CLAUCHRIE WINDFARM

BORROW PIT ASSESSMENT

ScottishPower Renewables

December 2019







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Contents

1		EXE	CUT	IVE SUMMARY	4
2		INT	ROD	UCTION	4
	2.2	1	Brie	ef	4
	2.2	2	Sco	pe of Report	4
3		SITE	E DE	SCRIPTION	5
	3.2	1	Geo	ography, Topography and Landuse	5
	3.2	2	Geo	blogy	5
		3.2.	.1	Superficial Geology	5
		3.2.	.2	Solid Geology	5
4		BOF	RRO	W PIT SEARCH AREAS	5
	4.2	1	Intr	oduction	5
	4.2	2	Crit	eria for Selection of Borrow Pit Search Areas	5
	4.3	3	Bor	row Pit Search Area Locations	6
		4.3.	.1	ВР А	6
		4.3.	.2	ВР В	6
		4.3.	.3	BP C	6
		4.3.	.4	BP D	6
		4.3.	.5	BP E	6
		4.3.	.6	BP F	6
		4.3.	.7	BP G	7
		4.3.	.8	ВР Н	.7
5		COI	NSTF	RUCTION REQUIREMENTS	8
	5.2	1	Roc	k Volume Requirements	8
	5.2	2	Add	litional Sources of Rock	8
6		COI	NSTF	RUCTION METHODS	9
	6.2	1	Exti	raction Operations	9
		6.1.	.1	Preparation Works	9
		6.1.	.2	Drainage	9
		6.1.	.3	Soils and Overburden Storage	9
		6.1.	.4	Rock Extraction and Processing	9
7		COI	NCLU	JSION1	0



EXECUTIVE SUMMARY 1

Clauchrie windfarm is a development proposed by ScottishPower Renewables for the installation of 18 wind turbines (the proposed Development). The area considered for development is of mixed use, predominantly coniferous commercial forestry with the more elevated ground on site being unforested.

This is a report on an initial review of the development area to identify possible locations for the temporary extraction of rock to supply the development with construction materials, specifically crushed rock. It is anticipated that the bulk of crushed rock will be utilised for construction of access roads and crane hardstandings. If the material encountered is of the required quality, it may be also considered as source of aggregate to produce concrete for wind turbine foundations.

At this stage of development an outline design has been completed for the proposed Development's infrastructure. This design estimates that the project will require approximately 143,666 cubic meters of crushed rock for the construction of access roads, crane hardstandings, temporary construction compounds, substation compounds and structural rock for turbine foundations. Eight borrow pit search areas have been identified which are estimated to yield approximately 147,825 cubic meters of rock for use in construction.

The geology of the site in general was assessed from site surveys and desktop studies. No intrusive geotechnical investigations have been undertaken to assess geology at the locations of the proposed extraction areas.

INTRODUCTION 2

2.1 Brief

SSG Projects have been commissioned to assess preliminary locations for the temporary extraction of rock at the proposed Development. The proposed Development comprises the erection of wind turbines, the construction and modification of new and existing access roads and the installation of a new substation and energy storage facility. The site boundary encloses an area of approximately 28 km². A site location for the development is provided in Figure 4.1 of the EIAR. A detailed description of the proposed development can be found within Chapter 4: Development Description (EIAR Volume 1).

2.2 Scope of Report

This Preliminary Borrow Pit Assessment for the proposed Development has been prepared to identify potential sources of rock within the development site required for the construction of the windfarm. The purpose of the assessment is to:

- Assess potential areas for the extraction of stone;
- Provide an estimate of the available aggregate from the source location;
- Identify overlying superficial soils;
- Identify underlying rock types;
- environment.

The criteria used to identify potential locations for Borrow Pit Search Areas (BPSAs) took into consideration topography, anticipated rock quality, environmental and physical constraints and proximity to required areas of fill. The criteria adopted is discussed further in Section 4.0 of this report. At this stage of development, the final quantities required to construct the development remain approximated. The design process will refine assumptions made on quantities of material required to construct the proposed Development.

