

ScottishPower Energy Retail Limited and Storegga Hydrogen Limited

Cromarty Hydrogen Project: Outline Peat Management Plan

Technical Appendix 4.1

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

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1 INTRODUCTION

- 1.1 This report provides an Outline Peat Management Plan for the Cromarty Hydrogen Project (hereafter referred to as the Proposed Development) and associated development infrastructure.
- 1.2 This report forms a Technical Appendix to the Environmental Appraisal Report (EAR) for the Proposed Development and should be read in conjunction with this document. It has been produced to address the requirements for excavation of peat and peaty soils during the Proposed Development construction process.
- 1.3 This report will consider total volumes of peat that need to be excavated and will set out options for reuse of the excavated material. Guidance on management and handling of excavated peat and soils will be provided.
- 1.4 Within this Technical Appendix the following definitions will be used:
- 'site access' covers the existing access track from the junction with the B9176 Struie Road up to the main site area;
 - 'the application site' refers to everything within the application red line boundary;
 - 'main site area' refers to the area where the hydrogen production facility will be sited; and
 - 'cable route corridor' refers to the area comprising the existing access track plus a 10-15 m buffer running between the main site area and the existing Beinn Tharsuinn Wind Farm.

Site location

- 1.5 The Proposed Development is on land located adjacent to the east of the operational Beinn Tharsuinn Windfarm (NGR NH 64225 81469), approximately 12 km north of Alness within the Highland Council region. The application site mainly comprises upland moorland and blanket bog. Within the application site approximately 68% of soils are indicated to be nationally important carbon-rich soils, deep peat and priority peatland habitat.

Development proposals

- 1.6 The construction phase of the Proposed Development would involve a number of different elements. **Chapter 1 Introduction** of the EAR describes the scheme elements in detail. The elements with particular relevance to peat are as follows:
- creation of a temporary construction compound;
 - creation of a hydrogen production facility;
 - creation of a substation;
 - installation of drainage features around permanent infrastructure;
 - temporary welfare facilities and site utilities including water supply and wastewater disposal; and

- removal, handling and temporary storage of peat and soils
- 1.7 Construction of the Proposed Development would also include resurfacing of the site access and laying cables along the cable route corridor. However, as resurfacing would occur on the site access and cables would be buried in the existing track verge, it is not anticipated that any peat would be removed during either of these activities and therefore they are not included as part of this assessment.
- 1.8 During operation of the Proposed Development it is not anticipated that any activities would involve the removal, handling or temporary storage of peat.
- 1.9 Full details of the Proposed Development design are provided in **Chapter 1** of the EAR.

Aims

- 1.10 This report aims to undertake a review of all available peat depth information for the Application Site and immediate environs, and to provide a series of calculations determining the estimated volumes of peat that will require excavation in order to allow the Proposed Development to progress. Options will be provided to address the use of the excavated peat within necessary restoration of the Proposed Development's infrastructure. A series of good practice measures relating to peat and soil handling and storage will also be provided.

Assessment method

- 1.11 The assessment has involved the following stages:
- desk study;
 - peat depth surveys and infrastructure design;
 - volume calculations for excavation and reuse; and
 - peat handling and storage guidance.

2 PEAT CONDITION

Developments on peat

Definition of peat

- 2.1 Scotland's Soils (2023) classifies peat as

An accumulation of partially decomposed organic material, usually formed in waterlogged conditions. Peat soils have an organic layer more than 50 cm deep from the soil surface which has an organic matter content of more than 60%.

