Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume III

Appendix 7.6: Borrow Pit Assessment

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RSK GENERAL NOTES

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EXECUTIVE SUMMARY

A Borrow Pit Assessment has been prepared for the Proposed Development to address the requirement for aggregate to construction access tracks into the Application Site. Most of the aggregate requirement would be provided from excavated material produced as part of the construction requirements. However, a sufficient volume of aggregate would be required to provide construction materials for the proposed construction compound and access tracks from the public road to the turbine area. One borrow pit has been identified as being suitable to provide the required volume of aggregate, located adjacent to the main access route to the west of Laithgwm. The quality of aggregate material may not be suitable for track running surfaces; if required, this material would be imported from an external source. Once no longer required for construction purposes, the borrow pit excavation would be back-filled with material arisings that are not suitable for use as aggregate. The restored landform would be designed to be in keeping with the natural slopes in the area and the emplaced material would be properly compacted to ensure longterm stability. A capping layer of topsoil would be placed to encourage revegetation of the restored landform. The borrow pit has been designed for stability, in line with requirements of the Quarries Regulations (1999).

1 INTRODUCTION

1.1 Introduction

1.1.1 This report provides a Borrow Pit Assessment for Foel Fach Wind Farm and associated infrastructure, hereafter referred to as the 'Proposed Development'.

1.1.2 The report forms a Technical Appendix to Volume II of the Environmental Statement (ES) for the Proposed Development and should be read in conjunction with **ES Volume II, Chapter 7 Land, Soils, and Water** and associated figures in **Volume IV**. It has been produced to address the requirement for aggregate for the Proposed Development to supply the construction needs for new and upgraded access tracks and hardstanding areas, including ongoing supply for track maintenance during the operation of the Proposed Development.

1.1.3 This report quantifies the aggregate requirement, appropriate locations within the application boundary from which this material can be sourced and addresses the suitability of the material for the required purpose. Potential impacts from aggregate extraction, processing, and transportation are considered and assessed. Design and mitigation measures to avoid or minimise these impacts are set out, along with a number of good construction practices that would be employed during all construction works.

1.2 Site Location

1.2.1 The Application Site ('Site') is located within the administrative boundary of Gwynedd Council, North Wales, approximately 3.1 km north east of Bala. Eryri National Park is situated to the west of the Site, with the nearest turbine (T01) located approximately 1.9 km east of the national park boundary. The Site elevation varies from approximately 225 metres (m) Above Ordnance Datum (AOD) to approximately 550 m AOD. The majority of the Site is located on an area of grazing moorland with a number of parcels of registered common land. Two registered common land parcels are located in the eastern area of the Site. The majority of the land within the Site is Countryside and Rights of Way Open Access land, with areas of agricultural land. A number of Public Rights of Way (PRoW) are present within and adjacent to the Site, although none are nationally designated trails. Small wooded areas are present within the Site. Ancient woodland and larger areas of forestry are present outside the application boundary, to the south.

1.3 Development Proposals

1.3.1 The Proposed Development infrastructure would include:

- 10 no. three bladed horizontal axis wind turbines, up to 200 or 220 metres in height to the blade tip (where specified)
- wind turbine foundations and hardstanding areas which will include crane pad hardstanding areas and laydown/storage areas
- an onsite substation
- a battery energy storage system (BESS)
- permanent wind monitoring equipment (LiDAR)
- site access improvements, through the upgrading of the existing junction off the B4501
- onsite access tracks (new roads and upgraded existing roads/tracks), passing places and vehicle turning heads
- underground power cables linking the wind turbines and the substation
- watercourse crossings and associated infrastructure
- drainage system
- micrositing up to 50 m
- onsite signage, and
- biodiversity enhancements proposals.

