Compound (2)	Hardstanding areas of 3,680m <sup>2</sup>	9,200	1.0	Hardstanding areas
	<b>Total =</b>	146,060		

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

Note (2) A contingency factor of 25% stone volumes to allow for a variation in ground conditions across the site.

## 9.2 Summary of Spoil Placement/Reinstatement Areas on Site

A summary of the potential spoil placement/reinstatement areas at the Lyrenacarriga Wind Farm site are given in Table 9.3.

Spoil volumes were calculated based on an excavation depth of 3m at turbines, 1m at the substation, 0.5m at the hardstands and 0.5m below the access tracks.

**Table 9.3: Summary of Spoil Placement/Reinstatement on Site**

Location	Spoil Volume (m <sup>3</sup> )	Comment
Borrow Pit 1	37,480	
Borrow Pit 2	32,850	
Borrow Pit 3	156,020	
<b>Total =</b>	226,350	



### 9.3 Guidelines for Borrow Pit Construction and Spoil Placement

Upon removal of the rock from the borrow pits, it is proposed to restore the borrow pits using excavated spoil within cells located inside the borrow pits. The excavated rock from the borrow pits will be used in the construction of the wind farm infrastructure elements (turbine bases, access tracks etc). The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated spoil to be contained safely. It is proposed to construct cells within the borrow pits for the placement of the excavated spoil. This is to allow for the safe placement and grading of the spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the borrow pits.

Figures 4 to 6 show typical construction details for the 3 no. borrow pits.

The borrow pits shall be typically constructed as follows:

- (1) The rock within the proposed borrow pit footprint will be removed by either breaking or blasting, depending on whether it can be excavated, determined from a ground investigation carried out at the proposed borrow pit location. However, it is unlikely that blasting will be required. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.
- (2) 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. This may vary and as excavation progresses into the back edge of the borrow pit, the base of the borrow pit may be raised to suit local conditions. Localised deepening of the borrow pit floor may be required depending on extraction operations.
- (3) Depending on the depth and type of rock present in the borrow pits it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses.
- (4) 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.
- (5) The stability of the rock faces within the borrow pit will be inspected by competent personnel 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.
- (6) Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pits. The rock buttresses will be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress will be inspected and approved by a competent person.
- (7) Infilling of the spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated spoil to be placed safely.



- (8) The height of the rock buttresses constructed will be greater than the height of the placed spoil to prevent any surface spoil run-off.
- (9) The use of temporary access ramps and long reach excavators during the placement of the excavated spoil is likely to be required.
- (10) Where possible, the surface of the placed spoil will be shaped to allow efficient run-off of surface water from borrow pit areas.
- (11) An interceptor drain should 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 on the re-instated borrow pit area.
- (12) Control of groundwater within the borrow pits may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
- (13) Silting ponds may be required at the lower side/outfall location of the borrow pit.
- (14) Supervision by a geotechnical engineer or appropriately competent person will be carried out for the works.
- (15) All the above general guidelines and requirements will be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pits will be compiled prior to construction.

#### 9.4 Spoil Placement alongside Excavated Access Tracks

The following recommendations/best practice guidelines for the placement of spoil alongside the access tracks will be applied during construction. Storage of spoil in this way will be considered an additional measure/storage solution, borrow pit storage is the primary storage solution. Recommendations for placement of excavated material along the access tracks has been included in this report for completeness.

- (1) The potential spoil placement locations to be identified are possibly alongside the existing excavated and proposed new access tracks with cross slopes of less than 10 degrees.
- (2) As a general guide, the spoil placed adjacent to the existing and proposed excavated access tracks will be restricted to a maximum height of 1m over a 5m wide corridor on both sides of the access tracks. It should be noted that the designer will define/confirm the maximum restricted height for the placed spoil.
- (3) The placement of excavated spoil is to be avoided without first establishing the adequacy of the ground to support the load.
- (4) Where there is any doubt as to the stability of the ground then no material shall be placed on to the surface.
- (5) Where practical, it will be ensured that the surface of the placed spoil is shaped to allow efficient run-off of surface water. Shaping of the surface of the spoil should be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil.



- (6) Finished/shaped side slopes in the placed spoil shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate.
- (7) Supervision by a geotechnical engineer or appropriately competent person will be carried out for the works.
- (8) An interceptor drain will be installed upslope of the designated spoil placement areas to divert any surface water away from these areas. This will help ensure stability of the placed spoil and reduce the likelihood of debris run-off.
- (9) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.



## 10 SUMMARY & RECOMMENDATIONS

### 10.1 Summary

FT was engaged by MKO to undertake a geotechnical assessment of the main proposed wind farm site. The assessment comprised a site walkover, desk study, summary of ground conditions, geotechnical considerations for infrastructure and an assessment of spoil and stone volumes for the proposed development.

The main findings of the site reconnaissance are as follows:

- (a) The ground conditions recorded on site from a limited number of exposures indicate that typically the site consists of topsoil over mineral soil over bedrock.
- (b) Based on visual inspection of a limited number of exposed ground conditions on site, the bedrock is likely to be suitable for re-use within the lower layers of access roads, crane hardstands, lay down areas, etc.
- (c) All proposed access tracks for the wind farm will comprise upgrading of existing founded access tracks and construction of new proposed access tracks using excavate and replace construction techniques.
- (d) No evidence of past failures or any signs of instability were noted on site.

A network of existing tracks is present on the site. It is proposed to upgrade these existing tracks and construct additional tracks to provide access to the turbine locations.

A total of three borrow pits are proposed for the site. The borrow pits are proposed to provide sufficient stone for the proposed development and also to provide a suitable storage area for spoil material generated from construction activities. Two of the borrow pits are located in the western cluster of the site, and one is in the eastern cluster.

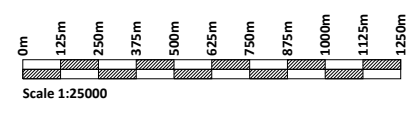
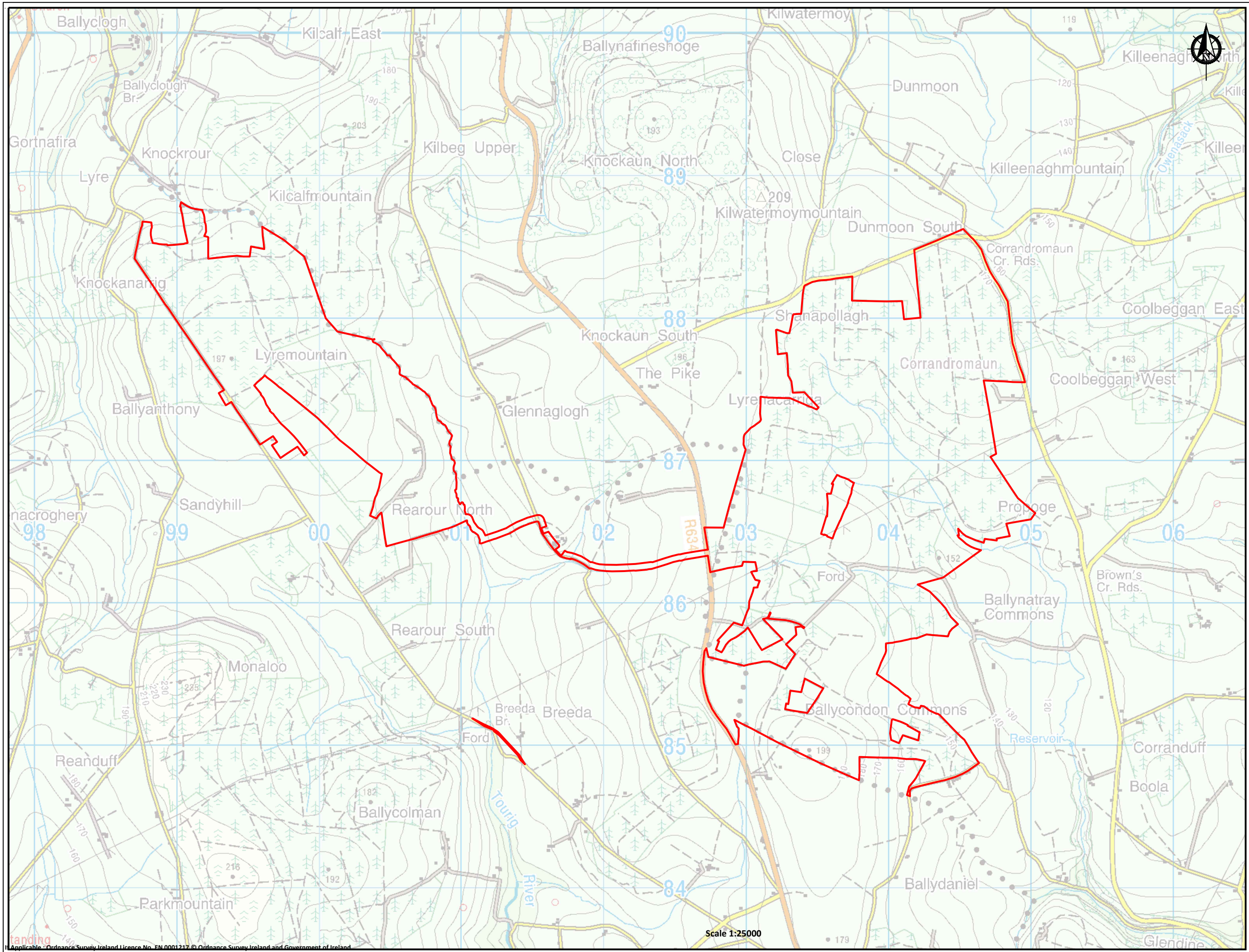
### 10.2 Recommendations

