Technical Appendix 8.2: Peat Management Plan

Vale of Leven Wind Farm

Vale of Leven Wind Farm Ltd

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1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by Vale of Leven Wind Farm Ltd to undertake a Stage 1 Outline Peat Management Plan (PMP) for the proposed Vale of Leven Wind Farm.

The proposed wind farm development site ('Proposed Development') is located approximately 2.5 km east of Bonhill with the larger settlements of Alexandria and Dumbarton located approximately 4 km to the west and south-west of the Proposed Development.

1.1 Site Description and Proposed Development

The Proposed Development is located on predominantly upland moorland that is managed as farmland grazing. The location and layout of the Proposed Development are detailed on **Figure 8.2.1** and **Figure 8.2.2.**

The Proposed Development comprises of 10 wind turbines, and associated infrastructure including:

- associated turbine foundations and transformers;
- hardstanding areas for erecting cranes at each turbine location;
- series of on-site access tracks connecting each turbine;
- underground cables linking the turbines to the grid connection;
- on-site substation;
- temporary construction compounds;
- turning heads;
- LiDAR unit; and
- Up to 3 borrow pits.

It includes measures to secure biodiversity enhancement which are set out in [xxx]

A full description of the proposed Development is provided in **Chapter 2: Proposed Development** of the EIA Report.

1.2 Scope and Objectives of Assessment

A desk study and comprehensive programme of soils and peat probing has been completed for the Proposed Development and the results are detailed within **Technical Appendix 8.1: Peat Landslide and Hazard Risk Assessment (PLHRA)**. This document uses this information and provides indicative volumes for peat extraction and outlines recommendations for the handling, re-use and storage of peat during construction and operation of the Proposed Development.

Areas of the Proposed Development where soils are less than 0.5 m thick are considered to be too thin to be classified as peat and are therefore classified as soils.

The purpose of this report is to ensure that there has been a systematic consideration of peat management and a quantitative assessment throughout the development process.

1.3 Methodology

1.3.1 Requirements of National Planning Policy 4

The intent of Policy 5 (Soils) of National Planning Policy 4 (NPF4)[1] is "*to protect carbon rich soils, restore peatlands and minimise the disturbance of soils from development*".

The Policy states [5(a)] that development proposals should only be supported if they are designed and constructed:

- in accordance with the mitigation hierarchy by first avoiding and then minimising the amount of disturbance to soils on undeveloped land; and
- in a manner that protects soils from damage including from compaction and erosion, and that minimises soils sealing.

Further [5(c)] confirms that development proposals on peatland, carbon rich soils, and priority peatland will only be supported if they are:

- essential infrastructure and there is a specific locational need and no other suitable site;
- the generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets;
- small-scale development directly linked to a rural business, farm or croft;
- supporting a fragile community in a rural or island area; or
- restoration of peatland habitats.

And [5(d)] confirms that where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify:

- the baseline depth, habitat condition quality and stability of carbon rich soils;
- the likely effects of the development on peatland, including on soil disturbance; and
- the likely net effects of the development on climate emissions and loss of carbon.

Policy 5 also confirms that the site specific (above) assessment [5(d)] "*should inform careful project design and ensure, in accordance with relevant guidance and the mitigation hierarchy, that adverse impacts are first avoided and then minimised through best practice. A peat management plan will be required to demonstrate that this approach has been followed, alongside other appropriate plans required for restoring and/ or enhancing the site into a functioning peatland system capable of achieving carbon sequestration*".

This stage 1 PMP considers the protection and safeguarding of peat and seeks to fulfil the requirements of Policy 5(d).

1.3.2 Mitigation Hierarchy

SEPA[2,3] has published guidance regarding the mitigation hierarchy for developments on peat which is summarised below:

1 Scottish Government (2023). https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2022/11/national-planning-framework-4-revised-draft/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4-revised-draft.pdf

2 Scottish Environment Protection Agency. 2010. Regulatory Position Statement – Developments on Peat.

3 Scottish Renewables, Scottish Environment Protection Agency. 2012. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

- Prevention – avoiding generating excess peat during construction (e.g., by avoiding peat areas or by using construction methods that do not require excavation such as floating tracks);
- Re-use – use of peat produced on-site in restoration or landscaping, provided that its use is fully justified and suitable;
- Recycling / Recovery / Treatment – modify peat produced on-site for use as fuel, or as a compost / soil conditioner, or dewater peat to improve its mechanical properties in support to re-use; and
- Storage – storage of peat up to a depth of 2 m is not classified as a waste and does not require authorisation from SEPA, however care must be taken to ensure that it does not cause environmental pollution.

1.3.3 Relevant Legislation and Guidance

Legislation relevant to the management of peat includes the following:

- The UK Climate Change Act 2008 (c 27);
- Environmental Protection Act 1990 (as amended);
- Landfill (Scotland) Regulations 2003 (as amended);
- The Waste Management Licensing (Scotland) Regulations 2011; and
- National Planning Framework for Scotland 4 (NPF4) (Scottish Government, February 2023).

Relevant guidance and information sources include:

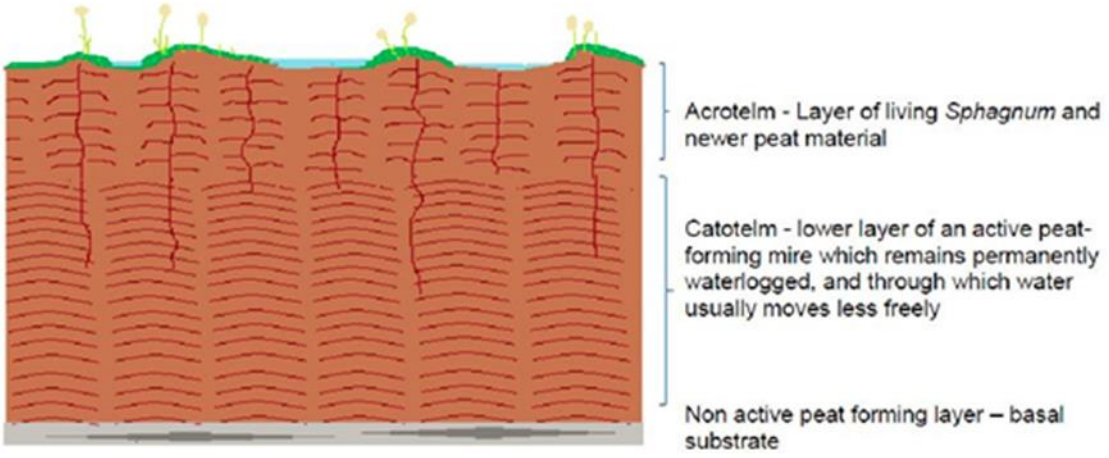
- SEPA Regulatory Position Statement - Developments on Peat (Scottish Environment Protection Agency, 2010);
- Good Practice during Windfarm Construction, 4th Edition (Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and AEECoW, 2019);
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, January 2017);
- SNH Carbon and Peatland Map 2016;
- Floating Roads on Peat - Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with reference to Wind Farm Developments in Scotland (Forestry Commission Scotland & Scottish Natural Heritage, 2010);
- Managing Geotechnical Risk: Improving Productivity in UK Building and Construction (Institution of Civil Engineers, 2001);
- Ground Engineering Spoil: Good Management Practice CIRIA Report 179 (CIRIA, 1997);
- Scottish Roads Network Landslides Study Summary Report (Scottish Executive, 2005); and
- Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low-Cost Roads on Peat (Forestry Commission, 2006).