1.3.2 Full details of the Proposed Development design are provided in **ES Volume II, Chapter 2: Description of the Proposed Development.**

1.4 Aims

1.4.1 This report aims to undertake a review of available relevant Site information, including all track design specifications, to produce borrow pit designs and Development Plans in order to address the aggregate need for the Proposed Development construction and operational maintenance. Recommendations are made for mitigation measures and reinstatement to minimise potential landscape, visual, hydrological and hydrogeological impacts from the excavations. Potential impacts from noise, dust and vibration are also considered.

1.5 Assessment Method

1.5.1 The assessment has involved the following stages:

- desk study
- site reconnaissance
- borrow pit design, and
- environmental review.

2 DESK STUDY

2.1 Information Sources

2.1.1 The desk study involved a review of available relevant information sources on the ground conditions in and around the site. Information sources included:

- Ordnance Survey (OS) mapping at 1:50,000, 1:25,000, VectorMap Local raster and OpenData mapping and Terrain 5 digital terrain model data.
- Historical OS mapping as available to view online.
- High-resolution orthorectified aerial imagery.
- British Geological Survey (BGS) online and digital geological mapping, 1:50,000 scale.
- Cranfield University Soilscapes mapping for England and Wales.
- Data provided by the applicant, including turbine foundation and track design specifications.
- Site data for the Proposed Development gathered by the project team.

2.2 Geology

2.2.1 Geological information is derived from the BGS GeoIndex (BGS, 2025). Bedrock and superficial geology are shown in **ES Volume IV, Figure 7.2: Bedrock Geology** and **ES Volume IV, Figure 7.3: Superficial Geology.**

Bedrock Geology

2.2.2 The Site is underlain by bedrock of Ordovician age, primarily belonging to four named formations: Nant Ffrancon Subgroup, Glyn Gower Siltstones, Ceiswyn Formation and the Moelfryn Mudstones Formation. These formations mainly consist of interbedded mudstones, siltstones and sandstones (BGS, 2025). All four formations have been dated to the Caradoc Series, from the Upper Ordovician period.

2.2.3 The Nant Ffrancon subgroup covers a small area in the west of the Site. The Glyn Gower Siltstones covers a larger part of the central and eastern areas of the Site. The Ceiswyn Formation covers the majority of the central area of the Site. These formations are characterised by coarse to fine-grained sedimentary units forming interbedded sequences.

2.2.4 The Moelfryn Mudstones Formation covers the southern central region of the Site. It comprises mainly fine-grained mudstone beds with thin siltstone and sandstone beds in places.

2.2.5 A number of historical earthquakes have been recorded in the region, two of which are within 5 km of the Site. These occurred in 1744 and 1903, with a Richter local magnitude (RML) of 2.9 and 2.3 respectively. Two modern instrument earthquakes are also located with 5 km of the Site, both towards the north-east near Ty-nant. The 1974 earthquake had an RML of 3.5 and the 1995 earthquake had an RML of 1.4.

Superficial Geology

2.2.6 The superficial geology consists primarily of diamicton till, with a small pocket of peat soil to the north of the Site at the col between Foel Tyn-y-ddol and Pen y Bwlch Gwyn (BGS, 2025). Diamicton till is a variable glacial sediment deposited in the Late Pleistocene, consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand.

2.2.7 No artificial ground was identified within the Site.

Mineral Extraction

2.2.8 No areas of mineral extraction are identified and there are no records of active mining or quarrying within the Site; however, there are a few disused quarries present within the Site (BGS, 2025).

2.3 Rock Volumes

2.3.1 Calculation of aggregate requirement was undertaken by the Applicant's design team, and a total required volume was provided for the purpose of borrow pit design and assessment.

2.3.2 A contingency of 20% was added to the estimated total, to allow for under-estimation in the requirements and for some of the excavated material being unsuitable for construction use. The design team estimates that most of the aggregate needed for the Proposed Development will be sourced from material requiring to be excavated for construction purposes. Consequently, the borrow pit evaluated in this report would primarily be required to supply aggregate for the proposed construction compound and access tracks from the public road to the turbines.

