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Peat Site Investigation Report

(Conditions 25 & 26, and
Reserved Matters Application)

Report Reference: ESP.8053.3713-04

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Proposed Adventure Park Afan Valley Resort Peat Site Investigation Report

(Conditions 25 & 26, and
Reserved Matters Application)

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Signature:

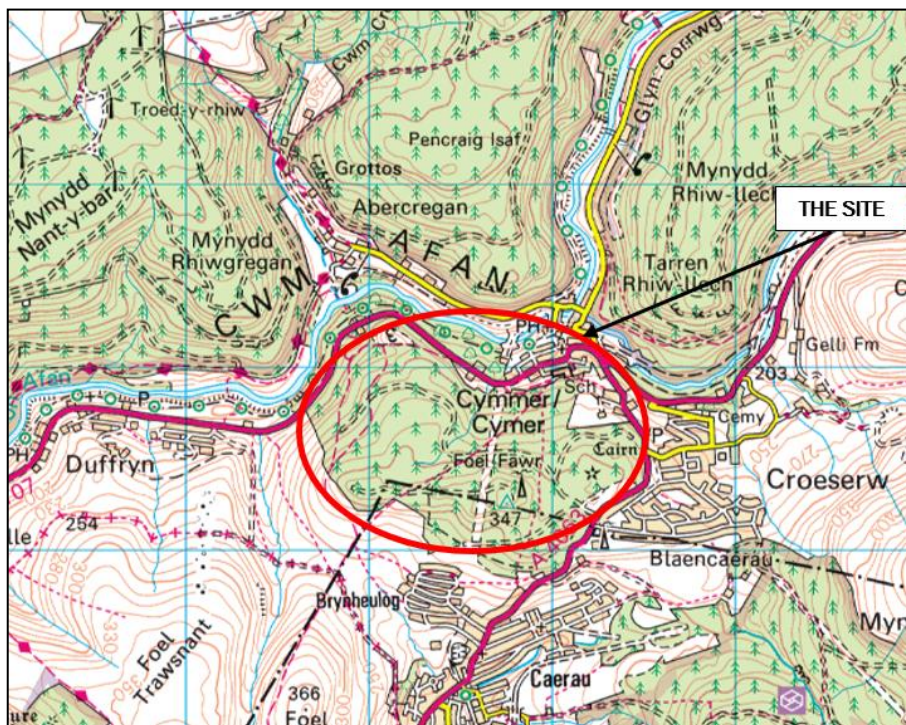
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1.0 INTRODUCTION

BACKGROUND AND SITE LOCATION

- 1.1 Wildfox Resorts Afan Valley Ltd., (hereafter known as the Client) are proposing to redevelop the subject site for leisure purposes. The Earth Science Partnership Ltd (ESP) were instructed by Stantec UK Ltd., acting on behalf of the Wildfox Resorts Afan Valley Ltd., to undertake a detailed Peat site investigation and assessment. Previous investigations and assessments (Aecom, 2017 & 2018) identified peat to be present at the site, primarily an area of deep peat encountered in the south eastern extent.
- 1.2 The general site location is shown on Insert 1 below, the site boundary for this assessment is shown on Figure 1. The proposed development will comprise a large mixed use adventure resort comprising up to 600 lodges/apartments, a hotel, restaurants, retail units, leisure activities and outdoor sports which are in the early stages of planning. The proposed development layout is presented as Figure 2.
- 1.3 The site is located on the southern side of the Afan Valley, south of Cymmer, north of Caerau and west of Croeserw, South Wales. The National Grid Reference for the centre of the site is 285523 195668 and covers an area of approximately 130 hectares (Ha).



Insert 1: Site Location Plan from Ordnance Survey 1:50,000 scale map.
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OBJECTIVE AND SCOPE OF WORKS

- 1.4 An outline Planning approval has been granted subject to conditions, by Neath Port Talbot Council (NPTCBC) in January 2022 (Planning Application Reference P2018/0493). This report provides information to assist with the discharge of planning conditions 25 and 26; with regard the extend and presence of peat and an assessment into peat impact avoidance, as detailed below.

Condition 25: Prior to or as part of the first reserved matters submission on each phase (or subphase) of development identified within condition 7 above a ground investigation and hydrological survey shall be undertaken to establish the extent and depth of peat on the site and how the peat functions in relation to hydrology. The survey shall be submitted and approved in writing by the LPA.

Condition 26: As part of the first reserved matters for each phase (or sub-phase) of development identified within condition 7 a scheme shall be submitted to and approved in writing with the Local Planning Authority for peat impact avoidance, minimisation and management. This shall be informed by the ground investigation and hydrological survey and shall detail all impacts upon the peat resource on-site and in the neighbouring Caerau SINC, and set out appropriate mitigation measures. The scheme shall be implemented as approved.

