Technical Appendix 9.8: Borrow Pit Assessment

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9.8.1 Introduction

9.8.1.1 To reduce the volume of imported aggregate transported and any consequent environmental impacts, consideration has been given to source aggregate required for Internal Track construction, turbine bases, crane pads, compounds and hardstanding areas borrow pits within the Site (subject to further geotechnical evaluation). This report provides details of the proposed on-Site borrow pit for use during the construction phase of the Proposed Development. The Proposed Development is described in **Chapter 3: Site Description and Proposed Development (EIAR Volume 2)** and the proposed borrow pit search area is shown on **Figure 9.10 (EIAR Volume 3a)**. Section 9.8.4 of this report provides specific information about the borrow pit search areas and restoration details.

Aims of this Report

9.8.1.2 This report provides geo-engineering information on the potential for a borrow pit that would be opened within the Site. The aim of this assessment is to provide:

- A preliminary indication of the suitability of the bedrock as construction material;
- Potential borrow pit locations;
- Indicative borrow pit dimensions;
- Indicative extraction volumes;
- Estimates of overburden volumes at borrow pit locations;
- An indication of potential extraction methods;
- Recommendations for geotechnical testing; and
- Preliminary borrow pit re-instatement and rehabilitation proposals.

9.8.1.3 This report outlines the methodology used by Ramboll for borrow pit assessment along with the analysis undertaken; conclusions drawn and recommendations for borrow pit design.

Limitations

9.8.1.4 It should be noted that all borrow pit information provided within this report is indicative only and is based on desk study and reconnaissance of the Site alone. No intrusive investigation (other than peat probing) has been carried out and consequently the suitability of the rock, suggested extraction methods and volumes are broad estimates and should be treated as such. A detailed ground investigation (such as boreholes and trial pits) will be required to determine the suitability of the rock (extent and quality), potential for groundwater ingress, and to determine geotechnical parameters. Recommendations can then be made with regards to groundwater control, slope stability, extraction methods and finalised detailed design. The search areas have been identified for a borrow pit to allow for any adjustments following the results of the ground investigation. The final dimensions of the borrow pit are likely to be significantly different to the search area. (i.e., it will be smaller).

9.8.1.5 This report represents the findings and opinions of experienced geotechnical consultants based upon the information obtained from a variety of sources as detailed below. Ramboll believes the information obtained from third parties is reliable but does not guarantee its authenticity. The information has been accepted *de facto* but professional judgement has been used in its interpretation.

9.8.2 Methodology

9.8.2.1 This report comprises a desk-based study and notes compiled from a geo-engineering walkover survey. The desk study consisted of a review of the available geological and hydrogeological data together with additional information relating to the Site including:

- 1:50,000 and 1:25,000 scale Ordnance Survey (OS) topographic mapping;
- OS Elevation Digital Terrain Mapping (DTM) data;
- Review of geological mapping for the Site, British Geological Survey (BGS)[1] 1:50,000 scale;
- Review of publicly available aerial photography and OS aerial imagery;
- Groundwater vulnerability map of Scotland[2];
- BGS 1:625,000 scale hydrogeological map[3];
- Review of peat probe survey field data; and
- A site walkover to identify suitable borrow pit locations.

9.8.2.2 Three walkover surveys have been undertaken within the Site. The first survey was undertaken by Fluid Environmental in May 2024. Following the initial survey observations, two borrow pit search areas were initially identified. The borrow pit search areas were subsequently investigated during the second and third walkover surveys undertaken in July and November 2025.

9.8.2.3 During the post survey design process, one of the borrow pit search areas, to the west of Turbine 2, was removed due to significant peat encountered during the peat survey (up to 1.8 m in depth). The remaining proposed borrow pit location is discussed in detail within the Sections below and forms part of the Proposed Development.

9.8.2.4 All survey work recorded detailed field notes and photographs of the potential borrow pit sites, including details of the geological and hydrogeological aspects of each identified location. A hand-held GPS was used to determine the grid reference.

9.8.2.5 The suitable borrow pit location has been considered in more detail with preliminary layouts and volume estimates calculated of material which could be extracted. This is discussed in more detail in subsequent sections.