The quality of rock anticipated at the locations proposed for the BPSAs discussed in this report have been assessed against available literature and site walkovers. The final extent and estimate of material to be won at each of these locations will be confirmed following completion of an intrusive ground investigation exercise which will be undertaken if consent is granted for the proposed Development. 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 the proposed Development, onsite borrowing of rock provides significant environmental gains as the traffic volume on local roads would be significantly reduced due to the reduction in the requirement to import materials.

Detail management techniques for the extraction of rock and associated measures to protect the local



SITE DESCRIPTION

Geography, Topography and Landuse 3.1

The Site topography generally comprises smooth rounded hills and a gently undulating landform. The proposed Development infrastructure lies between 155 m and 410 m above sea level with the highest point within the application boundary being Craigenreoch (565m) in the north east of the Site.

The Site is rural in setting and is dominated by commercial forestry of varying age and felling status. A network of existing forestry tracks is present on Site. There are various minor watercourses together with Loch Scalloch which lies close the western boundary of the application boundary.

3.2 Geology

3.2.1 Superficial Geology

The BGS Geology map indicates that most of the site is underlain by Hummocky (moundy) Glacial Deposits -Diamicton, Sand and Gravel. Parts of the site are covered by peat deposits. There are some areas of Alluvium - Silt, Sand and Gravel on Site which are predominantly associated with the River Cree and its upstream tributaries, the Polmaddie and Fardin Burns. The Scalloch Burn also has alluvium deposits associated with it. There are portions of the Site, primarily the more elevated areas, for which the BGS has no superficial geology records. Parts of the site along the access route are overlain by Till, Devensian – Diamicton.

A comprehensive program of peat depth probing has been completed and has included a Phase I and Phase Il peat survey, details of which are incorporated within Chapter 7: Hydrology, Hydrogeology, Geology and **Soils** (EIAR Volume 1). Peat depths were recorded varying from nil to 3 m, with a small proportion of survey points (five of 1,950 probe locations) recording peat depth over 3m. An extract of the BGS superficial geology map for the Site is contained within Appendix A.

3.2.2 Solid Geology

The BGS 1:50,000 geology map indicates that the Site is underlain by sedimentary bedrock from the Kirkcolm Formation - Wacke.

The BGS geology map also highlights the presence of igneous intrusions located throughout the site. This igneous bedrock was formed approximately 359 to 444 million years ago in the Devonian and Silurian Periods. An extract of the BGS bedrock geology map for the Site is contained within Appendix A.

BORROW PIT SEARCH AREAS 4

Introduction 4.1

Eight possible sites were identified as BPSAs. The locations for each BPSA are identified within the BPSA Data Sheets Contained within Appendix B. Photographs are provided in Appendix C. Each site was selected based on a pre-determined criteria which included; peat depth, habitat, proximity to watercourses and GWDTE's, topography, quality of rock anticipated and proximity to work areas. This criterion is described further within 4.2

No site investigation has been carried out on Site and this would be required to assess the extent of rock and rock quality. Findings from the site investigation would also determine if the rock available would be suitable for use as a concrete aggregate.

Criteria for Selection of Borrow Pit Search Areas 4.2 The following criteria was used to select the optimum BPSAs across the site;

- Avoiding peat depths > 1.0m Good practice advises that infrastructure should avoid areas of peat. As detailed within section 3.2 peat deposits across the site vary from 0m to 3m in depth. Peat depths greater than 1m in depth were avoided during the BPSA selection process
- Habitat

The presence of sensitive habitats was taken into consideration during the selection of BPSA. Results from a national vegetation classification (NVC) survey and other ecological and ornithological surveys were taken into consideration during the selection process.

- Watercourses and GDWTE's The risks associated with polluting adjacent watercourses and GDWTE's from both silt runoff and fuel and hydraulic oils was taken into consideration during the selection of BPSAs. Watercourse buffers of 50m were maintained for the selection of BPSAs and GWDTE's with a classification of high and moderate sensitivity were avoided.
- Topography

To minimise the footprint of the excavation for borrow pits flat and shallow sloping ground was discounted. This would minimise the excavation/removal of overburden to access the bedrock beneath and reduce the susceptibility of open excavation to surface water run-off.

Historic use



Where other selection criteria were met sites used for rock extraction in the past have been favoured. Many of these were identified on Ordnance Survey maps and their suitability and likely remaining rock resource was assessed through visual inspection.