- 1.5 The objective of the proposed site investigation is to obtain information on the presence and extent of peat at the site. The investigation is required to satisfy the planning conditions above. The scope of works for the investigation was mutually developed between Stantec UK Ltd., (acting on behalf of the Client) and by ESP within an agreed budget, and comprised a site investigation to delineate the extents of peat at the site based on previous investigations (Section 4), geotechnical testing, assessment and reporting.
- 1.6 The contract was awarded on the basis of a competitive tender quotation. The terms of reference for the assessment are as laid down in the Earth Science Partnership proposal of 28th March 2022 (ref: 8053 – ESP Offer Letter Rev 4 - GISR).
- 1.7 The investigation and assessment was undertaken in April and May 2022.

LIMITATIONS OF REPORT

- 1.8 This report represents the findings of the brief relating to the proposed end use as detailed above. The brief did not require an assessment of the implications for any other end use or structures, nor is the report a comprehensive site characterisation and should not be construed as such. Should an alternative end use or structure be considered, the findings of the assessment should be re-examined relating to the new proposals.
- 1.9 Where preventative, ameliorative or remediation works are required, professional judgement will be used to make recommendations that satisfy the site-specific requirements in accordance with good practice guidance.
- 1.10 Consultation with regulatory authorities will be required with respect to proposed works as there may be overriding regional or policy requirements which demand additional work to be undertaken. It should be noted that both regulations and their interpretation by statutory authorities are continually changing.

- 1.11 This report represents the findings and opinions of experienced geo-environmental and geotechnical specialists. Earth Science Partnership does not provide legal advice and the advice of lawyers may also be required.
- 1.12 This report is issued as a digital version only.

2.0 PEAT BACKGROUND AND DEFINITION

PEAT FORMATION AND DESCRIPTION

- 2.1 Peat is a type of soil that consists of primarily of decomposed organic matter, derived mostly from plant material which accumulates in specific environmental conditions e.g. waterlogging, oxygen deficiency and low evapotranspiration losses.
- Peatlands in Wales can be divided to the following principal types:
 - Lowland Fens;
 - Bogs;
 - Lowland raised bogs; and,
 - Blanket Bogs
- 2.2 The soil profile of peat is typically composed of two main zones; the acrotelm and catotelm as detailed below:
- Acrotelm is the upper more fibrous layer above the level of the permanently saturated Peat, comprising a matrix of living plants and recently deposited dead material. C
 - Catotelm is the lower permanently waterlogged Peat that exists in an anaerobic environment (Marsden and Ebmeier, 2012) and is generally unable to withstand any excavation and handling without complete disintegration.

Topsoil and Organic Rich Soils

- 2.3 Topsoil refers to the uppermost surface layer of soil which typically contains partly decomposed organic debris and is high in nutrients. Organic rich soils contain high levels of organic matter however, also contain significant portions of inorganic matter and are not formed in the same environment as peat soils.

PEAT RESOURCE

- 2.4 Peatland has been recognised as a valuable resource by acting as a natural sink and source of greenhouse gases (primarily carbon dioxide and methane), as well as a valuable habitat for biodiversity and for water management. Excavation of peat can lead to significant carbon losses/emissions, therefore maintaining peatlands in good conditions can reduce net greenhouse gas emissions and allow for further carbon sequestration. Degraded peatlands release stored greenhouse gases as the exposed peat decomposes.

DEEP PEAT DEFINITION

- 2.5 Previous assessments have used a depth greater than of 0.5m to define the boundary of peat and deep peat. We understand that this was partly derived by a Scoping Opinion Addendum (ref. P2017/0825 dated 12th December 2017) provided by Neath Port Talbot County Borough Council that stated that areas of deep peat (defined as over 50cm in Wales) will be expected to be retained.
- 2.6 Deep peat is defined by the UK Forestry Standards (UKFS) as soil having a predominantly organic (peat) layer of a depth greater than 0.5m. The Forestry Commission Wales (FCW, 2022) also defines areas of deep peat as greater than 0.5m.
- 2.7 The Welsh Government Data Maps Wales website that provides the WOM21 Deep Peat and Modified

Deep Peat maps state that *'Deep peat is defined in the UK Forestry Standard (UKFS) as soil having a predominantly organic (peat) layer, of depth greater than 50 cm. Deep peat is especially important as a resource in Wales, as a carbon store, as well as an important substrate to support specialist habitats.'*

- 2.8 As discussed in Section 1, ESP have been instructed to undertake detailed site investigation works to delineate the extent of deep peat at the site. For the purpose of this assessment, deep peat is considered to be a layer of peat greater than 0.5m thickness. This report presents the findings of the site investigation.