1.3.4 Definition of Peat

Peat is defined as a material consisting of the partially decomposed remains of plant material and organic matter preserved over a period in a waterlogged environment resulting in anaerobic conditions, and is of depths > 0.5m.

Peat can be classed as two principal types, the acrotelm layer, and the catotelm layer as shown on **Plate 1-1**.

Plate 1-1: Drawing of two layered Structure of Active Bog Peatlands above Non-Active Peat



The acrotelm layer is found in the upper layer of peat where conditions are relatively dry and comprises living vegetation and partially decomposed plant material. Hydraulic conductivity in this layer tends to be higher in relation to distance from the water table. The thickness of the acrotelm layer varies depending on topography such as steepness of slope, peat hags, and hummocks. In particular, the acrotelm layer can be affected during periods of drought or as a consequence of drainage. Fibrous in texture, the acrotelm layer has some tensile strength and is generally considered to be stable for storage and re-use.

The catotelm layer is found under the acrotelm layer and comprises decayed plant material and organisms and is denser and with a very low hydraulic conductivity. The catotelm layer sits below the water table resulting in permanent anaerobic conditions. The catotelm layer is amorphous and has very low tensile strength making it less suitable for storage and re-use.

2.0 Site Work

2.1 Peat Depth Survey

Peat depth surveys have been undertaken across a number of phases by SLR. The surveys carried out followed best practice guidance for developments on peatland[4,5].

Phase 1 peat probing resulted in probing on a 100 m grid to allow for initial assessment of the Proposed Development which was used in preliminary site layout designs. Peat probing Phases 2, 3 and 4 involved detailed probing undertaken across the proposed layout, focussing on access tracks, turbine locations and other site infrastructure in response to design changes.

4 Scottish Renewables & SEPA (2012) 'Developments on Peatland Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste'.

5 Scottish Natural Heritage (SNH), SEPA, Scottish Government & James Hutton Institute. (2014)' Peat Survey Guidance; Developments on Peatland: Site Surveys'.

Peat is generally defined as an organic soil with a depth in excess of 0.5 m, if the soil is less than 0.5 m thick, then it is considered peaty soil. The peat was found to vary across the Proposed Development in terms of thickness and coverage.

Where the probing recorded less than 0.5 m thick, this has been considered to be an organic/peaty soil rather than peat.

The thickness of the peat was assessed using a graduated peat probe, approximately 6 mm diameter and capable of probing depths of up to 10 m. This was pushed vertically into the peat to refusal and the depth recorded, together with a unique location number and the co-ordinates from a handheld Global Positioning System instrument (GPS). The accuracy of the GPS was quoted as ±2 m, which was considered sufficiently accurate for this survey. All data was uploaded into a GIS database for incorporation into various drawings and analysis assessments.

Where the peat probing met refusal on a hard substrate, the 'feel' of the refusal can provide an insight into the nature of the substrate. The following criteria were used to assess material:

- Solid and abrupt refusal – rock;
- Solid but less abrupt refusal with grinding or crunching sound – sand or gravel or weathered rock;
- Rapid and firm refusal – clay; or
- Gradual refusal – dense peat or soft clay.

An assessment of the substrate was made and recorded at each probe hole. For use within this assessment, engineering judgement has been used to assess the substate at probes undertaken by other parties.

The relative stiffness of the peat was also assessed from the resistance to penetration of the probe and to the effort required to extract the probes (retrieval of the probe was often impossible for one person). In all instances refusal was met on obstructions allowing identification of subsurface geology.

2.2 Peat Depth Results

The results from all probing exercises listed above in Section 2.1 are detailed in the following sections and the peat depths identified on-site are shown in **Figure 8.2.3**.

A total of 2,372 peat probes were undertaken across all survey phases, with the results summarised in Table A below.

Table A: Peat Probing Results

Peat Thickness (m)	No. of Probes	Percentage (of total probes undertaken on-site)
0 (no peat)	44	1.9
0.01 – 0.49 (peaty soil)	1353	57.0
0.50 – 0.99	700	29.5
1.00 – 1.49	100	4.2
1.50 – 1.99	81	3.4
2.00 – 2.49	34	1.4
2.50 – 2.99	22	0.9
3.00 – 3.49	13	0.5
3.50 – 3.99	21	0.9
> 4.0	4	0.2

2.3 Peat Condition

Peat is described using the von Post[6] classification. Peat samples were collected by SLR in November 2022, using a peat auger and used to inform interpretations of the peat condition and underlying substrate.

Based on interpretations from probing and peat core samples, the peat within the Proposed Development is predominantly fibrous. There are some localised deposits of shallow peat that generally comprise clayey layers, whilst areas of thicker peat are predominantly fibrous layers.

Based on field descriptions at augering points, most of the shallow peat would be classified as between H2 and H5 in the von Post[6] classification, showing insignificant to moderate decomposition. Peat samples were collected by SLR in November 2022, using a peat auger and used to inform interpretations of the peat condition and underlying substrate.

The peat augering logs and photographs are provided within **Technical Appendix 8.1: Peat Landslide and Hazard Risk Assessment (PLHRA)**.

