ARCUS

ACKRON WIND FARM

APPENDIX 4.2

PRELIMINARY BORROW PIT ASSESSMENT

VERSION 1.0

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1 INTRODUCTION

1.1 Preparation of the Borrow Pit Assessment

This Preliminary Borrow Pit Assessment (BPA) for Ackron Wind Farm (the Development) has been prepared initially to provide details of potential borrow pit locations or aggregate extraction areas required for the construction of the wind farm.

It is anticipated that all of the turbine bases will be founded on bedrock composed of in-situ sedimentary rock types.

The purpose of the BPA is to:

- Assess potential borrow pit locations;
- Estimate available aggregate from the source location;
- Identify overlying superficial soils and define the materials that will be excavated as a result of the Development;
- Identify underlying rock types;
- Set out proposals for adequate intrusive investigations; and
- Detail management techniques for handling, storing and depositing peat for reinstatement.

Scottish Planning Policy (paragraph 243) states that Borrow Pits should only be permitted if there are significant environmental or economic benefits compared to obtaining material from local quarries, they are time-limited; tied to a particular project and appropriate reclamation measures are in place'. In the case of this particular development, progressing on-site borrowing provides significant environmental gains as the traffic volume on local roads (B class, C class and unclassified) would be significantly reduced, in turn reducing the traffic on the A897, a section of the North Coast 500 tourist route.

1.2 The Development Site

The wind farm area is situated on ground ranging from approximately 30 m AOD to 186 m AOD with the potential borrow pits located close to proposed turbine locations and adjacent to existing forestry tracks. The main access route originates from the west of the site via the A897 road.

The Development occupies an area of open hillside located to the east of the A897. The access road rises from approximately British National Grid (BNG) 289817, 962120 continuing east through woodland grant forestry on the northern side of Golval Hill with spurs extending to the south west side of Beinn Ruadh and the north-east of Golval Hill. Figure 1, 'Site Layout Plan' is included in Appendix A.

The main components of the Development are:

- Up to 12 three-bladed turbines with a maximum tip height of 149.9 m and rotor diameters of up to 136 m including external transformers (if required);
- Associated foundations, blade laydown areas and crane hardstandings at each wind turbine location;
- Access tracks linking the turbine locations;
- Substation compound incorporating electrical switchgear and wind farm control elements;
- Temporary construction compound;
- Network of underground cabling, running adjacent to the access tracks where possible;
- A permanent anemometry mast (up to 92 m);
- Up to two onsite borrow pits; and
- New site access off the A897.

Two possible borrow pit locations are proposed for the project, details of the two borrow pits are summarised in Section 3.2 of this report. Both borrow pits are located south of the access track and centrally located on site. Both borrow pit locations are situated to the north-east of Golval Hill with the northern-most located just north of T4 while the southern-most is located adjacent to the spur of track leading to T6. The details of each borrow pit are included in Section 3.0 of this report. The assessment has been completed through a targeted desk-based review of geological maps, Ordnance Survey (OS) contour data, aerial photography and from visual observations during site visits between March 2019 and May 2020.

No intrusive site investigation works have been undertaken to date.

2 GEOLOGY

2.1 Superficial Soils

Published geological mapping of superficial soils indicates the majority of the site to be underlain by superficial soils, predominantly Hummocky (Moundy) Glacial Deposits (HGMD) composed of rock debris, clayey till and poorly to well-stratified sand and gravel. Peat is recorded in the north eastern area of the Site as well as in localised pockets typically found in topographically flatter areas.

Figure 13.2 included in Environmental Impact Assessment (EIA) Report Volume 2 illustrates the superficial soils across the site area.

2.2 Bedrock Geology

Published bedrock geology mapping indicates the vast majority of the Site to be underlain by the Portskerra Psammite Formation with small areas of Strath Halladale Granite present at the western boundary and a mix of Luchair Sandstone, Rubha Sandstone and the Tobaireach Conglomerate Member along the northern boundary. No faulting exists on the Site.

Figure 13.3 included in EIA Report Volume 2 illustrates the bedrock geology across the site area.

2.3 Peat

Generally, the peat varies in depth across site according to local topographic conditions, with pockets of peat greater than 1.0m situated in topographically flatter areas. The majority of peat on site is less than 1.0m in depth.

Figure 13.5 included in EIA Report Volume 2 Environmental Impact Assessment Volume One illustrates the 'Interpolated Peat Depths' across the site area.