2.9 POLICY AND GUIDANCE

Peat Guidance

- 2.10 The Forestry Commission Wales (FCW) have developed a Guidance on peat soils accessible on the Natural Resources Wales website (NRW, 2022). The guidance is directly applicable to Wales with regards to forestry and deep peat. The Welsh government is currently actioning a 5 year Nation Peatland Action Programme focussed on peatland restoration in Wales (NRW, 2020)
- 2.11 Although not directly applicable in Wales, guidance on peat management has been developed by the Scottish Environment Protection Agency (SEPA, 2017).

Peat Management Hierarchy

- 2.12 A Peat Management Hierarchy is outlined in the SEPA document (SEPA, 2017) which details the following hierarchy of peat management options within development:
- **Prevent creation of waste peat:** minimise peat excavation and disturbance
 - **Use on-site/Use off-site for peatland restoration:** use of peat on-site within development plan e.g. restoration of hardstanding areas, road verges, borrow pits;
 - **Recycling/recovery:** Where peat cannot be used on site or off site, it may be spread on land for agricultural benefit, recycled through blending with other materials to form a soil substitute;
 - **Disposal:** Only after all other options have been explored and discounted.
- 2.13 This report generally follows the guidance outlined in the above document (SEPA, 2017) where applicable.

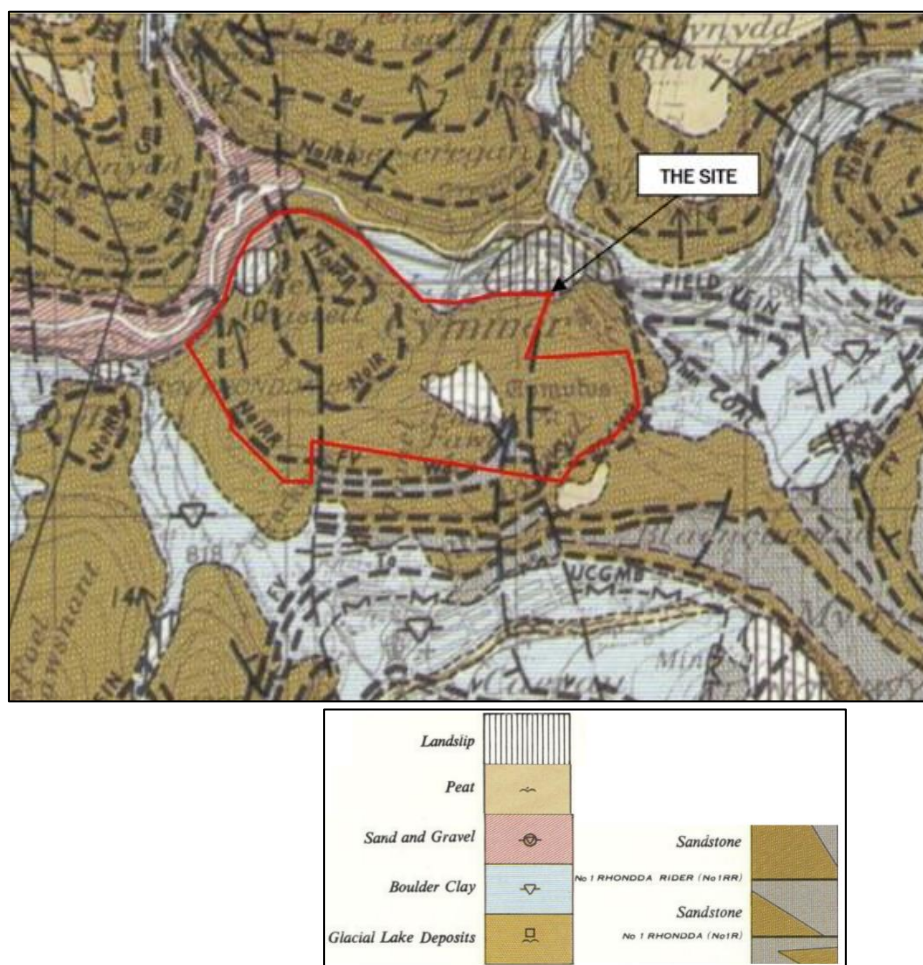
3.0 SITE SETTING

SITE CONTEXT AND TOPOGRAPHY

- 3.1 The site is located on the northern flank of Foel Fawr, immediately south of Cymmer occupying an area of approximately 130ha. The highest point is in the southern central area at an elevation of 347.14m AOD (at a trig point) with the majority of the site sloping north and northwest, occasionally steeply, towards the River Afan. The north western boundary is at an elevation of approximately 170mAOD rising to approximately 220m AOD towards north east at the north-eastern boundary extent.
- 3.2 The area primarily focused in this peat investigation and assessment is located in the south eastern extent of the site where deep peat has previously been identified by Aecom (2017 & 2018), see Section 4.0 for further details. This area is located at the south eastern boundary extent and is formed within a basin type feature (a topographical low surrounded by higher ground). Reference to a topographical survey (First Point Surveys, 2017 - Ref.5906-01) provided by Stantec Ltd., indicates that this basin (low) is at approximately 300m AOD, marginally varying across the area, rising to 310m AOD in the south western extent. Higher ground is present east (312mAOD), south (323mAOD) and west (347mAOD).
- 3.3 Two ponds are located at the lowest topographical point (approximately 300mAOD).