- 2.2 Organic soils which are 50 cm or thinner can also support peatland vegetation and as a result are also considered within Scotland's broader peatland system in Scotland's National Peatland Plan (NatureScot, 2015). These are often described as 'peaty gleys' or 'peaty podzols', reflecting key aspects of the underlying soil. Peaty soils have a higher plant fibre content and are less decomposed than peat.
- 2.3 Active peatland typically consists of two layers: the surface layer (acrotelm) and the deeper layer (catotelm). The acrotelm contains the living vegetation and consists of living and partially decayed plant material. It typically has a low but variable hydraulic conductivity and allows some through-flow of water within the plant material. The underlying catotelm is denser, with a very low hydraulic conductivity, and is formed from older decayed plant material. The catotelm varies in structure, in some areas retaining a proportion of fibrous material and in other areas being more humified and amorphous. The degree of humification typically increases with depth.
- 2.4 Underneath the peat-forming layers, the basal substrate can be a mineral soil, a superficial deposit such as glacial material, or bedrock. There may be a transition zone through a mineral-rich peaty layer at the base of the peat, although this is usually no more than 5 cm in thickness.

Importance of peat

- 2.5 Peatland forms a key part of the Scottish landscape, covering more than 20% of the country's land area, and forming a significant carbon store (Scotland's Soils, 2019). In addition, peatland is an internationally important habitat.
- 2.6 Active and healthy peatlands develop continuously, removing carbon dioxide from the atmosphere and storing it within the peat soil. Peatland protection and restoration form key parts of the Scottish Government's Climate Change Plan, which targets restoration of 250,000 ha by 2030 (Scottish Government, 2018). As of March 2020, over 25,000 ha of peatland had begun restoration, and in 2020 the government announced a £250 million ten-year funding package to support the restoration of degraded peat (Scottish Government, 2020). Restoration will need to be conducted at a faster pace to reach targets.
- 2.7 It is therefore important that developments in peatland areas recognise the importance of peatland as a habitat and carbon store. Careful planning of developments, and careful infrastructure design, can remove or minimise the disturbance of peat that would be needed to allow the development to proceed.

Development setting

Topography and geomorphology

- 2.8 The application site is located at an altitude of 210 to 505 m AOD. The highest location is at the westernmost end of the cable route corridor, where it meets the boundary of the existing Beinn Tharsuinn Wind Farm. The lowest location is at the eastern end of the access route where it leaves the B9176.
- 2.9 The main site area lies between 325 and 355 m AOD, sloping generally down to the south-east.
- 2.10 The Proposed Development is bounded to the north by the Cnoc Muigh-bhlàraidh (546 m AOD), the main site area is located on its lower slopes. To the west lie Beinn nan Oighrean (538 m AOD) and Beinn Tharsuinn (546 m AOD). The cable route corridor is bounded to the south by Meall a' Bhreacain (527 m AOD). The Allt na Meine runs adjacent to the north of the application site, intersecting it once as it travels under the site access, and the Allt Dearg runs adjacent to the south of the application site. The easternmost part of the application site is bounded by the B9176, providing site access.

Habitats and vegetation

- 2.11 The vegetation within the Application Boundary has been surveyed using the National Vegetation Classification (NVC) methods. The survey indicates that four main communities are present (**Figure 3.5**):
- H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath;
 - M6 *Carex echinata* – *Sphagnum recurvum/auriculatum* mire;
 - M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire; and
 - U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland.

Hydrology

- 2.12 The application site is located across three main catchment areas: Allt Muigh-bhlàraidh, Allt Dearg and Easter Fearn Burn. The catchment areas are shown on **Figure 4.7** of **Chapter 4**. The main site area is located across the boundary between the Allt Muigh-bhlàraidh to the north and the Allt Dearg to the south, with the Easter Fearn Burn catchment covering the cable route corridor in the north-west of the application site.

Allt Muigh-bhlàraidh catchment

- 2.13 The Allt Muigh-bhlàraidh catchment has a total area of 28.73 km² and drains 37.97% of the application site. The catchment is an upland region mainly characterised by peatland and moorland with some areas of commercial forestry.
- 2.14 The Craigroy Burn provides the main drainage for this catchment. An unnamed tributary to the Allt na Meine provides the main drainage within the application site, crossing below the site access. The Allt na Meine joins the Craigroy Burn at approximately NGR 268421 883807.

- 2.15 An artificial connection between the Allt Muigh-bhlàraidh and Allt Dearg catchments is present just upstream of Drochaid an Uillt Ruaidh. This connects the Allt Dearg to the upper part of the Fèith Ruadh, a tributary to the Allt na Meine.

