Ground Conditions Assessment Report

Waterfall Country Pontneddfechan – Visitor Infrastructure Scheme

PREPARED BY:	FOR:	DATE:	REFERENCE:
Jubb Consulting Engineers Ltd.	Andrew Scott Ltd	April 2024	23158-JCE-XX-XX-RP-GE-001-P2

Table of Contents

Table of Contents 1
List of Figures 2
List of Tables 2
1 Introduction 9
1.1 Commission 9
1.2 Objectives 9
1.3 Scope, Sources & Limitations 9
2 Site Setting 12
2.1 Site Location 12
2.2 Site Description 12
2.3 Site Proposals 13
3 Summary of Desk Study Information 15
3.1 Site History 15
3.2 Published Geology 15
3.3 Natural Soil Chemistry 16
3.4 Hydrogeology 16
3.5 Hydrology 17
3.6 Natural Ground Instability 18
3.7 Radon Risks 18
3.8 Mining and Mineral Extraction 18
3.9 Regulatory Information 18
3.10 Environmental Designations 19
3.11 Unexploded Ordinance (UXO) Risk 19
3.12 Preliminary Risk Assessment (Contamination) 19
4 Ground Investigation Works 22
4.1 General 22
4.2 Exploration Sampling Strategy 23
4.3 Contamination Testing 24
4.4 Geotechnical Testing 24
5 Ground Conditions 26
5.1 Ground Conditions Encountered 26
5.2 Summary of Geotechnical Parameters 30
5.3 Groundwater 30
5.4 Visual and Olfactory Evidence of Contamination 31
6 Generic Quantitative Risk Assessment (Contamination) 32
6.1 General 32
6.2 Proposed Development and Land Use 32
6.3 Risks to Human Health 32

6.4 Risk to Controlled Waters 35
6.5 Risks to Flora and Fauna 35
6.6 Risks to Adjacent Land and Third Parties 35
6.7 Potential Geo-Environmental Liabilities 35
6.8 Off Site Disposal 35
6.9 Updated Conceptual Site Model 35
6.10 Contamination Risk Summary 37
7 GEOTECHNICAL ASSESSMENT 38
7.1 Introduction 38
7.2 Excavations 38
7.3 Foundation Options 39
7.4 Floor Slabs 39
7.5 Earthworks 39
7.6 Protection of Buried Concrete 41
7.7 Pavement Design 41
7.8 Soakaway Design 43
8 FURTHER WORK 44
9 GEOTECHNICAL RISK REGISTER 45
10 References 46

List of Figures

Figure 1: Approximate Site Extents 12
Figure 2: Illustrative Masterplan 14
Figure 3: Extract of the BGS 1:10,560 Country Series (1932) Solid and Drift Mapping 16
Figure 4: Extract of the BGS 1:10,560 Country Series (1932) Solid Mapping 16
Figure 5: Surface Water (River) Flood Risk Mapping 17
Figure 6. Dynamic Probe Correlated to SPT N Value Results – Made Ground 27
Figure 7: Superficial Deposits Atterberg Testing 28
Figure 8: Particle size distribution chart 29
Figure 9. SPT Results – River Terrace Deposits 30
Figure 10: Compaction Curve – GSTL Lab 40
Figure 11: CBR vs Depth correlated from DCP Testing (Green – River Terrace Sands, Red – River Terrace Gravels, Purple – Made Ground) 42

List of Tables

Table 1. List of Standard References 10
Table 2: Summary of preliminary conceptual site model 21
Table 3: Sampling Strategy 24
Table 4: Contamination Suite 24
Table 5: Soil Contamination Testing 24
Table 6: Geotechnical Testing – GSTL and Chemtest Environmental Ltd 25
Table 7: Ground Conditions Summary 26
Table 8: Summary of Geotechnical Parameters 30
Table 9: Monitoring Well Installation Summary 31

Table 10. Summary of groundwater monitoring results 31
Table 11: Summary of Soil Contamination – Metals and Semi Metals 32
Table 12: Summary of Soil Contamination – PAHs 33
Table 13: In situ ground Gas Monitoring Results 34
Table 14: Updated Conceptual Site Model 36
Table 15. Summary of Compaction Results 40
Table 16: Summary of BRE-SD1 Concrete Sulphate Class Assessment 41

Appendix A: Site Location Plan i
Appendix B: Proposed Site Development Plan ii
Appendix C: Exploratory Hole Location Plans and Site Zonation Plan iii
Appendix D: Contamination Risk Assessment Methodology and Definitions iv
Appendix E: Hazwaste Classification Report v
Appendix F: Geotechnical Risk Register vi
Appendix G: Limitations and Exceptions vii

PROJECT INFORMATION

Project Information

Client	Andrew Scott Ltd

Project Details

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Location	Pontneffachan
Jubb Project Number	23158
Title	Ground Conditions Assessment Report

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1	09/02/2024	First Issue
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EXECUTIVE SUMMARY

Site Information	
Client	Andrew Scott Ltd
Project	Waterfall Country Pontneddfechan – Visitor Infrastructure Scheme
OS Co-ordinates	SN 900 075
Site Size	The site is irregular in shape approximately irregular in shape, measuring up to approximately 200x80m in size, covering an area of approximately 1.5 hectares.
Proposals	The site is proposed to be acquired by Neath Port Talbot Council and developed into a community/ visitor hub, and provide a permanent parking solution for the area.
Site Description	The site comprises a large, grassed field, with a number of farm buildings in the north. The site is accessed via the Pontneathvaughan Road which is located along the northern boundary. The site slopes to the southeast, and topographic levels drop from an elevation of around 80.0m above Ordnance Datum (AOD) in the north, down to 75.0m AOD in the southeast. An access track leads along the length of the eastern boundary to the underside of the A465 road. The River Neath flows south beyond the sites eastern boundary, approximately 2-3m below adjacent ground level and the river bank is vegetated, up to around 20-30° in angle. Immediately to the south of the site is an embankment rising above site levels by approximately 10m, this embankment is associated with the bridge which carries the A465 road over the River Neath at its convergence with the River Mellte.
Historic Site Uses	The majority of the site has remained open green field for the duration of the mapped period, dating back to 1884, with the restaurant building shown to be present. A tramway is shown along the northern boundary from the earliest mapping up until the 1950s, with the Pontneathvaughan Road constructed adjacent by 1918, and a smithy was present immediately north of the site until the time of the road realignment. The site area has contained various small structures throughout the mapping period in the northern area only, with ongoing reconfigurations and additions observed through the 20th Century. A building in the northeast was demolished around the 1990's. The track along the eastern boundary is also recorded from the earliest mapping period. To the south, the A465 road and its associated embankment forming the abutment of the bridge was constructed sometime in the 1970's.
Ground Conditions	
Geology	BGS records indicate the site is underlain by the South Wales Lower Coal Measures Formation, overlying Mudstone in the south and underlying Sandstone in the north with stratum dipping to the south. These deposits are shown to be overlain by superficial River Terrace Deposits over the majority of site, with small parcel of Alluvium in the far southeast. Made Ground is expected around the areas of existing and former construction in the northern area. The risk from coal mining to the site is considered negligible.
Hydrogeology and Hydrology	Hydrogeology

	The superficial River Terrace Deposits and the South Wales Lower Coal Measures Formation bedrocks beneath the site are classed as a Secondary (A) aquifers with a combined high groundwater vulnerability. Groundwater is likely to be present within the River Terrace Deposits, commensurate with the level of the River Neath, and providing base flow to the river. There are no active licensed groundwater abstractions within 500m of the site and the site is not within a groundwater Source Protection Zone (SPZ). <u>Hydrology</u> Run-off will likely flow east following the gradient of the sites topography, into the River Neath which is located directly east of the site and represents the sites closest water feature. A (low-)high risk of surface water flooding associated with limited areas along the eastern boundary, associated with the River Neath river banks, with low and medium risk areas present in lower lying areas in the far southeast where the River Neath meets the River Mellte.
Ground Conditions Encountered	Ground Conditions typically comprised approximately 0.25m topsoil, over granular River Terrace Deposit, which were recorded to maximum depths of 1.5mbgl. All exploratory holes refused or terminated due to high density and the presence of cobbles within the River Terrace Deposits. In the north, around existing and former development, Made Ground was encountered to maximum depths of 0.9m bgl. Groundwater was not encountered during the GI. However, this can be assumed to lie at a depth within the River Terrace Deposits commensurate with the level of the River Neath with gradient from the northwest.
Radon and Ground Gas	The site is within a Radon Affected Area where 10-30% of homes are estimated to be at or above the action level and therefore Full radon protection measures are required. However, it is recommended that an updated site-specific Radon Report is obtained to more accurately identify the Radon risk to site, and proposed structures. The gas monitoring results are pending completion of the monitoring program, awaiting agreements between the client and landowner to allow for site access to complete this.
Geo-environmental Assessment	
Contamination Assessment	Soil samples were tested against the general assessment criteria for "Public Open Space - Park" land uses using C4SL and S4UL. No exceedances were detected within the soils tested against the Generic Assessment Criteria values adopted for any contaminant. No asbestos was identified in any of the samples collected and tested. A Hazwaste assessment was carried out on all samples, all of which were identified as non-hazardous with respect to off-site disposal purposes.
Contamination Risk Classification	Low risk.
Outline Mitigation Strategy	No specific mitigation measures are required in terms of protection of human health from site soils, or in terms of risks to controlled waters. Standard task specific PPE and good hygiene practices should be adopted by site groundworkers.
Geotechnical Assessment	

Foundations and Floor Slabs	The proposed buildings are located over the northern area of site, where Made Ground was encountered down to depths of between 0.7m and 0.9m bgl. The Made Ground is not a suitable founding stratum so any foundations should extend through the Made Ground and into the underlying granular gravel River Terrace Deposits. Traditional shallow foundations should be suitable for the site, where an allowable bearing pressure of at least 125kPa is available for the granular gravel material. Due to the limited investigation depth of the GI undertaken due to limitations on the size of plant and permitted excavation volumes, it would be prudent to carry out additional trial pitting to greater depths to confirm the continuation of the River Terrace Deposits to beyond the depth of the zone of influence of the foundation. NHBC guidelines recommended that a suspended floor slab is used where the thickness of Made Ground exceeds 0.6m, and as this is the case in the areas of proposed, then it is recommended that the Made Ground is either excavated out down to the natural granular subgrade or re-compacted in order to support a ground bearing floor slab, otherwise a suspended floor slab should be used.
Excavations	Excavations within the development, are likely to consist of standard trench foundation excavations. Excavations are expected to be associated with attenuation drainage, the construction of roads and carparking, and minor soft landscaping alterations. Any excavations will extend through any Made Ground and into the granular River Terrace Deposits. Trial pits were carried out as part of the GI and are anticipated to be stable and achievable using a standard mechanical plant, however, dense gravels and cobbles may require or benefit from use of larger machinery, and excavations may prove slow with over break, possibly requiring shoring where battering is not appropriate. Shoring may also be required near public roads as not to undermine. Any surface or groundwater inflow into temporary excavations will likely drain themselves. However, depths to groundwater are not known and excavations are likely to become unstable below groundwater level which should be assumed from within 1m above the level of the River Neath.
Earthworks	Any cut and fill activities will likely be limited to the proposed attenuation basin in the central area of the site. Here granular superficial deposits are likely present to depths of at least 1.0m and based on the laboratory PSD tests, these soils can be classified as either a Class 1A (well graded granular material) where gravel, or Class 2A/B (wet/dry cohesive material, where sand, when used as a general fill. Compaction testing carried out within sand deposits (on the cohesive fraction material) indicates an OMC of 12%, compared to an average moisture content of around 19%. As such some form of moisture treatment may be required in order to reduce the moisture content in order for it to be compacted to 95% of its MDD.
Buried Concrete Classification	• Made Ground – DS-1 AC-1; and • Superficial Deposits – DS1 AC-1.
Pavement Design	Assuming stripping of the topsoil and any made ground, based on the obtained CBR results a performance approach can be adopted for the site with a preliminary design CBR value of **3%** to be achieved in sands (east) and **6%** in gravels (west). Where Made Ground is present at subgrade levels more variable ground conditions should be expected, although the results indicate a Performance Design Approach can be adopted providing material is compacted.