6 Von Post, L. and Grunland, E., (1926), 'Sodra Sveriges torvillganger 1' Sverges Geol. Unders. Avh., C335, 1-127

Plate 2-1: Von Post Classification for Peat Humification

von Post Classification for Peat Humification

Degree of humification	Decomposition	Plant structure	Content of amorphous material	Material extruded on squeezing	Nature of residue
H_1	None	Easily identified	None	Clear, colourless water	
H_2	Insignificant	Easily identified	None	Yellowish water	
H_3	Very slight	Still identifiable	Slight	Brown, muddy water; no peat	Not pasty
H_4	Slight	Not easily identifiable	Some	Dark brown, muddy water; no peat	Somewhat pasty
H_5	Moderate	Recognisable but vague	Considerable	Muddy water and some peat	Strongly pasty
H_6	Moderately strong	Indistinct (more distinct after squeezing)	Considerable	About ⅓ peat squeezed out; water dark brown	Fibres and roots more resistant to decomposition
H_7	Strong	Faintly recognisable	High	About ½ peat squeezed out; any water very dark brown	
H_8	Very strong	Very indistinct	High	About ⅔ peat squeezed out; also some pasty water	
H_9	Nearly complete	Almost unrecognisable		Nearly all the peat squeezed out as a uniform paste	
H_{10}	Complete	Not discernable		All the peat passes between the fingers; no free water visible	

2.4 Substrate

Where possible, in the SLR investigation, an assessment of the substrate was made, as described previously. From the evidence of the probing and sampling where available, the substrate falls into one of two principal categories:

- Granular (sand and/or gravel/weathered rock), of glacial origin and occasionally interbedded with silty sands;
- Rock, no rock samples were recovered from the probe locations although where exposed, the rock is seen to be sedimentary rocks; and
- Limited cohesive horizons were interpreted by the probing and encountered at the base of peat coring. However, it is likely that any cohesive material is weathered silty material at the top of the weathered glacial material.

2.5 Peat Depth at Infrastructure

The peat thickness and substrate at each proposed turbine and hardstanding location is summarised in Table B**.**

Table B: Ground Conditions at Each Wind Turbine and Hardstanding Location

Turbine No.	Peat Depth (m)	Substrate	Hardstanding No.	Peat Depth (m)	Substrate
T1	0.7	Granular	T1	0.6	Granular
T2	0.6	Granular	T2	0.4	Granular
T3	0.4	Granular	T3	0.3	Granular
T4	0.8	Granular	T4	0.6	Granular
T5	0.1	Granular	T5	0.5	Granular
T6	0.4	Granular	T6	0.5	Granular
T7	0.3	Granular	T7	0.5	Granular
T8	0.3	Granular	T8	0.4	Granular
T9	0.3	Granular	T9	0.4	Granular
T10	0.6	Granular	T10	0.9	Granular

3.0 Potential Impacts on Peat from Construction Activities

3.1 Wind Turbines

Wind turbine foundations in peatlands would normally require full and permanent excavation of peat to competent strata, with temporary excavation of peat from a wider diameter to enable safe access to the base of the excavation.

The resulting peat generated could be considered as a permanent loss, unless satisfactory re-use could be achieved within the Proposed Development. The peat would normally be used to reinstate track shoulders, around crane hardstandings and turbine bases.

3.2 Crane Hardstanding

In order to assemble the wind turbine and enable servicing during operation, crane pads are constructed adjacent to each wind turbine. These must be sufficient to take the weight of both the crane and turbine components, and therefore excavation to underlying competent strata is required. Without adequate drainage controls, permanent excavation may disrupt natural hydrological pathways.

Crane pads must remain in place for the life of the Proposed Development to enable routine inspection and maintenance. Peat generated from these excavations would be considered a permanent loss, unless satisfactory re-use could be achieved within the Proposed Development.

3.3 Temporary Construction Compounds

Temporary compounds are provided during the construction phase to enable storage of construction materials, turbine components and fuel, concrete batching plant, siting of welfare facilities and site offices. The temporary compounds have been sited in areas to avoid thick peat with only peaty soils <0.5m present. Due to their temporary nature, peat excavated for compounds would normally be stored and reinstated, and therefore re-use is required.

3.4 Substation

The substation is required to allow connection to the grid and would be permanent infrastructure. The substation location has been sited in an area to avoid thick peat with only peaty soils <0.5m present. The peaty soils would normally be used to reinstate track shoulders, and around the substation.

3.5 Borrow Pits

Where access track and hardstanding construction materials are required, it is intended to source the material from borrow pits on-site.

Peat overlying glacial till, weathered rock and bedrock is normally excavated and temporarily stored for the duration of construction, and then re-used for borrow pit restoration and landscaping post construction, and therefore re-use is required.

Borrow pits have been located to ensure that peat is shallow and therefore minimal peat would need to be excavated at each location.

For further information on proposed borrow pits, refer to the **Technical Appendix 8.4: Borrow Pit Appraisal** (BPA).

3.6 Access Tracks

Access tracks are required to enable passage of construction and servicing traffic around the Proposed Development. Over peatlands, the choice of access track design normally reflects the peat depths along the route, with shallow peat/organic soils <1m deep excavated to competent strata (cut and fill tracks), and deeper extensive areas of peat overlain by floating tracks (with no excavation) when slope gradients are suitable.

Access tracks are permanent infrastructure, so peat excavated for cut and fill would be considered a permanent loss, unless the peat can be re-used elsewhere within the Proposed Development.

In excavated tracks, the surface vegetation (i.e. habitat) would be lost unless stored and reinstated elsewhere, however the intention would be to re-use excavated turves and peat on verges and track shoulders and hardstandings for landscaping and restoration purposes.

Access tracks have the potential to disrupt natural hydrological drainage pathways, appropriate drainage would be designed to mitigate this.

3.7 Cable Trenching

Electrical cabling is typically buried or ducted adjacent to the access track network where practicable (cable trenching), either into existing peat (requires excavation, laying and backfilling) or wherever possible ducts are laid within reinstated material at the sides of floated tracks (no excavation of in-situ peat required). Where excavation is required, peat generated from cable trenching is normally replaced at its point of origin, and therefore is not considered a volume loss and re-use is a certainty.

4.0 Proposed Mitigation During Construction

There are a number of ways in which detailed design and construction activities can be specified to minimise impacts on peatlands. The following sections outlines briefly the likely mitigation required to minimise impact, based on the re-use of peat specific to key elements of the Proposed Development.

4.1 Wind Turbine Foundations

Wind turbine foundations represent permanent excavation and the primary mitigation measure is to locate the wind turbines to avoid the areas of deepest peat, thereby reducing excavated volumes. Six of the proposed turbines are located on peaty soil (< 0.5m) and four located on thin peat (0.5m - <1.5m). The average peat depth is 0.4 m, ranging from 0.1 m to 0.8 m.