Allt Dearg catchment

- 2.16 The Allt Dearg catchment has a total area of 8.58 km² and drains 49.87% of the application site. The catchment is predominantly commercial forestry with some upland areas to the north-east and north-west which are characterised by upland moorland and peatland.

- 2.17 The Allt Dearg provides the main drainage for the catchment. Several unnamed tributaries to the Allt Dearg have their source to the south of the cable route corridor. These flow south-east, joining the Allt Dearg just south of the main site area.

Easter Fearn Burn catchment

- 2.18 The Easter Fearn Burn catchment has a total area of 17.30 km² and drains 12.16% of the application site. The catchment is an upland region mainly characterised by peatland and moorland, with an area of commercial forestry and some areas of agricultural land in the north-east.

- 2.19 The Easter Fearn Burn provides the main drainage for this catchment. Several unnamed tributaries to the easter Fearn Burn have their source close to the north-eastern edge of the existing Beinn Tharsuinn Wind Farm. From here they flow north-east beneath the cable route corridor, forming the Allt Fearnna (main tributary to the Easter Fearn Burn) at NGR 262700 882279.

Catchment statistics

- 2.20 Catchment statistics for the application site are derived from the Flood Estimation Handbook Web Service (CEH, 2023). The catchment wetness index for the application site ranges from 0.48-0.58, indicating that soils within the application site are wet 48-58% of the time. The area has a base flow index (BFI HOST19) of between 0.26 and 0.38, indicating a low input of groundwater baseflow to surface watercourses. The standard percentage runoff (SPR HOST) is 46.57-56.55%, indicating that this percentage of rainfall on-site is converted into surface runoff from rainfall events; this represents a relatively high runoff risk where soils have a limited capacity to store rainfall and/or a slow infiltration rate and would quickly saturate, leading to rapid runoff.

Peat characteristics

- 2.21 NatureScot's Carbon and Peatland mapping indicates that the application site consists of a patchwork of peaty gleyed podzols and blanket peat which varies in depth, reflecting the underlying topography and hydrological setting (NatureScot, 2016).

- 2.22 There is evidence of modification to peatland across the wider area although most of this is outwith the application site. There is trackside drainage along most of the site access and cable route corridor. In addition, a number of drainage ditches are apparent to either side of the tributary to the Allt ne Meine north of the site access. A substantial cut-off ditch is present on the north side of the cable route corridor to the west of the main site area,

with additional drainage associated with the former Beinn Tharsuinn borrow pit immediately west of the main site area.

- 2.23 To the south of the site access, much of the land is under commercial forestry and has extensive drainage associated with tree planting. Two areas of former peat harvesting to either side of the B9176 at Aultnamain are also associated with extensive drainage and modification.
- 2.24 Phase 1 and 2 peat surveys found that areas of deeper peat are found outwith the infrastructure footprint at the northern and western margins of the main site area and are also found at some locations along the site access and cable route corridor. There is a large area of deep peat to the south-east of the main site area; it underlies a section of the site access but otherwise is outwith the application site.

Peat at the Proposed Development

- 2.25 The Proposed Development was identified as including areas of peat at an early stage, as indicated by superficial geology and soils mapping for the region. A broad-scale Phase 1 peat depth survey on a 100 m grid was undertaken by RSK in September 2021 to develop a picture of the overall pattern of peat deposits within a broader developable area. The survey results were used to inform the identification of an Area of Search which was taken forward to EIA Screening and subject to further study, in order to minimise incursion into areas of peat as far as possible.
- 2.26 A further Phase 2 peat depth and condition survey of the Area of Search was undertaken by RSK in October 2022 in order to provide more detailed data to underpin the design process and selection of the final main site area of the Proposed Development and minimise potential impacts on peat.
- 2.27 The combined peat depth data were used to generate a detailed map of peaty soil and peat depths for the Proposed Development. This is provided on **Figure 4.5 of Chapter 4**. Measured peat and soil depths range from 0.2 m to 3.6 m. A total of 109 peat depth measurements have been recorded for the Proposed Development and immediate surroundings.
- 2.28 The intention has been to avoid areas of peat where possible, and to minimise incursion into peat where it has not been possible to avoid it altogether. Approximately 53% of the Proposed Development infrastructure including drainage is underlain by peaty soil or topsoil no greater than 0.5 m deep, with 47% of infrastructure underlain by peat.