The following general recommendations are given.

- (1) Given the absence of peat on the site, all infrastructure will be founded.
- (2) Material excavated from access tracks and other infrastructure locations will be stored in the three borrow pits proposed for the site. If required, additional storage can be obtained by placing material alongside access tracks, as described in Section 9.4.



Legend  
 Planning Boundary











Scale (A3)  
 1:25000  
 Date - 23.12.20

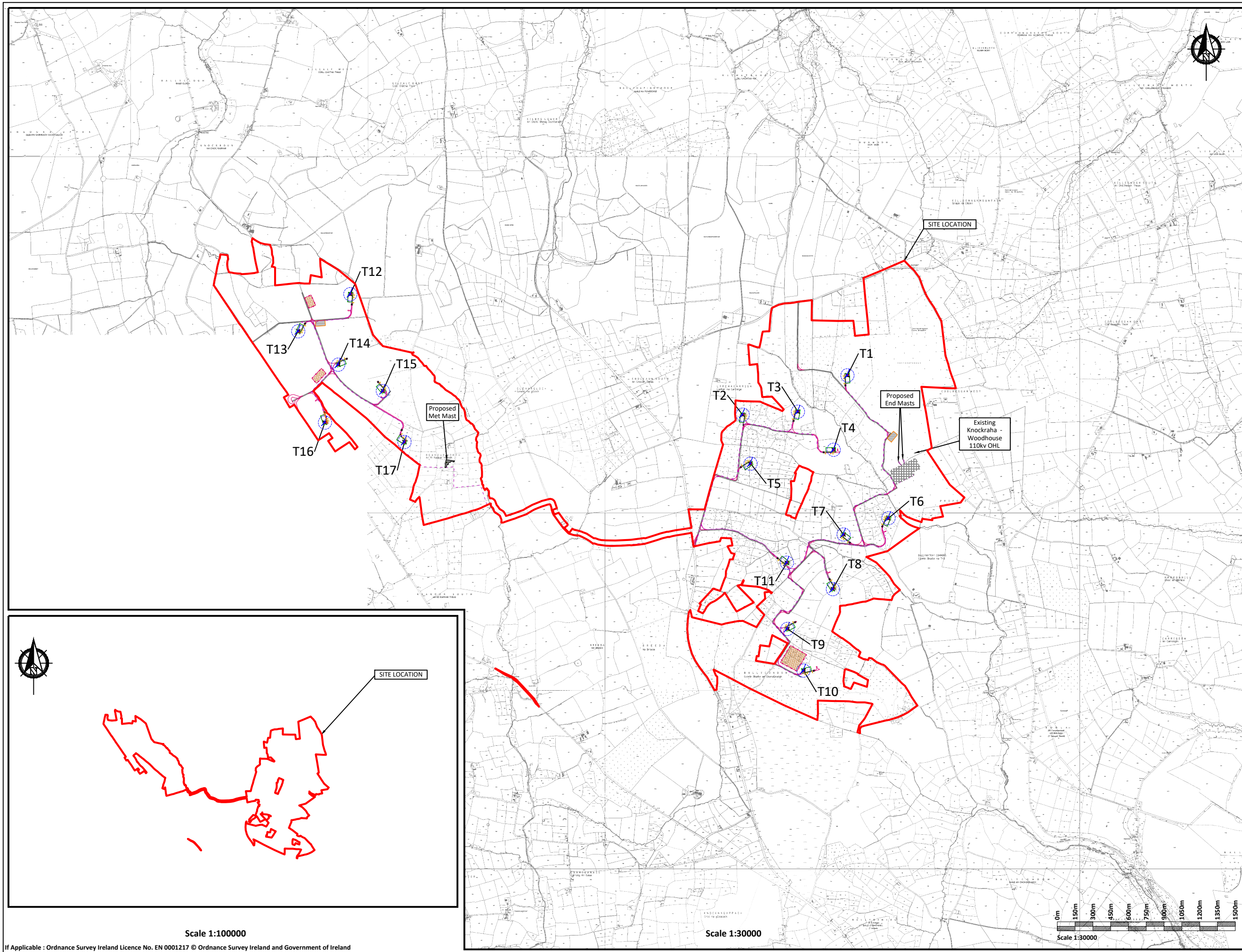
**FIGURE 1 : SITE LOCATION**

Drawn - POR  
 Checked - IH  
 Rev -



**Legend**

-  Planning Boundary
-  Proposed Turbine & Hardstanding
-  Existing Road to be Upgraded
-  Proposed New Access Track
-  Proposed Borrow Pit
-  Proposed Substation
-  Proposed Construction Compound
-  Proposed Met Mast and Surrounding Compound



Scale 1:100000

Scale 1:30000











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Scale (@ A3 )  
1:30000  
Date - 23.12.20