	Where localised soft spots are encountered with a CBR value of less than 2%, improvement works are likely to be required.
Soakaway Design	River Terrace Deposits are likely to be free draining and provide a good infiltration medium for permeable SUDS surfaces, as indicated within the preliminary soakaway testing carries out. The use of an infiltration basin is proposed on the edge of a Flood Zone 2/3, therefore, at times groundwater can be expected at or close to surface in this area which may have implications for proposed levels or construction of the attenuation.
Geotechnical Risk Category	• Geotechnical Category 1 – Conventional Structures.

1 Introduction

1.1 Commission

Andrew Scott Ltd working on behalf of the local council, are proposing to submit an outline planning application for the development of a new community/visitor hub, on a field located on the outskirts of the village of Pontneddfachan, in Powys.

To assist with Neath Port Talbot Councils acquisition of the site and the development of the site proposals, Jubb Consulting Engineers (Jubb) have been appointed to undertake a geotechnical and geo-environmental assessment of the ground conditions for the proposed site use.

This report constitutes the Ground Conditions Assessment (GCA) for the proposed development and provides advice for the geotechnical and geo-environmental design of the development and associated ground contamination or geotechnical hazards.

This report is for the private and confidential use of Andrew Scott Ltd (to whom alone is owed a duty of care) and their professional advisors and consultees; it may not be relied upon or reproduced by any third party for any use without the written agreement of Jubb.

1.2 Objectives

The objectives of this assessment are:

- to develop a preliminary Conceptual Ground Model (ground conditions) and preliminary Conceptual Site Model (contamination exposure model) to inform and make a preliminary assessment of key geo-environmental and geotechnical risks;
- to assess the geo-environmental ground conditions at the site with due regard to any previous investigation, remediation and validation works undertaken as part of the site enabling works. If necessary, to provide outline recommendations for risk mitigation based on the findings;
- to analyse the intrusive ground investigation results to determine ground conditions, obtain representative values for geotechnical analysis, and identify any geotechnical issues which may affect the proposed development; and
- to make an evaluation of any potential environmental or geotechnical hazards, risks and liabilities to the planned development of the site on the basis of the foregoing studies, and to provide engineering and environmental recommendations for the site, in view of the potential development of the site.

1.3 Scope, Sources & Limitations

A Phase 1 Geo-environmental desktop study has not been commissioned for the site, however, Section 3.0 of this report will summarise the available desk study information, as provided by the client, which includes an Envirocheck environmental report, historical mapping, and a CON29M Coal Mining Report.

- Envirocheck Report Summary, Pontneddfechan, Project Ref: 111560, dated 13/06/2022
- Envirocheck Report, Order reference: 296140106_1_1, dated: 26/05/2023
- Soil Site Report, Extended Soil Report, Cranfield University, Ref: 296140106_4, dated: 26/05/2022)
- CON29M Coal Mining Report, Sgwd Gwladys Coffee Bar & Lodge, Pontneathvaughan Road, The Coal Authority, dated: 26/05/2022
- (Utilities Survey) Pontneddfechan Neath, Drawing Ref: 6765 (Sheets 1-3), Landmark Surveys Wales, Dated: November 2023.

Following a scoping and tender exercise carried out by Jubb, a Ground Investigation (GI) was completed by Earth Science Partnership (ESP) in December 2023. The siteworks were originally attempted in October 2023, but works had to be postponed due to access being restricted by the land owner. This GI is to support and supplement the initial assessment of the site, see Section 4.0 and 5.0 for more details.

Due to considerable limitations relating to site access due to the current land ownership and respective legal agreements, significant restrictions were observed during the GI phase, discussed further in Section 4.0.

This report has been carried out in accordance with the following UK legislation and regulatory guidance for site investigations:

Table 1. List of Standard References

Standard Reference	Title	Publisher	Date
BRE SD 1:2005	Concrete in aggressive ground	BRE	2005
BS 10175:2011+A2:2017	Investigation of potentially contaminated sites. Code of practice. Code of practice	BSI	2017
CLR 11:2004	Model procedures for the management of land contamination - contaminated land report	EA	2004
BS EN 1997-1:2004+A1:2013	Eurocode 7. Geotechnical design. General rules	BSI	2013
NA+A1:2014 to BS EN 1997-1:2004+A1:2013	UK National Annex to Eurocode 7. Geotechnical design. General rules	BSI	2014
CIRIA C665:2007	Assessing risks posed by hazardous ground gases to buildings	CIRIA	2007
BS 8485:2015+A1:2019	Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.	BSI	2019
CIRIA C515:2000	Groundwater Control - Design and practice	CIRIA	2000
BRE 211:2015	Radon: Guidance on protective measures for new buildings and in conjunction with BGS updated radon mapping (Dec 2022).	BRE	2015
BS EN ISO 22475-1:2006	Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution	BSI	2006
BS 1377-1:2016	Methods of test for soils for civil engineering purposes. General requirements and sample preparation	BSI	2016
BS 1377-3:2018	Methods of test for soils for civil engineering purposes. Chemical and electro-chemical testing	BSI	2018
BS 1377-4:1990	Methods of test for soils for civil engineering purposes. Compaction-related tests	BSI	1990
BS 5930:2015	Code of practice for ground investigations.	BSI	2015
BS EN ISO 14688-1:2018	Geotechnical investigation and testing. Identification and classification of soil. Identification and description	BSI	2018
BS EN ISO 14688-2:2018	Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification	BSI	2018
BS EN 1997-2:2007	Eurocode 7. Geotechnical design. Ground investigation and testing	BSI	2007
NA to BS EN 1997-2:2007	UK National Annex to Eurocode 7. Geotechnical design. Ground investigation and testing	BSI	2007
BS EN ISO 17892-1:2014	Geotechnical investigation and testing. Laboratory testing of soil. Determination of water content	BSI	2014
BS EN ISO 17892-2:2014	Geotechnical investigation and testing. Laboratory testing of soil. Determination of bulk density	BSI	2014
BS EN ISO 17892-3:2015	Geotechnical investigation and testing. Laboratory testing of soil. Determination of particle density	BSI	2015
BS EN ISO 17892-4:2016	Geotechnical investigation and testing. Laboratory testing of soil. Determination of particle size distribution	BSI	2016
BS EN ISO 17892-8:2018	Geotechnical investigation and testing. Laboratory testing of soil. Unconsolidated undrained triaxial test	BSI	2018
BS EN ISO 17892-12:2018	Geotechnical investigation and testing. Laboratory testing of soil. Determination of liquid and plastic limits	BSI	2018
BS EN ISO 18674-1:2015	Geotechnical investigation and testing. Geotechnical monitoring by field instrumentation. General rules	BSI	2015

It should be noted that any ground investigation provides only a small sampling of any site and that ground conditions may differ both laterally (across the site) and vertically (with depth) between sample points. Such

differing conditions may thus remain undetected by fieldwork. Certain areas may not have been accessible to intrusive survey due to vegetation, live services or other obstructions.

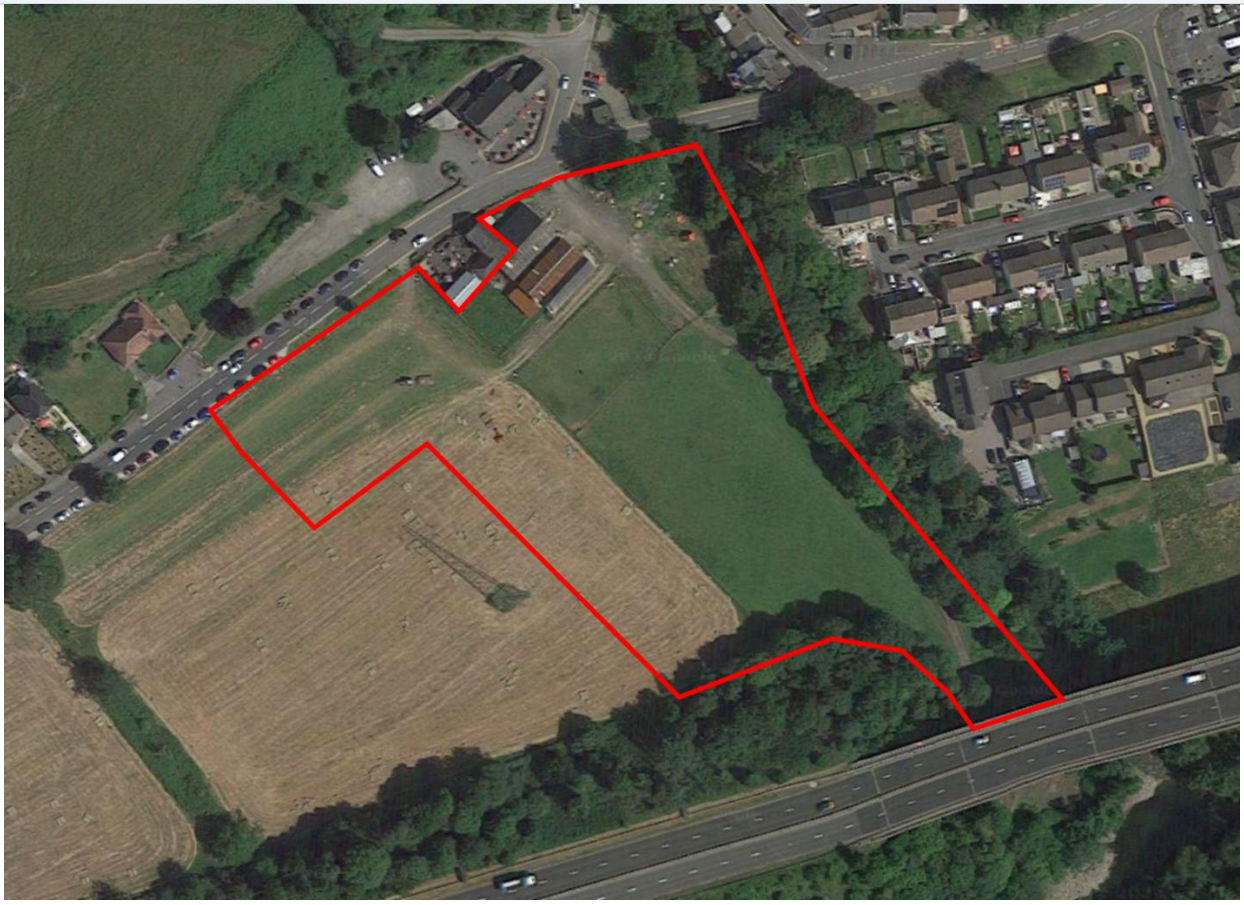
2 Site Setting

2.1 Site Location

The site is located to the southwest of the village of Pontneddfechan, in Powys and is situated on a plot of land directly south of Pontneathvaughan Road and north of the A465, approximately 19km north of Neath, on the southern boundary of the Brecon Beacon National Park. The River Neath flows just beyond the eastern boundary of the site and is joined by the River Mellte just beyond the southern boundary.

The site currently comprises an existing restaurant and café (to remain), and fields to the southeast, as well as part of the adjacent field to the west. The outline of the site is depicted in Figure 1 below.

Figure 1: Approximate Site Extents



The Ordnance Survey National Grid Reference at the centre of the site is SN 900 075.

A site location plan is reproduced in **Appendix A**.