Borrow Pit Constraints

9.8.2.6 One of the principal factors affecting borrow pit location is the thickness of overburden material, due to the increased effort required for its excavation and handling before the source of the aggregate

[1] British Geological Society BGS Geo Index mapping [Accessed 16/12/2025) Available: https://mapapps2.bgs.ac.uk/geoindex/home.html

[2] Scottish Environment Protection Agency flood map. [Accessed 16/12/2025] Available: http://map.sepa.org.uk/floodmap/map.html

[3] British Geological Survey, 1:625,000 scale digital hydrogeological data. [Accessed 16/12/2025] Available: http://www.bgs.ac.uk/products/hydrogeology/maps.html

is reached. Therefore, this assessment has sought to identify optimal borrow pit locations where there would be no, or only a very thin veneer of superficial deposits, especially peat (due to its high moisture content and broader environmental considerations).

9.8.2.7 In addition, the borrow pit assessment has sought to avoid areas of high groundwater table to reduce the potential for adverse effects on groundwater dependent terrestrial ecosystems (GWDTE). In doing so, the potential borrow pit locations also reduce the potential for erosion and additional processes required[4] (CAR), are considered not to be required. Groundwater levels within the proposed borrow pit search areas would be confirmed as part of the findings from detailed ground investigation.

9.8.2.8 The proposed borrow pit location has also been selected to avoid existing watercourses due to the potential for runoff of sediment and fine-grained material.

9.8.2.9 Consideration is also given to the potential for visual effects and impacts on the setting of cultural heritage features; however, it is considered that with sensitive development and appropriate restoration, long term significant effects associated with borrow pits can be avoided.

9.8.2.10 The location of the potential borrow pit has been selected to be close to the existing Internal Tracks and close to proposed Site infrastructure to allow early opening of borrow pits to support the construction effort and to minimise any additional new Internal Track requirements.

9.8.3 Desk Study and Site Information

9.8.3.1 The Site location and setting are described within **Chapter 3: Site Description and Proposed Development (EIAR Volume 2)**.

Topography

9.8.3.2 The Site is situated along the ridgeline connecting the hill formations of Meall Mor, Meall an Tuirc, Bendeallt and Cnoc Gille Mo Bhrianaig. Elevations range from 625 m Above Ordnance Datum (AOD) to 310 m AOD, with the topography descending from the ridge in all directions to Loch Glass, Loch Moire and Strath Rusdale.

Superficial Geology

9.8.3.3 The 1:50,000 scale geological mapping available from the British Geological Survey (BGS)[1] shows the superficial geology present across the wind farm infrastructure area within the Site are peat deposits. Glacial Diamicton deposits are predominantly present beneath the Internal Tracks to the northeast and southeast of the Site.

9.8.3.4 Peat probing undertaken in 2024 and 2025 confirmed the presence of peat across the Site and within isolated pockets along the Access Route. The findings of the survey are presented within **Technical Appendix 9.5: Peat Depth Survey Results (EIAR Volume 4)**.

9.8.3.5 The depth of superficial deposits has been taken into account when selecting potential borrow pit locations, typically avoiding areas with >0.5 m peat or other superficial deposits. A maximum depth of 0.3 m of peat was observed at the proposed borrow pit location. The borrow pit search area to the west of the Site was rejected as this had significant peat deposits across the majority of the borrow pit search. An overburden depth of less than 0.5 m has been assumed for the proposed borrow pit.

Bedrock Geology

9.8.3.6 The 1:50,000 scale geological mapping available from the British Geological Survey (BGS)[1] shows the majority of the Site is underlain by Precambrian aged Tarvie Formation, Psammite rocks belonging to the Lloch Eil Group. The BGS Lexicon describes the formation as a thinly bedded, siliceous to micaceous metamorphic sandstones with lenses of quartzite towards the base of the formation. To the eastern extents of the Site, Lower Old Red Sandstone formation rocks including sandstones and conglomerates are shown to be present. The proposed borrow pit is shown to be located within the Tarvie Psammite rock formation.

Structural Geology

9.8.3.7 BGS mapping[1] shows one fault line, running approximately in a southwest to northeast direction with unknown displacement. This fault line marks the boundary between the Tarvie and Old Red Sandstone rock formations.