**FIGURE 1A : SITE LOCATION BACKGROUND MAPPING**

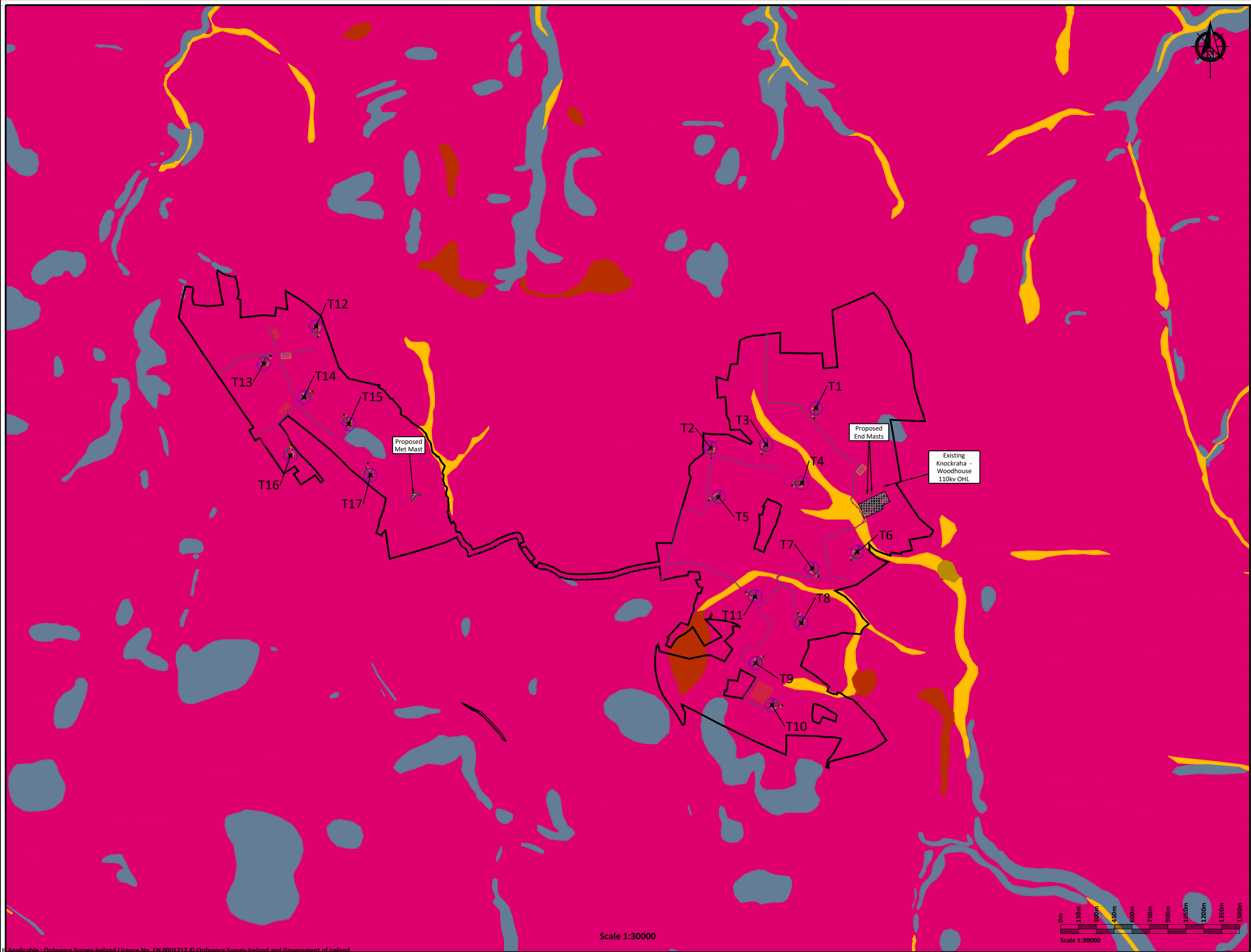
Drawn - POR  
Checked - IH  
Rev - C

**Legend**

-  Planning Boundary
-  Proposed Turbine & Hardstanding
-  Existing Road to be Upgraded
-  Proposed New Access Track
-  Proposed Borrow Pit
-  Proposed Substation
-  Proposed Construction Compound
-  Proposed Met Mast and Surrounding Compound

**Subsoils Legend**

-  A (Alluvium Undifferentiated)
-  Cut (Basin Peats)
-  GDSs (Sandstone Sands and Gravels)
-  Rck (Bedrock at surface)
-  TDSs (Sandstone Till)



Scale 1:30000



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Scale (@ A3 )  
1:30000









Date - 23.12.20

**FIGURE 2 : SUBSOILS GEOLOGY**






Drawn - POR  
Checked - IH  
Rev - C

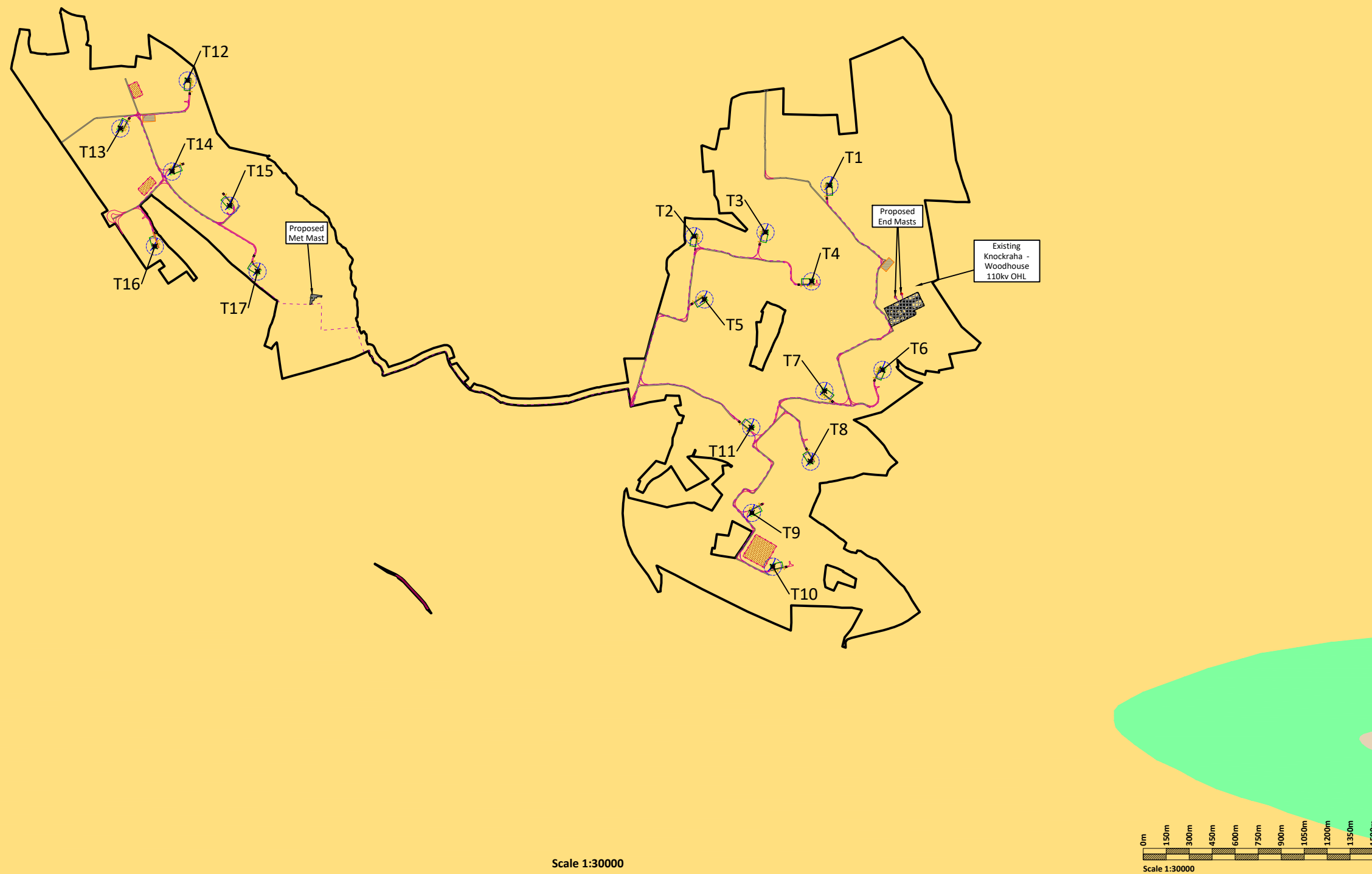


**Legend**

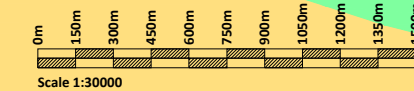
-  Planning Boundary
-  Proposed Turbine & Hardstanding
-  Existing Road to be Upgraded
-  Proposed New Access Track
-  Proposed Borrow Pit
-  Proposed Substation
-  Proposed Construction Compound
-  Proposed Met Mast and Surrounding Compound

**Quaternary Legend**

-  Ballytrasna Formation
-  Crows Point Formation
-  Gyleen Formation
-  Ringmoylan Formation
-  Waulsortian Limestone



Scale 1:30000



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Scale (@ A3 )  
1:30000  
Date - 23.12.20

