TECHNICAL APPENDIX 10.2: PEAT MANAGEMENT PLAN

Kirkton Energy Park

Prepared for: Kirkton Wind Farm Ltd

SLR Ref: 428.11143.00001
Version No: v1
November 2022

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1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by Wind2 Ltd on behalf of Kirkton Wind Farm Ltd (the applicant) to undertake a Peat Management Plan (PMP) for the proposed Kirkton Wind Farm (the proposed development). The site location is detailed in **Figure 10.2.1**.

The applicant is currently seeking section 36 consent and deemed planning permission for an energy park comprising 11 No. wind turbines, battery storage and associated infrastructure. It is this proposed development that has been analysed onsite and assessed within this report.

The proposed development site is located approximately 2.1km south of Melvich Village in the county of Sutherland in northern Scotland and is centred at National Grid Reference (NGR) NC 87999, 59788. The application boundary occupies an area of approximately 419.38ha (including the two potential abnormal load turning areas), although only a small proportion of this would be occupied by new infrastructure associated with the proposed development.

The proposed development would comprise 11 No. turbines along with associated infrastructure arranged as illustrated on **Figure 10.2.2**. The proposed development would include the following key components:

- 11 wind turbines with internal transformers with bladed heights of up to 149.9m;
- Associated turbine foundations and hardstanding areas;
- A total of approximately 7.52km of onsite tracks with associated water crossings, passing place and turning heads;
- Search areas for up to two borrow pits;
- One onsite substation compound, which will incorporate up to 20MW of battery storage;
- One temporary site construction compound;
- A network of onsite buried electrical cables; and
- Associated ancillary works.

For a full description of the proposed development, please refer to **Chapter 3: Description of Development** (EIAR Volume 2: Main Report).

1.1 Scope of Assessment

A comprehensive programme of soils and peat probing has been completed at the site as detailed within **Technical Appendix 10.1: Peat Landslide Hazard and Risk Assessment** (PLHRA). This report 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 at the site. Areas of the site where soils are less than 0.5m thick are considered to be too thin to be classified as peat and are therefore classified as soils.

Figure 10.2.3 and **Figure 10.2.4** show the areas of the site where soils/peat in excess of 0.5m have been identified. Areas within the site that are not impacted by proposed development infrastructure or which have been proven to have soil depths of < 0.5m are not within the scope of the PMP.

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

1.2 Methodology

Scottish Planning Policy states that *"Where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be release of CO_2 to the atmosphere. Developments should aim to minimise this release."*

The stage 1 PMP considers the excavation of peat and soil across the site as a result of construction of the Proposed development. It considers the potential for minimising excavation and disturbance in order to reduce any unnecessary surplus of soils and peat.

SEPA has provided a hierarchy of management approaches through which the effectiveness of the approach to peat management is optimised at development sites, as summarised below (SEPA 2017[1], Scottish Government, SNH and SEPA[2] SR and SEPA 2012[3]):

The objectives have been achieved by completion of the following:

- **Prevent Creation of Waste Peat –** 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 on-site or off-site for peatland restoration –** use of peat produced on-site in restoration or landscaping, providing that its use is fully justified and suitable;
- **Recycling/Recovery/Treatment –** modify peat produced on site for agricultural benefit; 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 2m 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, create an unnatural habitat or a safety risk.

In line with the guidance detailed above, a final PMP would be prepared post-consent, in advance of construction and would be informed by detailed peat probing around infrastructure locations (following tree removal) and by detailed ground investigation.

This report presents site-specific data and proposals to address the requirements of SEPA's guidance and proposes that **prevention** and **re-use** are the most appropriate means of managing peat excavated during construction at this site.

This report details the methodologies required to assess all potential surplus materials and presents preliminary estimates of the expected volume of excavated materials and required re-use volumes for reinstatement and restoration purposes.

In particular, this report considers the construction of access tracks, site compounds, turbine foundations and all other associated infrastructure which would result in the excavation of peat and sub-soils potentially resulting in surplus materials.

Many of the issues associated with peat on a wind farm site can be accommodated by modifying the development layout to avoid potentially difficult or sensitive areas. Such areas would include:

- areas of deep peat, requiring potentially large volumes of excavation;
- areas of very wet peat (such as flushes, pool and hummock complexes and gullied peatland);
- areas of moderate to steep slopes (where site infrastructure might increase the chance of peat instability); and
- areas of sensitive habitat.

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[1] SEPA (May 2017)., *SEPA Regulatory Position Statement – Developments on Peat and Off-site Uses of Waste Peat*) SEPA Guidance, WST-G-052. Version 1.

[2] Scottish Government, SNH, SEPA (2017)., *Peatland Survey. Guidance on Developments on Peatland*, on-line version only.

[3] Scottish Renewables, Scottish Environmental Protection Agency (2012) *Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste*, Version 1.

This report estimates the extent of materials generated during the construction phase and identifies potential areas where peat can be re-used through the following:

- the avoidance of creating surplus materials; and
- re-use of materials on site.

1.3 Legislation, Guidance and Good Practice

Legislation relevant to the management of peat includes the following:

- The Climate Change Act 2008;
- Environmental Protection Act 1990 (as amended);
- Landfill (Scotland) Regulations 2003 (as amended); and
- The Waste Management Licensing (Scotland) Regulations 2011.