GEOLOGICAL SETTING

- 3.4 The published 1:10:560 scale geological mapping of the area (Glamorgan Sheet XXVI NW) indicates the site primarily be underlain directly by Upper Coal Measures bedrock (Lower Pennant Measures). The site is directly underlain by Rhondda Beds sandstone with the Llynfi Beds underlying.
- 3.5 Hill Peat is indicated immediately beyond the south eastern boundary. Boulder Clay is indicated in the central northern extent and Glacial Sand and Gravel in the north western extent. Landslip deposits are shown in the central/eastern and northwest portions.
- 3.6 Reference to the 1:50,000 scale mapping (Sheet 248) (Insert 2) and up to date mapping available on the website of the British Geological Survey (BGS, 2022) indicates a similar succession, but the Boulder Clay has been renamed Glacial Diamicton and the Sand and Gravel renamed as Glaciofluvial Deposits, and Hill Peat renamed as Peat. The Rhondda Beds and Llynfi Beds are also renamed as Rhondda Member and Llynfi Member respectively.



Insert 2: Extract from BGS Geological Map Sheet 248 original 1:50,000 scale and key.
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HYDROLOGY AND HYDROGEOLOGY

- 3.7 Two ponds are located in the south eastern extent in a topographical low, associated with the area where deep peat has been previously identified (Aecom, 2017 & 2018).
- 3.8 In the area of deep peat and ponds (topographical low), we consider that ponds represent a perched water table and that a deeper main groundwater body is likely present at depth within the underlying Pennant Sandstone Measures Bedrock.
- 3.9 It is likely that given the topography in this south eastern extent, that the two ponds and surrounding peat deposits act as a catchment for surface water naturally flowing towards the topographical low point from high points to the west, south and east.

Habitat Setting

- 3.10 A National Vegetation Survey (NVC) has previously been undertaken as part of an Environmental Statement in 2016 (Nineteen47, 2016), (report ref: YO1116.V1). Extracts from this survey were provided to ESP by Keystone Environmental and are reproduced in Appendix A.

- 3.11 The survey identified habitat areas across the site which are considered important with regards to the peat.
- 3.12 In the area of deep peat identified in the south eastern extent by ESP (2022), and the primary focus of this investigation, vegetation classification identified as M25a and M6c mire were recorded. Across the remainder of the site small regions classified as M15d wet heath were recorded. The classifications are summarised below in Table 1. The extract from the survey, including site plans are provided as Appendix A, and should be referred to in full alongside this report.

Table 1: Summary of NVC classifications identified on site relating to peat (Nineteen47, 2016).

NVC type	Description
M6c	One small stand of vegetation near the pools was classified as M6c <i>Carex echinata</i> – <i>Sphagnum fallax/denticulatum</i> mire; <i>Juncus effusus</i> sub-community. It occurred on wet peaty ground in a depression and was visually distinctive due to the prominence of Common Cotton-grass <i>Eriophorum angustifolium</i> and extensive cover of <i>Sphagnum</i> species (especially <i>S. fallax</i>). M6 mire is the most widespread soligenous mire in the British uplands. It usually occurs in wet hollows, at seepage lines, on flushed slopes, in shallow gullies and along stream margins, all places with slowly moving acid groundwater. It nearly always lies over acid and moderately nutrient-rich deep, wet and peaty soils.
M25a	Near the pools, flushed ground supported a different kind of Purple Moor-grass dominated vegetation with floristics matching the M25 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire; <i>Erica tetralix</i> sub-community. This vegetation occurred over flushed peaty ground and was defined by co-dominant Purple Moor-grass and Soft-rush. It differed significantly from other superficially similar vegetation elsewhere on the site in supporting strong populations of <i>Sphagnum subnitens</i> and several other species of <i>Sphagnum</i> . M25 mire occurs mostly in the cool and wet western lowlands where it often marks out seepage zones and flushes or extends onto the fringes of ombrogenous bogs. Only species-rich forms of M2 are included within the Purple Moor-Grass and Rush Pastures Habitat of Principal Importance.
M15d	Across the site's plateau, small stands of building to mature-stage wet heath were also present where shallow peat soils occurred, especially on gently dipping north-facing slopes and on tracksides. All of these had the floristics of M15d <i>Trichophorum germanicum</i> - <i>Erica tetralix</i> wet heath (<i>Vaccinium myrtillus</i> sub-community). These were rendered visually conspicuous (in August) by the presence of abundant Heather, Cross-leaved Heath <i>Erica tetralix</i> and locally, Deer-grass <i>Trichophorum germanicum</i>. Other characteristic species included Green-ribbed Sedge <i>Carex binervis</i>, Purple Moor-grass, Bilberry, Brown Bent <i>Agrostis vinealis</i> and Wavy Hair-grass. M15 wet heath develops over oligotrophic, wet or seasonally waterlogged peat or peaty mineral soils within tracts of blanket mire, on hillsides and over moraines. It is particularly associated with thin or better drained areas of ombrogenous¹ peat. It can also extend onto deep peat where drainage, grazing, burning or other disturbance has damaged or modified the original mire vegetation.