4.2 Hardstandings, and Temporary Compounds

In relation to crane hardstanding, guidance is to avoid their full reinstatement post-construction, given the likelihood of re-use for maintenance activities associated with the wind turbines. Four of the proposed hardstandings are located on peaty soil (< 0.5m) and six located on thin peat (0.5m - <1.5m). The average peat depth is 0.5 m, ranging from 0.3 m to 0.9 m.

In relation to temporary compounds, the following good practice guidance applies:

- peat stripped from temporary compounds and hardstanding areas will not be stored higher than 1 m and could require to be seeded in the short term to prevent drying out, if stored for long residence times;
- stripped turves are used for final restoration, however where turves are insufficient or vegetation regeneration requires reseeding, temporary fencing may be considered around compound areas undergoing restoration in order to prevent grazing; and
- the choice of seed mix for reseeding should be appropriate to the ecological and hydrological conditions of the restored compound location and surrounding habitats and should be advised by the Ecological Clerk of Works (ECoW).

4.3 Borrow Pits

Peat may be re-used within Borrow Pits for the purpose of their restoration provided the method of re-use is consistent with the environmental reinstatement objectives of the Proposed Development and presents no residual risks from pollution of the environment or harm to human health. Further details on the Borrow Pits are provided within Technical Appendix 8.4.

Key issues for Borrow Pit restoration are:

- prevention of desiccation and carbon losses from peat used in the restoration;
- development of complete vegetation cover through emplacement of peat turves or seeding with an appropriate species; and
- fencing where required, to exclude grazing stock and to encourage vegetation establishment.

4.4 Access Tracks

In comparison to infrastructure specific to wind turbines, there is considerably more guidance[7,8] available to support access track design in peatlands. Guidance is generally focused on floating tracks and excavated tracks and is summarised below. Based on the avoidance of significant areas of deep peat with tracks all typically present on peat <1.0m

7 Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland, AEECoW (2019)., Good Practice During Wind Farm Construction. 4th Edition.

8 Scottish Natural Heritage, Forestry Commission (August 2010)., Floating Roads on Peat

and only limited sections of track on localised areas of peat >1.0m then the use of excavated tracks is proposed.

4.4.1 Excavated Access Tracks

Excavated tracks require complete excavation of soil/peat to a competent substrate. Excavated tracks will generally be undertaken where peat depths are less than 1m. This peat/soil would require storage ahead of re-use elsewhere within Proposed Development. Good practice guidance relates mainly to drainage in association with excavated tracks:

- trackside ditches should capture surface water (within the acrotelm) before it reaches the road;
- interceptor drains should be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table);
- any stripped peat turves should be placed back in the invert and sides of the ditch to assist regeneration and prevent erosion to the peat and wash out that could occur; and
- culverts and cross drains should be installed under excavated tracks to maintain subsurface drainage pathways (such as natural soil pipes or flushes). Discharge from constructed drainage should allow for as much diffuse dispersion of clean (silt free) water as possible while minimising disturbance to existing peatland as far as possible. Silt mitigation measures will be incorporated into all constructed drainage as per the requirements of the Construction and Environmental Management Plan (CEMP).

Although excavation is normally undertaken in peat of minor thickness (< 1.0m), there is a possibility of minor slippage from the cut face of the peat mass. Accordingly:

- free faces should be inspected for evidence of instability (cracking, bulging, excessive discharge of water or sudden cessation in discharge); and
- where significant depths of peat are to be stored adjacent to an excavation, stability analysis should be conducted to determine Factor of Safety (FoS) and an acceptable FoS adopted for loaded areas.

Regular routine inspections monitoring should be scheduled during and post-construction and undertaken by a suitably qualified geotechnical engineer.

4.5 Cable Trenches

Cable trenches either require peat excavation specifically for this purpose, or they can be constructed within landscaping of shoulders adjacent to floating tracks. Guidance[7] is as follows:

- utilise peat shoulders for cable lays where possible to minimise peat excavations specifically for this purpose, in this case, peat shoulders should be 1.0m to 1.5m thick;
- where cable trenching is constructed adjacent to a floating road, ensure the trench is backfilled to prevent void filling by material migration;
- minimise time between excavation of the cable trench and peat reinstatement, preferably avoiding excavation until the electrical contractor has cables on-site ready for installation; and
- avoid incorporating substrate materials in the excavation, to minimise contamination of the peat to be reinstated. Replace excavated materials sequentially.

4.6 Peat Excavation, Storage and Transport

Where peat is to be re-used or reinstated with the intention that its supported habitat continues to be viable, the following good practice outlined below applies.

4.6.1 Excavation

Excavated peat should be excavated as turves, including the acrotelm (surface vegetation) and a layer of adjoining catotelm (more humified peat) typically up to 500mm thick in total, or as blocks of catotelm; the acrotelm should not be separated from its underlying peat;

- the turves should be as large as possible to minimise desiccation during storage, though the practicalities of handling should be considered;
- contamination of excavated peat with substrate materials to be avoided at all times; and
- consider timing of excavation activities to avoid very wet weather and avoid multiple handling to minimise the likelihood of excavated peat losing structural integrity.

If possible, extract intact full depth acrotelm layers from the top surface of the peat deposit. This technique will maintain connectivity between the surface vegetation and the partially decomposed upper layers of the catotelm.

4.6.2 Storage

The following good practice applies to the storage of peaty soils/peat:

- stripped materials should be carefully separated to keep peat and other soils apart;
- to minimised handling and haulage distances, excavated material should be stored local to the site of excavation or end point of restoration;
- peat turves should be stored in wet conditions or irrigated in order to prevent desiccation (once dried, peat will not rewet);
- stockpiling of peat should be in large volumes to minimise exposure to wind and sun (and desiccation), but with due consideration for slope stability, but should not exceed 1 m in height to maintain stability of stockpile;
- stockpiles should be isolated from watercourses or drains with appropriate bunding to minimise pollution risks;
- excavated peat and topsoil stored separately, should be stored to a maximum of 1 m thickness;
- stores of non-turf (catotelm) peat should be bladed off to reduce the surface area and desiccation of the stored peat; and
- peat storage areas should be monitoring during periods of very wet weather, or during snowmelt, to identify early signs of peat instability.

4.6.3 Temporary Storage

Any peaty soils/peat to be removed during construction would require a temporary storage area near to the construction works/area of re-use. Where peat cannot be transferred immediately to an appropriate restoration area, short term storage will be required. In this case, the following good practice applies:

- peat should be stored around the turbine perimeter at sufficient distance from the cut face to prevent overburden induced failure;

- local gullies, diffuse drainage lines (or very wet ground) and locally steep slopes should be avoided for peat storage; and
- drying of stored peat should be avoided by irrigation or by seeding (although this is unlikely to be significant for peat materials stored less than 2 months).