2.4 Hydrogeology

The natural soils onsite are considered to be glacial deposits, or peat. The glacial deposit soils generally have a low permeability while peat is fairly permeable but will have high retention properties.

The Development site hosts three watercourses including Ackran Burn which issues on the northern slope of Golval Hill and drains west before joining Halladale River to the west of the Site; Giligill Burn which issues from south of Beinn Ruadh and drains west joining River Halladale to the west of the Site; and an unnamed watercourse which drains west joining Giligill Burn.

Details of the hydrogeology are included in Chapter 12: Hydrology and Hydrogeology of the EIA Report Volume 1.

2.5 Mining and Quarrying

The Coal Authority interactive map viewer[1] indicates that the site does not lie within a 'high risk' mining area. Additionally, there are no active mines within the vicinity of the site as indicated by BGS GeoIndex[2] .

Following site walkover and detailed review of aerial photography and the site's topography, there are opportunities to use steep topography in low lying areas to explore as possible borrow pit search areas.

[1] http://mapapps2.bgs.ac.uk/coalauthority/home.html

[2] http://mapapps2.bgs.ac.uk/geoindex/home.html

3 BORROW PIT ASSESSMENT

3.1 General

This section of the BPA identifies potential borrow pit locations within the Development site boundary that could be utilised in provision of aggregate for construction. This will be used in the construction of site access tracks, crane hardstanding areas, upgrades of existing forestry tracks and potentially concrete batching.

The proposed borrow pit locations have been selected based on their:

- Topography;
- Previous uses;
- Accessibility from existing or proposed access tracks;
- Orientation with respect to visibility;
- Potential aggregate volume; and
- Proximity of rock to the surface.

Steeper topography is preferable for quarrying, where soils coverage will be limited. Careful consideration was given to landscape and visualisation impacts, other considerations included proximity to watercourses, places of archaeological interest and forestry. The borrow pit locations are in areas where the peat cover is thin or vacant and where bedrock outcrops and aggregate reserves are expected to occur near the surface.

No intrusive site investigation works have been undertaken into the quality of rock that might be recovered at the time of preparing this BPA. However, it is anticipated that a full ground investigation will take place in advance of construction of the Development. The investigation will include the testing of material from within the proposed borrow pit areas to assess its suitability for reuse.

3.2 Borrow Pit Locations and Considerations

Two borrow pit search areas were initially identified from a combination of desk-based assessment of mapping and topography and site walkover survey. Other environmental constraints were also considered, including watercourse buffers and peat. A summary of both identified search areas is presented as follows.

3.2.1.1 Borrow Pit Location 1

Borrow Pit 1 is located north west of Akran Burn, approximate centre point BNG 291243, 962438. The site was selected due to it being adjacent to proposed on site tracks and situated on a topographically steep area.

BGS superficial soils information indicates that this area of the Development comprises Peat and HGMD, Peat probing undertaken on site recorded depths in this area ranging from 0.2m to 1.2m in depth. The solid geology mapping indicates the underlying bedrock to be Portskerra Psammite Formation belonging to the Glenfinnan and Loch Eil Group. No geological faulting is present within the borrow pit search area or immediate vicinity. The location does not encroach any other environmental development constraints.

Photograph 3.1 - Borrow Pit 1 – Viewing North

3.2.1.2 Borrow Pit Location 2

Borrow Pit 2 is located north east of Golval Hill, approximately centred at BNG 291413, 962003. The site was selected due its proximity to a proposed track leading to T6 and being located in a topographically steep area.

BGS superficial soils information indicates that HGMD is present at this area of the development. Peat probing undertaken recorded depths of less than 0.5m in the general vicinity of this borrow pit search area. The solid geology mapping indicates the underlying bedrock to be Portskerra Psammite Formation belonging to the Glenfinnan and Loch Eil Group. No geological faulting is present within the borrow pit search area or immediate vicinity. The location does not encroach any other environmental development constraints.

Photograph 3.2 - Borrow Pit Search 2 Viewing South-East

3.3 Findings and Recommendations

The ground modelling of BP1 and BP2 informs the assessment summary as set out in section 3.4. It should be noted that further investigations would be required to fully understand the feasibility of these options which would comprise rotary percussive drilling and rock sampling through coring and suitable geotechnical testing.