Quality of rock

Visual inspection of exposed rock on site indicate that it is of good quality for construction with no evidence of weathering and the rock is generally blocky in nature. In addition, the numerous historic and active borrow pits on site provide further, anecdotal, evidence that the rock is good quality. Testing will be undertaken as part of the Site Investigation (SI) works to determine the mechanical properties of the rock.

Haul Distances

Anticipated haul distances were taken into consideration during the selection process for BPSAs. Reducing hauls distances between BPSAs and final placement has the following benefits:

- Reduces volume of site traffic/number of haul vehicles and hence air pollution;
- Reduces H&S risk; and
- Reduces tracking of vehicles in periods of wet weather when plant movements should be kept to a minimum.

4.3 Borrow Pit Search Area Locations

Using the selection criteria summarised in section 4.1 in conjunction with a site visit to undertake visual inspections resulted in the identification of eight BPSAs. In addition to the BPSAs, an existing borrow pit utilised by the landowner FLS predominantly used for forest tracks, has been identified to provide a further source of rock for the proposed Development. The data sheet for each BPSA is contained within Appendix B. The data sheet provides commentary on the selection criteria as detailed within 4.1. The selected locations are summarised as follows:

4.3.1 BP A

BP A is in the southern area of the site approximately 1km from the site entrance on the A714. There is evidence at this location of previous rock extraction as shown in the photograph contained within Appendix C. There is evidence of good quality rock from historical workings. The topography is gently sloping and suitable for a borrow pit. The location of this BPSA has also been selected to provide a source of stone for access track upgrades and the construction of construction compound CC1.

4.3.2 BP B

BP B is located on the access track to site, intended to provide a source of stone for its upgrade. There is evidence at this location of limited historic rock extraction as shown in the photograph contained within Appendix C. The topography is a small hillock, which lends itself to an efficient borrow pit site.

4.3.3 BP C

BPC is located on the lower slopes of Kentie Hill and as such provides favourable topography for being able to extract large volumes of stone with a relatively compact footprint. Material won from BP C will be used for access track upgrades and the new section of track along the access route.

4.3.4 BP D

BP D is located to the north of the new section of access track on the access route. It is directly adjacent to a borrow pit which was opened by Forest and Land Scotland, the site's landowners. A visual inspection of the existing borrow pit clearly identifies that high-quality rock is available at this location. This borrow pit will provide a source of rock for the new section of access track, together with access track upgrades and material to construct the temporary construction compound CC2.

4.3.5 BP E

BP E is located on steeply sloping ground which will enable a working face of up to 15m to be achieved by excavating into the slope, providing an efficient location for rock extraction. The borrow pit's location has been selected to minimise haul distances to turbine locations as this borrow pit will chiefly be a source of material for crane hardstandings and access track construction in the eastern part of the Site.

4.3.6 BP F

BP F is located on gently sloping ground in the central part of site. It provides a source of rock for the construction of central and eastern site infrastructure. This borrow pit has been refined to avoid nearby areas of deep peat.



4.3.7 BP G

BP G is located on sloping ground in the central part of site. It provides a source of rock for the construction of central and western site infrastructure. BP G was selected primarily due to its central location and favourable topography.

4.3.8 BP H

BP H is the most westerly borrow pit proposed and has been selected to reduce haul distances to the western part of the site. It will provide a source of material to construct the control building compound and western tracks and crane hardstandings.



CONSTRUCTION REQUIREMENTS

5.1 Rock Volume Requirements

A summary of the indicative volumes of rock required is summarised in Table 5.1.

Table 5.1: Indicative construction stone requirement

Infrastructure	Volume (m ³)
Access track (new, cut)	41,187
Access track (new, floating)	20,808
Access track (upgrade)	24,384
Turbine formation	14,476
Crane hardstandings	25,749
Laybys	1,750
Met mast hardstanding	313
Compounds	10,000
Laydown area	5,000
TOTAL	143,666

5.2 Additional Sources of Rock

As shown in section 5.1, the eight proposed borrow pits on site have the capacity to supply all required rock for the Site's construction. There are other potential sources of rock which are expected to be available on site.