2.2 Site Description

The site is irregular in shape, approximately 200m in length by 80m in width along its longest axis and covers an area of approximately 1.5 hectares. The site comprises a large, grassed field over the majority of the site, with a number of farm buildings in the northern area, primarily as agricultural storage open shed structures. Immediately to the north of the site is a restaurant, a two story stone building, and a café, a smaller wooden outbuilding structure, both of which are excluded from the site area. The site is accessed via the Pontneathvaughan Road which runs along the northern boundary.

The site generally slopes to the southeast, and topographic levels drop from an elevation of around 80.0m above Ordnance Datum (AOD) in the north, adjacent with the road, down to 75.0m AOD in the southeastern corner where the River Neath flows south beyond the site boundary, approximately 2-3m below adjacent site levels. The resulting elevation change across site is around 5m over a distance of 200m

A maintenance track continues along the length of the eastern boundary leading to the underside of the A465 bridge in the south. The river bank is vegetated and covered with trees, is around 20-30° in angle, and is included within the site area. An electricity pylon is present in the western area, with overhead cables orientated northwest to southeast.

A single mature tree is present within the north (within areas of proposed development). Trees are present onsite along the sites eastern boundary adjacent the river, and a small wooded area is found immediately southwest of the site, upon the A465 bridge embankment area.

Immediately to the south of the site is an embankment rising above site levels by approximately 10m, this embankment is associated with the bridge which carries the A465 road over the River Neath at its convergence with the River Mellte.

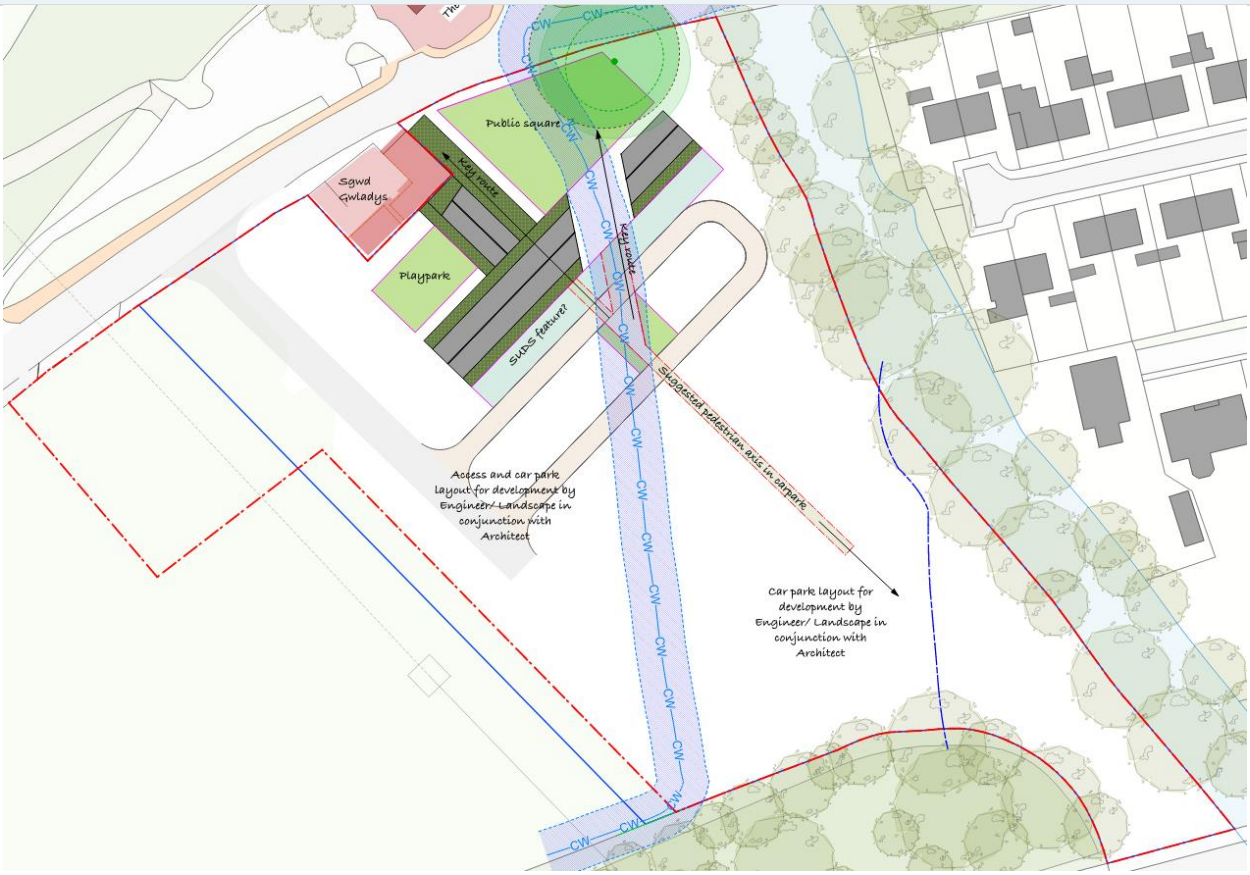
2.3 Site Proposals

The site is proposed to be acquired by Neath Port Talbot Council and developed into a community/ visitor hub, and provide a permanent parking solution for the area, alleviating local community pressures associated with the nearby tourist attraction; the Sgwd Gwladys Waterfall. The council Pre-Construction Information document includes the design and build of:

- A new community / visitor hub;
- A new bunkhouse;
- New public spaces;
- New drainage and highways works;
- Dedicated car parking; and
- Interpretation scheme

A site proposal plan (Ref: *Visitor Hub Master Plan, Neath Port Talbot CBC, Lower Pontneddfechan, Hiraeth, Drawing No. 2151 SK210, dated 05/2022*) is included in **Appendix B**, and shown in the figure below.

Figure 2: Illustrative Masterplan



3 Summary of Desk Study Information

A desk study was not commissioned as part of these works, but the following information has been provided by Andrew Scott Ltd and reviewed to understand any potential geo-environmental risk relating from any historical usage and its impact on the proposed development

- Envirocheck Report Summary, Pontneddfechan, Project Ref: 111560, dated 13/06/2022
- Envirocheck Report, Order reference: 296140106_1_1, dated: 26/05/2023
- Soil Site Report, Extended Soil Report, Cranfield University, Ref: 296140106_4, dated: 26/05/2022)
- CON29M Coal Mining Report, Sgwd Gwladys Coffee Bar & Lodge, Pontneathvaughan Road, The Coal Authority, dated: 26/05/2022
- (Utilities Survey) Pontneddfechan Neath, Drawing Ref: 6765 (Sheets 1-3), Landmark Surveys Wales, Dated: November 2023.

3.1 Site History

A review of the historic Ordnance Survey Maps dating back to 1884, shows that the majority of the site has remained open green field for the duration of the mapped period. A tramway is shown along the northern boundary from the earliest mapping up until the 1950s, with the Pontneathvaughan Road constructed adjacent by 1918. A smithy was present immediately north of the site until the time of the road realignment.

The stone restaurant building is shown to be present for the duration of the mapped period, with several small additions to it from the 1970s. The site area itself has contained various small structures throughout the mapping period in the northern area only, with ongoing reconfigurations and additions observed through the 20th Century, with a building in the northeast demolished around the 1990's. The track along the eastern boundary is also recorded from the earliest mapping period.

To the south, the A465 road and its associated embankment forming the abutment of the bridge was constructed sometime in the 1970's, which at the same time saw the dismantling of the railway line which ran 250m to the south of the site.

In the surrounding area, Pontneddfechan has shown a gradual expansion over the mapped period. The residential estate to the east was constructed sometime between 1964 and 1969, replacing a sewage treatment works, although leaving a sewage pumping station, adjacent to the river.

3.2 Published Geology

The BGS 1:50,000 Solid and Drift Mapping of Merthyr Tydfil, Sheet 231, the 1:10,560 Country Series (Sheet 49NE), Geological Survey of Great Britain National Grid Series 1:10 560 (Sheet 90NW), and the online BGS Geology of Britain Viewer, shows the site to be underlain by superficial deposits, comprising River Terrace Deposits associated with the adjacent River Neath, with Alluvial Deposits shown to directly underlie the lower lying southeastern corner of the site.

The River Terrace Deposits are noted to typically comprise sands and gravels, locally with lenses of silt, clay or peat, the historic BGS Country Series mapping indicates a predominantly gravel material underneath the site.

The solid geology beneath the site is shown to be the South Wales Lower Coal Measures Formation, with sandstone across the northern half of site, dipping 25-45° to the south, and mudstone (historically referred to as 'Shale'), across the southern half of site dipping to the north. A fault separates these two bedrocks down thrusting northwards, with a synclinal axis onsite just to the south of the geological bedrock boundary.

An extract of the geological maps is shown below in Figure 3 and 4 below.

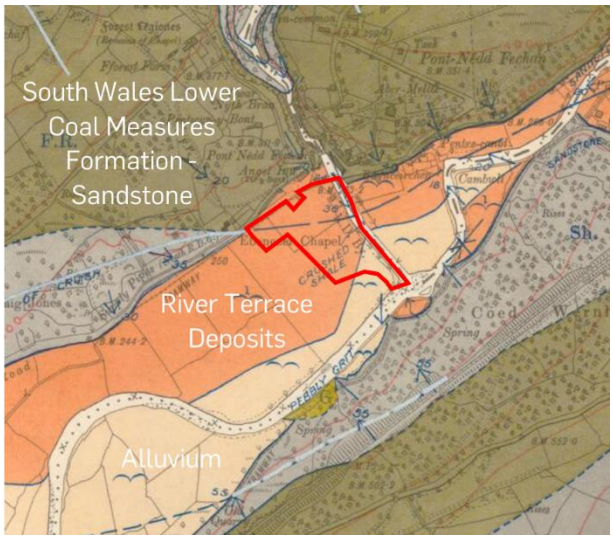


Figure 3: Extract of the BGS 1:10,560 Country Series (1932) Solid and Drift Mapping

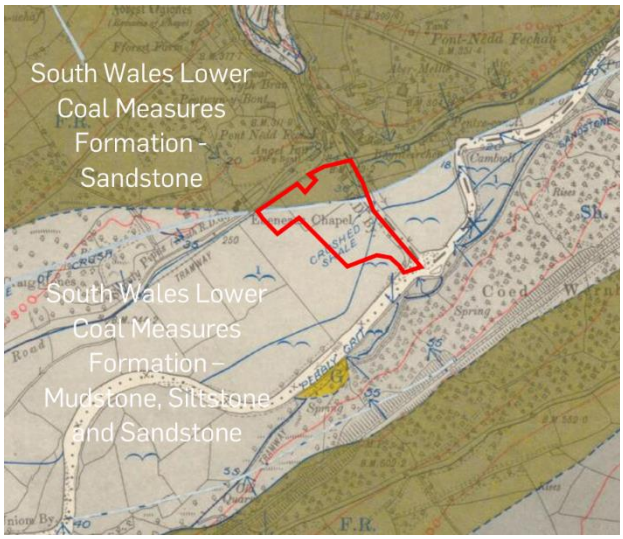


Figure 4: Extract of the BGS 1:10,560 Country Series (1932) Solid Mapping

Archived BGS Borehole Records

Historic archived borehole records are available across the extent of the A465 road to the south, typically drilled in the late 1960's prior to the A365 road construction. These indicate the presence of River Terrace Deposits as gravels and cobbles to depths of between 3-6m bgl, upon which the underlying bedrock was encountered, typically as a mudstone. These depths to bedrock translate to levels of approximately 70m AOD.

Underlying bedrock is typically recorded as medium dark grey mudstone with thin sandy or clay lenses, with 45° or steeper joints.

An initial groundwater strike was generally noted around the boundary with the mudstone at 70m AOD.

3.3 Natural Soil Chemistry

Information contained within the Environcheck report provides indicative concentration values for the natural soils at the site for a selection of contaminants of potential concern. These are listed below. Note, values have been cross checked with the BGS Geoindex and edited where discrepancies were identified.