From here on in, borrow pit search areas 1 and 2 will be named Borrow Working 1 and Borrow Working 2 respectively, in line with the referencing in the EIA Report.

3.4 Design

Based on the identified search areas, a three-dimensional outline design was undertaken to establish the target capacity required from the proposed borrow pits. This involved a civil design taking account of the overall proposed site layout levels and both existing and proposed access tracks in order to develop a viable borrow area. The outline design of each borrow working included a main worked area with earthwork batters and indicative drainage cut-off ditches, and therefore was finalised as a total area situated within the initial search areas. The details of the outline borrow working design is summarised in Table 3.1 below while Borrow Working Plans and Profiles are shown in Figure 2 and Figure 3 in Appendix A.

Table 3.1: Borrow Working - Assessment Summary

Borrow Working No.	Surface Area (m^2)	3D Model Total Cut Volume (m^3)	Interpolated Peat Depth (m)	Estimated Peat Volume (m^3)	Estimated Aggregate Available (m^3)
1	16,288	61,372	Peat < 0.5m	4,886	56,486
2	10,822	43,347	Peat < 0.5m	4,978	38,369
TOTAL	27,110	104,719	-	9,864	94,855

For the purposes of this outline borrow pit assessment, the volumes indicated in the table above are based on the following parameter:

- Borrow Working 1 area of approximately 130 m x 60m;
- Borrow Working 2 area of approximately 135 m x 55 m;
- Borrow Working floor levels taken from the levels associated with the existing access track; and
- Cut profile at 63° from borrow pit floor to intersection point of existing terrain.

4 METHODS OF WORKING

The requirement to produce various grades of aggregate will necessitate the use of mobile quarrying plant and equipment. This operation will comprise a number of different elements which are summarised in the following Sections.

It is possible that the quarried material will require blasting methods should testing prove relatively high strengths and competencies. Where this is required, it is proposed that a lightweight crawler mounted blast hole drill rig is employed together with an attendant compressor. Explosives will need to be considered in detail by the Contractor at construction stage relating to safe operation, transportation and storage. The Contractor may also wish to consider alternative methods suitable to the quality of the rock. All aggregate materials won in borrow pits will be subject to crushing and screening. The primary component of this operation will consist of a mobile crushing and screening system.

The Contractor will provide a plant setup that meets the Development requirements processing the rock to produce the quantities, quality and sizes of the material required. The construction of the Development access tracks will be undertaken utilising the majority of the aggregate produced from the borrow pit operations. It is intended that the access tracks will be constructed on the basis of normal best practice for the accommodation of wind turbine components.

The Contractor should undertake testing of the materials as the borrow pits are worked to ensure material quality is maintained, with particular reference to the ability of the materials to resist freezing/thawing and wetting/drying, and therefore serve the lifespan of the Development.

The appointed Contractor will provide a detailed risk assessment and method statement to cover the working methods employed within the borrow pits for approval during the construction phase.

4.1 Overburden Handling

Prior to progressing works at borrow pits, the areas will require to be stripped of superficial material overlying the bedrock. Material storage areas should be identified and the superficial soils carefully placed in segregated stockpiles within the appropriate storage area.

Access routes to the borrow pits will form part of the enabling works prior to the mobilisation of quarry plant. The main items of mobile quarry plant will be tracked, typically low ground pressure capable of traversing surfaces which have had only limited surface preparation.

4.2 Drainage of Borrow Pits

Temporary interception/peripheral bunds and cut-off drainage ditches ('clean water drains') should be constructed upslope of the borrow pits and cuts to prevent surface water runoff entering the excavation. Swales to collect runoff should be placed on the downslope of borrow pits and overburden / stockpiles will be designed to treat potentially silty runoff before discharging back into the drainage system.

A drainage and surface water management system will be required in order to control surface water run-off from borrow pit areas. Due to the nature and size of the proposed excavations, the drainage system should consist of a peripheral cut-off ditch together with attenuation features and soakaways. Drainage ditches should be installed using a tracked excavator and, where necessary, a hydraulic breaker.

Waste water discharged onto vegetated surfaces from borrow pits and earthworks areas should be directed away from watercourses and drainage ditches to avoid direct discharge.

Any sediment suspended within the treated water should be deposited amongst the rough surface vegetation.

4.3 Reinstatement Proposals

It is envisaged that overburden/soils will be carefully stored adjacent to the extraction areas for re-use.