Peat excavation volumes

- 2.29 **Table 4.1.1** sets out the estimated volumes of peat that need to be excavated in order to allow construction of the Proposed Development to proceed. Calculations have been made for each infrastructure footprint, making use of peat depth data for the relevant infrastructure element. The calculations provide subdivision into ‘acrotelm’ and ‘catotelm’.
- 2.30 For the purpose of these calculations, the acrotelm has been assumed to form the uppermost 0.5 m where peat is present. Acrotelm is known to vary in thickness, but it is recommended that peat turves are excavated to approximately 0.5 m where possible,

including the uppermost part of the catotelm, to promote quicker regeneration of disturbed areas following reinstatement.

- 2.31 Volumes of peaty soil and topsoil have not been included, in line with the definition of peat quoted above. Soils would also require excavation but are less sensitive than peat to both excavation and restoration.

Table 4.1.1: Peat excavation volumes for Proposed Development infrastructure

Scheme Element	Acrotelm (m ³)	Catotelm (m ³)	Total (m ³)
Hydrogen production facility	4,344	2,607	6,951
Substation	0	0	0
Temporary construction compound	1317	1481	2798
Total	5,661	4,088	9,748

Peat reuse

- 2.32 The guidance document *‘Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste’* (Scottish Renewables/SEPA, 2012) identifies a number of reuse options for excavated peat within wind farm developments. Although intended for wind farm developments the guidance is applicable to any development on peat and therefore provides useful guidance for the Proposed Development. These options have all been tested in practice and found to be effective, if undertaken with care and appropriate handling of the peat.

Dressing-off edges of constructed infrastructure

- 2.33 Excavated peat can provide a valuable means for dressing-off and reinstating the slopes and edges of constructed infrastructure. This should be undertaken as soon as practicable after construction and should be managed such that a suitable tie-in to the surrounding topography is created as part of the process. This has a twofold purpose – to reduce the visual effect of the infrastructure and to retain as much of the existing habitat as possible.
- 2.34 A secondary part of this would involve full reinstatement of the temporary construction compound, as this is only required for the construction stage of the Proposed Development.

Verge reinstatement on track sections

- 2.35 For cut tracks, the track margins can be reinstated to form a verge slightly raised above the track level. This acts as a partial visual screen for the track network. Well-designed track margins also help to direct track surface runoff into trackside drainage, where it can be redirected for treatment.
- 2.36 None of the existing tracks require upgrading; however, reinstatement of existing track verges can be undertaken where the ground has been left raw or where previous reinstatement has not been effective.

Peatland restoration

- 2.37 Peat can provide valuable material for ditch and peat channel blocking, as part of a peatland restoration plan on blanket bog. In areas with wider ditches, it may be appropriate to use saturated or unconsolidated peat behind dams, capped with acrotelm turves, in order to speed up the restoration process and regeneration of associated vegetation.

Peat reuse volumes

- 2.38 Calculations have been made to determine where excavated peat can usefully be reused within the Proposed Development, for the purposes of reinstatement and restoration. Estimated volumes for reuse are provided in **Table 4.1.2**, subdivided by different reinstatement and restoration methods that are appropriate for the Proposed Development.