- Arsenic – 35-45mg/kg
- Cadmium - <1.8mg/kg
- Chromium – 60-90mg/kg
- Lead - <100mg/kg
- Nickel – 30-45mg/kg

None of the above determinants are expected at natural concentrations of concern in respect to Public Open Space (POS) – Park use.

3.4 Hydrogeology

The Envirocheck Report indicates the superficial River Terrace Deposits and (limited) Alluvial Deposits, as well as the solid geology beneath the site, are all classed as Secondary (A) aquifers with a combined high groundwater vulnerability.

The Envirocheck Report indicates a limited potential of groundwater flooding in the northern are of site with elevated risks to property below ground level and surface level in the lower lying central and southern areas of site. As the site is next to a river, and the geology has a high permeability, groundwater will likely be in direct

continuity with the river. These will therefore respond to precipitation in near unison, and on this basis, part of the site may be subject to groundwater flooding in unison with fluvial flooding.

Groundwater is likely to be contained within the granular superficial River Terrace Deposits in commensurate with the adjacent River Neath water levels. The underlying lower permeability mudstones potentially restricting vertical migration of the groundwater, however steep jointing of mudstone bedrock, up to 45°, is expected providing permeable pathways, and the sandstone underlying the northern area is likely to have higher permeability.

Off site, some historic springs are recorded on the boundary of the mudstone and sandstone formations, these are recorded in mapping dating back to the 1920-1950's within areas underlain also by Glacial Till, however, onsite, where the bedrock boundary is overlain with River Terrace deposits, no springs are recorded throughout available historic mapping.

The River Terrace Deposits likely form the base flow of the river and therefore groundwaters likely flow east to the River Neath. Recharge to the River Terrace Deposits would be expected to take place from rainfall and surface water runoff, and relating to the water levels of the nearby watercourses.

There are no active licensed groundwater abstractions within 500m of the site.

The site was not within a groundwater Source Protection Zone (SPZ).

3.5 Hydrology

Surface water features in the vicinity of the site include the River Neath, immediately to the east of the site, which flows south. This river joins the River Mettle approximately 50m to the south of the site, which flows southwest to Neath, feeding into the Bristol Channel.

Surface water run-off from the majority of the site is likely to flow southeast following the gradient of the sites topography into adjacent rivers, or drain through the underlying granular and permeable River Terrace Deposit, both of which will ultimately flow in the River Neath. Figure 5 below shows a mapping extraction of Natural Resources Wales Flood Risk Mapping:

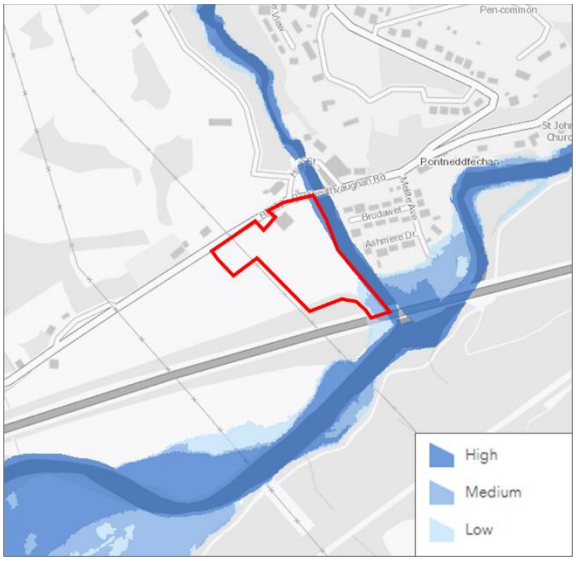


Figure 5: Surface Water (River) Flood Risk Mapping

Natural Resources Wales mapping shows a low-high risk of surface water flooding associated with areas along the eastern boundary, associated with the river bank of the River Neath, with low and medium risk areas extending onto site in the far southeast where the site levels are lower and the River Neath meets the River Mellte.

There are no surface water abstractions recorded within 500m of the site.

3.6 Natural Ground Instability

The Envirocheck report identified the following in respect to natural ground instability on site.

A moderate risk of compressible soils has been identified on site, associated with the localised Alluvial Deposits in the far southeast of the site. A moderate risk of landslides has been identified on site, which is associated with the road embankment immediately to the south of the site.

However, neither of these risks are expected to affect the development proposals as the alluvial deposits are likely to be limited in thickness and extent and are not indicated below any development areas, and the bridge embankment stability is unlikely to pose a risk to the development. The risks from collapsible ground, ground dissolution, running sands, and shrinking and swelling clays, are all considered to be low (or below) risk.

3.7 Radon Risks

Although the available Envirocheck Report indicates that 3-5% of properties are estimated to be at or above the Action Level, this report dates back to May 2022, prior to a significant update to the Radon Potential Map, and Radon Indicative atlas for Great Britain, dated December 1st 2022. This update comprised the addition of new measurements, an updated geological map, and a revised statistical methodology, and altered Radon risk of much of the UK.

Since this update, the online indicative atlas indicates the site to lie within a 1km grid area where the worst case condition is recorded as 10-30% of properties are estimated to be at or above the Action Level, which indicates that full radon protection measures will be required. Given that this is worst case conditions that occur within the 1km grid, it may not apply to the site specifically, so it is recommended that an updated site specific Radon Report is obtained to more accurately identify the Radon risk to site, and proposed structures.

3.8 Mining and Mineral Extraction

The Envirocheck report indicated that the site was within an area which may be affected by coal mining activity, so the Coal Authority recommended that a coal mining report was carried out.

A CON29 Coal Mining Report was obtained from the Coal Authority and provided by the client for the site. The report indicates that the site is not within a surface area that could be affected by any past or present recorded underground coal mining, with no recorded coal mine entries known to the Coal Authority within the site area.

Therefore the risk from coal mining is considered negligible and is not considered further within this report.

No BGS mineral sites are recorded within 250m of the site.

3.9 Regulatory Information

9 no. discharge consents are located within 250m of the site. All relating to a sewage disposal works approximately 100-150m to the east, either effective or amended and for the discharge of storm overflow tanks or final effluent into surface watercourses, either tributaries of the River Neath, or the River Mellte.

8 no. pollution incidents are located within 250m of the site, generally to the north and northeast.

The most significant pollution incidents being a Major incident (Category 1), from September 1994, from the pollution of chemicals (detergents/surfactant) from near the Angel Motel approximately 250m to the northeast of the site. The receiving water was not given, although mapping indicates the closest watercourse is the River Mellte.

The remaining 7 no. pollution incidents generally relate to the pollution of crude sewage (and in a single case algae) in the 1990's, the latest of which was August 1997. These events were classified as either Minor or Significant incidents (Category 3 or 2).

As the Envirocheck report refers to a wider site area, the report does indicate a number of these pollution incidents are 'onsite', which is not accurate for the site boundary as discussed in this report.

1 no. contemporary trade directory entry relating to vehicle repairs was located 100m to the north of the site, but is now inactive.

3.10 Environmental Designations

The site is within Brecon Beacon National Park and is designated by Natural Resources Wales to be in special area of conservation.

3.11 Unexploded Ordinance (UXO) Risk

A non-specialist UXO screening exercise has been undertaken from review of readily available bomb risk maps, historical and geological maps. These sources suggest a low bomb risk, and indicated no further assessment was required.

3.12 Preliminary Risk Assessment (Contamination)

The following section provides a Preliminary Risk Assessment (PRA) of contamination at the site and develops an initial Conceptual Site Model (CSM) to establish whether there are any potentially unacceptable risks associated with proposed development at the site.

The CSM provides a method to characterise potential site risks, by outlining potential sources of contamination, identifying potential receptors that may be impacted, and determining potential pathways by which sources may affect receptors.

A preliminary CSM has been derived from an assessment of the sites' environmental setting, site history, and information provided within the Envirocheck report.

The Risk Assessment Methodology and Definitions are set out in **Appendix C** to this report.

3.12.1 Potential Sources of Contamination

The potential contaminants described below were identified from a study of the site history. The principal contaminative sources are as follows:

<u>On-site (locally in area of existing development)</u>

- Made Ground, associated with historical construction activities, including the construction of farm structures, the embankment and road construction, various demolition and building reconfiguration work, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAH and petroleum hydrocarbons.
- Ground gases (carbon dioxide and methane) from organic materials in any Made Ground or within the River Terrace Deposit soils on site.

<u>Off-site</u>

- Made Ground and contamination associated with the former tramway possibly including elevated concentrations of metals, metalloids, PAH and petroleum hydrocarbons.
- Made Ground associated with the construction of the embankment and A465 bridge of the in the south (1970s).
- Smithy (predating 1920) possibly including elevated concentrations of metals, metalloids, and PAH

No other potential off-site sources of contamination were identified.

3.12.2 Potential Receptors

The following potential receptors were identified, based on the proposed development of the site for Public Open Space (Park) purposes:

- People (site end users – staff and visitors).
- Development end use (buildings, utilities and landscaping).
- Groundwater: Secondary A aquifer status of the River Terrace Deposits and South Wales Lower Coal Measures Formation bedrock.
- Surface water: overland flow to eastern and southeastern boundary and off-site to nearby Rivers.
- Surface water: proposed surface water features (attenuation basins).

3.12.3 Preliminary Conceptual Site Model (CSM)

The potential key contaminative substances, potential receptors and possible pathways are summarised in the table below, assuming a worst-case scenario.

The preliminary CSM will be used to target any further site investigation and will be developed and refined, based on the results of the site investigation.

Table 2: Summary of preliminary conceptual site model

Preliminary Conceptual Site Model						
Sources	**Receptor**	**Pathway**	**Consequence**	**Probability**	**Risk**	**Comments**
Made Ground, associated with historical construction activities including: • Onsite historic buildings • The onsite track • Building maintenance possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAH and petroleum hydrocarbons.	People Building Groundwater Surface water	Ingestion Inhalation Direct Contact Root uptake Leaching through unsaturated zone	Medium	Low likelihood	Low	Isolated to previously/ currently developed area in the north and along the eastern boundary. Very low risk to majority of site.
Made Ground from offsite sources including: • Former Tramways • Smithy possibly including elevated concentrations of metals, metalloids, asbestos fibres, ACM, PAH and petroleum hydrocarbons.	People Building Groundwater Surface water	Ingestion Inhalation Direct Contact Root uptake Leaching through unsaturated zone	Medium	Unlikely	Low	Isolated to previously/ currently developed area in the north and along the eastern boundary. Very low risk to majority of site.
Ground gases (carbon dioxide and methane) from organic materials in any Made Ground or within the River Terrace Deposit soils on site.	People Building	Inhalation Migration into buildings Root uptake Leaching through unsaturated zone	Medium	Unlikely	Low	To be investigated with a program of ground gas monitoring following the installation of groundwater and gas monitoring wells.

4 Ground Investigation Works

4.1 General

A ground investigation (GI) was undertaken by Earth Science Partnership (ESP) after being scoped by Jubb. The GI comprised a combination of window sampling, trial pitting and soakaway testing and were carried out on the 6th and 7th December 2023. A number of restrictions and limitations impacted the proposed GI scope as explained below.

The ground investigation comprised the following site activities;

- 5 no. window sample boreholes (WS01 to WS05) to maximum depths of 1.50m bgl
- 5 no. dynamic probe test (DP01 to DP05), adjacent to the corresponding window sample borehole locations, to maximum depths of 1.9m bgl
- 3 no. installations to maximum depths of 1.5m, within the window sample boreholes
- 3 no. monitoring visits to record gas/groundwater levels.
- 5 no. trial pits (TP01, TP02, TP03A, TP03B, and TP04) across the site to provide general site coverage and to allow soakaway testing to be carried out.
- 2 no. soakaway tests in selected pits to determine the suitability of attenuation basins and/ or permeable paving (carried out to BRE 365 if possible - not).
- 6 no. TRL DCPs at selected locations in order to provide correlated CBR results.