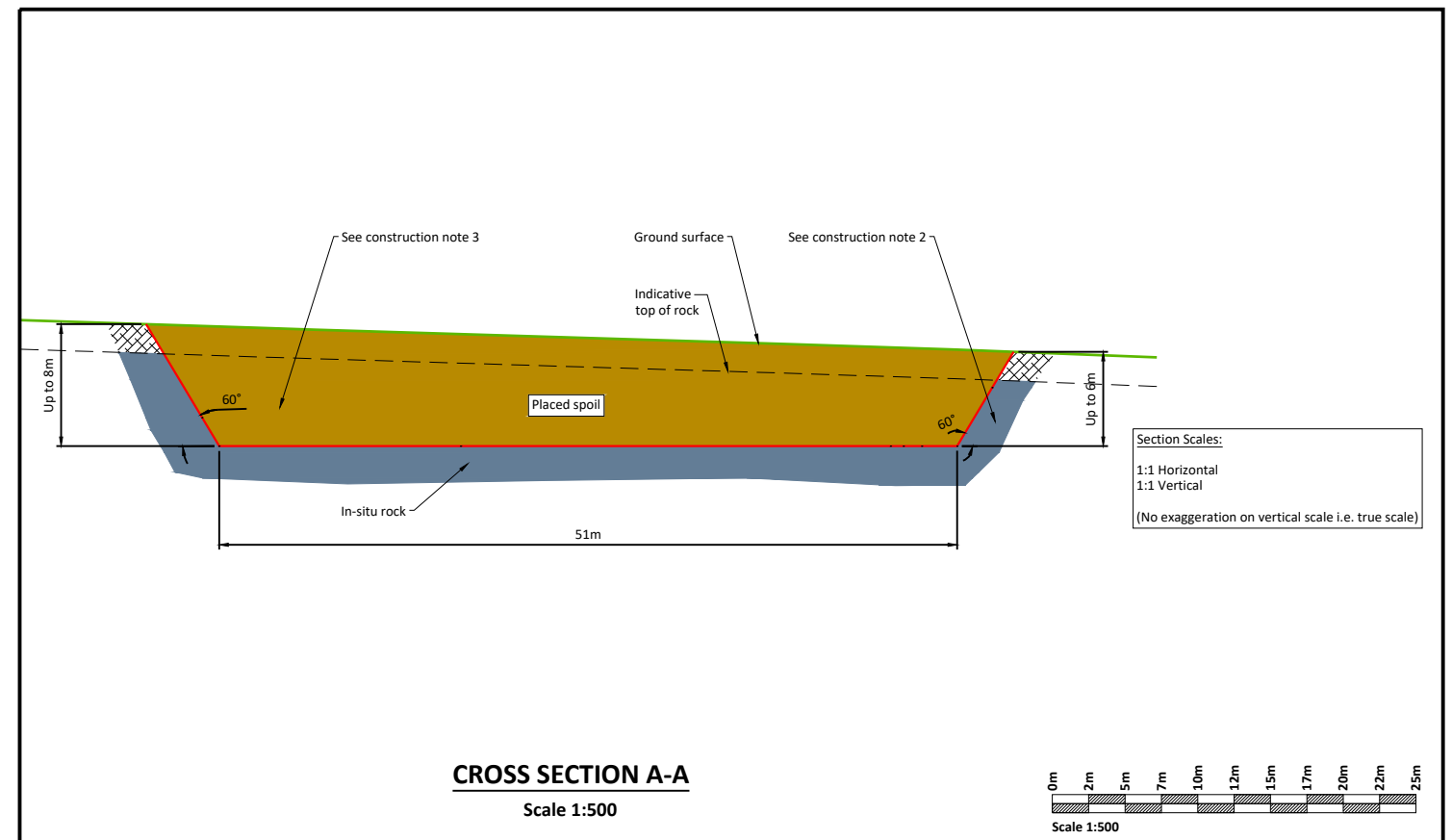
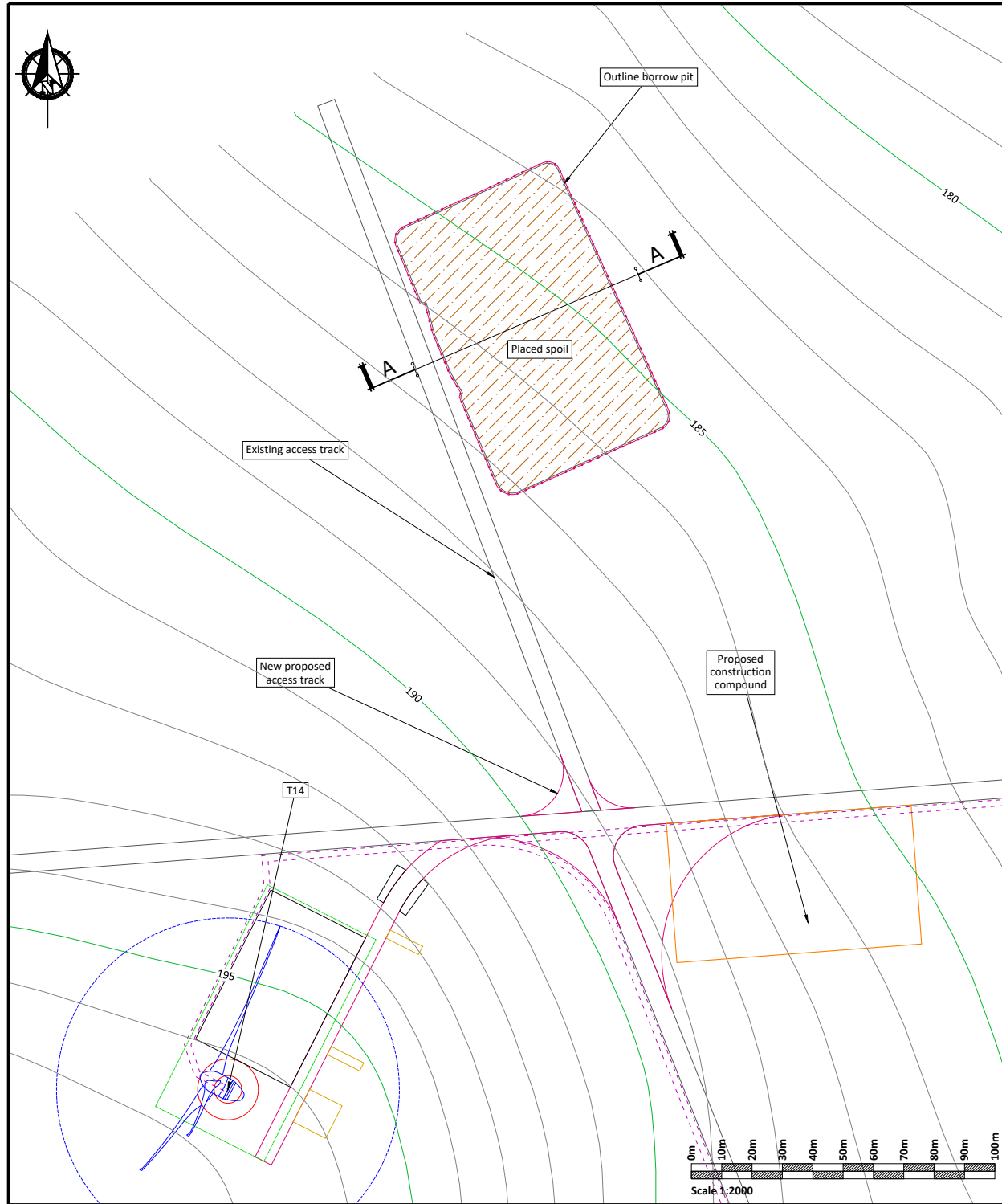
**FIGURE 3 : BEDROCK GEOLOGY**

Drawn - POR  
Checked - IH  
Rev - C



**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. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.
- (2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.
- (3) Infilling of should commence at the back edge of the borrow pit and progress towards the borrow pit entrance. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed spoil and will allow the borrow pit to be developed and infilled in cells.
- (4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be reinstated safely.
- (5) Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arising's.
- (6) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.
- (7) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.
- (8) Further guidelines on the construction of the borrow pit is included within Section 9.1 of the Geotechnical Assessment Report.