Hydrology

9.8.3.8 The BGS 1:625,000 scale hydrogeology mapping[3] defines the rocks as follow:

- Tarvie Psammite formation – Low productivity aquifer with limited groundwater in near surface weathered zone and secondary fractures; and
- Old Red Sandstone Formation - Moderately productive aquifer. Locally important multi-layered aquifer.

Surface Water Features

9.8.3.9 The majority of the Site area is located within the River Alness catchment. The southern regions of the Site are within the River Glass catchment. The River Glass is assessed to have an overall Moderate condition under the Water Framework Directive (WFD) Classification.

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

9.8.3.10 A hydrogeological assessment of potential GWDTEs concluded that all of the areas identified by the ecological assessment of National Vegetation Classification (NVC) communities as potential GWDTEs are considered to have a low likelihood of groundwater dependency within the Site. The findings of the assessment are presented within **Technical Appendix 9.3 Groundwater Dependent Terrestrial Ecosystem (GWDTE) Assessment (EIAR Volume 4)**.

9.8.3.11 The borrow pit search areas have been selected to avoid borrow pit extraction within 50 m of existing watercourses or waterbodies and with standard mitigation (i.e., an upslope cut-off/diversion ditch to intercept surface water together with minor attenuation features or soakaways) the borrow pit is not considered likely to have any significant effect on surface water.

Suitability of Bedrock within the Site as an Aggregate

9.8.3.12 The western extent of the Site is predominantly underlain by metamorphic rock formations, predominately comprising Psammite rock. The eastern extents of the Site are underlain by sandstones and conglomerates. As the proposed borrow pit lies within the western Site extents then it is assumed that Psammite rock would form the bulk of the site-won rock. No Rock formations were observed within either borrow pit search area. It is therefore assumed that the rock would be largely medium to coarse grained.

[4] The Water Environment (Controlled Activities) (Scotland) Regulations 2011

9.8.3.13 Psammite is a metamorphic or metasedimentary sandstone. Sandstone rock is a commonly used source of construction aggregate and, according to the BGS, the majority of sandstone quarried in the UK is used for crushed rock aggregate. Its suitability as aggregate largely depends on its strength, porosity and durability, which are in turn governed by characteristics such as mineralogical composition, grain size and sorting, cementation and weathering state.

9.8.3.14 A key factor in the suitability of the rock as aggregate is the mineral constitution and mode of occurrence, as often their quality is not uniform. The weathering state of the rock is also of high importance, as this weakens the aggregate and reduces durability. The depth of weathering is dependent on the distribution of joints and other rock discontinuities.

9.8.3.15 No rock formations were observed within the borrow pit search areas during the walkover surveys. Therefore, the rock type, discontinuity spacing and bedding orientation cannot be verified at this stage. An assumed rock type and weathering profile has been assumed for the purposes of this assessment based on the desk study information above.

9.8.3.16 The proposed borrow pit locations will need detailed investigations to verify rock type and quality, bedding orientation and weathering profile to minimise extraction of unsuitable or argillaceous material with a potential for high fines content after excavation/grading.

9.8.4 Borrow Pit Location and Restoration Details

9.8.4.1 The proposed borrow pit has been selected based on a preferential morphology for stone extraction (limited cover, rock close to surface and steep slopes). The proposed borrow pit location has been sited to avoid areas with >0.5 m peat or other significant depths of superficial deposits. The location also takes account of visual, ecological, hydrological and cultural heritage constraints. The location identified allows for any adjustments following the results of the ground investigation. The borrow pit is smaller in size relative to that of the borrow pit search area.

9.8.4.2 The borrow pit search areas are located with the aim of providing two areas of Site-won rock within the Site, to minimise transportation of aggregate.

9.8.4.3 The preliminary estimation of potential material quantities which could be extracted from the proposed borrow pit is provided in Table 9.8.1. The volume has been calculated from 3D modelling of the borrow pit assuming all extraction is undertaken from a single layer or 'bench', taking account of gradients of the ground surface and the indicative borrow pit footprint dimension and depth approximations. Please note that these figures do account for a 20% reduction due to wastage (associated with bands of unsuitable fine-grained bedrocks or highly weathered material) or bulking of excavated materials.