The exploratory hole locations were decided by Jubb, based on the outline of the preliminary development proposal, with holes being moved accordingly with regards to site constraints at the time of the siteworks.

The exploratory hole locations are shown in the exploratory hole plan contained in **Appendix C**, the exploratory hole locations shown in this figure were measured out by ESP on-site. They were not accurately located using surveying equipment due to site access being restricted on the return visits, when the survey was proposed.

4.1.1 Limitations

Restrictions put in place by the landowner (and tenant) prior to the works, meant that the actual site works were reduced from the original Jubb scope.

In order to be allowed access to the site and carry out the proposed works, a limitation was agreed between the Client and the landowner restricting the volume of the excavations to a maximum of 1m^3 of soil from each trial pit excavation, thus limiting the depth of the trial pits. In addition, significant care was required to minimise surface damage from plant, and thus a smaller excavator was used and surface boarding was included and used to reduce surface soil damage and rutting. Due to this, along with the careful backfilling and re-compaction requirements of the trial pits, it was not possible to carry out the soakaway testing with 3 fillings, in accordance with the BRE 365, within the time frame allowed).

Due to the density and thickness of the underlying geology (River Terrace Deposits), the window sample boreholes (WS's) and dynamic probes (DP's) refused shallower than the proposed depths of 5m bgl, reaching respective maximum depths of 1.50m and 1.62m bgl.

The exploratory holes were set out at locations provided by Jubb and adjusted where necessary to take account of site constraints.

The factual ground investigation works will be detailed in the ESP factual report (*pending outstanding surveying and monitoring*).

4.1.2 Window Samples

A total of 5 no. window samples (WS01 – WS05) were drilled to depths of between 1.00m and 1.50m bgl. Standard Penetration Tests (SPTs) were taken at the base of each location to prove the refusal. regular intervals of 1.0m throughout each window sample to allow assessment of in-situ density or stiffness of the ground.

All window samples, were terminated shallow of target depths due to refusals within the shallow River Terrace Deposits, associated with the presence of cobbles, ceasing further progression of the drilling rig.

Disturbed samples were taken at regular intervals within all window samples to give a comprehensive record of strata encountered, with environmental samples being taken at select intervals within all window samples. Pocket penetrometer tests were undertaken within the cohesive deposits where ground conditions were suitable.

Groundwater and gas monitoring standpipes were installed to the base of selected boreholes, WS01, WS02 and WS04, on completion, to depths of between 1.20 m and 1.5m bgl, to allow for groundwater and gas monitoring to be carried out. The remaining window sample locations were backfilled with arisings on completion.

4.1.3 Dynamic Probe Tests

A total of 5 no. dynamic probe tests were carried out across the site, adjacent to each of the windows sample borehole locations, carried out from ground level to depths of between 0.55m and 1.62m bgl, to allow assessment of in-situ density or stiffness of the ground. In each case very dense ground was encountered stopping further progression of the test and leading to refusal and termination. These allowed for derived N values to be obtained.

4.1.4 Trial Pits

A total of 5 no. trial pits (TP01, TP02, TP03A, TP03B, and TP04) were excavated around the site in areas permitted and to achieve maximum coverage given the site restrictions. The excavations were undertaken to depths of between 0.50m and 1.25m bgl, limited due to the legal agreement between the client and the landowner, restricting the volume to be excavated to a maximum of 1m^3 at each location. Excavations were completed using a 5 tonne tracked excavator.

Disturbed, bulk geotechnical and environmental soil samples were taken at regular intervals throughout the pits. After detailed examination, measurement and sampling, (and soakaway testing in TP02, and TP04) the excavations were backfilled with arisings and compacted in layers using the machines bucket to match pre-existing conditions.

Both TP03A and TP3B refused at 0.50m on a "*very dense flat surface of probable compacted slag*", likely associated with a former access track associated with the A365 bridge/ embankment construction. The excavator was unable to penetrate this layer, and so excavations did not extend further.

A trial pit, TP05, was originally scoped and positioned in the far southeast to target the area of site were alluvial deposits are likely to extend, despite no structures being proposed in the area. Due to excavation restrictions, time restrictions and wet surface soils, it was not possible to carry out this excavation.

4.1.5 In-situ Testing

4.1.5.1 TRL Dynamic Cone Penetrometer (DCP) Tests

TLR Dynamic Cone Penetrometer (DCP) testing was carried out around the site in areas of proposed pavement or hardstanding. A number of these TRLs were undertaken adjacent window samples locations. The tests were performed to maximum depths of approximately 1.0m bgl in order to obtain an equivalent California Bearing Ratio (CBR) value.

4.1.5.2 Soakaway Testing

Soakaway testing was carried out within trial pits TP02 and TP04, at depths of 1.25mbgl and 1.0mbgl respectively, with the base of the pits within the granular River Terrace Deposits.

Two fills were carried out at TP02, and a single fill within TP04, due to time constraints as a result of restrictions detailed above. The water soaked away sufficiently for an infiltration rate to be calculated. A third location was originally proposed, but the site restrictions, meant that this third soakaway location was not undertaken.

4.2 Exploration Sampling Strategy

Exploratory hole locations were positioned to provide sufficient coverage of the site as follows:

Table 3: Sampling Strategy

Exploratory Hole	Notes/Rational
WS1 – WS5 / DP01 – DP05	Window sample boreholes and dynamic samples were positioned for general site coverage and were relocated to account for site constraints. They were also to allow for the sampling of any made ground and shallow superficial deposits, to obtain derived N values to be obtained, and to allow installation of groundwater and gas standpipes.
TP01, TP02, TP03A, TP03B, and TP04	Trial pits were positioned originally for general site coverage and were relocated to account for site constraints. They were also to allow for the collection of bulk soil samples for laboratory testing, and to enable soakaway testing.
DCP01 – DCP06	TRL DCP, in-situ CBR testing positioned across the site to determine CBR values of shallow subsoils at founding depths to aid with pavement design.

4.3 Contamination Testing

The sampling strategy was based on obtaining sufficient samples from across the site. 6 no. samples of topsoil, Made Ground and shallow residual soils were submitted for a general brownfield suite of testing, determinants as detailed below. These were scheduled immediately after the ground investigation campaign to avoid any laboratory holding time deviations.

Table 4: Contamination Suite

Suite	Determinants
Contamination Suite (Brownfield) - Soil	As, B, Cd, Cr(III), Cr(VI), Cu, Hg, Pb, Ni, Se, V, Zn, PAH's (PAH-16 and total), total TPHs (C10-C40), Phenols, Organic Matter, and Asbestos (screening).

The geo-environmental testing was carried out by DETS (UKAS and MCERTS accredited) on behalf of ESP. Sub-samples were taken from the exploratory holes and placed in appropriate environmental containers before being sent by courier to the laboratory in cool boxes. The number of soil samples tested are summarised in the table below.

Table 5: Soil Contamination Testing

Exploratory Hole	Depth (mbgl)	Stratum	Analysis Undertaken
WS01	0.6	Made Ground	Contamination Suite (Brownfield) - Soil Arsenic, Boron, Cadmium, Chromium, Chromium - III, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc Organic matter, pH, cyanide – total, PAH - Speciated (EPA 16), Total Petroleum Hydrocarbons (TPH), Phenols - total (monohydric) Asbestos
WS02	0.6	Superficial Deposits	
WS03	0.1	Topsoil	
WS04	0.1	Topsoil	
WS05	0.3	Made Ground	
TP04	0.2	Topsoil	

4.4 Geotechnical Testing

Geotechnical testing for the current phase of works was carried out by GSTL and Chemtest Environmental Limited in accordance with *BS1377: Methods of test for soils for civil engineering purposes*, as listed in the table below:

Table 6: Geotechnical Testing – GSTL and Chemtest Environmental Ltd

No. of Tests	Test	Test Method
Classification Tests		
2	Moisture Content tests	BS1377: Part 7.
2	Atterberg tests	BS1377: Part 2.
5	Particle Size Distribution tests (wet sieve)	BS1377: Part 2.
Compaction Testing		
1	Dry density / moisture content (2.5kg Rammer Compaction)	BS1377: Part 4.
Chemical Testing		
5	BRE Suite D	BRE Special Digest

5 Ground Conditions

5.1 Ground Conditions Encountered

The ground conditions encountered during the ground investigation are summarised in the table below.

Table 7: Ground Conditions Summary

Description	Stratum	Encountered in	Depth range to top of stratum (m bgl)	Depth to base of stratum (m bgl)	Average thickness (m)
Grass followed by: dark brown very clayey gravelly SAND, occasional low cobble content	Topsoil	TP02, TP04, WS02, WS03 and WS04	0.00	0.20-0.30	0.25
Dark brown clayey sandy fine to coarse angular to subrounded GRAVEL/ gravelly SAND with fragments of brick, and occasional plastic and concrete. Medium cobble content, or; Grey sandstone COBBLES (Rare rope and possible fabric noted in TP03A/B).	Made Ground	TP01, TP03A, TP03B, WS01, and WS05	0.00	0.70-0.90	0.80
Light brown clayey sandy fine to coarse rounded to subrounded GRAVEL/ gravelly SAND, with a medium rounded to subrounded cobble content	River Terrace Deposits - Gravel	All exploratory locations except TP03A, TP03B	0.25/0.90	Unproven	

5.1.1 Topsoil

Topsoil was encountered in TP02, TP04, WS02, WS03 and WS04, down to depths of between 0.20m – 0.30m bgl. This material was typically recorded as dark brown very clayey gravelly sand, with occasional low subrounded cobble content, is likely to have been reworked due to historic agricultural ploughing.

5.1.2 Made Ground

Made Ground was encountered in TP01, TP03A, TP03B, WS01, and WS05 to depths of between 0.50m and 0.90m bgl, these locations correspond to areas in the north where historic and existing structures are present, in areas adjacent Pontneathvaughan Road, and along the agricultural track on site along the eastern boundary. A Site Zonation Plan delineating the suspected extent of Made Ground across the site, this plan is shown in **Appendix C**.

The Made Ground typically comprised either a clayey gravelly sand, or a sandy gravelly clay, and cobble content was generally low to medium. Anthropogenic fragments include rare brick, concrete, plastic, rope and fabric.

Made Ground was encountered to depths of 0.70-0.80m bgl in areas of the site where historic and existing structures are present (WS01 and WS05), to depths of to a depth of 0.9m bgl along the edge of Pontneathvaughan Road (TP01), and to depths exceeding 0.5m bgl in areas along the agricultural track along the eastern boundary (TP03A and TP03A).

In the case of TP03A and TP03B, Made Ground was encountered to depths of at least 0.5m bgl before further trial pit progression was no longer possible due to a “very dense flat surface". Therefore the thickness of the Made Ground in this area, or along the former track is not known. The Made Ground and obstructions in this area likely relate to a former track structure associated with the development and construction of the bridge and embankment to the south of the site.

5.1.2.1 Classification Testing

A single sample of Made Ground was tested for moisture content and Atterberg limits. A moisture content of 14% was obtained. Atterberg testing indicated that the material was non-plastic, and therefore a plasticity index values was not obtained.

A particle size distribution (PSD) test was carried out on the same sample taken from the superficial Made Ground soils at a depth range of 0.30-0.80m bgl (WS101). The plot showing the grain size distribution are shown in Figure 8 in Section 5.1.3.1, below, alongside the PSD results from River Terrace Deposit soils.

This sample comprised 24% cobbles, 56% gravel, 11% sand and 9 silt and clay, and can therefore be described as silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles).