There are a number of guidance documents appropriate to the activities planned on site which have been used to guide this assessment, including as follows:

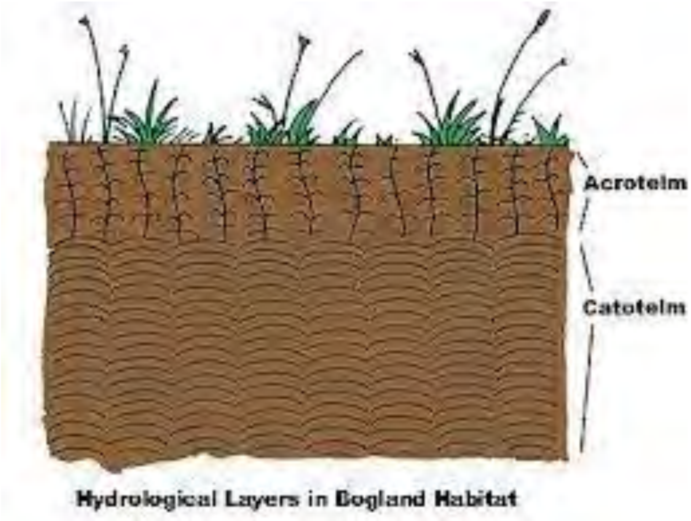
- Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only, Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (SR, SEPA);
- SEPA Regulatory Position Statement – Developments on Peat (SEPA, February 2010);
- Good practice during wind farm construction (SR, SNH, SEPA, FCS, HES, Marine Scotland Science, 4th Edition 2019);
- Floating roads on peat (SNH, FCS; August 2010);
- Constructed tracks in the Scottish Uplands (SNH, September 2015); and
- Restoration techniques using peat spoil from construction works (SEPA 2011).

1.4 Definitions of Peat

Peat is defined as a sedimentary material consisting of the partially decomposed remains of plant material and organic matter preserved over a period of time in a waterlogged environment resulting in anaerobic conditions, and is considered to be 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** and described in the following paragraphs.

Plate 1-1: Hydrological Layers in Bogland Habitat



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 Occurrence of Peat

2.1 Peat Conditions

Peat depth surveys have been undertaken across two phases by SLR. Phase one peat probing was conducted in September 2020 and resulted in the whole site undergoing probing on a 100m grid to allow for initial assessment of the site which was used in preliminary site layout designs. Further phase one peat probing was carried out on Upper Bighouse land, in May 2021, in order to assess the expanded site area. Phase two probing was conducted in January 2022 which saw detailed probing undertaken across the proposed layout, focussing on access tracks, turbine locations and other site infrastructure.

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

Thin peat was classed as being 0.5m to 1.5m thick, with deposits in excess of this being classed as thick peat. The thickness ranges used were intended to reflect the probability of instability associated with both peat slides (in thin peat) and bog slides. Where the probing recorded less than 0.5m thick, this has been considered to be an organic/peaty soil rather than peat.

The results of the probing survey are detailed within **Figure 10.2.3** and **Figure 10.2.4** with a summary of peat depths included within **Table 2-1** below.

Table 2-1: Peat Probe Data

Peat Thickness (m)	No. of Probes	Percentage (%) (of total probes undertaken on-site)
0	31	1.8
0-0.49	960	54.7
0.5-0.99	401	22.8
1.00-1.49	130	7.4
1.50-1.99	115	6.6
2-2.49	32	1.8
2.5-2.99	52	3.0
3-3.49	16	0.9
3.49-3.99	15	0.9
4+	3	0.17

In summary the peat depth probing has shown that:

- the peat was found to vary across the site in terms of thickness, surface slopes and apparent characteristics;
- peat thickness varies from 0m to 5.2m in the site; and
- probing identified hummocky glacial deposits across many of the slopes across the site, with bedrock identified at or near surface on many of the steeper slopes.

The probing surveys and sampling undertaken by SLR identified the following profiles within the peat:

- Soft to firm from surface to base of peat;
- Relatively firmer, vegetative root system at surface to approximately 0.5m, underlain by slightly softer, partially waterlogged peat to base; and
- Vegetation still present to base of peat and clearly identifiable.

Based on field descriptions, most of the shallow peat would be classified as between H_3 and H_4 in the von Post classification[4], showing slight decomposition with some amorphous material. The deeper peat generally in excess of 1.5m is more decomposed and would be in the range of H_5 to H_7.

Where possible, the deeper areas of peat have been avoided. Where peat (>0.5m) could not be avoided, floated tracks have been proposed to limit the excavation of peat, where possible. **Figure 3.6: Indicative Track Detail** (EIAR Volume 3) provides details of proposed access tracks. **Table 2-2** below shows the peat thickness at each proposed turbine location.

Table 2-2: Ground Conditions at Proposed Turbine Locations

Turbine No.	Peat Thickness (m)	Peat Conditions	Slope (°)
T1	0.8	Thin Peat	7.8
T2	0.6	Thin Peat	6.0
T3	0.8	Thin Peat	5.1
T4	0.4	Peaty Soil	5.8
T5	0.1	Peaty Soil	7.3
T6	1.0	Thin Peat	6.5
T7	0.7	Thin Peat	2.7
T8	0.9	Thin Peat	1.5
T9	0.3	Peaty Soil	3.2
T10	0.1	Peaty Soil	3.7
T11	0.3	Peaty Soil	3.6

[4] von Post, L. and Grunland, E., (1926), '*Sodra Sveriges torvillganger 1*' Sverges Geol. Unders. Avh., C335, 1-127.

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 development site. 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 development site.

3.3 Construction Compound

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.

Due to their temporary nature, peat excavated for compounds would normally be stored and reinstated, and therefore re-use is required.

3.4 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. Peat is not anticipated at any of the proposed borrow pit options for the Proposed development.

For further information on proposed borrow pits, refer to **Technical Appendix 10.3: Borrow Pit Appraisal**.

3.5 Access Tracks

Access tracks are required to enable passage of construction and servicing traffic around the site. 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 peats overlain by floating tracks (with no excavation).

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

No excavations are undertaken for floating tracks, and therefore there is no associated peat excavation.

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 (including along the verges of floated track sections) and hardstandings for landscaping and restoration purposes.

Both types of access track have the potential to disrupt natural hydrological drainage pathways, appropriate drainage would be designed to mitigate this. For further information, see **Technical Appendix 3.1: Outline CEMP**.

3.6 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 section outlines briefly the likely mitigation required to minimise impact, based on the re-use of peat specific to key elements of the proposed development.