- 3.13 It should be noted that the survey provided an indication of the extent of the different habitats types associated with peat, however it has likely changed to some degree and would need to be updated with repeat botanical survey to be relied upon to inform the distribution of important habitats.

4.0 PREVIOUS PEAT ASSESSMENT

PREVIOUS PEAT ASSESSMENT

- 4.1 Two previous peat assessments are available for the site and are included in Appendix B.

Aecom, December 2017

- 4.2 The first (Aecom, December 2017) was a visual assessment of the whole site to record areas of potential peat. This suggested six areas of where peat may be present, as indicated on Figure 1; some of these areas extended off site. Recommendations were given to undertake site investigation in each of the areas to confirm the presence of deep peat.

Aecom, May 2018

- 4.3 The second assessment (Aecom, May 2018), Summary of Findings in Relation to the Peat Survey (May 2018) includes the findings of a site investigation undertaken by Terra Firma (April 2018). Physical investigations identified a single area of deep peat i.e., those containing peat to a depth or thickness of, or greater than 0.5m below ground level which was located in the east of the site, as shown in Figure 5 of the Aecom report.
- 4.4 The report states that it understood that areas of peat greater than 0.5m thick are not to be developed as they present a valuable resource and are to be protected, these are areas of deep peat.

5.0 EXPLORATORY INVESTIGATION (ESP, 2022)

INVESTIGATION POINTS

Introduction

- 5.1 The intrusive investigation was undertaken between 4th to 13th April 2022 in accordance with BS5930:2020), and was designed to investigate the lateral and vertical extents of peat where it had been previously suspected and identified at the site (Section 4 and Figure 1). It comprised hand excavated trial pitting, Mackintosh probing and geotechnical laboratory analysis.
- 5.2 The exploratory holes were supervised and logged by an engineering geologist in general accordance with BS5930:2020, BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2018, and BS EN ISO 14689:2018. The Von Post Humification Scale (Von Post, 1926) was adopted for classification. Laboratory testing has also been used to classify the peat, in accordance with Hobbs, 1986.
- 5.3 The investigation point positions are shown on Figures 3a to 3c.
- 5.4 The ground levels and coordinates of the investigation points were obtained by ESP using a handheld GPS device on completion and are shown on the various hole records.

Investigation Strategy

- 5.5 The investigation strategy was generally designed in accordance with BS5930:2020 and was targeted at areas where the presence of peat had been potentially identified on site by Aecom 2017. Thus 6 areas were investigated for the presence of deep peat.
- 5.6 Where deep peat was located, the adopted methods were chosen to allow for efficient delineation of the deep peat, taking into account the hazards associated with large scale machinery in such ground conditions. The strategy mostly comprised the use of a mackintosh probe to provide an indication of soils of low resistance, typically consistent with peat. Where required, hand excavated trial pits were subsequently undertaken to confirm the ground conditions.

Mackintosh Probing

- 5.7 Mackintosh probing was undertaken at 140no. positions as indicated on Figures 3a to 3c. The results of the probing is displayed as Appendix C.
- 5.8 The testing was undertaken from the existing ground surface. Appropriate precautions were taken during the testing to ensure the safety of ESP operatives. A 4.5kg weight is allowed to drop over a height of 280mm driving cone and associated rods into the ground. The number of blows required to penetrate successive 100mm intervals are recorded until refusal. It should be noted that dynamic proving is a 'blind' test in that no indication of the nature of the materials other than their resistance to penetration can be identified from the test.
- 5.9 In certain areas, a small hand excavated pit was excavated to confirm the shallow soils and to confirm the absence or presence of peat at shallow depth. This was carried out predominantly near the boundary of the deep peat area.