9.8.4.4 No account has been taken in the calculations for 'winning' rock during the construction phase (e.g. through track and turbine base excavations and widening of the existing track). The extent of material sourced in this manner would minimise the extraction of rock from the borrow pit.

9.8.4.5 Overburden/soils together with processing residue would be carefully stockpiled adjacent to the excavation void for use in the borrow pit restoration process. The stockpiles would be located and battered to limit instability and erosion. Silt fences and mats would be used to minimise sediment levels in runoff from the stockpiles.

9.8.4.6 It is anticipated that, upon completion, the borrow pits would be partially reinstated. This would involve the reworking of faces to stabilise them, partial infilling with site-won material and landscaping with soils excavated during construction of the Proposed Development. There would also be the potential for environmental enhancement by creating small wetlands or other desirable habitats, further details of which are set out within **Technical Appendix 7.4: Outline Biodiversity and Environmental Management Plan (EIAR Volume 4)**.

9.8.4.7 Borrow pit restoration would utilise processing residues and overburden and would create slopes within the excavation at an approximate gradient of 2 (V) in 1 (H). The crest of the slopes would intersect the uppermost rock face at a position which partially obscures the lower part of the faces. The toe of the restoration faces would be blended in to the borrow pit floor, which itself would be re-profiled to allow drainage and the re-introduction of appropriate cover. The upper part of the borrow pit faces would remain exposed and would be allowed to become weathered. It is envisaged that this face would acquire an appearance similar to that of other natural rock exposures in the locality.

Borrow Pit Details

9.8.4.8 An indicative borrow pit design has been prepared and includes the following details and assumptions:

- The footprint area of the excavation for the proposed borrow pit;
- A typical cross section for the borrow pit;
- Assumed quarry face profile approximately 70°;
- The borrow pit floor is excavated to a nominal depth but would in practice be inclined gently down slope into the excavation;
- The maximum height of any single face would be no more than 20 m; and
- Drainage would be managed using a peripheral cut off ditch.

Proposed Borrow Pit

9.8.4.9 The proposed borrow pit is located to the west of Turbine 3 within the northern extents of the Site, as shown on **Figure 9.10 (EIAR Volume 3a)**. Peat cover of <0.5 m is locally present at this location based on the peat probe surveys undertaken.

Table 9.8.1: Proposed Borrow Pit (NGR 254010, 872910)

Borrow Pit Site Area	Maximum dimensions of search area: 280 m length 110 m width
Borrow Pit Search Area	25,973 m²
Borrow Pit Excavation Dimensions	Assumed dimensions: 180 m length 115 m width
Height of Excavation	15.9 m maximum
Area of Land Impacted	16,732 m^2 (Total Footprint incl. tie-in) 9,448 m^2 (Total Footprint excl. tie-in)
Slope Angle from DTM mapping	The slope angle of the search area is approx. 11°
Elevation of floor during construction	591 m to 611 m Above Ordnance Datum (mAOD)
Details of Extraction	No rock was observed within the borrow pit search area. As such, rock type, rock quality and weathering profile are all assumed. The assumptions are: ▪ Hard digging to easy ripping is assumed (Psammite).

Table 9.8.1: Proposed Borrow Pit (NGR 254010, 872910)	
	▪ Orientation and spacing of discontinuities are unknown, As such a 27° angle of repose is assumed for the faces of the excavation.
Overburden Type and Depth	Superficial deposits during the peat probing survey recorded a maximum depth of 0.3 m of peat in this location, an overburden of less than 0.5 m is assumed.
Indicative volume of aggregate extraction	Approximate volume of 96,000 m^3 once 20% reduction applied.
Aggregate Composition	Assumed medium to coarse grained metasandstone (Psammite) with moderate to high weathering potential.