Rock is likely to be recovered from turbine excavation works. Each turbine foundation will require an excavation of approximately 3.5m in depth and a minimum diameter of 37m. This could yield approximately 44,000m³ of additional rock which could be used for infrastructure construction. An existing FLS borrow pit at NGR 229259,588440 contains a supply of ready-blasted and crushed rock, and there is potential for this site to be extended.

Should additional sources of rock be utilised, the volume of rock extracted from the borrow pits would be reduced accordingly.

A total maximum volume of aggregate required from the stone extraction areas would be in the order of 143,666 m³. From the BPSAs, borrow pits have been sized to be able to meet this demand for material, as detailed in Table 5.2.

Table 5.2: Borrow pit yields

Borrow Pit No.	NGR Reference	Approximate Dimensions (m)	Yield Volume (m ³)*
BP-A	231610, 582191	40 x 90 x 5	8,100
BP-B	231632, 583173	50 x 50 x 8	9,000
BP-C	233146, 585491	70 x 80 x 12	30,240
BP-D	232893, 587465	100 x 60 x 5	13,500
BP-E	232783, 589209	70 x 70 x 15	33,075
BP-F	230958, 589386	60 x 90 x 7	17,010
BP-G	229086, 588354	80 x 80 x 10	28,800
BP-H	227437, 587524	60 x 60 x 5	8,100
TOTAL			147,825

* Yield volume assumes a 90% recovery rate to allow for overburden and the presence of any unsuitable

material.

8

5



CONSTRUCTION METHODS

Extraction Operations 6.1

The requirement to produce various grades of aggregate for different use i.e. bulk fill, track sub-base, track capping etc would necessitate the use of specialist crushing and grading mobile plant. The operation to extract stone from the proposed locations is summarised as follows.

6.1.1 Preparation Works

Initial site investigation (SI) works would be undertaken prior to commencement of construction activities. The SI would determine the quantity and suitability of rock at each of the proposed BPSA locations. Detailed designs for each of the borrow pit (BP) would be developed following review of the SI results.

Preparatory works associated with each of the BPs would commence at the start of construction for the proposed development. BPSAs would be worked in accordance with Quarries Regulations 1999.

Information obtained from site visits and peat probing indicate there are limited soils and overburden at each of the BPSAs as detailed within the BP Data Sheets incorporated within Appendix B. On commencement of BP development, soils and overburden materials would be stripped from the area and stored in a bund as set out in Section 6.1.3.

6.1.2 Drainage

Prior to commencement of activities associated with the development of the BPs a detailed drainage system incorporating adequate mitigation measures would be installed to prevent silt pollution around the perimeter of each BP. This detail would be incorporated within the Project Construction Method Statement, Environmental Management Plan and Water Quality Management Plan which are expected to be required by conditions attached to any consent.

Under the SEPA CAR Licence system the Contractor would be required to obtain a CAR Licence prior to works commencing. This process would ensure that the mitigation measures proposed meet the required level of detail expected by SEPA.

Mitigation measures may include (but not be limited to):

- Overburden/loose soil would be stabilised and sheeted (should it be required). Mound heights would not exceed 3m
- The floor of any BP excavation would be sloped into the hill, to provide attenuation of any accumulated run off. Sump points would be formed to allow settlement of suspended solids prior to dispersion by pump to vegetated areas away from local watercourses.

In addition, the following pollution prevention measures would be implemented to minimise any pollution risk that may arise through the increased surface run-off and sediment mobilisation likely to be generated by each extraction area:

- Installation of vegetated cut-off drains, peripheral bunds and ditches around the working areas would intercept uncontaminated surface run-off and divert it around the works ensuring that uncontaminated surface water does not become laden with silt, and
- Installation of swales to collect runoff placed on the downslope of borrow pits and overburden areas to collect potentially silty run-off.
- capture suspended solids generated during the operation of the extraction areas and to minimise the spread of runoff to the wider environment including the potential GWDTE's adjacent to BPs.
- from direct discharge to watercourses.