For crane pads, borrow pits and compounds (with longer term storage requirements), the following good practice applies:

- peat generated from crane pad locations should be transported directly to its allocated restoration location, to minimise the volume being stockpiled with the possibility of drying out;
- stores of catotelmic peat should be bladed off to reduce their surface area and minimise desiccation;
- where transport cannot be undertaken immediately, stored peat should be irrigated to limit drying and stored on a geotextile mat to promote stability; and
- monitoring of large areas of peat storage during wet weather or snowmelt should be undertaken to identify any early signs of peat instability.

4.6.4 Transport

The following good practice applies to transport:

- movement of turves should be kept to a minimum once excavated, and therefore it is preferable to transport peat planned for translocation and reinstatement to its destination at the time of excavation; and
- if HGVs/dump trucks that are used for transporting non-peat material are also to be used for peat materials, measures should be taken to minimise cross-contamination of peat soils with other materials.

4.6.5 Handling

Following refinement of the site peat model, a detailed storage and handling plan should be prepared as a detailed PMP forming part of the detailed CEMP, including:

- best estimate excavation volume at each infrastructure location (including peat volumes split into area/volume of ‘acrotelm’ or ‘turf’, and volume of catotelm) which would be achieved by undertaking additional probing in line with current guidance following removal of trees post-consent;
- volume to be stored locally and volume to be transferred directly on excavation to restoration areas elsewhere (e.g. disused quarries, borrow pits or forest drains) in order to minimise handling;
- location and size of storage area relative to turbine foundation, crane hardstanding and natural peat morphology / drainage features; and
- irrigation requirements and methods to minimise desiccation of excavated peat during short term storage.

These parameters are best determined post-consent in light of detailed ground investigation with the micro-siting areas for each element of infrastructure.

4.7 Restoration

Restoration works shall be undertaken in accordance with Technical Appendix 6.6: Outline Biodiversity Enhancement Management Plan.

During restoration, the following best practice should be followed:

- carefully evaluate potential restoration sites, such as borrow pits for their suitability, and agree that these sites are appropriate with the ECoW, landowners and relevant consultees;
- undertake restoration and revegetation or reseeding work as soon as possible;
- where required, consider exclusion of livestock from areas of the Proposed Development undergoing restoration, to minimise impacts on revegetation; and
- as far as reasonably practicable, restoration should be carried out concurrently with construction rather than at its conclusion.

4.8 Drainage Measures

Drainage design for the Proposed Development is a critical mitigation measure in maintaining the hydrological conditions. In order to maintain hydrological conditions, the following requirements of the drainage measures should be met;

- development of drainage systems that would not create areas of concentrated flow or cause over, or under, saturation of peat habitats;
- development of robust drainage systems that would require minimal maintenance;
- a robust design of drainage systems and associated measures (i.e. silt traps, etc.) to minimise sedimentation into natural watercourses. Method statements should be prepared in advance to mitigate against a slide occurring and should include, but not be limited to, the use of check dams and erosion protection to limit flows and prevent contamination of watercourses; and
- measures shall be put in place to ensure drainage systems are well maintained, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction, e.g. inclusion of maintenance regimes for drainage systems into a construction management plan or similar.

4.9 Monitoring and Inspection

There would be frequent, routine and regular inspections of peat in all stockpiles and temporary storage areas as part of the PMP audit process. Inspections would assess in situ peat physical conditions, integrity of containment and temporary drainage conditions, and they would seek to confirm that stockpile design and management was adequate to prevent erosion and peat slide. These inspections would take place weekly during stockpile creation and storage.

Should any problems be observed during regular visual inspections of peat stockpiles, this would invoke implementation of an appropriate corrective action which would be recorded and monitored for effectiveness. Types of corrective actions would include, but would not necessarily be limited to; modification of temporary drainage, additional or modified bunding, incorporating of sediment fencing if required, light re-grading to correct any areas of surface erosion, etc.

Regular, frequent inspections of peat conditions during construction and restoration phases of work would be carried out by the Geotechnical Engineer and ECoW as follows:

- Peat Hazard Emergency Plan should be introduced to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators.
- Geotechnical Risk Register is developed and maintained by the appointed geotechnical engineer;

- peat surface, peat profile and peat consistency conditions would be carried out as part of ground investigations prior to the start of construction. This information would provide detailed information on the baseline conditions for each part of the infrastructure footprint;
- restored peat conditions would be inspected immediately after restoration to ensure that the methods detailed in the PMP had been correctly implemented and to inform any corrective actions should they be required; and
- the physical condition of peats would be retained as carefully as possible both at the peat storage and the peat restoration stages. This is particularly important for vegetation establishment.

5.0 Site Based Peat Excavation and Management Assessment

This Stage 1 outline PMP has been undertaken as part of the EIA Report for the Proposed Development to ensure that there is an understanding of the extent of peat within the Proposed Development, the total amount of peat that might be excavated, a demonstration that the current design avoids areas of deep peat where possible and that the reuse of the excavated materials is certain and minimised where possible, and in line with updated industry good practices and guidance.

Table C below provides and estimate of peat volumes to be excavated and re-used during the construction of the Proposed Development. The table also demonstrates the following:

- the avoidance of thicker peat areas where possible;
- re-use of the excavated materials is minimised where possible;
- and any excavation and re-use is undertaken in line with updated industry good practices and guidance; and
- limitations and consideration for future work.

Table C: Excavation Materials Management Plan

Method	Volume of Excavated Peat (m^3)	How much of this can be re-used on site (%)	Opportunity for Avoidance or Minimisation of Excavated Material	Re-use Requirements	Hierarchy Adherence	Limitations and Considerations
Access Track (Excavated) **Total length of the excavated tracks would be 8.8 km with an average peat depth of 0.52 m.**	**27,288 m^3**	**96%**	**The access track route has been subject to a number of design iterations to avoid deeper peat and steep slopes.**	**Verge restoration and visual screening, particularly along access track. Sections of the route may require cut and fill and these slopes would require restoration to minimise visual impact** **26,238 m^3 of excavated peat and peaty soil would be used along access tracks.**	**Avoidance was first level of screening to avoid areas of thicker peat. Routing has been planned on thinner peat or peaty soils where possible.** **The layout design has been guided by constraints which highlight ecological, hydrogeological and geomorphological - all of which identify the peat areas to avoid.**	**Requires detailed ground investigation to fully characterise peat.** **Detailed assessment may identify further lengths of floating access tracks, which would further reduce requirement for excavation.**
Turning Heads **6 No. have been proposed.**	**1,694 m^3**	**53%**	**Tracks have been subject to several design iterations, to avoid thick peat where possible.**	**Verge restoration around turning heads 900 m^3**	**Avoidance was first level of screening to avoid areas of thicker peat.**	**Requires detailed ground investigation to fully characterise peat.**
Turbine Foundations **10 No. turbines with average excavation of 28 m diameter and**	**2,708 m^3**	**30%**	**Turbine locations have been subject to a number of design iterations to avoid thicker**	**At turbine foundations topsoil would be stripped keeping top 200mm of turf intact. This would be stored**	**Avoided areas of thick peat for turbine bases where possible to minimise removal of excessive materials.**	**Requires detailed ground investigation to fully characterise peat.**