Peat stability is assessed in a site specific Peat Landslide and Hazard Risk Assessment (**Technical Appendix 10.1**) and the control and management of the drainage is presented in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils** (refer to EIAR Volume 2).

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 turbine locations for the proposed development are located on thin peat, with five turbines located on peaty soils. The average peat depth is approximately 0.5m, ranging from 0.1m to 1m.

4.2 Crane 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.

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

- peat stripped from compound and hard standing areas would not be stored higher than 1m 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.

4.3 Borrow Pits

Peat could 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 site and presents no residual risks from pollution of the environment or harm to human health (SEPA, 2017[1]).

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[5,6] available to support access track design in peatlands. Guidance is generally focused on floating tracks and excavated tracks and is summarised below.

4.4.1 Floating Access Tracks

Over deeper peat (typically >1.0m), floating tracks are used to remove the requirement for peat excavation and limit disruption of hydrological pathways. The success of construction requires careful planning to take account of the unique characteristics of peat soils. Specific guidance[5] is available on design, the duration and timing of construction, the sequence of construction and the re-use of peat on the shoulders of the floating access track. Floated tracks will be utilised where possible when consistent peat depths of greater than 1-1.5m are identified along with shallow topography in the area (generally below 5%) and the section is long enough to make floating track appropriate.

Design of Floating Access Tracks

The following issues should be considered during detailed design of floating access tracks:

- adopting conservative values for peat geotechnical properties during detailed design (post-consent);
- applying a maximum depth rule whereby an individual layer of geogrid and aggregate should not normally exceed 450mm without another layer of geogrid being added;
- on gently sloping ground and where the access track runs transverse to the prevailing slope, accommodating natural hydrological pathways such as flushes and peat pipes through installation of a permanent conduit within or underneath the track and allowing for as much diffuse discharge (while minimising disturbance to existing peatland) on the downslope as possible;
- ensuring transitions between floating tracks and excavated tracks (or other forms of track not subject to long term settlement) are staged in order to minimise likelihood of track failure at the boundary between construction types;
- scheduling access track construction to accommodate for, and reduce peat settlement characteristics; and
- re-use of existing roads (with upgrading if required), where possible.

Duration and Timing of Construction of Floating Access Tracks

The critical factor in successful construction of floating access tracks is the timescale of construction, and the following good practice guidance is provided:

- the settlement characteristics of peat; should be accommodated by appropriate scheduling of access track construction, as follows:
  - prior to construction works, the setting out the centreline of the proposed access track to identify any ground instability concerns or particularly wet zones;
  - identifying 'stop' rules, i.e. weather dependent criteria for cessation of access track construction based on local meteorological data; and
  - maximising the interval between material deliveries over newly constructed access tracks that are still observed to be within the primary consolidation phase.

[5] 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.

[6] Scottish Natural Heritage, Forestry Commission (August 2010)., *Floating Roads on Peat*

Sequence of Construction

The sequence of construction is normally stipulated in guidance provided by the supplier of the geotextile or geogrid layer, and suppliers are often involved in the detailed access track design. Good practice in relation to the sequence of access track construction is as follows:

- retaining rather than stripping the vegetation layer (i.e. the acrotelm, providing tensile strength), and laying the first geotextile/geogrid directly on the peat surface;
- adding the first rock layer;
- adding the second geotextile/geogrid, and add overlying graded rock fill as a running surface;
- heavy plant and Heavy Goods Vehicles (HGV) using the access tracks during the construction period should be trafficked slowly in the centre of the track to minimise dynamic loading from cornering, breaking and accelerating;
- ensuring wheel loads should remain at least 0.5m from the edge of the geogrid, markers should be laid out, monitored and maintained on the access track surface to clearly emphasise these boundaries; and
- ongoing 'toolbox' talks and subsequent feedback to construction and maintenance workers and drivers to emphasise the importance of the implementing the above measures.

Use of Peat as Trackside Shoulders

A key opportunity to re-use peat is to employ it in landscaping of constructed access tracks. Wedge-shaped reinstatement at the margins of a floating access track (which is elevated above the peat surface) is termed shoulders, and good practice guidance is as follows:

- re-using peat excavated from elsewhere on site as shoulders adjacent to the floating track;
- peat shoulders should taper from just below the track sides (thereby preventing over high shoulders from causing ponding on the track surface) to join the surrounding peat surface, keeping as natural a profile as possible to tie in with existing slope profiles;
- limiting the width of peat shoulders to avoid unnecessary smothering of intact vegetation adjacent to the floating track;
- peat must not be laid too thinly (minimum 0.5m) to avoid drying out;
- peat must not be compressed during reinstatement to prevent cracking; and
- where possible these should be capped with turves or seeded as quickly as possible to prevent run off erosion and should not be left bare for excessive periods.

4.4.2 Excavated Access Tracks

Excavated tracks require complete excavation of soil/peat to a competent substrate. Excavated tracks would generally be undertaken where peat depths are less than 0.5m. This peat/soil would require storage ahead of re-use elsewhere on site. Good practice guidance[1] 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 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.

As with floating tracks, regular routine monitoring should be scheduled post-construction to ensure that hydrological pathways and track integrity have been suitably maintained.

4.5 Cable Trenches

Cable trenches either require peat excavation specifically for this purpose, or they could be constructed within landscaping of shoulders adjacent to floating tracks. Guidance[5] 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 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 would 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 1m 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 an issue for peat materials stored less than two 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 would be provided as part of the detailed PMP and should be prepared, including:

- best estimate excavation volume at each infrastructure location (including peat volumes split into area/volume of ‘acrotelm’ or ‘turf’, and volume of catotelm).

- 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

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 site 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.

5.0 Site Based Peat Excavation and Management Assessment

This Stage 1 PMP has been undertaken as part of the Environmental Impact Assessment Report for the proposed development to ensure that there is an understanding of the extent of peat on site, the total indicative 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.