2.3.3 The necessary total aggregate volume required is **18,500 m^3**. With a 20% contingency, this amounts to a total of **22,200 m^3**.

2.3.4 One borrow pit area has been identified to provide suitable rock for use as aggregate in access tracks and construction compound. The volumes of material that could be supplied from the borrow pit are provided in **Table 7.6.1**.

Table 7.6.1 Aggregate Volumes

Aggregate Source	Required Volume (m^3)	Design Volume (m^3)
Borrow Pit 1	22,200	24,000
Total (m^3):	**22,200**	**24,000**

2.4 Design Optimisation

2.4.1 Design optimisation considers alternative directions and modes of working. The optimised borrow pit designs provide in the first instance for the rock requirement while also considering, in line with MTAN1 (Welsh Government, 2014), potential impacts on:

- landscape
- ecology
- hydrology, and
- hydrogeology.

2.4.2 Potential impacts on human beings relate principally to operational factors and include:

- noise,
- vibration,
- dust, and
- visibility.

2.4.3 The physical constraints of rock suitability and topography, and the requirement to plan for a suitable restoration scheme, have been primary considerations in the borrow pit design. The preferred option has been to open up a single borrow pit to supply rock aggregate for the main site access for the Proposed Development. The rock within the turbine area has been assessed visually by an experienced geotechnical specialist as potentially suitable for track and hardstanding construction; however, rock exposure within the turbine area is relatively limited and there may be local variations that restrict suitability of some of the aggregate, particularly for track running surfaces.

2.4.4 Should Site-won aggregate not be suitable for running surfaces, suitable material would be imported to Site from an external source.

3 BORROW PIT METHOD OF WORKING

3.1 The Quarries Regulations 1999

3.1.1 The principles of the Quarries Regulations 1999, as set out in the Health & Safety Executive's (HSE) document "Health and Safety at Quarries: The Quarries Regulations 1999 Approved Code of Practice" (HSE, 2013), would be followed by the appointed Contractor to provide a safe working environment during the development of the Proposed Development's borrow pit. The excavation designs must, in the first instance, provide safe and stable slopes which encompass the principle of '*design for closure*'. Haul and access roads should be of adequate width for the plant to be used on-site and allow for the provision of edge protection in all locations where applicable.

3.2 Groundwater Protection

3.2.1 The Environment Agency's "Guidance to Protect Groundwater and Prevent Groundwater Pollution 2017", adopted by Natural Resources Wales (NRW), provides a regulatory framework to prevent pollution of the groundwater environment. In relation to this, the "Groundwater Protection Technical Guidance 2017" adopted by NRW sets out good practice guidelines to prevent pollution of the groundwater environment. These guidelines reflect good operational practices and would be implemented at the Proposed Development.

3.2.2 Where authorisations are required for process plant operations or consents to discharge (under the *Pollution Prevention & Control (England & Wales) Regulations 2000*), these would be obtained in advance from NRW.

3.3 Borrow Pit 1: Development

3.3.1 Photograph 7.6.1 below shows a view across the area of Borrow Pit 1 (BP1).

3.3.2 The existing topography of the proposed borrow pit area, the borrow pit Development Plan and the borrow pit cross-section line are shown in **Figure 7.6.1** at the rear of this report.

Photograph 7.6.1: Proposed location for BP1, looking north upslope from NGR SH 91827 40932.

3.3.3 BP1 is located in the western part of the Site on the southern slope of an unnamed hill at approximately 340 m AOD. It is adjacent to the main site access track. Areas of exposed bedrock are visible. The borrow pit area is on a south-south-west facing slope. It has been mapped as having A1.1.1 Broadleaved Woodland to the south-west of the borrow pit area and A2.1 Dense/continuous Scrub – semi-natural within the borrow pit footprint and extending to the north-west.

Topsoil Stripping and Storage

3.3.4 Results from the peat depth survey and visual appraisal from the reconnaissance survey show that there is no peat soil cover within the proposed borrow pit area. Topsoil depths are under 0.1 m across this area and the ground is well-drained.