Method	Volume of Excavated Peat (m^3)	How much of this can be re-used on site (%)	Opportunity for Avoidance or Minimisation of Excavated Material	Re-use Requirements	Hierarchy Adherence	Limitations and Considerations
0.44 m thickness of peat.			peat and steep slopes.	adjacent to the base working area and would be limited to 0.5 m height. 800 m^3		
Hardstanding 10 No. with an average excavation area of 7800 m^2. 0.51 m thickness of peat at hardstanding locations.	39,780 m^3	12%	Hardstanding locations have been influenced by the turbine design iterations to avoid thicker peat and steep slopes.	At crane hardstandings topsoil would be stripped keeping top 200 mm of turf intact. This would be stored adjacent to the base working area and would be limited to 0.5 m height. 4,800 m^3	Avoided areas of thick peat for turbine bases to minimise removal of excessive materials. Orientation of crane hardstandings to be designed following detailed ground investigation, to avoid constraints and minimise requirement for peat excavation.	Requires detailed ground investigation to fully characterise peat.
Substation compound with an approximate area of 7,500 m^2 and 0.48 m thickness of peat.	1,575 m^3	22%	The proposed substation compound would largely be located on peaty/glacial soils adjacent to the proposed access tracks.	Materials would be re-used on site to reinstate working areas and for appropriate landscaping. 350 m^3	Avoided siting substation on thick peat areas where possible.	Requires detailed ground investigation to fully characterise ground conditions.
Main Construction Compound with	1,800 m^3	100%	The proposed construction compound would	Materials would be re-used on site to reinstate working	Avoided siting Construction Compound	Requires detailed ground investigation to fully

Method	Volume of Excavated Peat (m^3)	How much of this can be re-used on site (%)	Opportunity for Avoidance or Minimisation of Excavated Material	Re-use Requirements	Hierarchy Adherence	Limitations and Considerations
an approximate area of 100 m x 100 m and 0.18 m thickness of peat.			largely be located on peaty/glacial soils adjacent to the proposed access tracks.	areas and for appropriate landscaping. 5,000 m^3	on thick peat areas where possible.	characterise ground conditions.
Satellite Construction Compound North with an approximate area of 30 m x 30 m and 0.54 m thickness of peat.	486 m^3	93%	The proposed construction compound would largely be located on peaty/glacial soils adjacent to the proposed access tracks.	Materials would be re-used on site to reinstate working areas and for appropriate landscaping. 450 m^3	Avoided siting Construction Compound on thick peat areas where possible.	Requires detailed ground investigation to fully characterise ground conditions.
Satellite Construction Compound South with an approximate area of 30 m x 30 m with no peat encountered.	0 m^3	0%	-	-	-	No peat encountered.
Borrow Pits There are 3 No. borrow pit options, generally with	Borrow Pit 1: 2,448 m^3 Borrow Pit 2: 2,000 m^3 Borrow Pit 3: 1,296 m^3	100%	There is limited peaty soils/peat overlying the selected borrow pits.	Limited peaty topsoil can be stockpiled and used for restoration. Peat/peaty soils from elsewhere on-site could be used to restore the proposed	Site selection avoided areas of peat for borrow pits, identified sites on bedrock or close to minimise removal of excessive materials.	Current calculations are based on conservative re-use and based on the use of all three borrow pits. Detailed ground investigation is required to

Method	Volume of Excavated Peat (m^3)	How much of this can be re-used on site (%)	Opportunity for Avoidance or Minimisation of Excavated Material	Re-use Requirements	Hierarchy Adherence	Limitations and Considerations
limited peat cover.				**borrow pits with the following volumes:** **Borrow Pit 1: 14,400m^3** **Borrow Pit 2: 16,000m^3** **Borrow Pit 3: 14,400m**		**assess the ground conditions at each site.**
Total Excavated	**81,075 m^3**		**Total Re-use**	**83,338 m^3**		

6.0 Peat Excavation Considerations

This section of the stage 1 outline PMP includes the method for dealing with peat which could potentially be classified as waste (only if the above volumes estimate significant quantities of catotelmic peat, which cannot be re-used).

Table D outlines where those materials that are likely to be generated on-site, fall within the Waste Management Licensing (Scotland) Regulations 2011.

Based on the results presented in Table D, it has been concluded that all of the materials to be excavated on-site would fall within the non-waste classification as most of the topsoil and peaty soils would be re-used on-site. Based on a detailed probing exercise and visual inspection of the peat, it is predominantly fibrous peat which would be suitable to be re-used on-site. Typically the peat was found to be fibrous and fairly dry within the top metre before becoming slightly more pseudo-fibrous with depth.

The majority of the excavated peat is therefore entirely re-useable as it is predominantly fibrous and easily re-used on-site. Areas of deep peat have been avoided by design, where possible.

Table D: Excavated Materials – Assessment of Suitability

Excavated Material	Indicative Volume on Site by % of total excavated soils	Is there a suitable use for material	Is the Material required for use on Site	Material Classified as Waste	Re-use Potential	Re-use on Site
Mineral Soil	25	Yes	Yes	Not classified as waste	Yes	Will be re-used in reinstatement of floated access track verges, cut and fill verges, road verges, side slopes and check drains. Peripheral embankments of turbine bases, crane hardstandings and restoration of borrow pits.
Turf (Surface layer of vegetation and fibrous matt)	35	Yes	Yes	Not classified as waste	Yes	
Acrotelmic peat	35	Yes	Yes	Not classified as waste	Yes	Will be re-used in reinstatement of floated access track verges, cut and fill verges, road verges, side slopes and check drains. Peripheral embankments of turbine bases, crane hardstandings and restoration of borrow pits.
Catotelmic Peat (amorphous material unable to stand unsupported when stockpiled >1m)	5 Very limited as it has been avoided by design.	Potentially	Potentially *	Potentially if not required as justifiable restoration of habitat management works	Limited	If peat does not require treatment prior to re-use it can be used on-site providing adequate justification and method statements are provided and approved by SEPA. If it is unsuitable for use without treatment then it may be regarded as a waste. However every attempt to avoid this type of peat has been incorporated into the design.