Each borrow pit should be suitably re-instated with topsoil and any available peat, peaty soils and turves to re-establish hydrological and ecological conditions and reduce any potential visual impacts. There is a potential for till or sands and gravels to be available for reinstatement purposes.

The reinstated peat/soil surface would be profiled to allow drainage and the re-introduction of appropriate vegetation cover would tie into existing topography. The upper part of the quarry face 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.

The reinstated profile will be of varying thicknesses above the base of the borrow pit and will be gently sloping from the track edge to the quarry face, generally with thicknesses representative to that of the peat and soils initially stripped from borrow pits areas.

The conjectured reinstatement profiles are shown in Figure 2 and 3 in Appendix A.

4.4 Borrow Pit Working Programme

Of the possible borrow pits recommended, Borrow Working 1 is located closest to the site entrance and will be worked earliest in the construction programme. This borrow pit could be utilised for initial track construction, upgrade of existing tracks and any general enabling works from the site entrance including track widening where required.

5 CONCLUSION

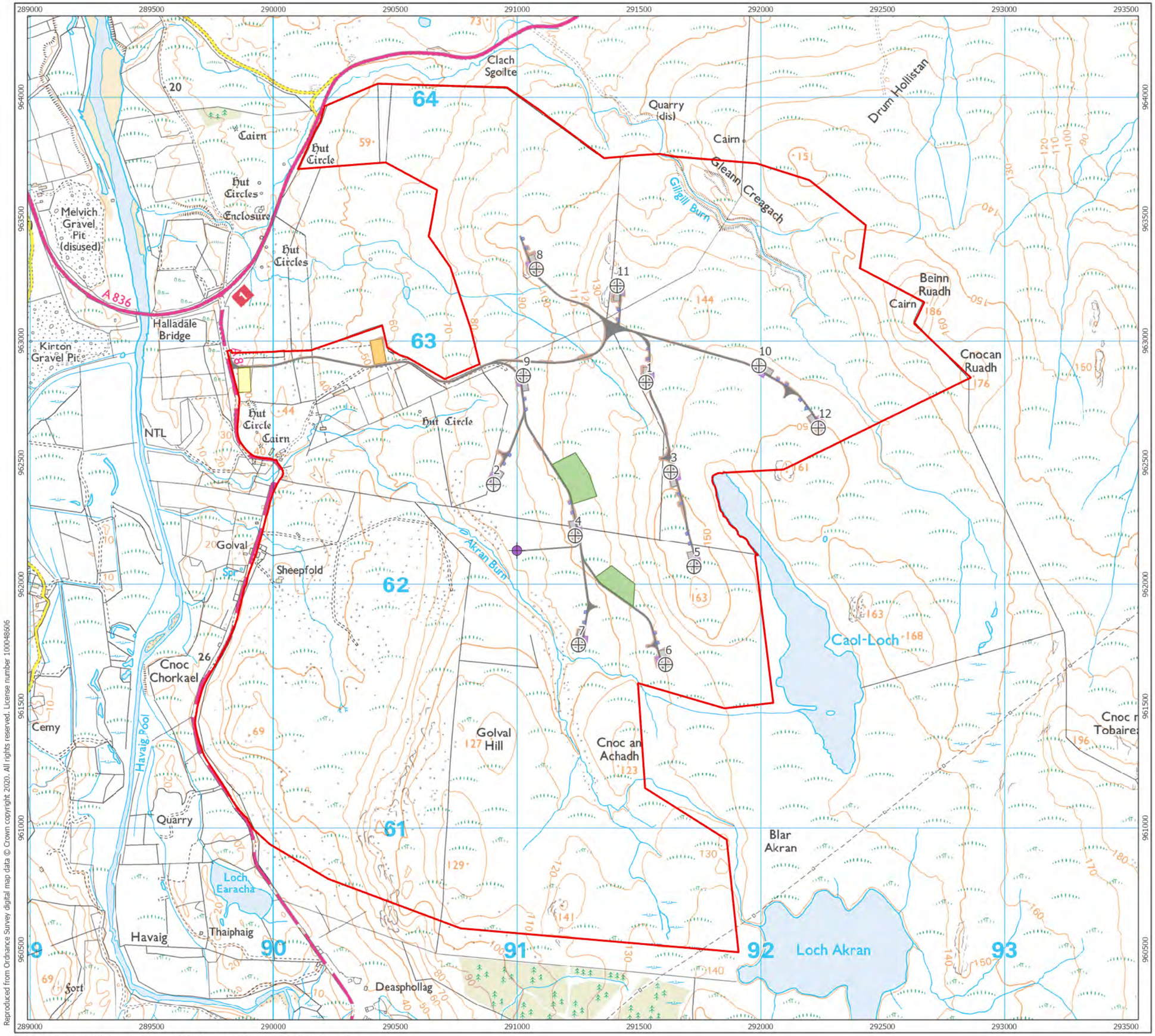
The siting of the borrow pits within the Development has been made on the basis of proximity to the existing and proposed access tracks, consideration of topography, geology and identified constraints. Based on the desk-based assessment, it is anticipated that there are adequate locations on site to position proposed borrow pits which would achieve the required aggregate quantities for the development.