3.3.5 The borrow pit would be worked in strips, to ensure that only enough aggregate for the proposed main access track is obtained and to limit the impacts of the borrow pit to as confined an area as possible.

3.3.6 Topsoil would be removed in strips from the initial excavation area and would be stored in a temporary storage area. Topsoil would be stored in mounds which would not exceed 2 m in height, to minimise compaction of the soil. Additionally, the mounds would be shaped to promote shedding of water. Some limited blading would be undertaken on the soil mound surface to assist in the shedding of water and to minimise surface erosion in wet conditions. Mounds would not be compacted.

3.3.7 As the borrow pit excavation develops, the topsoil would be removed in advance of the active excavation. Removed topsoil, plus rock material unsuitable for use as aggregate or fill, would be used in the final restoration of the borrow pit.

Extraction of Rock

3.3.8 The borrow pit area is underlain by rocks from the Ceiswyn Formation. This formation is characterised by interbedded silty-mudstones and siltstones with subordinate sandstones and tuffs. The Frondderw Tuff Member is located below the Ceiswyn Formation and consists of coarse to fine-grained rhyodacitic tuff and tuff-rich sandstones.

3.3.9 The Ceiswyn Formation is relatively soft and therefore extraction by ripping is proposed as the most suitable extraction method. Ripping is described by (Roughton International, 2000) as follows:

> *"A ripper consists of one or more steel shanks or tines fitted to a strong frame that is mounted on the rear of a bulldozer. The ripper tines are drawn through the ground causing it to break."*

3.3.10 The number of tines used would depend on the strength and condition of the rock, and the ripping technique/equipment to be used would depend on the depth requirement for each section of the borrow pit.

3.3.11 The spacing of ripper passes influences the final size of material produced: close spacing produces finer-grade material as compared with a wider spacing. Cross-ripping can also limit production of oversized material that may require post-processing such as crushing. Ripping as deep as possible helps to loosen the maximum amount of material, but ripping to partial depth can help to reduce the proportion of oversized material produced. Use of a second bulldozer to pull the ripper dozer may extend the range of the ripper into harder material, thus avoiding the need to blast or make use of a 'pecker' in harder sections.

3.3.12 The borrow pit is located in the western part of the Site. Access to the borrow pit is provided by the existing access track to Llaithgwm, which may need widening to provide suitable access for a bulldozer.

3.3.13 BP1 is on a south-facing slope immediately west of the main site access track. The borrow pit is designed to have two main working faces and two subsidiary faces with a slightly sloping floor level at 335 m AOD.

3.3.14 The faces would be up to 10 m in height with a maximum angle of 75° from the horizontal, to maintain stability within the excavation. The general direction of working would be from the south, with the ripped rock removed and transported to the relevant area of construction via the existing tracks and new constructed tracks.

3.3.15 Effects from noise and dust during rock extraction would be minimised by keeping the use of processing plant to a minimum. Processing plant would be operated only for short periods of time, as necessary to provide the aggregate requirement for construction works. Careful design of the ripping process would minimise any requirements for crushing.

Drainage

3.3.16 The borrow pit area would have perimeter drainage installed prior to the start of excavations. The preferred method would be to use earth bunds, rather than installation of cut-off drains, to divert surface water around the proposed excavation area. Cut-off drains would only be used if earth bunds are not suitable. Earth bunds would be covered with a geotextile material and seeded to prevent mobilisation of sediment from the bund structures.

3.3.17 Any cut-off drains would be minimised in terms of length and depth, to minimise concentration of flows and unnecessary diversion of water. Water discharge from drainage systems would be spread across the ground in order to minimise changes to flow in downstream sensitive habitats and would not be discharged directly into sensitive habitat areas.