The proposed development comprises 11 wind turbines and associated crane hardstandings, a single access point for construction traffic, two abnormal load turning areas, onsite access tracks of both floating and cut construction (including upgrade to existing tracks), a temporary construction compound, permanent substation with battery storage, and operations building and underground cabling.

Based on the results presented in **Table 5-1**, primarily generated from Appendix 01: the Excavated Materials Calculator, the calculated excavated materials which is primarily peat or peaty soils are outlined and summarised in **Table 5-1**.

5.1 Peat Survey

5.1.1 Probing

Probing has been undertaken by SLR over two phases to an approximate 100m grid, with a second more detailed phase. The results have been used to produce a peat isopach map (**Figure 10.2.3**). A total of 1,755 probe locations were undertaken in areas of identified peaty soil/peat to determine the thickness thereof; and the overall conclusion regarding peat stability is that there is a low risk of peat instability over most of the site, although some limited areas of medium risk have been identified.

The layout has been carefully designed to minimise excavating or disturbing thick peat, where possible, and where this cannot be avoided, mitigated by the use of floating roads.

Table 5-1: Excavation Materials Management Plan

Method	Estimated Volume of Excavated Material (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
Excavated Access Track Total Length of the new cut access tracks on site would be 5.0km. The excavated tracks would be located on an average peat depth of 0.37m.	9,317m^3 (5,036m x 5m x 0.37m))	81%	The access track route has been subject to a number of design iterations to avoid deeper peat and steep slopes. Where possible track width would be minimised.	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. 7,554 m^3 (5,036m x 3m x 0.5m) 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.
Floating Access Track It is anticipated that 0.5km of floating tracks would be required, which would generate no surplus peat.	Not applicable	Not applicable	No excavated material except where cable trenches are proposed (see below).	Verge restoration along access tracks ~ 3,051m^3 (2,034m x 3m x 0.5m)	Looked at different cut off depths for floating access track. Based on >1m depth.	Verge restoration must avoid impacting existing unexcavated peat.

Method	Estimated Volume of Excavated Material (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
Existing / Upgraded Access Track It is anticipated that 2km of existing tracks on-site would be upgraded.	203m^3 (2,034m x 1m x 0.1m)	100%	Existing tracks have been utilised where possible to minimise the disturbance of the peat.	Verge restoration along access tracks 1,073m^3 (447m x 3m x 0.8m)	Avoidance was first level of screening to avoid areas of thicker peat. Routing has been planned to utilise existing tracks.	Requires detailed ground investigation to fully characterise peat and conditions of existing track.
Passing Places It is anticipated that 3 No. passing places are required along the access tracks.	338m^3 (70m x 5m x 0.41m) x 3	100%	Tracks have been subject to several design iterations, to avoid thick peat where possible.	Verge restoration along access tracks ~ 384m^3 (80m x 2m x 0.8m) x 3	Avoidance was first level of screening to avoid areas of thicker peat.	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.
Turbine Bases – formation only 11 No. turbines With average excavation of 25m diameter x 0.53m (average thickness of peat at turbines).	4,686m^3 (32m x 32m x 0.53m) x 11	45%	Turbine locations have been subject to a number of design iterations to avoid thicker peat and steep slopes. Average thickness of peat at turbine sites is ~0.53 m	At turbine foundations topsoil would be stripped keeping top 200mm of turf intact. This would be stored adjacent to the base working area and would be limited to 1m height. 2,112m^3 (96m x 2m x 1m) x 11	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	Estimated Volume of Excavated Material (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
Crane Hardstandings 11 No. crane hardstandings. With average excavation of 75m x 15m x 0.49m with additional areas for cranes and blades.	4,760m^3 (75 x 15 x 0.49) x 11	92%	Crane hardstanding locations have been influenced by the turbine design iterations to avoid thicker peat and steep slopes. Average thickness of peat at crane hardstanding sites is ~0.49 m.	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 1m height. 4,400m^3(200m x 2 x 1) x 11 could be re-used to dress the edges of the hardstanding area.	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.
Blade Laydown and ancillaries	1,798m^3 (85m x 5 x 0.49) x 11	100%	Crane hardstanding locations and adjacent temporary laydown areas have been influenced by the turbine design iterations to avoid thicker peat and steep slopes.	2,090m^3 (95m x 2m x 1m) x 11 could be re-used on site to reinstate working areas and for appropriate landscaping.	Avoided areas of thick peat for turbine bases to minimise removal of excessive materials.	Requires detailed ground investigation to fully characterise peat.

Method	Estimated Volume of Excavated Material (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
					Orientation of crane hardstandings to be designed following detailed ground investigation, to avoid constraints and minimise requirement for peat excavation.	
Turning Heads 1	209m^3 (120m x 6m x 0.37m) x1	100%	Tracks have been subject to several design iterations, to avoid thick peat where possible.	Verge restoration along access tracks 394m^3 (246m x 2m x 0.8m)	Avoidance was first level of screening to avoid areas of thicker peat.	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 2	418m^3 (60m x 6m x 0.37m) x4	100%	Tracks have been subject to several design iterations, to avoid thick peat where possible.	Verge restoration along access tracks 806m^3 (126m x 2m x 0.8m) x4	Avoidance was first level of screening to avoid areas of thicker peat.	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.

Method	Estimated Volume of Excavated Material (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
Substation, Control Building and Battery Compound	1,125m^3 (100m x 75m x 0.15m)	50%	The proposed substation location 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. 560m^3 (350m x 2m x 0.8m)	Avoided siting substation on thick peat areas where possible.	Requires detailed ground investigation to fully characterise ground conditions.
Temporary Construction Compound	668m^3 (125m x 50m x 0.11m)	100%	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. 688m^3 (125m x 50m x 0.11m)	Avoided siting Temporary Construction Compound on thick peat areas where possible.	Requires detailed ground investigation to fully characterise ground conditions.
Borrow Pits There are 2 No. borrow pit options, generally with limited peat cover.	Borrow Pit 2 (South) 11,322m^3 (170m x 111m x 0.6m) Borrow Pit 1 (North): 9,620m^3 (110m x 165m x 0.53m)	Not applicable	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 borrow pits with the following volumes: Borrow Pit North: 11,322m^3 (170m x 111m x 0.6m) Borrow Pit South: 10,890m^3	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 seven borrow pits. Detailed ground investigation is required to assess the ground conditions at each site.