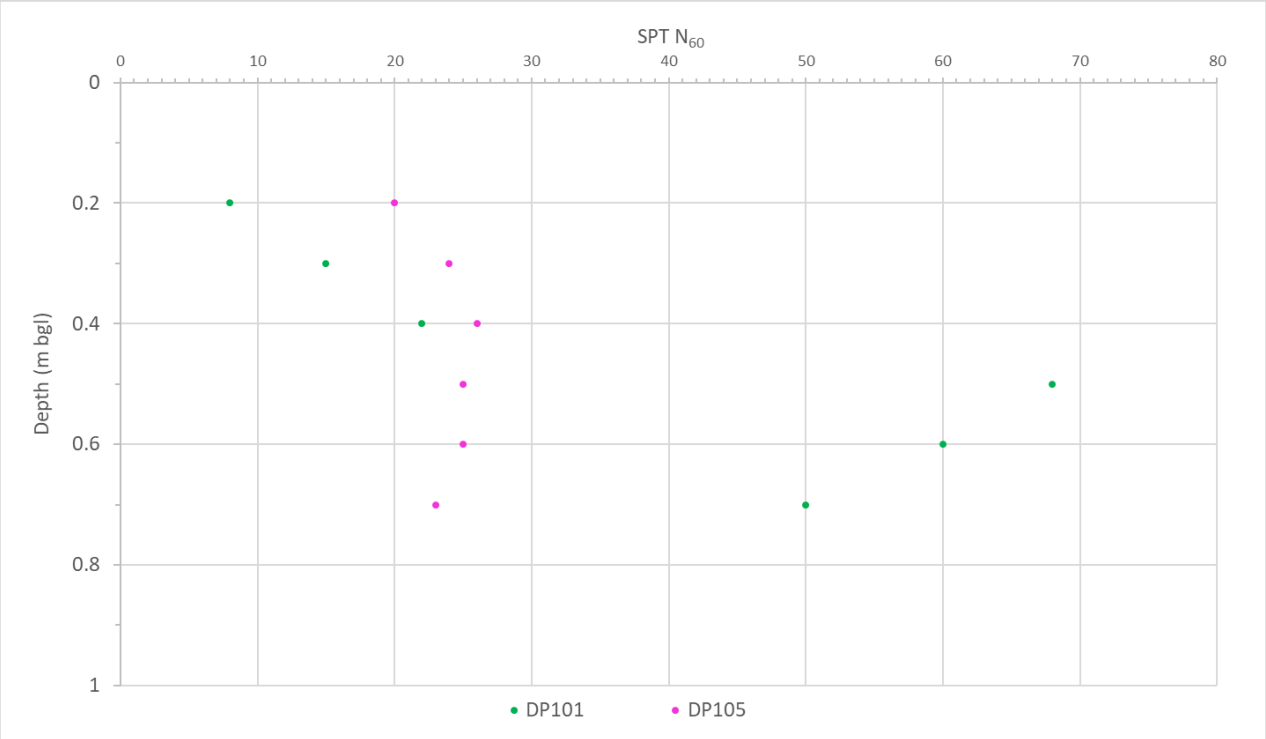
5.1.2.2 Strength Testing

Dynamic probe testing was performed adjacent to window samples from ground level and allowed for a total of 12 no. derived SPT N values to be obtained. These values were collected from 2 no. dynamic probe locations, where Made Ground was encountered (WS/DP101 and WS/DP105), the testing was carried out between 0.20m and 0.70m bgl depth, and were terminated at refusal depths (derived N values >50).

Derived N values within the Made Ground soils ranged between 8 and 68, typically indicating medium dense to very dense soils. An average value of 31 and a lower quartile of 21 can be calculated, which indicated a medium dense granular soil, and is similar to that of the testing undertaken within the superficial soils (lower quartile N value of 22), discussed in Section 5.3.1.2.

Derived N value results are as shown in the figure below. The results split into the two locations, which indicates the higher (3 no.) values shown relate to WS/DP101.

Figure 6. Dynamic Probe Correlated to SPT N Value Results – Made Ground



5.1.3 River Terrace Deposits

The GI encountered superficial River Terrace Deposit soils across the entirety of the site, with the exception of TP03A and TP03B, which refused on a layer of Made Ground hardstanding. In each case, where encountered, all exploratory holes refused within River Terrace Deposit soils, between depths of 1.0-1.5m bgl. The material was described as either a clayey sandy gravel or clayey gravelly sand or (sandstone) cobbles. Cobble content was generally low to medium, and are likely to be significant contributing factor to the dynamic probe and window sample refusals encountered.

The River Terrace Deposits were encountered in all exploratory locations, across the entirety of the site, directly below the topsoil or Made Ground, from between 0.20-0.90m bgl, to unproven depths (exceeding between 1.0-1.5m bgl).

In the case of TP04 and WS02, in the southeastern area of site, looser clayey gravelly sands were encountered in the upper 1m of site soils, which, based upon the nearby TRL DCP results (DCP02, DCP03B, and DCP04), are likely to extend across the eastern area of the site, near the river in the upper 0.8-1.0m bgl of soils. These sands may represent Alluvial Deposits.

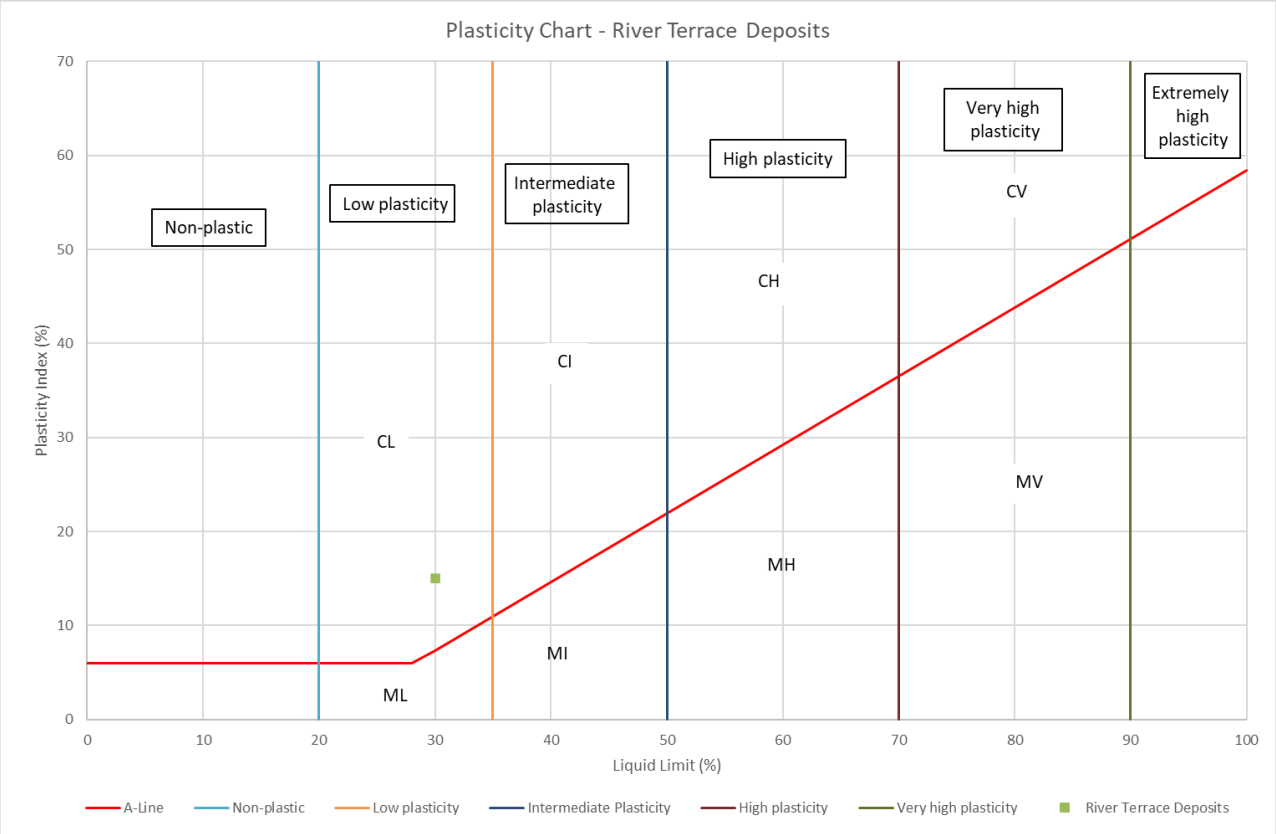
The likely extents of these soils are shown in the Site Zonation Plan presented in **Appendix C**.

5.1.3.1 Classification Testing

A total of 4 no. soil samples were taken from the River Terrace Superficial Deposits, 1 no. for moisture content and Atterberg testing, and 4 no. for particle size distribution (PSD) tests, taken from a depth range of 0.70-1.20m bgl.

The moisture content test indicated a moisture content of 13%. Atterberg testing, on the cohesive portion of the sample (material <0.425mm), indicated a plasticity index value of 15%, which relates to low plasticity, low volume change potential cohesive fraction soils. An A line plot of the result are shown in the figure below.

Figure 7: Superficial Deposits Atterberg Testing

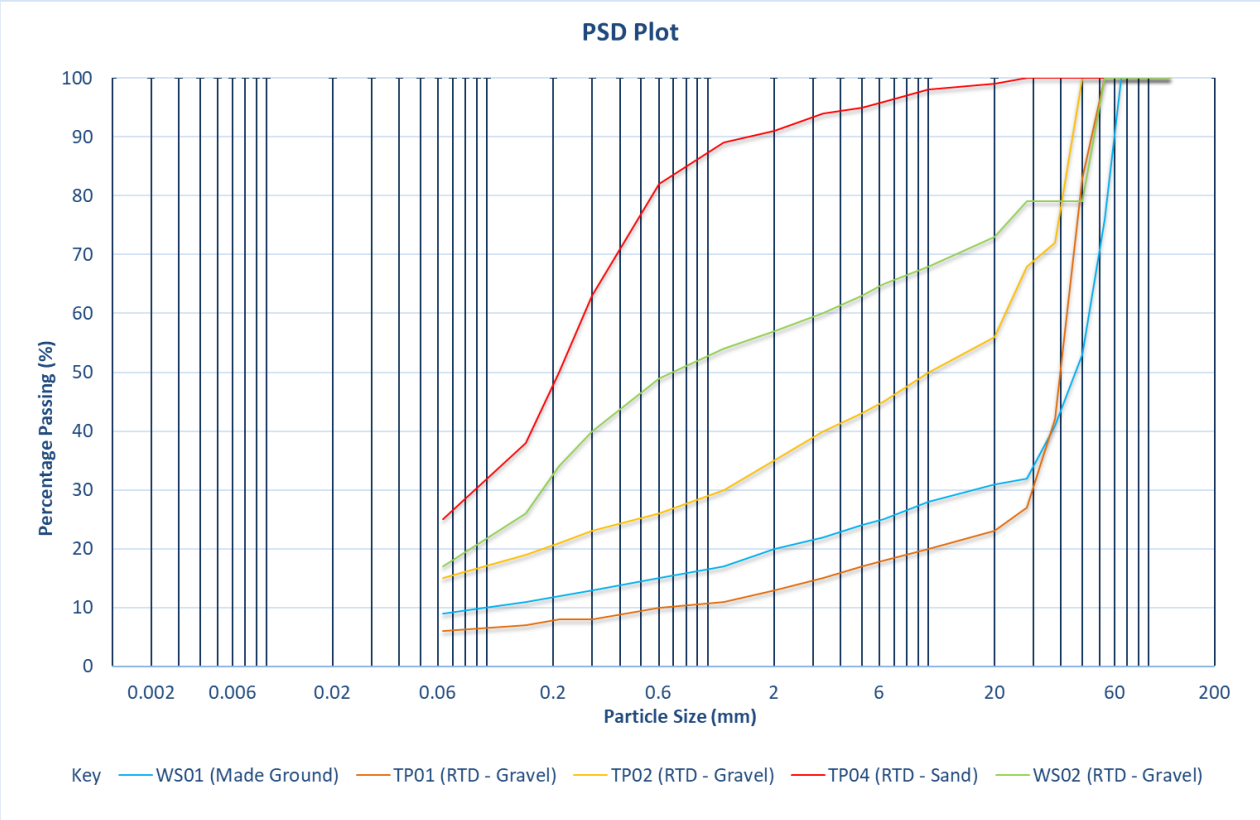


The results of the 4 no. particle size distribution (PSD) tests indicated all soils were granular in nature, with clay/silt content ranging from 6% up to 15% (average – 16%), sand content ranging from 7% up to 66% (average – 34%), gravel content ranging from 9-87% (average – 50%), and with cobble contents generally 0%, but 17% in a single case. The lack of cobble content is likely from sampling bias and in reality, is likely to be greater, so engineer logging will likely give a better indication of cobble content.