Hand Excavated Trial Pits

- 5.10 5no. hand excavated trial pits (Y37 to Y41) were undertaken to confirm the presence of peat on 13th April 2022 using hand tools. The trial pits were excavated to depths of between 0.9m and 1.2m. The trial pit records are presented as Appendix D, and their positions are shown on Figures 3a to 3c.
- 5.11 Disturbed samples were collected from the trial pits for laboratory testing as shown on the trial pit records.
- 5.12 On completion, the trial pits were backfilled with arisings in layers, and the Topsoil reinstated on the surface. The arisings were left slightly proud of the adjacent surface to allow for future settlement.
- 5.13 A photo-ionisation detector (PID) was used during the trial pitting to measure the levels of total volatile hydrocarbons present in the recovered soils.
- 5.14 Headspace analyses were undertaken whereby samples of the soil were collected in sealed plastic bags from the exploratory holes and then left for a period of time (in the sun to allow any volatiles present to escape into the headspace above the soil). The PID was then used to measure the levels of total volatile organic compounds (VOC) within the headspace above the sampled soils. The results are presented in Table 2 below.

Table 2: Summary of PID results

Location	Depth of test (m)	Maximum PID reading (ppm)
Y37	0.8	0.4
Y37	1.0	0.6
Y38	0.2	0.3
Y38	0.5	0.2
Y39	0.5	0.5
Y39	1.1	0.4
Y40	0.7	0.2
Y40	0.9	0.2
Y41	0.3	0.1
Y41	0.5	0.0

SAMPLING STRATEGY

Soil Sampling

- 5.15 Soil samples were collected from the exploratory holes for geotechnical laboratory testing. The sampling procedures were selected on the basis of the suitability for the laboratory testing proposed.

GEOTECHNICAL LABORATORY TESTING

- 5.16 Geotechnical laboratory testing was undertaken on samples from the suitable quality classes recovered from the exploratory holes in order to obtain information on the geotechnical properties on the soils beneath the site.
- 5.17 The following tests were undertaken by a UKAS accredited laboratory (Geo Site and Testing Services Ltd) on samples selected by ESP in accordance with the methodologies presented in BS1377:1990. The results are presented in Appendix E.

- Natural moisture content (9no. tests)
- Atterberg limits (9no. tests)
- Loss on ignition (9no. tests)
- Organic content, total carbon, total organic carbon (9no. tests)
- Bulk and dry density (9no. tests)

6.0 DEVELOPMENT OF REVISED PEAT EXTENTS

GROUND CONDITIONS

Peat Extents

- 6.1 The site investigation identified deep peat in one of the six areas investigated, located in the south eastern portion of the site where previous assessments identified deep peat, Aecom 2018.
- 6.2 The other five potential areas of peat were found not to contain deep peat which supports the findings of the Aecom (2017) investigation.
- 6.3 The area where deep peat (thickness greater than 0.5m) has been delineated in the southeast of the site, as shown in Figure 3c. The deep peat extents in relation to the proposed development is shown on Figure 2.
- 6.4 Generally, where deep peat is considered to be present, the results of the Mackintosh probing indicated depths of less than 1.0m. However, in some areas the depth was recorded as being in excess of 1m and in one location anticipated to be greater than 3.5m where probing was terminated within soft material. A summary of the locations where peat was encountered at greater than 0.5m depth is provided in Table 3 below, these positions are also shown on Figure 3c.

Table 3: Summary of deep peat ground conditions.

Location ID	Depth of Peat ¹	Location ID	Depth of Peat ¹
MP-A1-S1-P1	0.8m	MP-A1-S8-P1	2.5m
MP-A1-S1-P2	1.0m	MP-A1-S9-P2	1.6m
MP-A1-S1-P3	1.0m	MP-A1-S9-P1	1.2m
MP-A1-S2-P2	0.6m	MP-A1-S9-P3	1.0m
MP-A1-S2-P3	1.1m	MP-A1-S9-P4	1.9m
MP-A1-S2-P4	0.8m	MP-A1-S10-P1	2.0m
MP-A1-S2-P5	0.6m	MP-A1-S10-P2	2.0m
MP-A1-S3-P1	0.8m	MP-A1-S10-P4	1.1m
MP-A1-S3-P3	0.9m	MP-A1-S10-P5	0.9m
MP-A1-S3-P5	0.8m	MP-A1-S11-P3	1.8m
MP-A1-S5-P2	0.7m	MP-A1-S11-P5	1.6m
MP-A1-S5-P3	0.7m	MP-A1-S12-P1	0.8m
MP-A1-S5-P4	0.6m	MP-A1-S12-P3	1.3m
MP-A1-S7-P1	3.5m ²	MP-A1-S13-P1	0.7m
MP-A1-S7-P2	1.7m	MP-A1-S13-P3	0.6m
MP-A1-S7-P5	0.6m	MP-A1-S14-P1	0.9m
MP-A1-S8-P2	1.0m	MP-A1-S14-P3	0.6m

Notes:

1. Soft ground conditions encountered during Mackintosh probing are considered likely to represent peat.
2. Base of peat materials not confirmed.