Method	Estimated Volume of Excavated Material (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
				(110m x 165m x 0.5m)		
Total Excavated	42,658m^3		Total Re-use	43,046m^3		

Based on the values indicated, there is a balance of materials with no surplus peat anticipated to be generated on site – See Appendix 01.

Should further ground investigation information become available, the figures would need to be re-calculated, the figures in the table are indicative only.

6.0 Peat Excavation Considerations

This section of the stage 1 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 6-1 below outlines where those materials that are likely to be generated on-site, they fall within the Waste Management Licensing (Scotland) Regulations 2011.

Based on the results presented in **Table 6-1**, 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 – pseudofibrous 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 more amorphous with depth.

The majority of the excavated peat is therefore entirely re-useable as it is predominantly fibrous and easily re-used onsite. Areas of deep peat have been avoided by design, where possible, and by utilising floated roads on areas of peat (> 0.5m), where possible.

Table 6-1: 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	Would 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	Would 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 >1 m)	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 could be used on-site providing adequate justification and method statements are provided and approved by SEPA. If the peat is unsuitable for use without treatment then it could be regarded as a waste. However, every attempt to avoid this type of peat has been incorporated into the design.

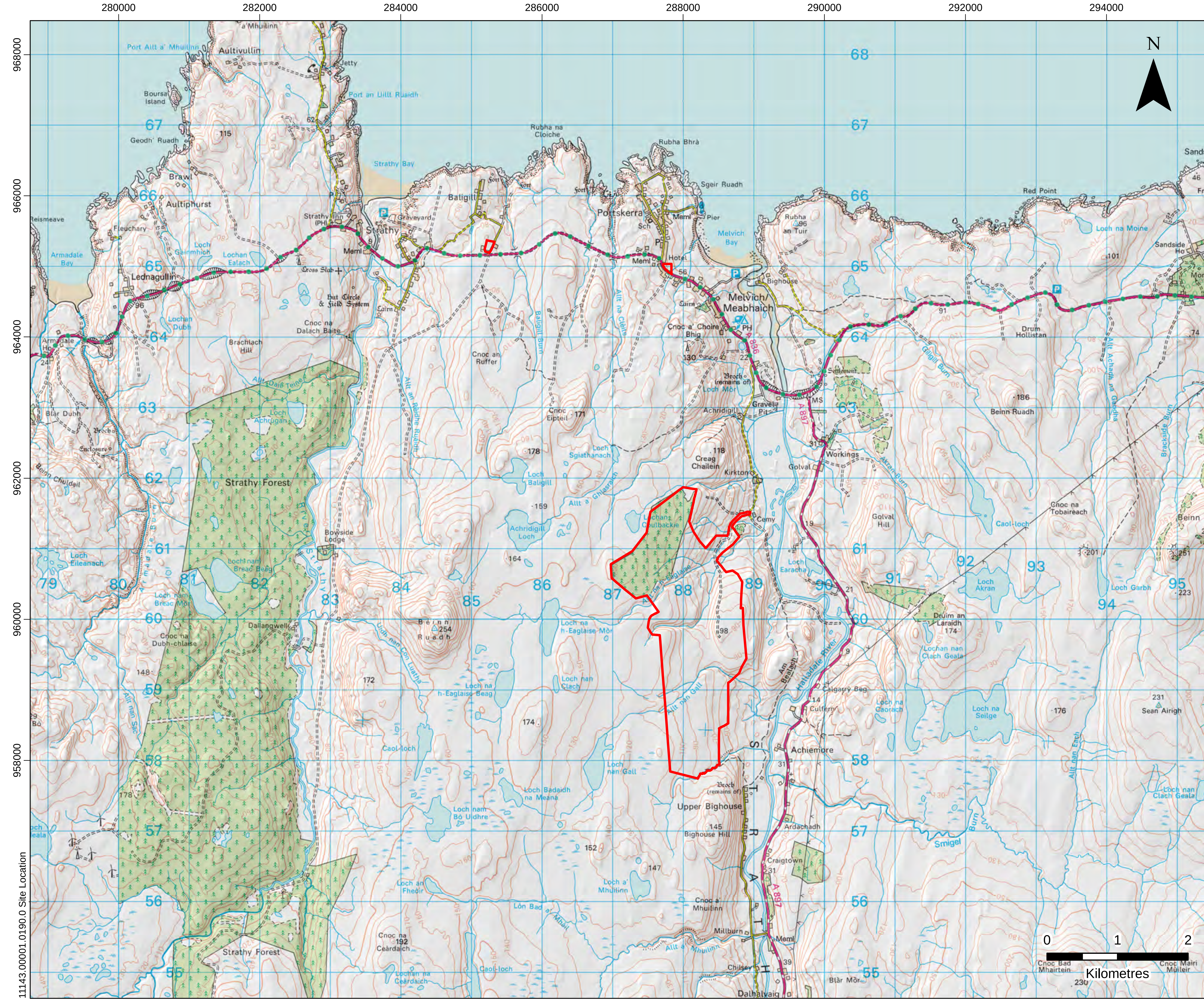
*Such uses for this type of material are limited, however there could be justification for use in the base of borrow pits to maintain waterlogged conditions and prevent desiccation of restored area and in some habitat management works such as gully or ditch blocking where saturated peat is required to mimic mire type habitats and encourage establishment of sphagnum.