The results generally indicated "*silty/clayey fine to coarse sandy fine to coarse GRAVEL*", and below topsoil and above 1m bgl in the southeastern, slightly lower lying areas, "*fine to coarse gravelly silty/clayey fine to coarse SAND*". These results corroborate with the field descriptions.

The results of all the PSD testing undertaken (including that of the Made Ground sample) is shown in the figure below.

Figure 8: Particle size distribution chart



5.1.3.2 Strength Testing

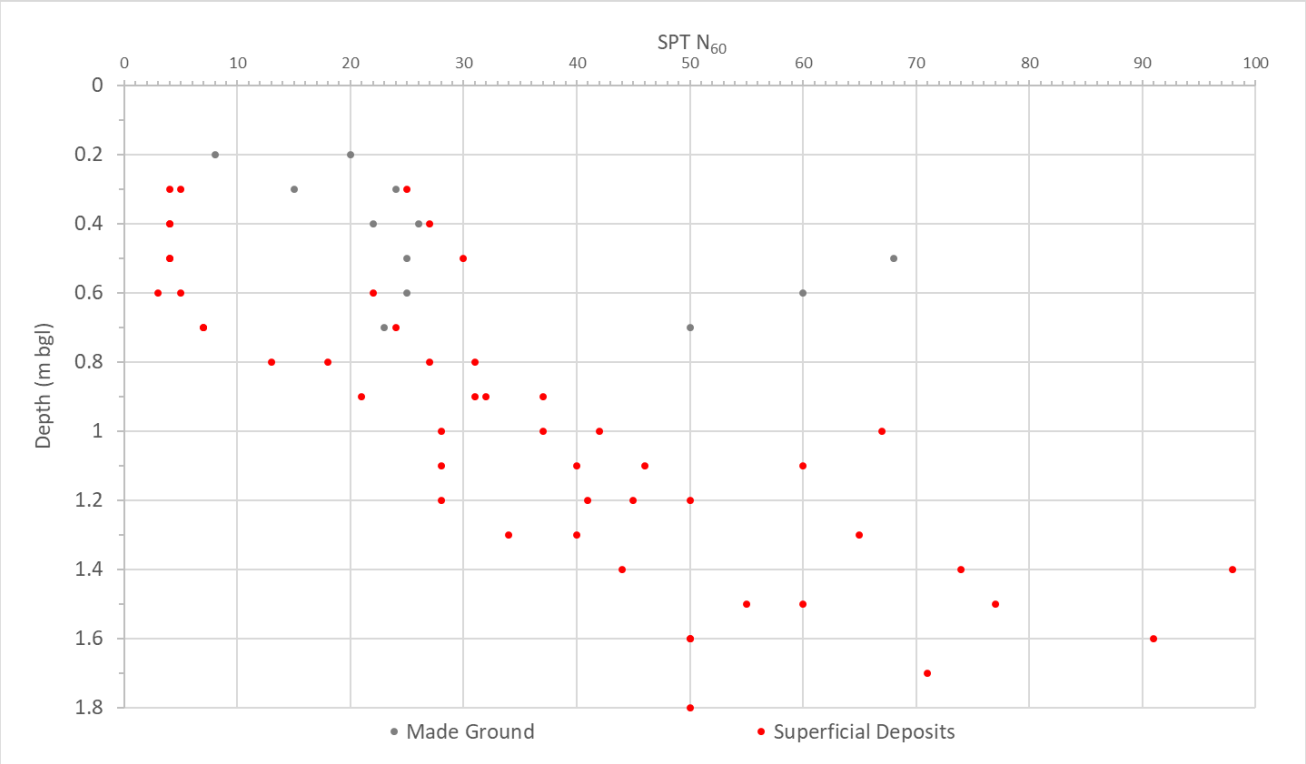
Dynamic probe testing was performed adjacent to window samples from ground level and allowed for a total of 49 no. derived SPT N values to be obtained. These values were collected from 4 no. dynamic probe locations (WS/DP102-105). DP101 did not penetrate the base of the Made Ground. The testing was carried out between 0.30m and 1.80m bgl depth.

Derived N values within the River Terrace Deposit soils ranged between 3 and 98, typically indicating medium dense to very dense gravel soils, an average value of 36 and a lower quartile of 21 can be calculated. Generally the results indicate a medium dense gravel soil to depths of around 1.0m bgl, becoming dense granular soil thereafter. Although in the case of WS02, where fine grained sand soils were encountered, lower derived N values are observed between 3 and 7, indicating loose shallow soils down to around 0.70m bgl. A review of the TRL DCP results alongside dynamic probe testing indicates these looser sand soils are also likely to extend across the eastern area (DCP02, DCP03B and DCP04) up to depths of around 0.90m bgl, and are underlain by the denser River Terrace Deposit gravels.

With the exception of DP101, which did not penetrate Made Ground, the dynamic probe tests refused between depths of 1.10m and 1.8m bgl, in River Terrace Deposits comprising gravel or cobble stratum, in no cases did dynamic probes refuse within the sand deposits.

Derived N value results from the River Terrace Deposits are as shown in the figure below.

Figure 9. SPT Results – River Terrace Deposits



5.2 Summary of Geotechnical Parameters

The soil parameters for the granular River Terrace Deposits present on site are derived from laboratory tests and suitable known correlations from in-situ testing. The derived soil parameters are shown in the table below. Note that the parameters are not characteristic parameters and the designer should select appropriate parameters based on the relevant geotechnical design.

Table 8: Summary of Geotechnical Parameters

Parameter	Geological Unit
	River Terrace Deposits – Granular
Unit Weight (γ) kN/m^3	19
Effective Angle of Friction (Φ')	33-35
E (MPa)	30-45
Effective Cohesion (c') kPa	0

5.3 Groundwater

Groundwater was not encountered within exploratory holes during the GI works. Groundwater monitoring standpipes were installed in three of the exploratory holes and three subsequent monitoring visits were scheduled to be undertaken at times when site access was permitted.

At the time of writing 1 No. of the 3 No. visits has been undertaken, and it is understood that new access agreements are required with the landowner for these remaining visits to be undertaken.

The installation details and results of the monitoring visits are summarised in the table below.

Table 9: Monitoring Well Installation Summary

Borehole ID	Groundwater Level During GI	Installation depth (mbgl)	Reported response zone (mbgl)	Stratum
WS101	Not encountered	2.80	0.5-1.5	MG & RTD
WS102	Not encountered	4.00	0.5-1.2	RTD
WS105	Not encountered	1.10	0.5-1.5	RTD

Notes: MG – Made Ground, RTD – River Terrace Deposits

Table 10. Summary of groundwater monitoring results

Date	Elevation (m AOD)		Groundwater Level (m BGL / m AOD)		
	Top of borehole	Base of Well	03/08/2023	*Pending*	*Pending*
WS01	-	-	Dry	-	-
WS02	-	-	Dry	-	-
WS04	-	-	Dry	-	-

Notes: Top of borehole and base of well m AOD levels require surveying in of coordinates – pending further access agreements

The results from the groundwater monitoring will be reported upon in a report revision or within a subsequent letter report, upon completion of the program.

However, as the site is next to a river, approximately 2-3m below the eastern site levels, and the site is underlain with a geology of high permeability, groundwater will likely be in direct continuity with the river, within 1m above the river water levels, with gradient from the northwest. The groundwater levels is expected to fluctuate with the river levels, responding to precipitation and therefore may be subject to groundwater flooding associated with fluvial flooding.

5.4 Visual and Olfactory Evidence of Contamination

Rare inclusions of anthropogenic material were encountered within the Made Ground in the northern area around existing structures, as rare brick fragments, and concrete. Additionally plastic fragments were noted in TP01, adjacent the road on the northern boundary, and fragments of rope and fabric were noted along the areas of the on-site track along the eastern boundary edge (TP03A/B) above a layer of very dense or compacted former road surface at 0.5m bgl, recorded as "*probable compacted slag*".

No other visual or olfactory evidence of contamination was noted.

6 Generic Quantitative Risk Assessment (Contamination)

6.1 General

The following comprises a Generic Quantitative Risk Assessment (GQRA) of contamination risk, in accordance with the methodology set out in **Appendix D**.

The following updated conceptual model information has been taken from the information obtained in **Section 4.0 and Section 5.0** and from the site walkover. Contamination testing carried out during the ground investigation has been used to supplement the preliminary conceptual model presented in **Section 4.0.**

6.2 Proposed Development and Land Use

It is understood the site is to be developed into a community centre with car parking and therefore a Public Open Space (POS) – Park use has been adopted. The development predominantly comprises a permanent parking solution for the area, as well as a community/ visitor hub, and some form of attenuation drainage/ basin.

6.3 Risks to Human Health

6.3.1 Soils

This section summarises chemical results from the recent geotechnical investigation carried out by ESP.

The generic assessment criteria used in this case are generally the LQM/CIEH Suitable 4 Use Levels (S4ULs), based on minimal or tolerable risk and are intended to be protective of human health. Different criteria are provided for a variety of land use, and the criteria for "Public Open Space – Park" has been adopted here.

Both the C4SL and S4UL are based on current best practice and reflect the most up to date guidance and legislation. The exception to this is use of the C4SL levels for Lead, as S4UL are not provided for this substance.

A total of 6 no. samples were sent to laboratories for chemical testing, these samples included 2 no. of Made Ground, 3 no. of topsoil, and 1 no. of shallow superficial deposit soils, and due to the lack of any exceedances or distinct elevations, these results are reported together as a single data set with any relationships highlighted and discussed separately. A summary of the chemical test results and a comparison against the relevant assessment criteria used in this case, are given in the tables below.

In accordance with best practice, individual exceedances of the relevant assessment criteria or identified elevations have been identified and comment provided where necessary.

For data sets with low sample numbers, such as the ones undertaken as part of this report, individual sample test results are compared directly with the screening values. Larger and non-targeted data sets are subject to statistical testing.

6.3.1.1 Metals and Semi Metals

The table below summarises the chemical results for metals and semi-metals on site from the current phase of investigation:

Table 11: Summary of Soil Contamination – Metals and Semi Metals

Contaminant	C4SL/ S4UL mg/kg	Source	Measured concentrations mg/kg		95% UCL***	Number of individual exceedances
			Minimum	Maximum		
Arsenic	170	S4UL	5.9	56	-	0/6
Beryllium	63	S4UL	0.3	1.3		0/6
Boron	46000	S4UL	<0.2		-	0/6
Cadmium	532	S4UL	<0.1	1.3	-	0/6

Chromium (III)	33000	S4UL	11	18	-	0/6
Chromium (VI)	220	C4SL	<1.0		-	0/6
Copper	44000	S4UL	15	41	-	0/6
Lead (ref 1)	580	S4UL	19	180	-	0/6
Mercury (Elemental)	30	S4UL	<0.05	0.09	-	0/6
Nickel	3400	S4UL	6.5	23	-	0/6
Selenium	1800	CIEH	<0.5		-	0/6
Vanadium	5000	S4UL	14	40		0/6
Zinc	170000	-	52	81	-	0/6

- C4SL – DEFRA Category 4 Screening Levels (2014).
- S4UL – CIEH/LQM Suitable 4 Use Levels (2015).
- SGV – CLEA Soil Guideline Values (2009).
- *95% Upper Confidence Limit (UCL) statistical analysis not undertaken where there are no contaminant exceedances and/or insufficient number of samples

No significant metal elevations were detected, with no exceedances above POS Park use GAC values for metals and semi-metals. Slightly elevated metals (Lead and Arsenic) were noted in topsoil samples from WS03 and WS04, within the western field, although not drastically outside of the NSI Topsoil UK Soil Observatory (UKSO) figures, which indicate natural Lead concentrations of around 75mg/kg, and natural Arsenic concentrations around 36mg/kg.