*Such uses for this type of material are limited, however there may be justification for use in the base of borrow pits to maintain waterlogged conditions and prevent desiccation of restored area and in some habitat management works such as gully or ditch blocking (subject to review by a suitably qualified engineer) where saturated peat is required to mimic mire type habitats and encourage establishment of sphagnum. Further details are available within Technical Appendix 6.6 OBEMP.

7.0 Summary

This Stage 1 outline PMP presents a pre-construction assessment of the expected peat extraction and reuse volumes associated with the works phase of the construction of the Proposed Development.

Through a process of continued design refinement (focused on minimising peat excavation volumes) and adoption of best practice working method, the development is expected to achieve an overall peat balance, i.e. the volume (and character) of excavated peat compliments requirements for re-use and reinstatement. Thus, all excavated material will be required for reuse as part of the works and no surplus peat is anticipated. Further details on enhancement are available within Technical Appendix 6.6 OBEMP.

The figures detailed within this report are to be considered indicative at this stage. The total peat volumes are based on a series of assumptions for the layout of the proposed development and peat depth data averaged across discrete areas of the Proposed Development. Such parameters can still vary over small scale areas and therefore topographic changes in the bedrock profile could impact the total accuracy of the volume calculations. The accuracy of these predictions would be improved and updated with the results of further detailed peat probing data, to be carried out during refinement in accordance with 2017 guidelines, as part of detailed ground investigation to be undertaken post-consent. Post-consent, the Stage 1 PMP and the CEMP would be updated with information obtained during detailed ground investigations and design stage.

These plans would be developed to update the CEMP, with post-construction restoration plans. This would be reviewed and monitored along with the updated PMP and CEMP to ensure compliance with method statements and to keep track of volumes.

The Proposed Development supports peat of moderately decomposed peat with a very distinct plant structure that is considered suitable for re-use during reinstatement work, e.g. dressing of infrastructure edges, restoration and borrow pit restoration. Good practice standards, which will be outlined in the CEMP, relating to excavation, handling and storage of peat, shall ensure against any compromise to the structural integrity of the peat and its associated suitability for reuse.

Avoidance of localised pockets of deep peat that would otherwise require excavation will continue to be a key design refinement objective. Furthermore, it is expected that such micro-siting onto land supporting shallower peat deposits shall be possible during the works.

Figures

Technical Appendix 8.2: Peat Management Plan

Vale of Leven Wind Farm

Vale of Leven Wind Farm Ltd

SLR Project No.: 405.13034.00001

27 September 2023

236000 238000 240000 242000 244000 246000 248000

684000 682000 680000 678000 676000

13034.00001.0033.0 Site Location

LEGEND

Application Boundary

N

VALE OF LEVEN WIND FARM

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VALE OF LEVEN WIND FARM

PEAT MANAGEMENT PLAN (PMP)

SITE LOCATION

FIGURE 8.2.1

Scale 1:40,000 @ A3

Date JUNE 2023

0 1 2 Kilometres

240000 241000 242000 243000 244000

681000 680000 679000 678000

LEGEND

- Application Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Crane Pad
- Proposed Substation
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed LiDAR Unit Location

N

T01 T02 T03 T04 T05 T06 T07 T08 T09 T10

Knockshannoch

Nobleston Wood

Auchenreoch Glen

Murroch Glen

WEST DUNBARTONSHIRE

Meikle White Hill 353

Little White Hill

Black Craig

Doughnot 374 (375)

Kilometres 0 0.5 1

VALE OF LEVEN WIND FARM

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VALE OF LEVEN WIND FARM

PEAT MANAGEMENT PLAN (PMP)

SITE LAYOUT

FIGURE 8.2.2

Scale 1:15,000 @ A3

Date JUNE 2023

13034.00001.0034.0 Site Layout

242000 243000 244000 245000

681000 680000 679000

Muir
Finland Burn
Lang Dyke
Cairn
Hill of
Standing Stones
Cairn
(remains of)
Pappert Hill
Pappert Hill
Well
257
Gallangad Burn
Quarry
(dis)
Ford
Knocksharoch
Waterfall
Grouse Butts
Hazel Glen
Auchenreoch Moir
Auchenreoch
Donachy
Spouts Burn
Meikle White Hill
353
WEST DUNBARTONSHIRE
42
44
45
262
220
230
240
250
210

T01 T02 T03 T04 T05 T06 T07 T08 T09 T10

N

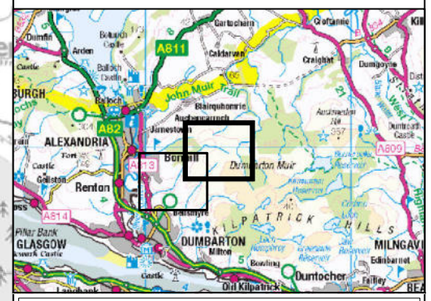
0 0.5 1
Kilometres

LEGEND

- Application Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Crane Pad
- Proposed Substation
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed LiDAR Unit Location
- Phase I Peat Probe Location
- Phase II Peat Probe Location
- Phase III Peat Probe Location
- Phase IIII Peat Probe Location

Peat Depth (m)

- 0
- 0 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- > 3



VALE OF LEVEN WIND FARM

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VALE OF LEVEN WIND FARM

PEAT MANAGEMENT PLAN (PMP)

PEAT DEPTH

FIGURE 8.2.3.1

Scale	Date
1:10,000 @ A3	JUNE 2023

13034.00001.0035.0 Peat Depth

240000 241000 242000 243000

679000 678000

LEGEND

- Application Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Crane Pad
- Proposed Substation
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed LiDAR Unit Location
- Phase I Peat Probe Location
- Phase II Peat Probe Location
- Phase III Peat Probe Location
- Phase IIII Peat Probe Location

Peat Depth (m)