7.0 Conclusion

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 proposed development's layout and peat depth data averaged across discrete areas of the site. Such parameters can still vary over small scale 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[2], as part of detailed ground investigation to be undertaken post-consent. The figures shown in the tables suggest that the volumes of peat excavated onsite would be re-used without creating surplus materials which would require to be classified as waste. Post-consent, the Stage 1 PMP and the Outline CEMP (**Technical Appendix 3.1**) would be updated with information obtained during detailed ground investigations and design stage.

These plans would be developed to update the Outline 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.

FIGURES



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APPENDIX
PEAT MANANGEMENT PLAN

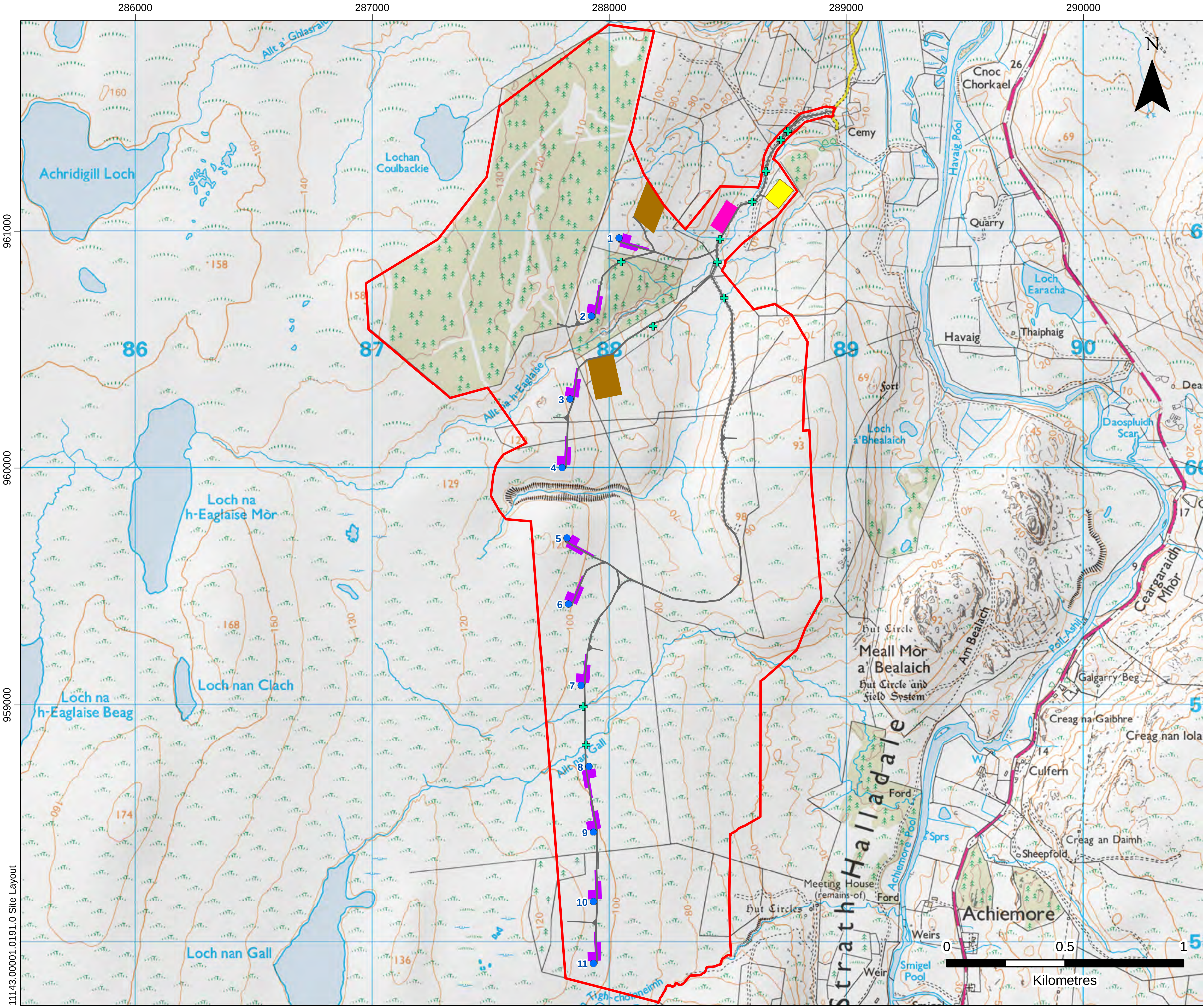
SITE LOCATION

FIGURE 10.2.1

Scale 1:50,000 @ A3

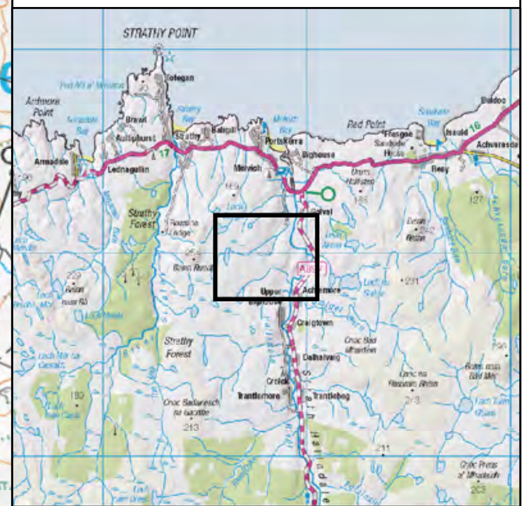
Date NOVEMBER 2022

11143.00001.0190.0 Site Location



LEGEND

- Application Boundary
- Proposed Turbine
- Proposed Track / Turning Head / Passing Place
- Proposed Crane Pad
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Watercourse Crossing