Table 4.1.2: Estimated soil and peat volumes for different reuse options

Reuse option	Acrotelm (m ³)	Catotelm (m ³)	Total (m ³)
Dressing-off edges of hydrogen production facility	1,100	0	1,100
Dressing-off edges of substation	100	0	100
Restoration of temporary construction compound	1,500	0	1,500
Peatland restoration	2,800	4,000	6,800
Totals	5,500	4,000	9,500

- 2.39 All figures in **Table 4.1.2** have been rounded down to the nearest 100 m³ to make allowance for uncertainties present within the figures.
- 2.40 Reinstatement and dressing-off have assumed a maximum depth of 0.6 m and a maximum width of 2.5 m from the infrastructure margin, to be varied in practice as best suits the local ground conditions.
- 2.41 It has been assumed that peat reuse for the dressing-off and restoration of Proposed Development infrastructure would use entirely acrotelmic peat, although some catotelmic peat may be used in areas with natural hollows.
- 2.42 Approximately 49.7% of the excavated acrotelmic peat would be used in restoration of Proposed Development infrastructure. The remaining excavated peat, both acrotelmic and catotelmic, would be used for peatland restoration within the vicinity of the application site. Peatland restoration works would focus on the main areas where peat haggling and erosion have been identified, such as north of the cable route corridor, and could also be used to block ditches in and around the application site.
- 2.43 **Technical Appendix 3.1 Outline Biodiversity Enhancement Plan** indicate areas identified as potential restoration areas.

PEAT HANDLING & STORAGE

Peat excavation

- 2.44 During the construction of the Proposed Development infrastructure, the Principal Contractor would adopt the following good practice guidelines with relation to peat excavation:
- Where peat conditions are suitable, peat turves would be excavated as intact blocks of the uppermost 0.5 m including the vegetated surface acrotelm layer and the upper part of the catotelm.
 - In areas where peat conditions do not allow clean removal of peat turves, the upper layer of peat would be removed as divots or mulch rather than as turves. Careful handling would help to keep the vegetated blocks largely the right way up.
 - Underlying peat would be extracted as close to intact as is feasible within the constraints of the area. Remoulding of the peat by the excavator would be kept to a minimum.
 - Excavated materials would be classified depending on their composition, and each type would be stored separately. Anticipated material classes are: peaty soils and topsoil, subsoil, acrotelmic peat, catotelmic peat, mineral soil, and rock.
 - Excavated peat would be transported as short a distance as practicable for either reuse or temporary storage, in order to minimise loss of structure during transport.
- 2.45 Peat and soil stripping can be adversely affected by wet weather. The following ‘stop’ conditions are recommended to guide any peat and soil stripping activity (**Table 4.1.3**; CH2M & Fairhurst, 2018).

Table 4.1.3: Recommended ‘stop’ conditions (CH2M & Fairhurst, 2018)

‘Stop’ Rule	Requirements
High intensity rainfall	Rainfall during construction greater than 10 mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25 mm
7-day cumulative rainfall (1)	Preceding 7 days of rainfall greater than 50 % of the monthly average
7-day cumulative rainfall (2)	Preceding 7 days of rainfall greater than 50 mm

- 2.46 Monitoring of rainfall for ‘stop’ conditions would require access to a suitable local source of data, such as the Met. Office’s climate station at Tain Range, to allow identification of these conditions being exceeded in order to allow appropriate action to be taken.

Temporary storage

- 2.47 Temporary storage of peat should be avoided or minimised wherever possible. This is best achieved by transporting the peat to an allocated reuse location as soon as practicable following excavation. This would help to retain its structural integrity as far as possible, would minimise volumes of peat requiring storage and would help to prevent the peat drying out.