6.1.3 Soils and Overburden Storage

Following the installation of the drainage system, topsoils/peat and overburden would be stripped from the work area. Materials would be excavated separately and stockpiled adjacent to the BPSA working areas. Stripped materials would be placed to provide a natural bunded barrier, which would help to prevent public access to the borrow pit and prevent surface run-off from entering the BPSA from surrounding land. Temporary fencing would be used to provide an additional physical barrier to prevent unauthorised public access whilst the BP is active. Additional overburden material not placed in the peripheral bund would be temporarily stored in an overburden area, located immediately adjacent to the BP working area. All soils would be stored in accordance with British Standard BS8601:2013 and BS 3882:2015. As illustrated within the BP Data Sheets contained within Appendix B, it is not anticipated that large quantities of peat will be encountered. Any peat encountered within the proposed BP working area would be extracted and stockpiled in a dedicated area agreed with the Environmental Clerk of Works (ECoW). Peat management would be undertaken in accordance with a Peat Management Plan.

6.1.4 Rock Extraction and Processing

On completion of stripping soils and overburden from the footprint of the BP, rock extraction activities would commence. This is likely to involve a combination of blasting and mechanical crushing. Where blasting is required it is proposed that a lightweight crawler mounted blast hole drill rig is deployed with associated compressor. On completion of blasting, stone will be taken to mobile mechanical stone

Silt traps, silt fences and/or straw bales would be used in conjunction with swales, if required, to

Water discharge from sediment ponds would be directed to rough surface vegetation and kept away



crushers for subsequent processing. The final plant arrangement will be dependent on the phasing of the BPSA development and the anticipated volumes of rock to be extracted at each location. Plant located at each of the BPs will be equipped with appropriate spill kits to address fuel/oil spillage should an incident occur. Fuelling of plant will be undertaken at predetermined locations agreed with the project ECoW.

7 CONCLUSION

ScottishPower Renewables is proposing an 18 turbine wind farm development near Barhill in South Ayrshire, Scotland. The development is proposed on an upland area predominantly comprising commercial forestry.

The area is predominantly underlain by sedimentary bedrock from the Kirkcolm Formation – Wacke.

The project will have a requirement for approximately 143,666 m³ of construction stone material mainly for the construction of access roads, crane hardstandings and construction compounds.

A desktop study and site walkover were carried out to identify potential sources of construction stone and suitable areas for stone extraction within the development site to provide enough rock material for the project.

The assessment took into consideration information from recently completed environmental surveys, these included:

- Peat depth;
- Presence of watercourses;
- Presence of GWDTEs; and
- Habitat sensitivities.

Taking into consideration the existing environment, the geology of the area and the layout of the proposed development eight BPSAs were identified. Key considerations in the selection process were rock quality and quantity, sustainability, haul distance, cost effectiveness and potential environmental impacts.

Further investigation is required on all identified BPSAs to determine extent of rock, rock type and suitability for use as rock fill for the construction of access road, crane platforms and aggregate for use in concrete.

Based on initial calculations it is expected that there will be sufficient material acquired on site to match the construction requirements.



APPENDIX A: FIGURES

Figures:

- Superficial Geology
- Bedrock







LEGEND:

	Site boundary
•	Wind turbine
	Site infrastructure
	Borrow pit search area
	Existing borrow pit
	5
BGS S	Superficial Deposits (1:50k)
BGS S	Superficial Deposits (1:50k) Glacial Deposits - Sand and Gravel
BGS S	Superficial Deposits (1:50k) Glacial Deposits - Sand and Gravel Alluvium - Silt, Sand and Gravel
BGS S	Superficial Deposits (1:50k) Glacial Deposits - Sand and Gravel Alluvium - Silt, Sand and Gravel Till, Devensian – Diamicton

NOTES:

Contains British Geological Survey materials © UKRI 2019

No available information

Client:

ITPEnergised

Project:

Clauchrie Windfarm

Drawing Title:

Superficial Deposits Plan

Date: November 2019

Scale: 1:50,000 @ A3

Drawn/Checked: RB / AP



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APPENDIX B: DATA SHEETS





LEGEND:



NOTES:

*

195

Strang

Location (NGR): 231610, 582191 Dimensions (m): 40 x 90 x 5 Yield (m^3): 8,100

Rock extracted from this location is proposed to be used for access track upgrades and construction compound CC1 to limit haul distances.