3.3.18 Surface water collecting in borrow pit excavation would be directed into a settlement pond to allow for removal of sediment. Treated water would not be discharged into or directly upslope of the A1.1.1 habitat area, to minimise potential for water and nutrient flushing into this area. If necessary, water would be directed into trackside drainage to avoid potential impacts on the sensitive habitat area.

Restoration

3.3.19 Any unusable material from borrow pit excavations and from groundworks relating to the wind farm construction would be used to backfill the borrow pit to provide a restored landform in keeping with the natural slopes in this area. Excavated material would be placed against the rock face and carefully compacted to form a stable substrate. This work would be undertaken in stages, to ensure that each stage of reinstatement is properly placed and compacted prior to further material being added. Restored slopes would not exceed 27° to ensure slope stability is maintained.

3.3.20 If necessary, the borrow pit edges would be softened with respect to the immediately adjacent hillside by ripping earthworks. This is only likely to be needed in some parts of the excavation.

3.3.21 Once the reinstatement of excavated material is complete, topsoil would be replaced over the restored material to facilitate revegetation and the final restoration of the borrow pit. The soils would contain a natural seedbank and it is anticipated that natural vegetation would re-establish over time. Additional seeding may be required; this would be assessed by the Environmental Clerk of Works (ECoW) at the point of restoration and a suitable seed mix would be identified for this process.

4 ENVIRONMENTAL REVIEW

4.1.1 Most potential environmental effects associated with borrow pit development have been considered within the relevant ES chapters. As a result, this section provides a brief review of environmental issues not addressed elsewhere.

4.1.2 Borrow pit operations are relatively small-scale, owing to the small aggregate volume requirement for the new and upgraded access tracks and hardstanding areas.

4.2 Access

4.2.1 A public footpath runs adjacent to one of the excavation faces of BP1. This track is planned for upgrading to provide the main access route into the Site. It is anticipated that the footpath would require formal temporary diversion or closure as part of the Proposed Development in order to protect members of the public using the route. Any necessary rerouting would be undertaken in line with regulatory requirements and diversion signing would be put in place as required.

4.3 Dust

4.3.1 Dust emissions can arise from ripping, processing, loading-out and stockpiled material. They are sensitive to weather conditions, typically being worst in dry and windy weather. Water sprays would be available at the Proposed Development for use in dust suppression in dry and windy conditions, to control and minimise dust emissions. Any processing plant brought to the Proposed Development would have integral dust suppression systems to control dust emissions during processing. Effects from dust would be limited to active excavation at the borrow pit, notably during ripping, processing and loading-out of oversized and processed material. With appropriate controls in place, effects from dust emissions would be negligible.

4.4 Lighting

4.4.1 Any lighting associated with the borrow pit would have a clearly defined purpose and be directed to where it is required in order to provide a safe working environment. Lighting would only be used when necessary and would be switched off when not required.

4.5 Site Stability

4.5.1 Site stability has been assessed as part of the survey and design work for the borrow pit and has been incorporated into the design as part of a safe working environment. The proposed restoration scheme takes into consideration the requirement for long-term safety with respect to future land use.

5 CONCLUSIONS

5.1.1 This report sets out details with respect to the operational design for the borrow pit for the Foel Fach Wind Farm, to supply the aggregate needed for the proposed access track requirements. The borrow pit design and recommended methods of operation are in line with the Health and safety at quarries: Quarries Regulations 1999 Approved Code of Practice (HSE, 2013) to provide a safe working environment and minimise risk of instability.

5.1.2 An Environmental Review of potential effects from the borrow pit operation has been undertaken. Use of best practice working methods and other mitigation methods as appropriate would be put in place during all borrow pit operations. It is concluded that residual effects would be minor, long-term and adverse during borrow pit operation, decreasing to negligible following full restoration of the borrow pit areas.