- 2.48 An Environmental Clerk of Works (ECoW) would maintain a schedule of reuse and restoration areas and would direct whether excavated peat should be stored or transported directly to a suitable reuse location. Immediate reuse is likely to be more practicable in the later stages of construction.
- 2.49 Soils, peat turves/divots and peat would all be stored separately. The following outline good practice would be applied to all areas of peat and soil storage:
- Excavated materials would not be stored immediately above excavation faces, in order to prevent overburden-induced failure.
 - Local drainage lines, areas of very wet ground and locally steep slopes would be avoided for excavated material storage, including peat.
 - Careful handling of upper-layer peat divots, from areas where peat turves cannot be excavated, would help to retain vegetated blocks the right way up.
 - Catotelmic peat would be stored separately from vegetated peat blocks, in mounds up to 1 m high.
 - Limited smoothing or 'blading' of stockpiled catotelmic peat, topsoil and subsoil would help to shed rainwater and prevent ponding of water on the stockpile.
 - During periods of dry weather, light spraying of the temporary peat stores would be applied in order to minimise drying.
 - All temporary storage areas for excavated peat and soils would be at least 50 m from any watercourse.
 - Runoff from stored peat and soils would be managed to avoid impacts to habitats and watercourses. Where necessary, drainage control measures such as use of silt fences would be put in place.
 - Monitoring of peat storage areas may be required during wet weather or snowmelt. This would be undertaken by the Contractor, with findings reported to the ECoW.
- 2.50 Storage areas would be assessed for suitability during construction works and priority would be given to areas near the material source; key constraints would be slope, watercourses and sensitive habitats. A location immediately adjacent to the eastern edge of the main site area has been identified as being potentially suitable for storage of peat and soil as the land is relatively flat, it is downslope of the main construction areas and sufficiently far from watercourses (**Figure 4.1.1**). However, it is outwith the application site and therefore would require discussion with the relevant land owners for permission.

Reinstatement and restoration

- 2.51 The following principles would be applied in all situations where peat is being reinstated:
- Reinstatement of peat turves and vegetated peat divots would ensure that surface re-vegetation is encouraged as early as possible. Vegetated peat must only be used for surface layer reinstatement.
 - Re-seeding of any significant areas of bare peat would be undertaken with a suitable species mix appropriate to the surrounding habitats. Careful planning of reinstatement should minimise areas of bare peat by appropriate distribution of vegetated peat turves and divots.

- Grazing by livestock and deer may need to be prevented in sensitive areas, by selective use of fencing, until re-vegetation has become established.
- In the event that stored peat becomes dewatered or desiccated, this material would not be exposed in the upper part of any reinstatement area in order to minimise any further character loss. Storage of excavated peat would be minimised in order to prevent or limit dewatering and desiccation.