Considerations for the assessment of borrow pits following consent of the Development include:

- Ground investigations and relevant geo-environmental analysis undertaken prior to finalising borrow pit proposals;
- Three-dimensional design should be undertaken following detailed design and ground investigations to confirm the capacity of the proposed borrow pits; and
- Detailed profiles of borrow pit excavations including existing ground levels, proposed excavation levels and a conceptual restoration profile for each borrow pit should be produced once final borrow pit extents have been agreed.

Following the results of the above and prior to the construction of the windfarm, the appointed Principal Contractor will update the Construction Environmental Management Plan (CEMP in Appendix A4.1) as required and in agreement with the statutory bodies.

APPENDIX A – FIGURES



P:\Projects\Engineering\Projects\3138 Ackron\3138 Ackron.aprx\3138-REP-142 Fig1 Site Layout Plan

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- Site Boundary
- Proposed Turbine Location

Site Infrastructure

- Access Track
- Borrow Pit
- Construction Compound
- Crane Hardstanding
- Crane Pads
- Earthworks
- Laydown Area
- Substation
- Meteorological Mast

1:15,000 Scale @ A3

0 250 500 m

NORTH

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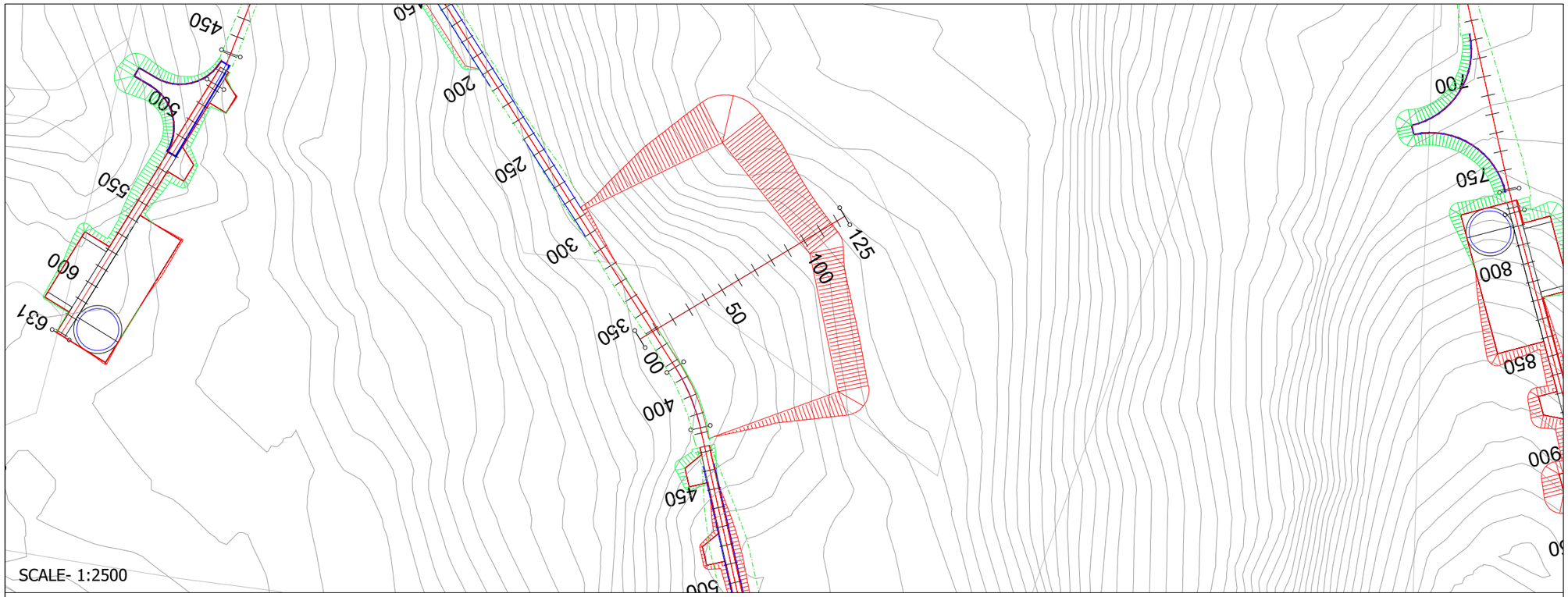
Checked By: DB	Date: 11/11/2020