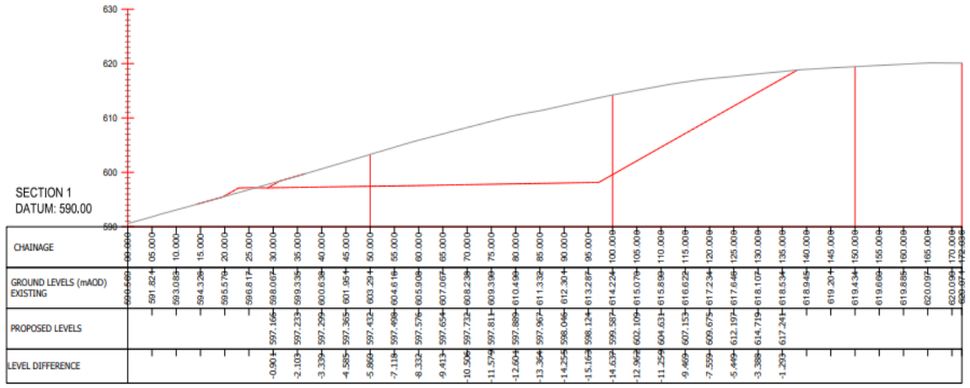


Figure 1 Borrow Pit Cross Section

9.8.5 Summary

9.8.5.1 No exposures of bedrock were observed during the walkovers across the Site and specifically the proposed borrow pit location. As such assumptions have been made based on the published BGS[1] data and the Site setting (slope angles and ground cover). Won materials within the Site would likely comprise of metasandstones and mudstones in the north and sandstone, siltstone and mudstones in the south. A detailed assessment to determine the suitability of the rock would be required to confirm the exact extraction methods based on the intrusive site investigation data[5].

9.8.5.2 Indicative aggregate volumes from the proposed borrow pit are assumed to be in the order of 96,000 m³ based on the dimensions and levels provided in Table 9.8.1. However, this would depend on various factors including:

- results from the detailed design and intrusive investigation work prior to extraction including volume, quality and quantity of rock available for extraction at each location; and
- potential visual impacts at each location.

9.8.5.3 The estimated aggregate volume requirement for the Proposed Development is 61,000 m^3. It is estimated that the volumes of material available from the borrow pit location is 96,000 m^3, therefore would provide sufficient material for all construction requirements for the Proposed Development. However, detailed analysis of the rock quality for reuse as structural fill would be required following ground investigation.

9.8.6 Construction Requirements

Extraction Operations

9.8.6.1 The requirement to produce various grades of aggregate would necessitate the use of mobile plant and equipment. This operation would comprise of a few different elements which are summarised below.

Excavation of Materials

9.8.6.2 Hard digging to easy ripping is envisaged to be the methodology required for extraction of materials based on the assessment of the anticipated rock type from published data within the Site. Rock samples should be taken for strength testing by an approved geotechnical laboratory to derive point load and Unconfined Compressive Strength (UCS) values. The contractor may wish to re-evaluate any alternatives to the requirement for digging on the basis of the available rock quality data (drilling and blasting may be required but it is considered unlikely).

Initial Stripping and Preparation

9.8.6.3 The Internal Track to the borrow pit would need to have some preparation prior to the introduction of the main items of excavation plant, particularly, those located off the existing Internal Tracks to the Site.

9.8.6.4 It is anticipated that initial preparation would consist of a series of passes using an excavator with blade along or near to the final route of the permanent Internal Track. This would have the effect of removing vegetation and any soft material, and also in compacting the weathered material located immediately above the bedrock. The gradients of prepared Internal Track would be no steeper than 1(V) in 10(H). The borrow pit would be accessed from the existing Internal Track network. There is the potential for some short sections of track to be constructed from imported materials, unless locally sourced suitable materials can be located. In addition, the area of the proposed borrow pits would require to be stripped of the superficial material including any soil which lies above bedrock. This material would need to be carefully lifted and placed in storage mounds within an appropriate storage area.

Crushing and Screening

9.8.6.5 The primary component of this operation would consist of a mobile crushing and screening system. Modern mobile crushing plants are available in different formats and are usually available complete with screening capability. The contractor would need to provide a plant setup that meets the project requirements in terms of the ability to process the raw material, the quantities of the material required and the quality and size gradings of the product.