Organic Soils

- 6.5 Organic rich topsoil was encountered in all hand excavated trial pits, with the exception of Y38, to a maximum depth of 0.2m. The soils generally comprise dark grey clayey silt with abundant rootles and

plant remains including branches. No water release was recorded on compression and generally a weak or no odour was noted.

- 6.6 The results of the Mackintosh probing indicated that outside the area identified to contain no deep peat, organic rich topsoil was encountered between depths of 0.1 and <0.5m depth with the majority of results (85%) recorded as ≤0.2m.

UPDATED HYDROLOGY AND HYDROGEOLOGY

- 6.7 The hand excavated trial pits identified groundwater in all pits with the exception of Y40. The groundwater strikes were recorded between 0.2 and 0.4m depth and were generally within the upper portions of the peat strata. The groundwater levels did not rise past their strike depths.
- 6.8 The area of deep peat is enclosed by higher ground to the south, west, east and less so to the north. This effectively forms a basin and it is considered likely that surface water in the immediately surrounding areas flows from these higher points into the deep peat area, or basin. The lowest area of the deep peat area also has the ponds, and it is considered likely water flows to the ponds.

PEAT DESCRIPTIONS AND PROPERTIES

- 6.9 The hand excavated pits identified the peat to typically comprise, brown very compressible amorphous non-fibrous to fibrous peat with moderate to strong organic odour. Generally muddy water was released on compression and abundant brown to black organic material was recorded throughout. An example of the soils encountered in Y40 is provided below:
- Dark brown thinly laminated (1mm) very compressible very wet pseudo-fibrous PEAT. Brown muddy water released on compression. Relict sphagnum moss present. Strong odour recorded. Abundant brown to black plant remains recorded.
- 6.10 Full details of the strata encountered are displayed on the investigation points records in Appendix D.
- 6.11 Laboratory testing within the peat, indicated liquid limits between 351 and 747%, plasticity indices between 285 and 688%, and natural moisture contents between 286 and 609%. The modified plasticity indices (after the coarse-grained particles have been removed) suggest that the soils would be generally classified as extremely high plasticity. A summary of further geotechnical analysis is provided below in Table 4.

Table 4: Summary of Laboratory Testing

Analysis	Range Recorded
Moisture Content	286 – 609%
Bulk Density	0.57 – 3.89 mg/m ³
Dry Density	0.08 – 1.01 mg/m ³
pH	4.2 – 5.7
Total Organic Carbon (TOC)	33.7 – 58.9 % w/w C
Organic Matter Content	58.1 – 94.2 % w/w
Loss on Ignition (at 440°)	55.1 – 85.6 % w/w
Notes:	
1. Full geotechnical laboratory results are displayed in Appendix E.	

- 6.12 Based on the results of the geotechnical laboratory, the samples analysed have been classified using the mire stages classification detailed in Hobbs 1986. The classified peat soils are summarised in Table 5 below.

Table 5: Mire stages, morphology and humification classification (Hobbs, 1986 and Von Post, 1926)

Sample Location and Depth	Peat Classification ¹	Humification Scale ²
Y37 – 0.8m	Second Stage – Transition Peat	H4 – Brown Peat
Y37 – 1.0m	Second Stage – Transition Peat	
Y38 – 0.2m	Second Stage – Transition Peat	H5 – Brown Peat
Y38 – 0.5m	Second Stage – Transition Peat	
Y39 – 0.5m	First/Second Stage – Fen Peat	H4 – Brown Peat
Y39 – 1.1m	First/Second Stage – Fen Peat	
Y40 – 0.9m	Second Stage – Transition Peat	H5 – Brown Peat
Y41 – 0.3m	First/Second Stage – Fen Peat	H6 – Brown Peat
Y41 – 0.5m	First/Second Stage – Fen Peat	
Notes:		
1. Mire classification details provided in Table 2 of Hobbs, 1986.		
2. Humification scale detailed in Von Post, 1926.		

7.0 GEOTECHNICAL DISCUSSION

- 7.1 Areas of deep peat (peat greater than 0.5m thick) should not be developed upon and this is discussed further in Section 8 below. This section provides general comments on development in areas with organic soils.

PROPOSED DEVELOPMENT

- 7.2 The site investigation works have identified one area of deep peat in the south eastern extent of the site. It is understood that the detailed proposed development plan is to be developed and will preclude the use of the land identified as Deep Peat.
- 7.3 The current proposed development, as shown in Figure 2, suggests that staff parking, accommodation lodges and the mountain zone and access roads are proposed outside of the area identified to contain deep peat.