Updated peat management plan

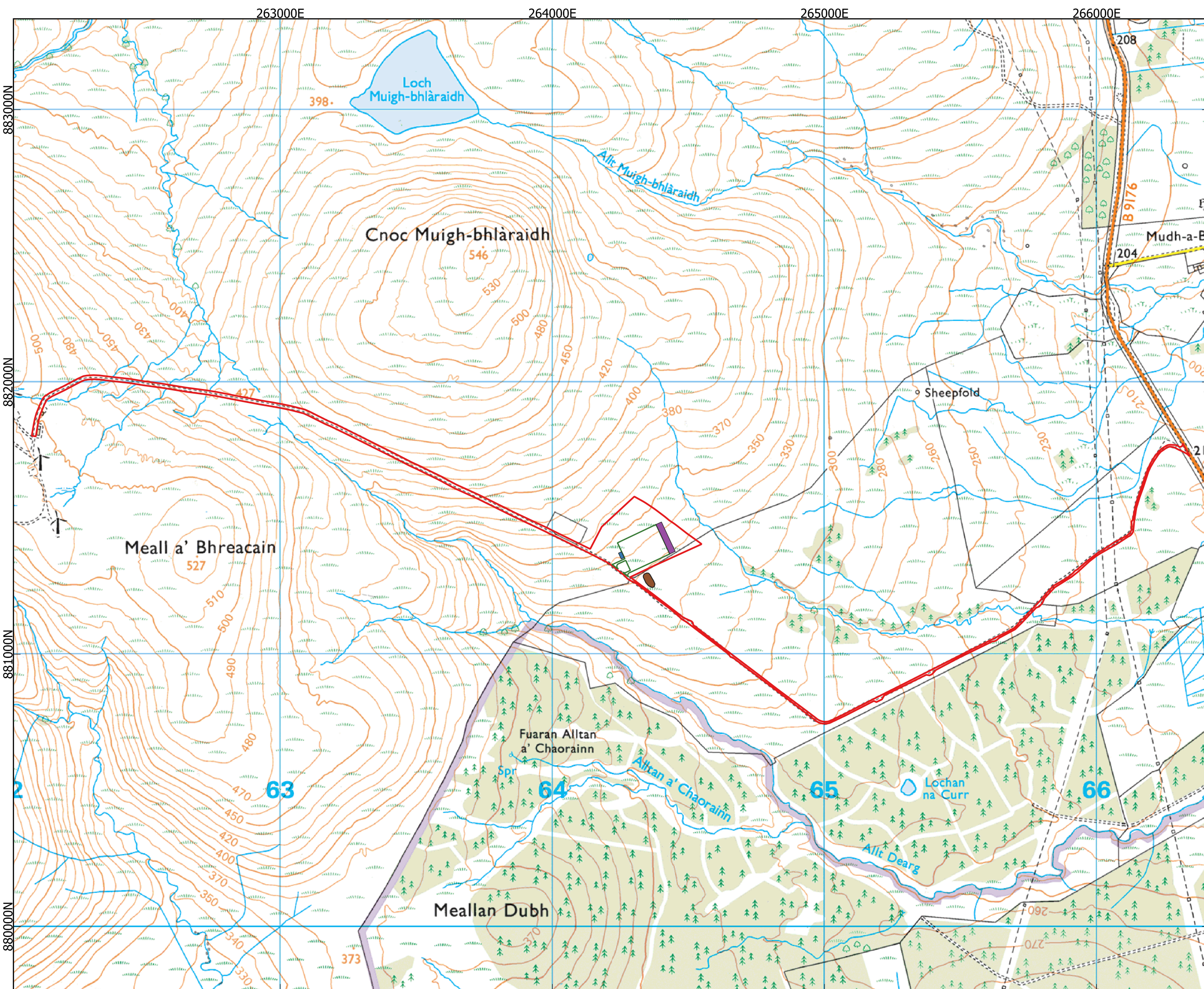
2.52 The Outline Peat Management Plan presented here would be updated and refined as necessary with further site-specific detail once ground investigation results become available. This would involve recalculation of peat volumes requiring excavation and storage. Location-specific reinstatement would be directed by the ECoW, taking account of specific local variation in topography and natural ground conditions. The Construction Peat Management Plan, to be prepared post-consent, would be a live document, with revisions added as necessary during the construction process.

3 SUMMARY

- 3.1 This Outline Peat Management Plan provides an assessment of the likely volumes of peat that would require excavation during the construction of the Proposed Development, and of the volumes of peat that can legitimately be used in reinstatement of development infrastructure. The assessment has included consideration of all proposed infrastructure that would require construction and excavation work where peat would require removal.
- 3.2 The assessment indicates that there would be limited opportunity for reuse of excavated peat within the Proposed Development and that the majority of excavated peat would be used in peatland restoration works outwith the application site.
- 3.3 Approximately 58% of the excavated peat would be acrotelmic, which provides good opportunities for promoting re-establishment of peatland vegetation around construction areas. Sensitive reinstatement would help to minimise the visual impact of the construction works as well as minimising the habitat loss from construction.

4 REFERENCES

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- Legend**
- Application boundary
 - Hydrogen Production Facility
 - Construction Compound
 - Substation
 - Potential peat storage area

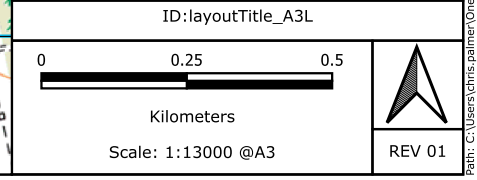


Rev	Date	Description	Drn	Chk	App
01	09/10/2023	Updated infrastructure layout	CP	CI	CI
00	17/07/2023	Potential peat storage area	CP	CI	CI

Cromarty Hydrogen Project



TITLE: Figure 4.1.1
 Potential peat storage area



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