Site Layout Plan
Figure 1

Ackron Wind Farm
Borrow Pit Assessment



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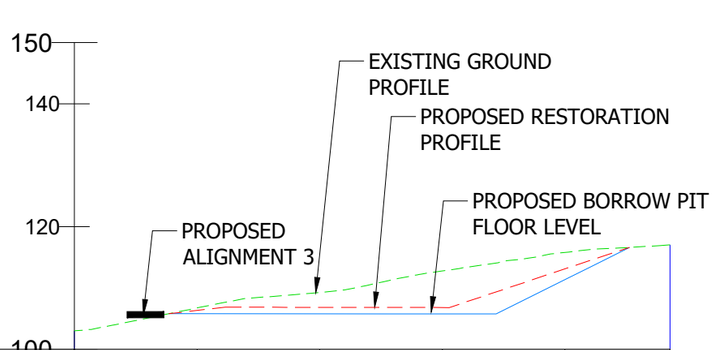

Proposed Levels		105.786	105.782	105.780	111.362	
Existing Levels	103.000	106.733	109.248	112.762	115.761	117.000
Chainage	00.000	20.000	40.000	60.000	80.000	97.151

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AS SHOWN Scale @ A3

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Borrow Pit 1

Figure 2

Ackron Wind Farm
Borrow Pit Assessment

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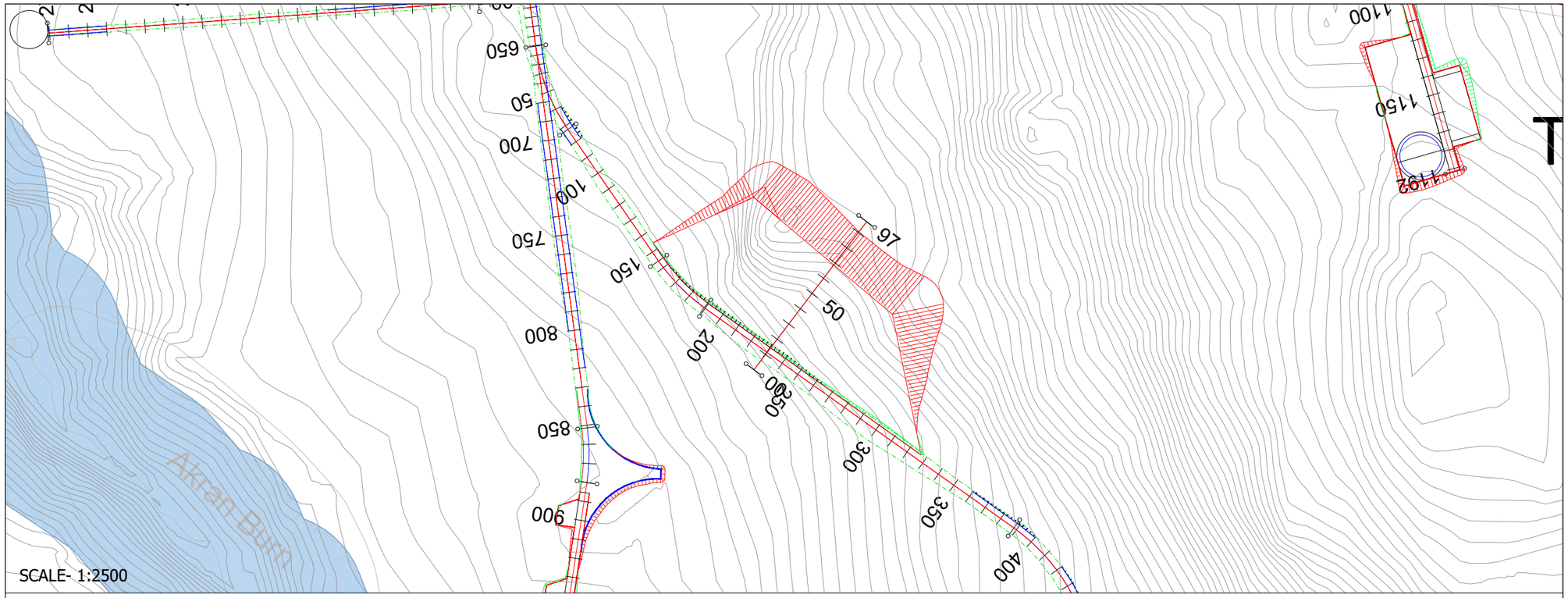