- 0
- 0 - 0.5
- 0.5 - 1
- 1 - 1.5

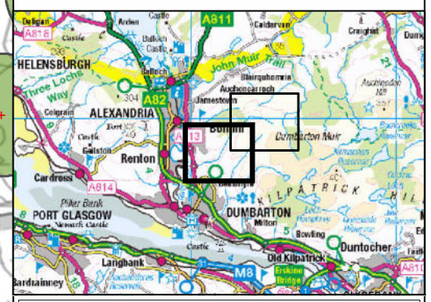
N

T08

Quarry (dis) O'hare Pappert Bonhill Liby PO FB Falls Schs FBs Braehead Redburn Waterfalls Waterfall Hazel Glen Highdykes Glendonachy Auchenreoch Beech Wood Mains Broomhill Wood Murroch Glen Auchenreoch Glen Waterfall Waterfall Waterfall Waterfall Murroch Ford Wood Waterfall Black Wood Garshake Burn Overtoun Burn School Maryland Barr Wood

0 0.5 1

Kilometres



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VALE OF LEVEN WIND FARM

PEAT MANAGEMENT PLAN (PMP)

PEAT DEPTH

FIGURE 8.2.3.2

Scale	Date
1:10,000 @ A3	JUNE 2023

13034.00001.0035.0 Peat Depth

Annex A Excavated Materials Calculations

Technical Appendix 8.2: Peat Management Plan

Vale of Leven Wind Farm

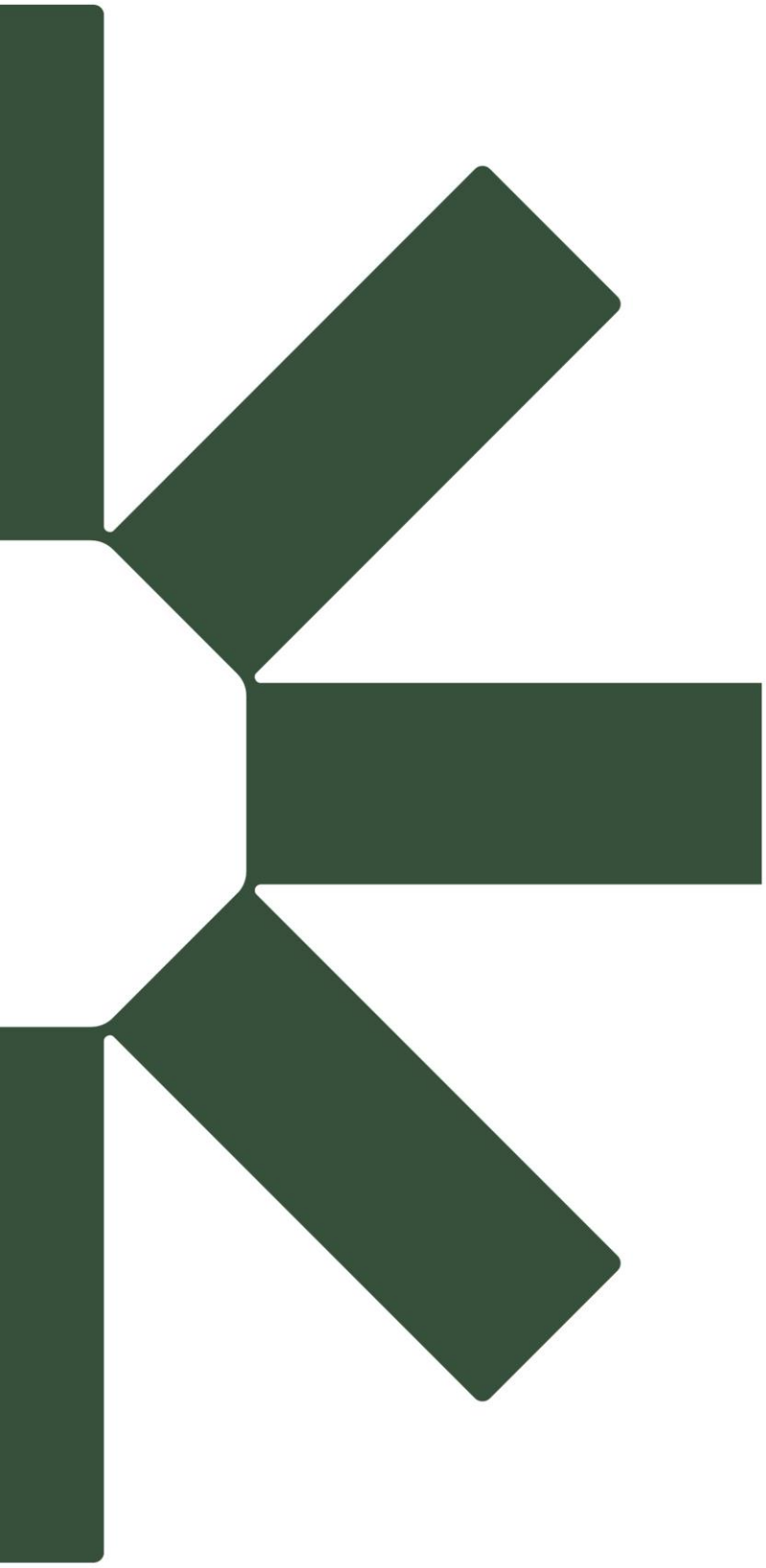
Vale of Leven Wind Farm Ltd

SLR Project No.: 405.13034.00001

27 September 2023

Infrastructure	Length (m)	Width (m)	Area (m^2)	Average Depth (m)	Number	Total Volume Excavated (m^3)	Length (m)	Width (m)	Area (m^2)	Average Depth (m)	Number	Total Re-use Volume (m^3)
Site Track (Excavated)	8746	6	52476	0.52	1	27288	8746	1.5	13119	1.00	2	26238
Turning Heads	-	-	543	0.52	6	1694	100	1.5	150	1.00	6	900
Turbine Bases - formation only	-	-	615	0.44	10	2708	80	2	160	0.50	10	800
Hardstandings	-	-	7800	0.51	10	39780	480	2	960	0.50	10	4800
Substation	100	75	7500	0.21	1	1575	350	2	700	0.50	1	350
Main Construction Compound	100	100	10000	0.18	1	1800	100	100	10000	0.50	1	5000
Satellite Construction Compound North	30	30	900	0.54	1	486	30	30	900	0.50	1	450
Satellite Construction Compound South	17	18	306	0.00	1	0	17	18	306	0.00	1	0
Borrow Pit 1	-	-	7200	0.34	1	2448	-	-	7200	2.00	1	14400
Borrow Pit 2	-	-	8000	0.25	1	2000	-	-	8000	2.00	1	16000
Borrow Pit 3	-	-	7200	0.18	1	1296	-	-	7200	2.00	1	14400

Total Excavated Volume (m^3)	**81075**
Total Re-use Volume (m^3)	**83338**
Net Balance (m^3)	**-2263**



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