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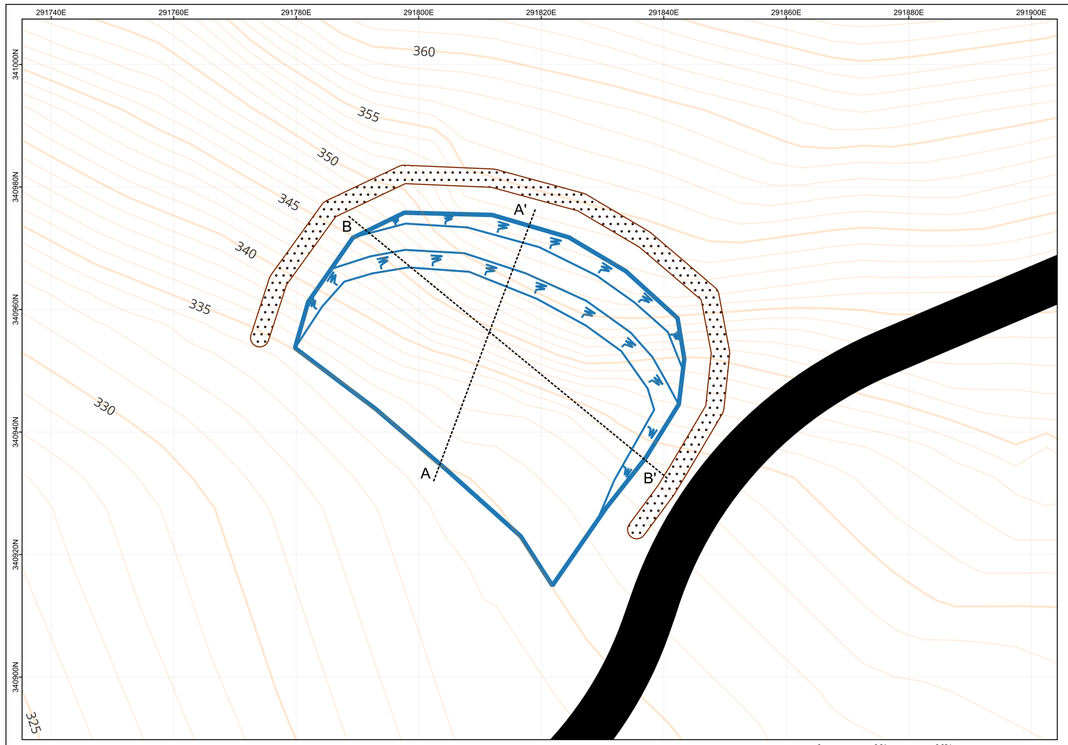
FIGURES