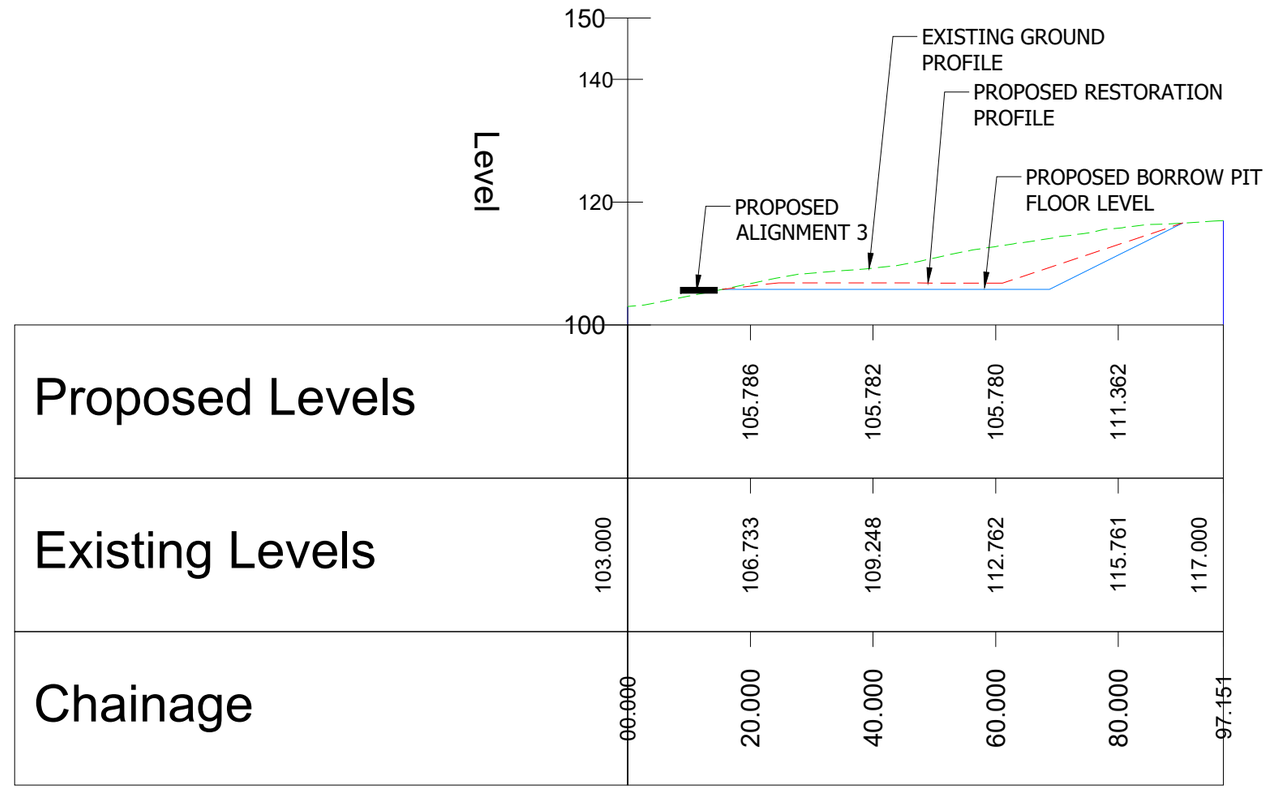

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Borrow Pit 2

Figure 3

Ackron Wind Farm
Borrow Pit Assessment

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