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1:2000

Date - 23.12.20

**FIGURE 4 : BORROW PIT - PLAN & CROSS SECTION DETAILS**

Drawn - POR

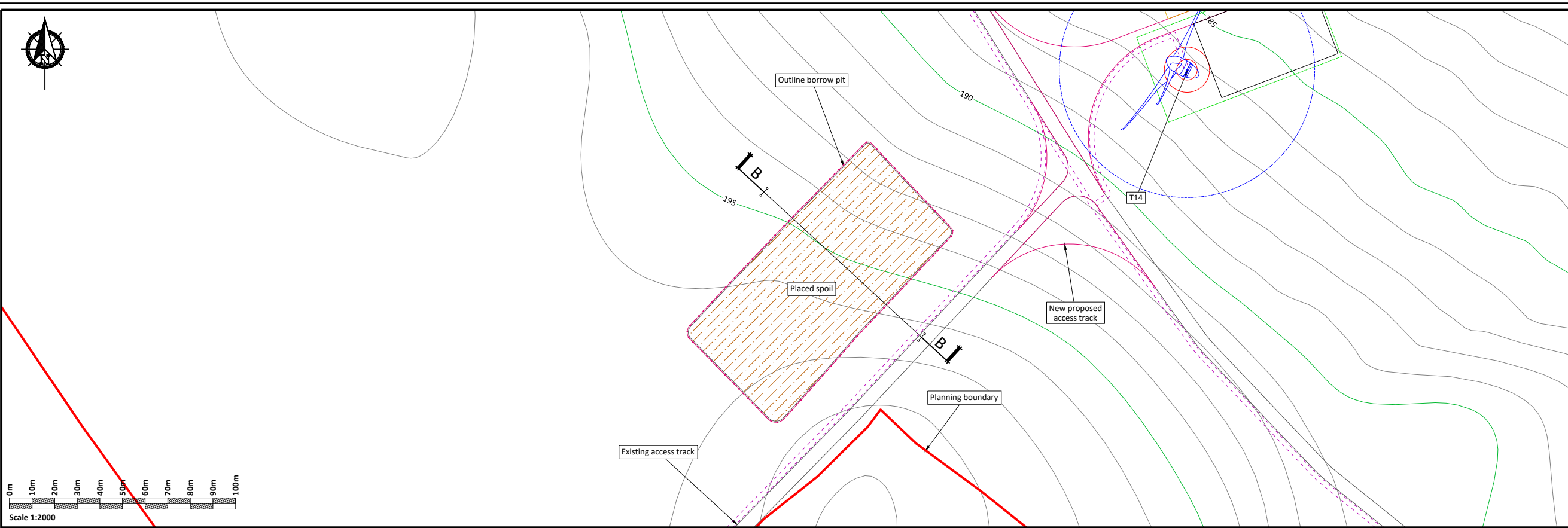
Checked - IH

Rev - C

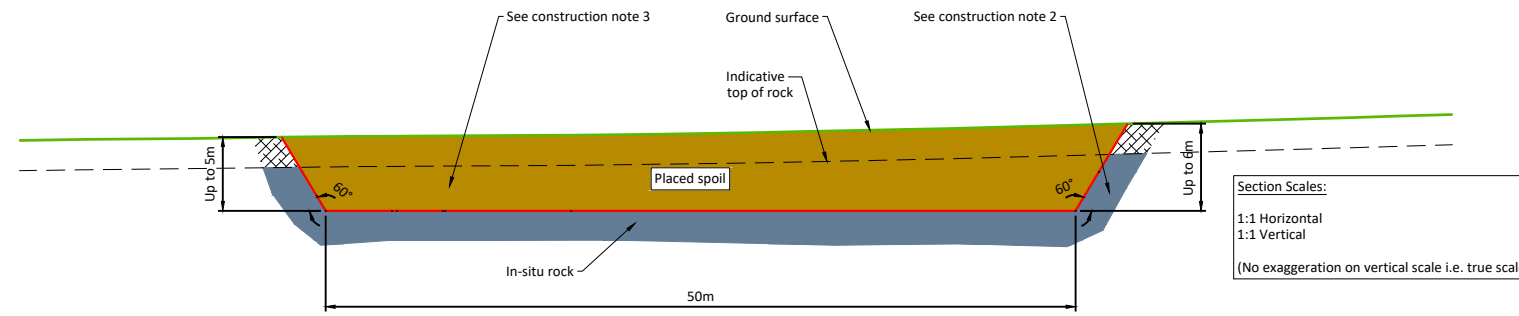


**Construction Notes Borrow Pit:**

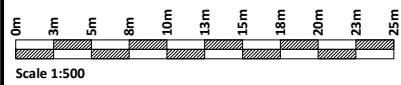
- (1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.
- (2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.
- (3) Infilling of should commence at the back edge of the borrow pit and progress towards the borrow pit entrance. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed spoil and will allow the borrow pit to be developed and infilled in cells.
- (4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be reinstated safely.
- (5) Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arising's.
- (6) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.
- (7) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.
- (8) Further guidelines on the construction of the borrow pit is included within Section 9.1 of the Geotechnical Assessment Report.