TOPSOIL AND ORGANIC-RICH SOILS

- 7.4 In parts of the site situated outside where deep peat was identified, it is understood that any topsoil and organic rich soils (<0.5m thick) will be removed from the footprint of any proposed structures and infrastructure e.g., roads.
- 7.5 The proposed scheme is likely to include the reuse of the topsoil and organic rich soils on site as top cover and it is considered likely that this site won material will be suitable for reuse after testing and possible amelioration if required. The topsoil and organic rich soils should be carefully removed prior to commencement of any work and stockpiled separately for later reuse on or off-site. Further guidance on the requirements for handling topsoil and organic rich soils are specified in outlined in BS:3882 (2015)

GROUND GAS

- 7.6 The peat encountered was recorded to contain abundant organic material and would be considered to present a potential source of ground gas. A subsequent phase of intrusive investigation following the issue of this report is to include ground gas monitoring and will assess the associated risks.

PROPOSED DEVELOPMENT

- 7.7 Whilst we consider that the key areas of concern have been identified and our assessment has been robust in identifying areas of suspected peat, there may be small, isolated areas of deeper organic rich topsoil or peat on site that have not been identified; if present, they are considered likely to be small and thin.
- 7.8 Care should be taken during further site investigations, clearance works and future construction work to assess the ground accordingly. All areas of deep peat (greater than 0.5m thickness) are not to be developed upon.

8.0 DEEP PEAT MANAGEMENT

- 8.1 Based on the information reviewed to date, it is considered that deep peat is representative of peat strata greater than 0.5m in thickness, as per UK Forestry Standards (UKFS). Deep peat is considered an important resource in Wales. Peatlands in a good condition play a vital role for biodiversity, regulation of water flow and quality and are a carbon store. We understand that a Scoping Opinion Addendum (ref. P2017/0825 dated 12th December 2017) provided by Neath Port Talbot County Borough Council stated that areas of deep peat (defined as over 50cm thick in Wales) are expected to be retained.
- 8.2 Protection and regeneration of deep peat areas within Wales is becoming increasingly important and it is an environmental value should be considered as part of the wider development design.
- 8.3 All deep peat reserves should be retained and protected as part of the design.

MITIGATION STRATEGY

- 8.4 The area where deep peat (greater than 0.5m thickness) has been identified presents a constraint to the proposed scheme that the masterplan will need to take into consideration for the development of the site. The guidance outlined in Section 2 (SEPA, 2017), should be considered as part of the detailed development design.
- 8.5 Peat in excess of 0.5m thick was identified and delineated in one area of the site, see Figure 2. Any deep peat identified is required to be left in-situ, undisturbed and protected during construction and during the site operation stage. Any development will not be permitted where deep peat was identified as shown on Figure 3c. It should be noted that any excavation, on-site reuse, off-site recovery, recycling or disposal of deep peat is not proposed as part of the development.
- 8.6 In order to protect the deep peat areas during construction works, it is recommended that a buffer zone of a minimum 5m be established around the identified deep peat area. This will mitigate the impact of construction works on the peat area and protect construction workers from the risks associated with working in soft, compressible ground. The buffer zone should form a physical barrier in the form of fencing/hoarding to segregate any works from these area.
- 8.7 Any drainage proposals will need to mimic the current hydrological and hydrogeological conditions within the deep peat catchment basin as required for the protection of the deep peat. Any surface water drainage within the surface water catchment will need to be directed to the basin with the peat and the ponds. In addition, surface water collected from roof runoff will need to be directed into the ground using shallow infiltration to mimic the near surface groundwater regime at this part of the site.

9.0 SUMMARY AND RECOMMENDATIONS

9.1 An area of deep peat has been delineated in the south eastern extent of the site where an enclosed surface water catchment area has formed within a topographical low. We consider that the development will be amended to restrict development in the deep peat area and that the deep peat is to be retained and protected as part of the design wherever possible.

9.2 In summary:

- Where peat is present at a thickness greater than 0.5m depth, the peat is required to remain undisturbed, in-situ and be retained as part of development design. No structures should be developed in these areas, where organic-rich soils are less than 0.5m thickness it may be feasible to remove and replace with a suitable fill;
- Any drainage proposals will need to mimic the current hydrological and hydrogeological conditions within the deep peat catchment basin as required for the protection of the deep peat;
- Whilst it is considered that the key area of concern has been identified, it cannot be discounted that further small, localised areas of peat or deep peat are present at the site and therefore care should be taken during further site investigation, clearance and development works;
- A buffer zone should be adopted around the deep peat area, both for the protection of the peat reserves and constructions workers and plan; and
- Guidance with regards to the protection of deep peat (see Section 2), should be followed in detailed development design and construction phases.

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