Figure 7.6.1 Borrow Pit Development Plan and Borrow Pit Cross Section



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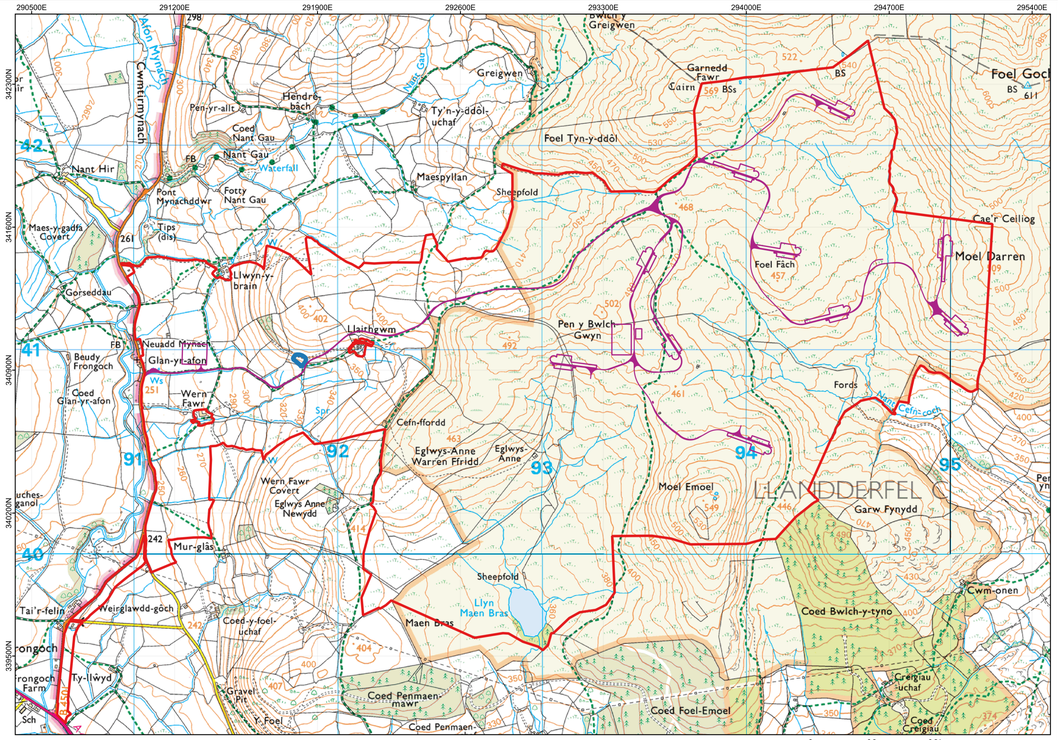
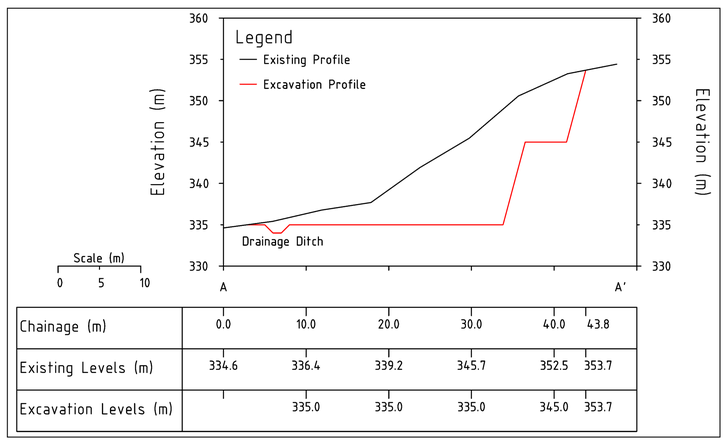
1. Borrow Pit Overview