**PLAN**  
Scale 1:2000



**CROSS SECTION B-B**  
Scale 1:500



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Scale (@ A3 )  
1:2000

Date - 23.12.20

**FIGURE 5 : BORROW PIT - PLAN & CROSS SECTION DETAILS**

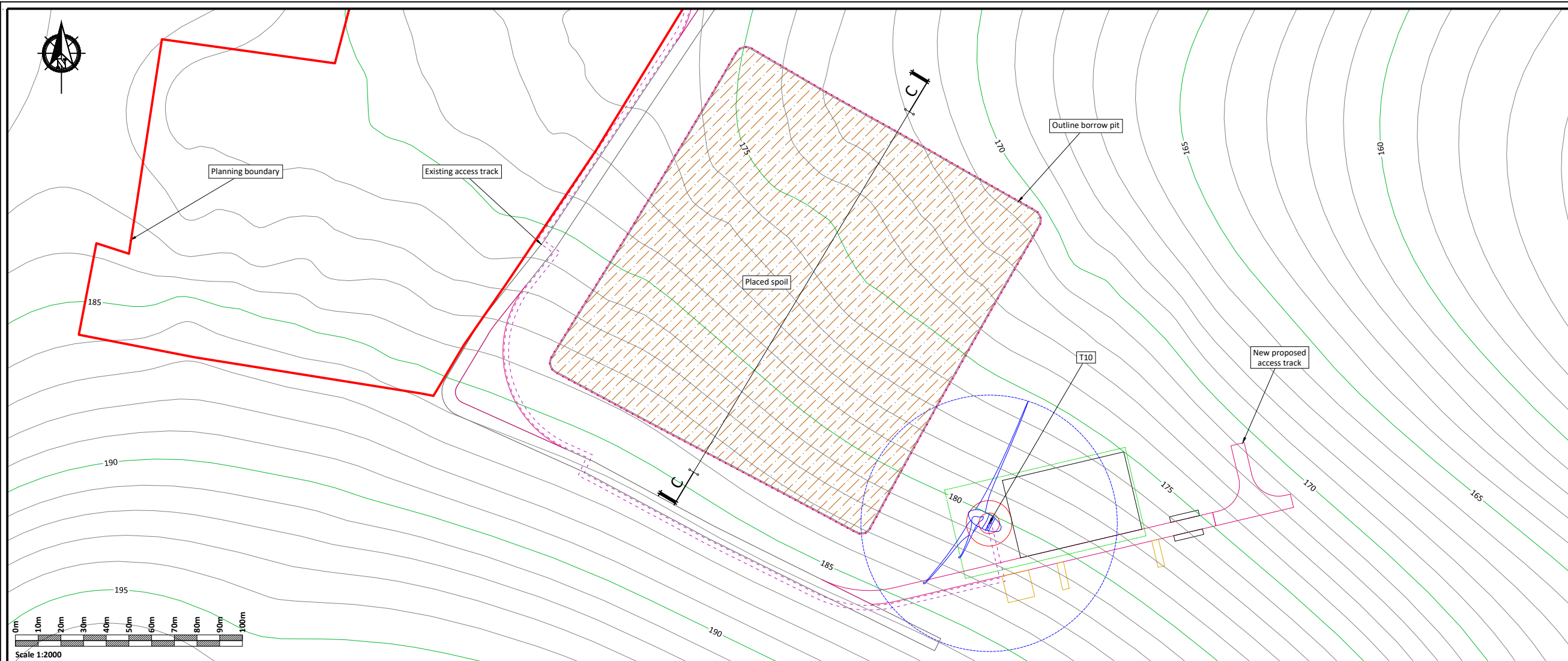
Drawn - POR

Checked - IH

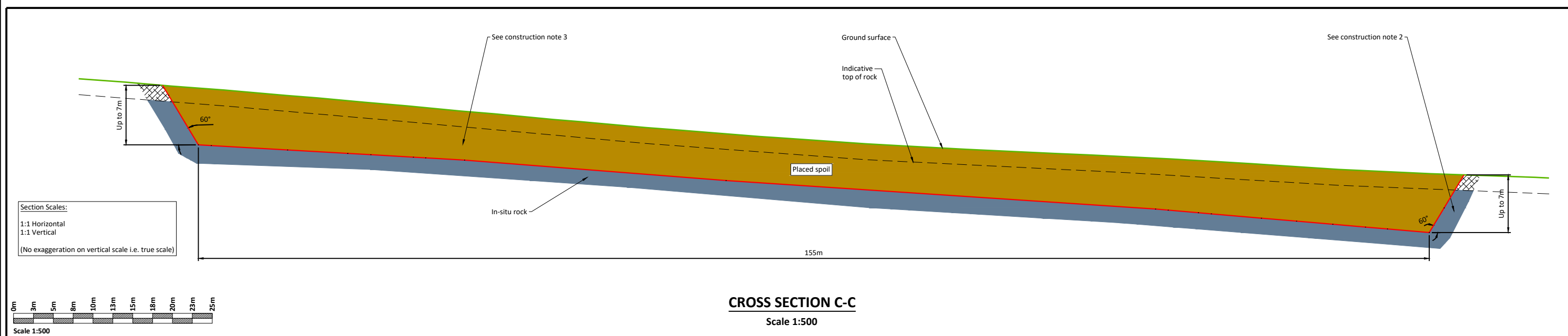
Rev - C

**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. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.
- (2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.
- (3) Infilling of should commence at the back edge of the borrow pit and progress towards the borrow pit entrance. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed spoil and will allow the borrow pit to be developed and infilled in cells.
- (4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be reinstated safely.
- (5) Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arising's.
- (6) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.
- (7) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.
- (8) Further guidelines on the construction of the borrow pit is included within Section 9.1 of the Geotechnical Assessment Report.



**PLAN**  
Scale 1:2000



**CROSS SECTION C-C**  
Scale 1:500

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Scale (@ A3 )  
1:2000  
Date - 23.12.20

**FIGURE 6 : BORROW PIT - PLAN & CROSS SECTION DETAILS**

Drawn - POR  
Checked - IH  
Rev - C



**FEHILY  
TIMONEY**  
— 30 YEARS —

CONSULTANTS IN ENGINEERING  
& ENVIRONMENTAL SCIENCES

## **APPENDIX A**

Site Inspection Photographs

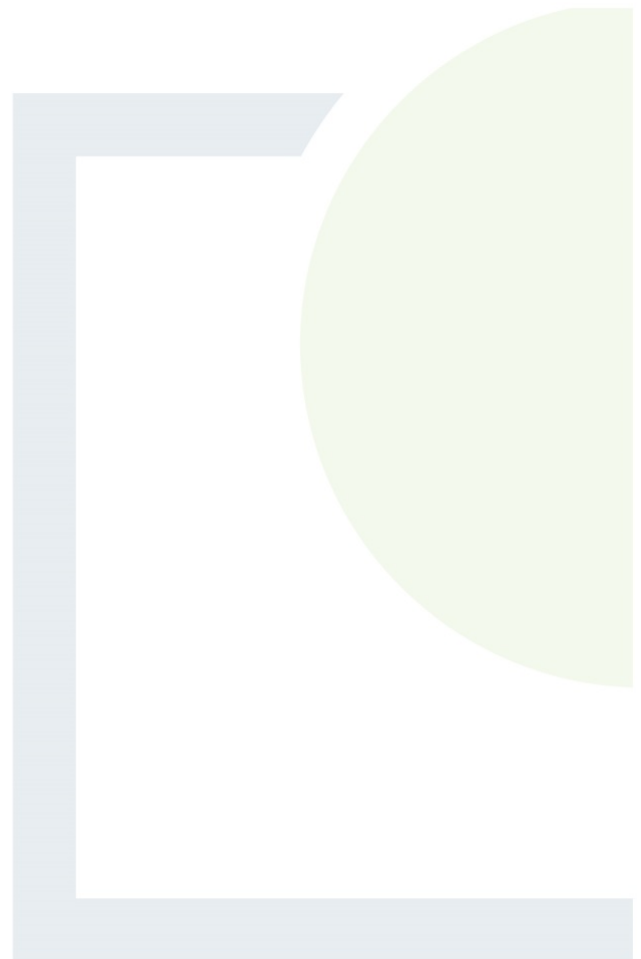


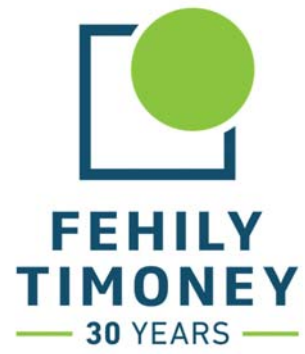




Photo 1: Example of an existing access track on site



Photo 2: Example of an existing access track on site



CONSULTANTS IN ENGINEERING,  
ENVIRONMENTAL SCIENCE & PLANNING

## APPENDIX B

Ground Investigation  
Information



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP01

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204028

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87541

**CLIENT:** Innogy


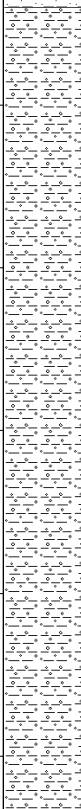
**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~165mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown, dry organic sandy/clayey Topsoil. (possible made ground, may have been dug before, or spoil from access track ditches)
					1		Very Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone gravels and cobbles.
				-1.90			
				-2.35	2		Hard, dry, weathered and angular gravel and cobbles of Siltstone, possible weathered bedrock.
							Total Depth of Trial Pit
					3		

<b>REMARKS:</b> No water inflows. Trial pit dry and stable.	<b>PIT LENGTH:</b> 2.2m <b>PIT BREADTH:</b> 1.0m <b>FINAL DEPTH:</b> 2.35m <b>EXCAVATOR:</b> JCB
---	---

<b>LEGEND</b> ∇ - Water strike D - Disturbed sample B - Bulk disturbed sample W - Water sample V - Vane test T - No. of threads R - Average length of ribbons Dil - Dilatancy recorded ND - No dilatancy recorded	<b>PAGE</b> 1 of 1
	<b>SCALE</b> as shown

TRIAL PIT LOG							TRIAL PIT NUMBER: TP02
PROJECT NUMBER: P1453-0			DATE STARTED: 28/05/2020		EASTING: 204099		
SITE: Lyrenacarraiga WF			LOGGED BY: MGill		NORTHING: 87461		
CLIENT: Innogy			CONTRACTOR: NO'K (JCB)		ELEVATION: ~165mOD		
Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.20			Brown, dry organic sandy/clayey Topsoil with grass rootlets
					1		Stiff to Very Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone cobbles/boulders at depth.
				-2.70			Total Depth of Trial Pit
					3		
<b>REMARKS:</b> No water inflows. Trial pit dry and stable.							<b>PIT LENGTH:</b> 2.2m <b>PIT BREADTH:</b> 1.0m <b>FINAL DEPTH:</b> 2.7m <b>EXCAVATOR:</b> JCB
<b>LEGEND</b> ▽ - Water strike D - Disturbed sample B - Bulk disturbed sample W - Water sample V - Vane test T - No. of threads R - Average length of ribbons Dil - Dilatancy recorded ND - No dilatancy recorded							<b>PAGE</b> 1 of 1  <b>SCALE</b> as shown
<b>HYDRO-ENVIRONMENTAL SERVICES</b> 22 Lower Main Street Dungarvan Co. Waterford Tel: 058-44122 Fax: 058-44244 Email: info@hydroenvironmental.ie							



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP03

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204176

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87377

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~165.5mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Black/Brown, dry organic sandy/clayey Topsoil with roots
					1		Stiff to Very Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional siltstone boulders.
				-1.60			Stiff to Very Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with increasing frequency of angular siltstone cobbles and boulders with depth.
				-1.80	2		
					3		Total Depth of Trial Pit

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 1.8m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP03A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204289

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87296

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~162mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.20			Black/Brown, dry organic sandy/clayey Topsoil with roots
					1		Very Stiff, dry, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till).
				-2.00	2		Dense to Loose, reddish brown, dry, medium to fine grained SAND with occasional rounded and angular gravels of siltstone/sandstone.
				-4.00	4		Total Depth of Trial Pit
					5		

**REMARKS:**  
 Face of old borrow pit cleaned and logged.  
 No water seepages noted.  
 Face of pit was dry and stable.