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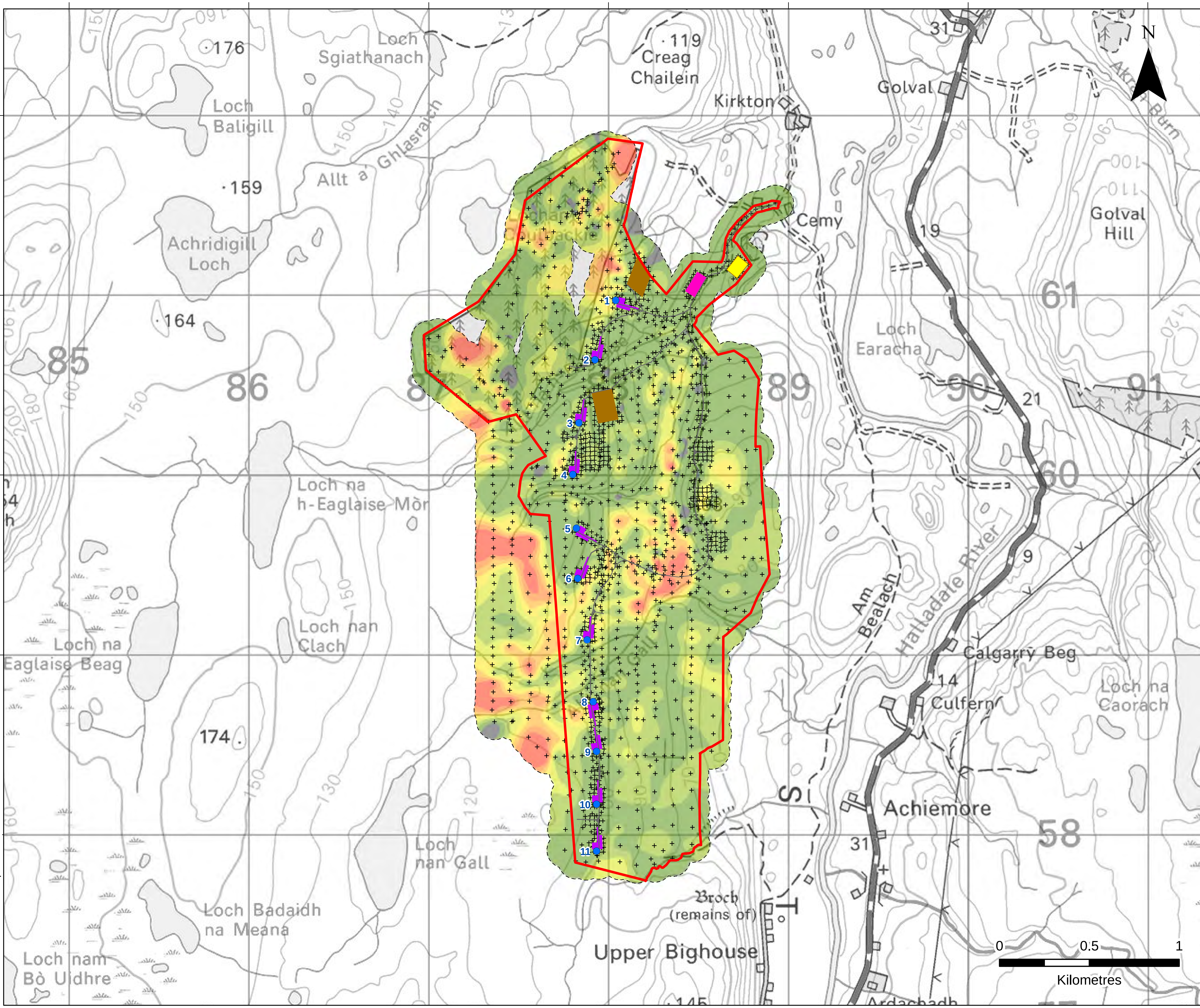
APPENDIX
PEAT MANAGEMENT PLAN

SITE LAYOUT

FIGURE 10.2.2

Scale	Date
1:15,000 @ A3	NOVEMBER 2022

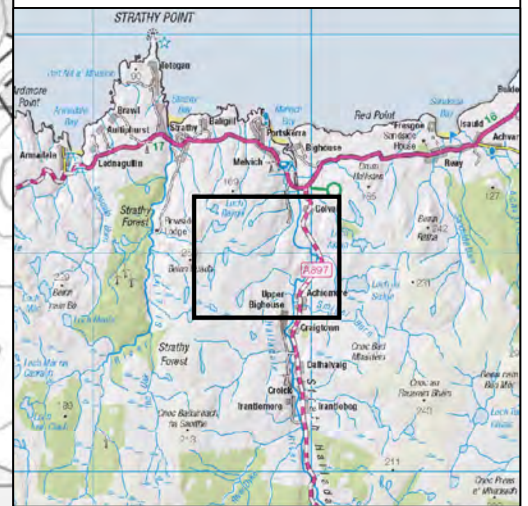


LEGEND

- Application Boundary
- Proposed Turbine
- Proposed Track / Turning Head / Passing Place
- Proposed Crane Pad
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- 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



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APPENDIX
PEAT MANAGEMENT PLAN