9.8.6.6 It is also envisaged that a rubber tyred front-end loader would also be required to serve the crushing and stockpiling operation, as well as to produce loadout facilities for the truck and shovel-based roadmaking operation.

[5] A revision of the graphical method for assessing the excavatability of rock, Pettifer and Fooks, Quarterly Journal of Engineering Geology and Hydrogeology 1994; v. 27; p. 145-164,

Drainage

9.8.6.7 A drainage and surface water management system would be provided to control surface water runoff. Due to the relatively small size of any proposed excavation together with the associated plant site, the system would comprise of a peripheral cut-off ditch together with minor attenuation features or soakaways.

9.8.6.8 Given the low to moderate permeability and generally thin veneer of the overlying peat and superficial deposits it is not anticipated that groundwater ingress would be significant. However, the flow capacity of the bedrock would need to be determined to identify whether fracture flow is likely to be encountered and if standing water is likely to collect in the base of the excavation.

9.8.6.9 Water entering the borrow pit would need to be removed by either gravity drainage design or pumping depending on the overall morphology of the pit. The general topography in the areas identified is conducive to gravity drainage owing to the moderate to steep slopes. Discharge consent/Environmental Authorisations Regulations licence may be required from the Scottish Environmental Protection Agency (SEPA) for this activity. Water removed from the excavations would be passed through an appropriate sediment settling system to remove suspended sediment prior to discharge. The constructed drainage system and water pumped from the excavations would not be discharged directly to any natural watercourse.

9.8.6.10 It is not anticipated that volumes of groundwater that would require management would be encountered by the opening of the borrow pits at the Site due to the high elevations and slope angles. However, the groundwater regime would need to be verified through further ground investigation.

Environmental Management

9.8.6.11 The Proposed Development would be designed, constructed, operated and decommissioned in line with relevant environmental legislation, guidance and good practice, to ensure that soils, and both groundwater and surface water are not contaminated.

9.8.6.12 During construction activities, a Construction Environmental Management Plan (CEMP) would be used to manage the potential impacts on the environment, and a specific plan covering borrow pits would be developed as part of the CEMP.

9.8.6.13 Assuming good practice techniques are adhered and the implementation of mitigation measures as discussed above, it is anticipated that residual impacts from borrow pit activities on surface water, groundwater and soils would not be significant.

9.8.7 Conclusions and Recommendations

9.8.7.1 A reconnaissance walkover and supporting field surveys have been carried out within the Site to identify potential borrow pit locations. One viable potential borrow pit search area location has been identified from desktop data analysis, fieldwork and visual appraisals.

9.8.7.2 The surveys demonstrated that the area of greatest potential in terms of bedrock excavation are located within the northern area of the Site within the Tarvie Psammite rock Formation. No existing borrow pits were observed within the Site.

9.8.7.3 The proposed borrow pit to the north of the Site is likely to be predominantly coarse grained, but maybe occasionally interbedded with fine grained materials. The quality of any finer grained materials present would be verified through further ground investigation to minimise material unsuitable for construction being generated at the borrow pit location. No ground investigation has been undertaken within the Site to inform the assessment.

9.8.7.4 The proposed borrow pit is located on slopes with a slope angle of approximately 11°, which could be excavated within a single layer of excavation. The overburden depths within the proposed borrow pit location are generally shallow (<0.5 m) and possesses limited potential for peat cover.

9.8.7.5 The estimated amount of aggregate which could be won from the proposed borrow pit has been calculated as approximately 96,000 m³. This figure allows for a 20% reduction for unsuitable material or bulking of materials on excavation. This figure is in excess of the estimated volume of aggregate required during the construction phase of the Proposed Development.

9.8.7.6 The primary use of aggregate arisings would be for the construction of Internal Tracks using unbound aggregate to the turbine suppliers' specifications and conforming to the Specification for Highways Works.

9.8.7.7 Detailed ground investigations, slope stability assessments and geotechnical testing would be required to inform the detailed design of the borrow pit to confirm the suitability of the material for use as part of the Proposed Development. It is anticipated that impacts on groundwater, surface water and soils from extraction of aggregate would not be significant, assuming use of good practice construction techniques and implementation of mitigation measures as set out in this document.