**PIT LENGTH:** n/a  
**PIT BREADTH:** n/a  
**FINAL DEPTH:** n/a  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP04

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204403

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87158

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~161mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Black/Brown, dry organic sandy/clayey Topsoil with roots
					1		Stiff to Very Stiff, reddish brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till).
				-1.60			Stiff to Very Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with increasing frequency of angular siltstone cobbles and boulders (possible weathered bedrock) in green and red sand matrix at depth.
				-2.30			Total Depth of Trial Pit
					3		

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.3m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP04A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204478

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87419

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~172mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.20			Red/brown, dry organic sandy/clayey Topsoil with roots, and orange staining on clay (iron).
				-0.85			Stiff, dry, reddish brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till).
				-2.30	1		Loose to medium dense, dry, slightly clayey, sandy GRAVEL with angular and rounded gravels of siltstone and sandstone, and increasing angular gravel content with depth.
					2		
					3		Total Depth of Trial Pit

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.3m

**EXCAVATOR:** JCB

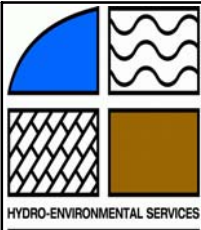
**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown





**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP04B

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 204585

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87912

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:**

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown, dry, sandy CLAY (Topsoil) with grass roots
							Stiff, dry, grey/brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till).
				-0.64			Loose to medium dense, dry, clayey SAND.
					1		
					2		
				-2.20			Total Depth of Trial Pit
					3		

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.2m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP06

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 204143

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 86979

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~139.5mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.50			Dark brown, organic, stoney clayey Topsoil (ploughed field, close to stream).
				-0.70			Medium dense, red/brown, gravelly CLAY (gravelly clay layer above main till).
				-1.80	1		Very Stiff, damp, reddish brown, mottled, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till), with occassional cobbles of siltstone/sandstone.
strong water inflow			▼	-2.30	2		Wet, Loose to Medium dense, reddish brown, sandy, angular and sub-rounded GRAVEL of siltstone/sandstone.
							Total Depth of Trial Pit
					3		

**REMARKS:**

Water inflow @ 2.1mbgl.  
Trial pit collapsing below 1.8mbgl after water inflow.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.3m

**EXCAVATOR:** JCB

**LEGEND**

- ▼ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP09

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 204409

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 86831

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~139mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown, damp organic sandy/clayey Topsoil with surface water seepage
					1		Soft to Firm, damp, reddish brown, slightly sandy, slightly gravelly (sticky) mottled SILT /CLAY (Devonian derived glacial till).
				-2.30	2		
					3		Total Depth of Trial Pit

**REMARKS:**

Surface water seepage at ground level.  
Trial pit damp but stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.3m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown





**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP10A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 204823

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 86604

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~142mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			Brown, dry, sandy CLAY (Topsoil) with grass roots
					1		Loose to medium dense, dry, slightly gravelly, clayey SAND, with very occasional cobbles of siltstone/sandstone.
					2		
					3		
				-3.20			Total Depth of Trial Pit
					4		

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 3.2m  
**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP011

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 204344

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 86461

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~142mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.18			Brown, dry, sandy/clayey Topsoil with grass roots.
	TP11/S1	B			1		Stiff, dry, reddish brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till), with occasional gravel and cobbles of siltstone, and pockets of sand (weathered cobbles of sandstone).
				-2.30	2		
					3		Total Depth of Trial Pit

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.3m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP012

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 204177

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 86239

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~146mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Red/brown, sandy/clayey Topsoil (ploughed field).
					1		Very Stiff, dry, reddish brown, slightly sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional cobbles of siltstone/sandstone.
				-2.05	2		Loose to Medium Dense, dry, reddish brown, sandy, angular and sub-rounded GRAVELS and COBBLES of weathered siltstone/sandstone.
				-2.30			Total Depth of Trial Pit
					3		

**REMARKS:**  
 No water inflows.  
 Trial pit dry and stable.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 2.3m  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP15

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 203477

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 85502

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~178mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.65			Loose, dry, black, angular gravel and cobbles of red siltstone and sandstone, in peaty sandy matrix (possible made ground).
				-1.70			Stiff, dry, reddish brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till), with occasional cobbles of siltstone/sandstone.
				-1.90			Loose to Medium dense, reddish brown, sandy, angular and sub-rounded GRAVEL of siltstone/sandstone, possible weathered bedrock.
					2		Total Depth of Trial Pit
					3		

**REMARKS:**

No water inflows  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 1.9m

**EXCAVATOR:** JCB

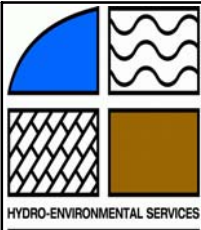
**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown





**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP16

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 29/05/2020

**EASTING:** 203610

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 85140

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~186mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.20			Soft, dry, black, organic peaty Topsoil.
				-0.80			Stiff, dry, reddish brown, slightly sandy, slightly gravelly SILT /CLAY (Devonian derived glacial till), with occasional cobbles of siltstone/sandstone.
				-2.00	2		Loose to Medium dense, reddish brown, sandy, angular and sub-rounded GRAVEL of siltstone/sandstone, possible weathered bedrock.
							Total Depth of Trial Pit
					3		

**REMARKS:**

No water inflows  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.0m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP17

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 200367

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87065

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~163mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Brown, dry organic sandy/clayey Topsoil.
					1		Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone gravels and cobbles.
				-2.10	2		
					3		Total Depth of Trial Pit

**REMARKS:**  
 No water inflows.  
 Trial pit dry and stable.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 2.1m  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP18

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 200159

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87492

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~183mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Brown, dry organic Topsoil with tree roots.
					1		Stiff, reddish brown, slightly gravelly, sandy SILT /CLAY (Devonian derived glacial till), with occasional angular green sandstone cobbles at depth.
				-2.00	2		Weathered green angular Sandstone bedrock in clayey/sandy matrix. Refusal at 2.35mbgl
				-2.35			Total Depth of Trial Pit
					3		

<b>REMARKS:</b> No water inflows. Trial pit dry and stable.	<b>PIT LENGTH:</b> 2.2m <b>PIT BREADTH:</b> 1.0m <b>FINAL DEPTH:</b> 2.35m <b>EXCAVATOR:</b> JCB
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<b>LEGEND</b> ▽ - Water strike D - Disturbed sample B - Bulk disturbed sample W - Water sample V - Vane test T - No. of threads R - Average length of ribbons Dil - Dilatancy recorded ND - No dilatancy recorded	<b>PAGE</b> 1 of 1  <b>SCALE</b> as shown
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**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP18A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199995

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87450

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~187mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Brown, dry organic Topsoil.
				-1.20	1		Stiff, reddish brown, slightly gravelly, sandy SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone cobbles at depth.
				-2.20	2		Stiff, reddish brown, sandy, gravelly, SILT /CLAY (Devonian derived glacial till), with increasing green angular sandstone gravel and cobbles with depth. Possible weathered bedrock from 2.0mbgl.
							Total Depth of Trial Pit
					3		