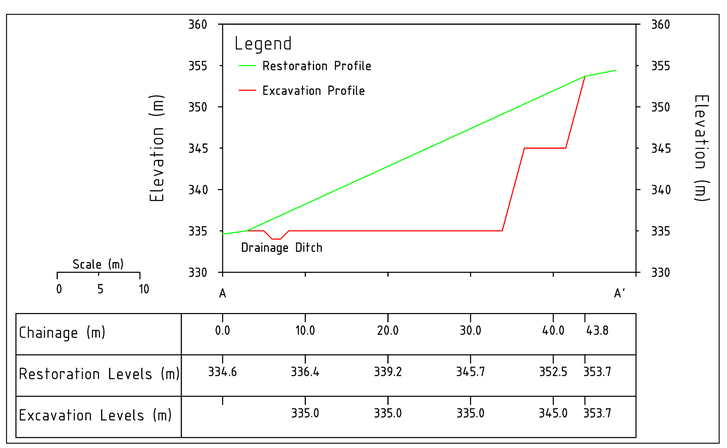
Scale: 1:15000 @A1

2. Borrow Pit Location



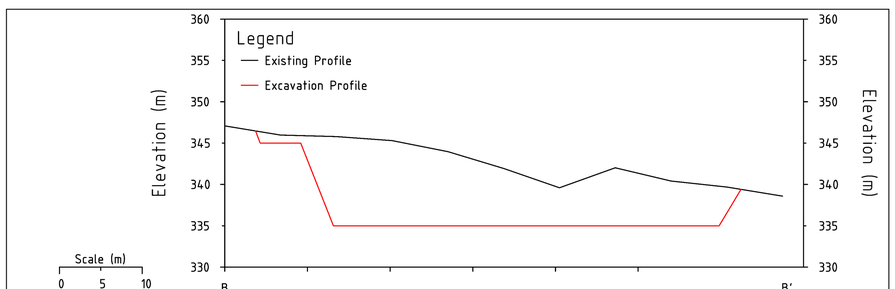
Chainage (m)	0.0	10.0	20.0	30.0	40.0	43.8
Existing Levels (m)	334.6	336.4	339.2	345.7	352.5	353.7
Excavation Levels (m)		335.0	335.0	335.0	345.0	353.7

3. A-A' Excavation Cross-section



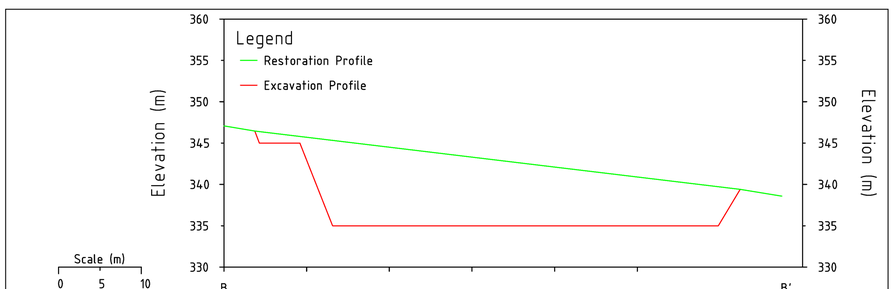
Chainage (m)	0.0	10.0	20.0	30.0	40.0	43.8
Restoration Levels (m)	334.6	336.4	339.2	345.7	352.5	353.7
Excavation Levels (m)		335.0	335.0	335.0	345.0	353.7

4. A-A' Restoration Cross-section



Chainage (m)	0.0	10.0	20.0	30.0	40.0	30.0	60.0	62.4
Existing Levels (m)	347.1	345.9	345.3	343.1	339.8	341.4	339.8	339.4
Excavation Levels (m)		342.9	335.0	335.0	335.0	335.0	335.3	339.4

5. B-B' Excavation Cross-section



Chainage (m)	0.0	10.0	20.0	30.0	40.0	30.0	60.0	62.4
Restoration Levels (m)	347.1	345.7	344.5	343.3	342.1	340.9	339.7	339.4
Excavation Levels (m)		342.9	335.0	335.0	335.0	335.0	335.3	339.4

6. B-B' Restoration Cross-section

Notes:
1. The elevation contours in "1. Borrow Pit Overview" represent metres above ordance datum and are derived from the Ordnance Survey 5m DTM.
2. The Soil Storage shows an indicative layout.

LEGEND: 1. Borrow Pit Overview

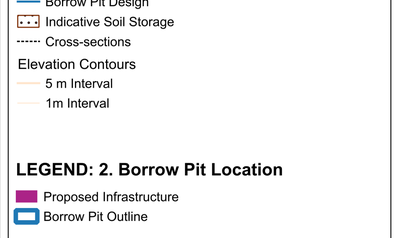
- Red Line Boundary
- Proposed Infrastructure
- Borrow Pit Design
- Indicative Soil Storage
- Cross-sections

Elevation Contours
- 5 m Interval
- 1m Interval

LEGEND: 2. Borrow Pit Location

- Proposed Infrastructure
- Borrow Pit Outline

CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: Metres



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1.1	18/11/2025	Second Draft	DM	CP	CI
00	24/06/2025	First Draft	CP	EA	CI

Foel Fach Wind Farm

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TITLE:

Figure 7.6.1
Borrow Pit Development Plan and Borrow Pit Cross-section

ID:P664094_Figure7.6.1 Borrow Pit Development Plan and Borrow Pit Cross-section

N W E S

REV 1.1

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