Watercourse

Watercourse buffer (50m)

Water vole

Water vole buffer (10m)

Ornithology constraint

Cultural heritage constraint

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Client:

ITPEnergised

Project:

Clauchrie Windfarm

Drawing Title:

BPA Data Sheet

Date: November 2019 Scale: as shown @ A3 Drawn/Checked: RB / AP

Strang





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+**	LEGEND:
	Site boundary
4	 Wind turbine
* 5	Tracks / hardstandings
	Clauchrie laybys
* *	Control building compound
	Construction compound
	Laydown area
*	 Met mast
	Borrow pit search area
* *	FLS borrow pit
	NOTES:
*	Dimensions (m): 70 x 80 x 12
	Yield (m^3): 30,240
/ * /	Rock extracted from this location is
(**	proposed to be used for access track
	beyond the River Cree to limit haul
***1	distances.
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\ <u>*</u> *	
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Project:

Clauchrie Windfarm

Drawing Title:

BPC Data Sheet

Date: November 2019

Scale: as shown @ A3

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Peat probing indicates peat depth generally less than 1m.

adverse impact on this sensitivity.

	LEGEND:
*	Site boundary
1 39	Wind turbine
TA Cotta	Tracks / hardstandings
11/1 114	Clauchrie laybys
	Control building compound
*	Construction compound
16	Laydown area
,117,	Met mast
alle alle	Borrow pit search area
MI,	FLS borrow pit
**	
*	NOTES:
*	Location (NGR): 232783, 589209 Dimensions (m): 70 x 70 x 15
*	Yield (m^3): 33,075
**	Rock extracted from this location is
	proposed to be used for access track
*	upgrades and turbine hardstands to the east of the site to limit haul distances.
**	
* .	
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NOTES:

Location (NGR): 230958, 589386 Dimensions (m): 60 x 90 x 7 Yield (m^3): 17,010

Rock extracted from this location is proposed to be used for access tracks and turbine hardstands to the east and centre of the site to limit haul distances.

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Client:

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Project:

Clauchrie Windfarm

Drawing Title:

BPF Data Sheet

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EGEN	D:
	Site boundary
•	Wind turbine
	Tracks / hardstandings
	Clauchrie laybys
	Control building compound
	Construction compound
	Laydown area
•	Met mast
	Borrow pit search area
	FLS borrow pit

NOTES:

Location (NGR): 229086, 588354 Dimensions (m): 80 x 80 x 10 Yield (m^3): 28,800

Rock extracted from this location is proposed to be used for access tracks and turbine hardstands to the centre and west of the site to limit haul distances.

Watercourse

Watercourse buffer (50m)

Water vole buffer (10m)

Ornithology constraint

Cultural heritage constraint

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Client:

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Project:

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Drawing Title:

BPG Data Sheet

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NOTES:

Location (NGR): 227437, 587524 Dimensions (m): $60 \times 60 \times 5$ Yield (m^3): 8,100

Rock extracted from this location is proposed to be used for access tracks and turbine hardstands to west of the site and the control room compound to limit haul distances.

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Client:

ITPEnergised

Project:

Clauchrie Windfarm

Drawing Title:

BPH Data Sheet

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Scale: as shown @ A3

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APPENDIX C: PHOTOGRAPHS

Introduction

This Appendix contains photographs of the Borrow Pit Search Areas. Not all sites were able to be photographed.



Borrow Pit A



Borrow Pit B



BPA is located on the access road. The site has suitable topography for a borrow pit and rock was visible close to the surface.

BPB is located on the access road. The site has previously been used for rock extraction but was observed to have an ample supply of rock remaining. The site has suitable topography for a borrow pit and rock was visible close to the surface.



Borrow Pit C



BP C is located in the access road and due to its favourable topography has potential to yield circa 33,000m³ of rock. It is proposed to be a source of stone to supply access track upgrades and the new section of track beyond the River Cree.

Borrow Pit D



evident in this photograph, it being largely unweathered and blocky in nature.

BP D is an extension to a recent but currently inactive borrow pit pictured above. The quality of the rock is



FLS Borrow Pit





An existing FLS borrow pit with good stockpiles of crushed rock.





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