<b>REMARKS:</b> No water inflows. Trial pit dry and stable.	<b>PIT LENGTH:</b> 2.2m <b>PIT BREADTH:</b> 1.0m <b>FINAL DEPTH:</b> 2.2m <b>EXCAVATOR:</b> JCB
	<b>PAGE</b> 1 of 1

<b>LEGEND</b> ▽ - Water strike D - Disturbed sample B - Bulk disturbed sample W - Water sample V - Vane test T - No. of threads R - Average length of ribbons Dil - Dilatancy recorded ND - No dilatancy recorded	<b>SCALE</b> as shown
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**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP19

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199657

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87270

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~191mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Refusal on possible bedrock at 1.8mbgl				0.00	0		Ground Surface
				-0.15			Brown, dry organic sandy/clayey Topsoil.
					1		Stiff, reddish brown, sandy, gravelly SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone gravel and cobbles.
				-1.50			Strong, dry, red weathered angular siltstone bedrock in clayey sand matrix.
				-1.80			Possible weathered bedrock from 1.8mbgl.
					2		Total Depth of Trial Pit
					3		

**REMARKS:**

No water inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 1.8m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP20

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199759

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87789

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~184mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Brown, dry soft Topsoil with grass roots. (ground rutted from machinery tracks)
					1		Stiff, reddish brown, slightly gravelly, sandy (sticky) SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone gravels and cobbles with depth.
water inflow at 2.0mbgl			∇	-2.00	2		Total Depth of Trial Pit
					3		

**REMARKS:**  
 Water inflow @ 2.0mbgl.  
 Trial pit stable.  
 Ground rutted from machinery, soft ground during winter conditions (possible seepage area towards local stream to the north)

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 2.0m  
**EXCAVATOR:** JCB

**LEGEND**  
 ∇ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE**



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP21

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199659

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87764

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~189mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Brown, dry Topsoil with grass roots.
					1		Stiff, reddish brown, slightly gravelly, sandy SILT /CLAY (Devonian derived glacial till), with increasing angular cobbles with depth.
				-1.80			
				-2.20	2		Medium dense, reddish brown, sandy, angular GRAVEL/COBBLES of siltstone/sandstone.
							Total Depth of Trial Pit
					3		

**REMARKS:**

No water strikes or inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.2m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

**PAGE** 1 of 1

**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP21A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199625

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 87622

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

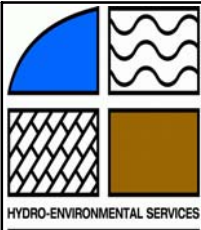
**ELEVATION:** ~197mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown, dry sandy/clayey Topsoil.
							Stiff, reddish brown, slightly gravelly, sandy SILT /CLAY (Devonian derived glacial till), with occasional angular siltstone cobbles at depth.
				-0.85	1		Strong, dry, weathered angular siltstone bedrock in sand and clay matrix. Possible weathered bedrock from 1.35mbgl.
				-1.35			Total Depth of Trial Pit
					2		
					3		

<b>REMARKS:</b> No water inflows. Trial pit dry and stable.	<b>PIT LENGTH:</b> 2.2m <b>PIT BREADTH:</b> 1.0m <b>FINAL DEPTH:</b> 1.35m <b>EXCAVATOR:</b> JCB
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<b>LEGEND</b> ▽ - Water strike D - Disturbed sample B - Bulk disturbed sample W - Water sample V - Vane test T - No. of threads R - Average length of ribbons Dil - Dilatancy recorded ND - No dilatancy recorded	<b>PAGE</b> 1 of 1  <b>SCALE</b> as shown
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**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP22

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199416

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 88109

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~193mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown, organic topsoil, with vegetation roots and moss.
							Stiff, reddish brown, slightly sandy, gravelly SILT/CLAY (Devonian derived glacial Till).
				-1.20	1		
	TP22/S1	B					Medium dense, reddish brown, slightly sandy, slightly clayey, angular and rounded GRAVEL with frequent angular and rounded cobbles (weathered Devonian Sandstone bedrock).
				-2.10	2		
							Total Depth of Trial Pit
					3		

**REMARKS:**

No water strikes or inflows.  
Trial pit dry.

**PIT LENGTH:** 2.2m

**PIT BREADTH:** 1.0m

**FINAL DEPTH:** 2.1m

**EXCAVATOR:** JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

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**SCALE** as shown



### TRIAL PIT LOG

TRIAL PIT NUMBER: TP23

PROJECT NUMBER: P1453-0

DATE STARTED: 28/05/2020

EASTING: 199601

SITE: Lyrenacarraiga WF

LOGGED BY: MGill

NORTHING: 88115

CLIENT: Innogy

CONTRACTOR: NO'K (JCB)

ELEVATION: ~187mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Black/brown,dry, organic peaty/clayey Topsoil, with vegetation roots.
					1		Stiff, brown, slightly sandy, gravelly SILT/CLAY (Devonian derived glacial till), with occasional angular and rounded cobbles, and increasing cobbles with depth.
				-2.20	2		
					3		Total Depth of Trial Pit

**REMARKS:**

No water strikes or inflows.  
Trial pit dry and stable.

PIT LENGTH: 2.2m

PIT BREADTH: 1.0m

FINAL DEPTH: 2.2m

EXCAVATOR: JCB

**LEGEND**

- ∇ - Water strike
- D - Disturbed sample
- B - Bulk disturbed sample
- W - Water sample
- V - Vane test
- T - No. of threads
- R - Average length of ribbons
- Dil - Dilatancy recorded
- ND - No dilatancy recorded

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SCALE as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP23A

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199529

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 88133

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~190mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
					1		Stiff, reddish brown, slightly sandy, gravelly SILT/CLAY (Devonian derived glacial Till), with occasional angular and rounded cobbles.
				-2.00	2		
							Medium dense, reddish brown, slightly sandy, angular and rounded GRAVEL, with occasional angular and rounded cobbles, and increasing angular cobbles with depth suggesting weathered bedrock.
				-2.90	3		Total Depth of Trial Pit

**REMARKS:**  
 No water strikes or inflows.  
 Trial pit dry and stable.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 2.9m  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

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**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP23B

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199479

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 88307

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~188mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Brown/black organic CLAY (topsoil)
					1		Loose, reddish brown, platy GRAVEL of siltstone/sandstone.
				-1.40			
				-1.60			Dense, reddish brown, slightly sandy, angular GRAVEL of siltstone/sandstone with increasing angular cobbles with depth suggesting weathered bedrock.
					2		Total Depth of Trial Pit
					3		

**REMARKS:**  
No water strikes or inflows.  
Trial pit dry and stable.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 1.6m  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

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**SCALE** as shown



**TRIAL PIT LOG**

**TRIAL PIT NUMBER:** TP24

**PROJECT NUMBER:** P1453-0

**DATE STARTED:** 28/05/2020

**EASTING:** 199744

**SITE:** Lyrenacarraiga WF

**LOGGED BY:** MGill

**NORTHING:** 88142

**CLIENT:** Innogy

**CONTRACTOR:** NO'K (JCB)

**ELEVATION:** ~180mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			Black/brown,dry, organic peaty topsoil, with vegetation roots.
				-1.80	1		Stiff, reddish brown, slightly sandy, gravelly SILT/CLAY (Devonian derived glacial Till).
				-2.20	2		Stiff, reddish brown, slightly sandy, very gravelly SILT/CLAY with occassional angular cobbles (Devonian derived glacial Till).
							Total Depth of Trial Pit
					3		

**REMARKS:**  
 No water strikes or inflows.  
 Trial pit dry.

**PIT LENGTH:** 2.2m  
**PIT BREADTH:** 1.0m  
**FINAL DEPTH:** 2.2m  
**EXCAVATOR:** JCB

**LEGEND**  
 ▽ - Water strike  
 D - Disturbed sample  
 B - Bulk disturbed sample  
 W - Water sample  
 V - Vane test  
 T - No. of threads  
 R - Average length of ribbons  
 Dil - Dilatancy recorded  
 ND - No dilatancy recorded

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**SCALE** as shown



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