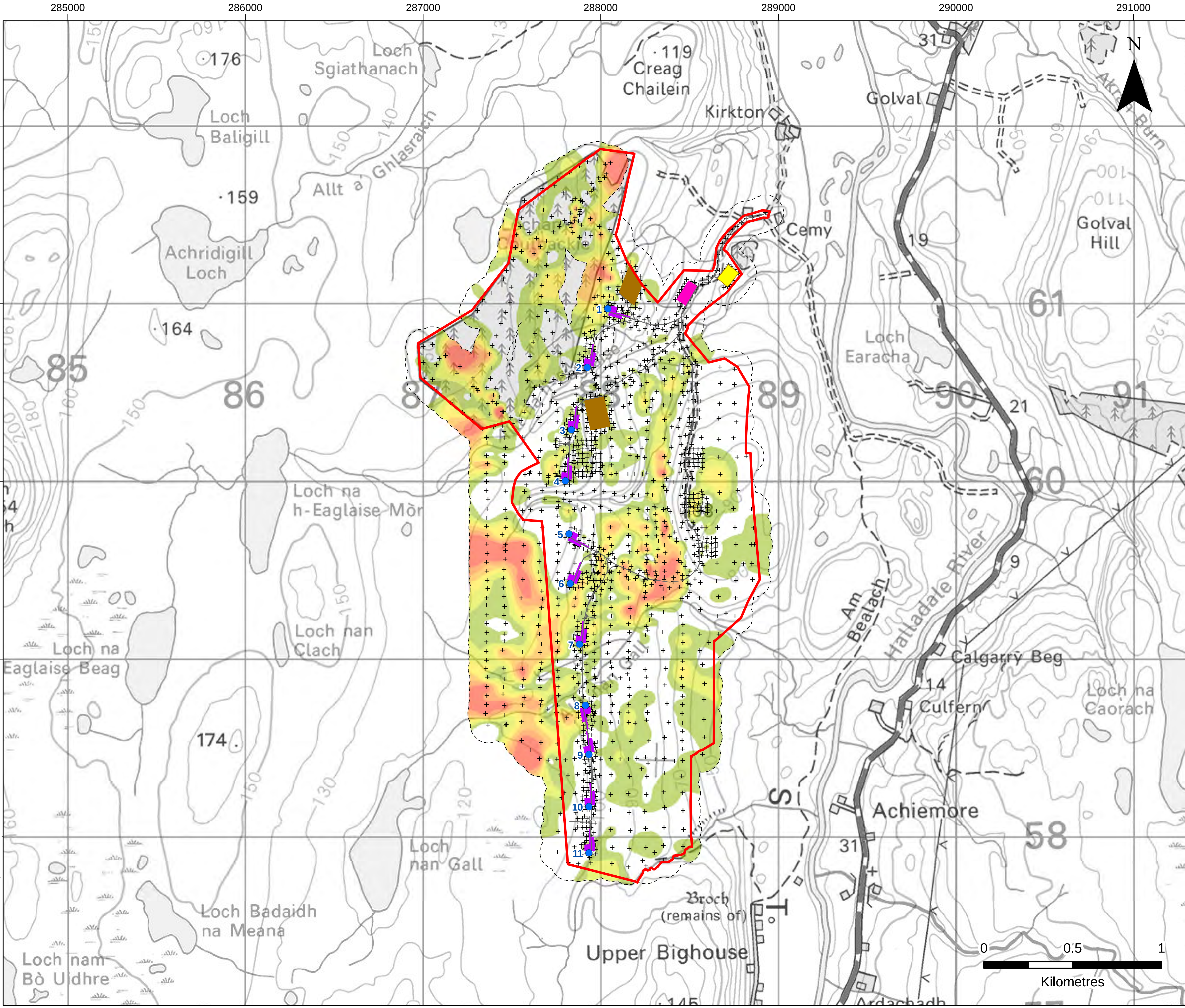
PEAT DEPTH PLAN

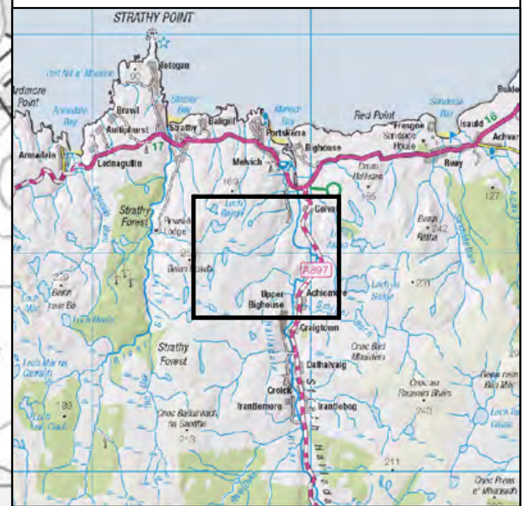
FIGURE 10.2.3

Scale 1:20,000 @ A3

Date NOVEMBER 2022

11143.00001.0192.0 Peat Depth





LEGEND

Application Boundary

Proposed Turbine

Proposed Track / Turning Head / Passing Place

Proposed Crane Pad

Proposed Substation Compound

Proposed Temporary Construction Compound

Proposed Borrow Pit

Peat Probe Location

Peat Depth (m)

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

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APPENDIX
PEAT MANAGEMENT PLAN

PEAT DEPTH > 0.5M

FIGURE 10.2.4

Scale 1:20,000 @ A3

Date NOVEMBER 2022

11143.00001.0193.0 Peat Depth Over 0.5m

APPENDIX 01

Excavated Materials Calculator

Infrastructure	Length (m)	Width (m)	Average Depth (m)	Number	Total Volume Excavated (m3)	Length (m)	Width (m)	Average Depth (m)	Number	Total Re-use Volume (m3)	Notes
New Excavated Track	5036	5	0.37	1	9317	5036	3	0.5	1	7554	
Existing Upgraded Track	2034	1	0.10	1	203	2034	3	0.5	1	3051	
Floating Track (on site)	447	7	2.09	1	0	447	3	0.8	1	1073	
Turbine Bases (Formation only)	25	25	0.53	11	2860	75	2	1	11	1650	
Crane Hardstandings	75	15	0.49	11	4760	200	2	1	11	4400	
Blade laydown and ancillaries	85	5	0.49	11	1798	95	2	1	11	2090	
Turning Heads	120	6	0.37	1	209	246	2	0.8	1	394	
Turning Heads	60	6	0.37	4	418	126	2	0.8	4	806	
Passing Places	70	5	0.41	3	338	80	2	0.8	3	384	
Substation and Control Building	100	75	0.15	1	1125	350	2	0.8	1	560	
Temporary Construction Compound	125	50	0.11	1	688	125	50	0.11	1	688	
Borrow Pit North	170	111	0.60	1	11322	170	111	0.60	1	11322	
Borrow Pit South	110	165	0.53	1	9620	110	165	0.50	1	9075	

Total Excavated Volume (m3)	42658
Total Re-use Volume (m3)	43046
Net Balance (m3)	-388

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