6.3.1.2 Polyaromatic Hydrocarbons

The table below summarises the results for speciated PAHs on site.

Table 12: Summary of Soil Contamination – PAHs

Contaminant	SGV/ GAC (mg/kg)	Source	Measured concentrations (mg/kg)		95% UCL***	Number of individual exceedances
			Minimum	Maximum		
Naphthalene	1900	S4UL	<0.03	<0.03	-	0/6
Acenaphthylene	30000	S4UL	<0.03	<0.03	-	0/6
Acenaphthene	30000	S4UL	<0.03	<0.03	-	0/6
Fluorene	20000	S4UL	<0.03	<0.03	-	0/6
Phenanthrene	6200	S4UL	<0.03	0.10	-	0/6
Anthracene	150000	S4UL	<0.03	<0.03	-	0/6
Fluoranthene	6300	S4UL	<0.03	0.20	-	0/6
Pyrene	15000	S4UL	<0.03	0.15	-	0/6
Benzo[a]anthracene	56	S4UL	<0.03	0.04	-	0/6
Chrysene	110	S4UL	<0.03	0.09	-	0/6
Benzo[b]fluoranthene	15	S4UL	<0.03	0.06	-	0/6
Benzo[k]fluoranthene	410	S4UL	<0.03	<0.03	-	0/6
Benzo[a]pyrene	12	S4UL	<0.03	<0.03	-	0/6
Indeno[123-cd]pyrene	170	S4UL	<0.03	<0.03	-	0/6
Dibenz[ah]anthracene	1.3	S4UL	<0.03	<0.03	-	0/6
Benzo[ghi]perylene	1500	S4UL	<0.03	<0.03	-	0/6

Notes:

- S4UL – CIEH/LQM Suitable 4 Use Levels (2015).
- *95% Upper Confidence Limit (UCL) statistical analysis not undertaken where there are no contaminant exceedances and/or insufficient number of samples

No exceedances of PAH above POS Park use GAC values were recorded in any of the samples tested, and were typically under the laboratory limit of detection (LOD), in the majority of determinants in samples of topsoil, and Made Ground. No spatial pattern across site was identified in these slight elevations.

No determinants were identified above LODs within the single sample of River Terrace Deposit soils.

6.3.1.3 Petroleum Hydrocarbons

Testing for petroleum hydrocarbons was carried out as total petroleum hydrocarbons only, as no distinct source or olfactory contamination was identified.

The TPH C10-40 range of the 6 no. samples tested were below their limit of detections in 3 no. cases (<0.10mg/kg), and between 22 – 58mg/kg in the remaining 3 samples, all considered very low when compared to the most stringent speciated GAC value (Aromatic EC >16-21) of 7700mg/kg.

As no distinct source or olfactory contamination was identified petroleum hydrocarbons with carbon chains below C10 are not considered likely to be within any of the samples collected, and therefore testing of these was not carried out.

6.3.2 Ground Gas

Groundwater and Gas monitoring standpipes were installed in WS01, WS02, and WS04. The window sample wells were installed to the base the boreholes (depths of 1.5, 1.2 and 1.5m respectively) and were selected for appropriate site coverage and as these penetrated to the greatest depths.

The monitoring results to date are shown below in the table below.

Table 13: In situ ground Gas Monitoring Results

Date	Atmospheric Pressure (mb)	Bore hole No:	Methane CH4 (%)	Carbon Dioxide CO2 (%)	Oxygen (%)	Flow Rate (l/hr)
05/01/2024	995-994 Falling	WS01	0.0	0.7	18.1	0.0
		WS02	0.0	2.0	16.5	0.0
		WS04	0.0	0.7	18.4	0.0
Pending		WS01				
		WS02				
		WS04				
Pending		WS01				
		WS02				
		WS04				

Two further visits are due to be undertaken but due to legal issues with the access have not been carried out to date. Based on the first visit, the recorded soils conditions and the lack of any significant gas source on site, the initial results indicate a Characteristic Situation 1 (CS1) – very low risk, so no specific gas protection measures other than those required for radon protection, are required.

This section will need updating once the final monitoring visits have been undertaken.

6.3.3 Radon

As discussed in Section 3.7, since a British Geological Society (BGS) dataset and guidance update on 1st December 2022, the site is indicated be within area where 10-30% of properties are estimated to be at or above the Action Level (elevated since the original Envirocheck report obtained prior to this date).

Full radon protection measures are likely to be required for proposed structures within the site, unless an updated site specific radon report is obtained for the site and indicates otherwise.

6.3.4 Asbestos

Asbestos screening was carried out on a total of 6 no. samples, of shallow soils, and no asbestos was identified within any of the samples. The risk of asbestos contamination soils to topsoil across the majority of the site (grassed areas) is considered low.

Before the demolition of existing buildings is carried out, it is recommended that an assessment of ACM presence is undertaken by a specialist contractor.

6.4 Risk to Controlled Waters

Given that no significant source of contamination has been identified on site and the fact that the majority of the site is generally underlain by natural soils with no evidence of any contamination, no significant risk to controlled waters is expected and therefore not considered further.

6.5 Risks to Flora and Fauna

Based on the current proposed masterplan there are areas of soft landscaping shown so consequently a plant life risk assessment has been undertaken to assess the suitability of site won soils for re-use in these areas.

Generally copper, nickel, zinc, cadmium and mercury can inhibit plant growth so the results for these have been compared with values given in the Department of Environments, Code of Practice for Agricultural Use of Sewage Sludge, 1996.

There were no elevated concentrations any of the metals, therefore there is no risk to plants considered.

6.6 Risks to Adjacent Land and Third Parties

No significant risk to neighbouring occupiers has been identified.

6.7 Potential Geo-Environmental Liabilities

Potential geo-environmental liabilities under Part 2A of the Environmental Protection Act 1990 (as amended) and the Groundwater Regulations (GWR) 2009, relating to the site in its current condition and proposed end use is not considered likely based on the tests data available.

6.8 Off Site Disposal

<u>Hazwaste</u>

All soil sample data has been screened and classified in accordance with WM3 methodology (using Hazwaste Software) to identify if the site soils would be classified as hazardous or are non-hazardous waste for disposal purposes.

The WM3 waste assessment indicates all material tested on the site are non-hazardous and as such, should any soils be excavated and removed from site they can be deposited at a non-hazardous or an inert landfill.

A copy of the Hazwaste Assessment Report is provided in **Appendix E**.

6.9 Updated Conceptual Site Model

Table 16 shows the updated conceptual site model, which has been formulated based on the information obtained in the ground investigation and historic data.

Table 14: Updated Conceptual Site Model

Updated Conceptual Site Model						
Sources	**Receptor**	**Pathway**	**Consequence**	**Probability**	**Risk**	**Recommended Action (to clarify level of risk and assess suitable mitigation measures or to mitigate the risk)**
Made Ground, associated with historical construction activities including: • Onsite historic buildings • The onsite track • Building maintenance possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAH and petroleum hydrocarbons.	People Building Groundwater Surface water	Ingestion Inhalation Direct Contact Root uptake Leaching through unsaturated zone	Medium	Low likelihood	Low Very Low (majority of site – undeveloped areas)	Remaining risk isolated to previously/ currently developed area in the north and along the eastern boundary. No exceedances of metals recorded is any samples collected and tested. No asbestos identified within soil tested.
Made Ground from offsite sources including: • Construction of the Embankment • Former Tramways • Supply pipes • Smithy possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAH and petroleum hydrocarbons.	People Building Groundwater Surface water	Ingestion Inhalation Direct Contact Root uptake Leaching through unsaturated zone	Medium	Unlikely	Low Very Low (majority of site)	Isolated to previously/ currently developed area in the north and along the eastern boundary. No evidence of hydrocarbon contamination encountered and no exceedances, and only minor elevations above laboratory LODs within the samples tested. No asbestos identified within soil tested.
Ground gases (carbon dioxide and methane) from organic materials in any Made Ground or within the River Terrace Deposit soils on site.	People Building	Inhalation Migration into buildings Root uptake Leaching through unsaturated zone	Medium	Unlikely	Low	No distinct sources of ground gas identified, soil organic content considered low. Gas monitoring confirmed the site to be a Characteristic Situation 1 – very low risk.

6.10 Contamination Risk Summary

No exceedances were detected within the soils tested against the Generic Assessment Criteria values adopted for any contaminant.

No asbestos was identified within the Made Ground or topsoil encountered across the site.

The current gas risk at the site has been categorised as Characteristic Situation of CS1 (Very Low Risk) requiring no special protection, this will need updating once all the monitoring visits have been completed.

All samples tested were classified as 'non-hazardous waste'.

Given that there were no significant source and no exceedances of any contaminant recorded across the site, the risk to groundwater or offsite controlled waters is considered very low

Based on the above assessment, no specific mitigation measures are required in terms of protection of human health from site soils, or in terms of risks to controlled waters.

Standard task specific PPE and good hygiene practices should be adopted by site groundworkers.

7 GEOTECHNICAL ASSESSMENT

7.1 Introduction

The site is proposed to be developed for use as a council owned community/ visitor hub, and provide a permanent parking solution for the area, alleviating local community pressures associated with the nearby tourist attraction; the Sgwd Gwladys Waterfall. The council Pre-Construction Information document includes the design and build of:

- A new community / visitor hub;
- A new bunkhouse;
- New public spaces;
- New drainage and highways works;
- Dedicated car parking; and
- Interpretation scheme

Proposed buildings cover a limited area in the north around the existing restaurant and café building and where existing and historical structures have previously been located, so Made Ground and former footings associated with these are expected to be present. Across the central, western and southern areas of site the development is understood to comprise car parking and some form of attenuation drainage solution. It is not known whether proposed levels will differ from the current site levels.

7.2 Excavations

It is not known what the proposed finished levels for the site are, but, given the current site levels in relation to the adjacent roadway and development proposals, significant level changes are not anticipated. Excavations should be readily achievable using standard mechanical plant with toothed buckets. However, the GI indicates the River Terrace Deposits become dense below around 1m, with an increasing amount of cobbles present, so larger machinery will be required to excavate depths of greater than 1m.

Excavations within the development, are likely to consist of standard trench foundation excavations for the proposed structures, as well as excavations associated with attenuation drainage and minor soft landscaping alterations. As the majority of the site is to comprise car parking, the excavation of shallow soils to subgrade levels for pavements will likely represent a major portion of the excavation undertaken onsite. Any excavations will extend through any Made Ground and through the granular River Terrace Deposits. Temporary excavations within the granular material encountered on the site should be stable in the short term at angles of no greater than 1V:2H (26°). Any excavations if required adjacent to the public highway, such as the northern boundary, may require temporary shoring as to not undermine, but given the space available batters will likely be achievable.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be obtained from the Construction Design and Management Regulations (2015); Construction Information Sheet 47: Inspections and Reports (2005) and HSG47: Avoiding Danger from Underground Services.

Groundwater was not encountered during the ground investigation or within the subsequent (winter-time) monitoring program which extended to below likely founding depths, although the depth to groundwater beneath the investigated levels is not known, groundwater levels are expected to be in direct continuity with the river. Therefore if excavations exceed 1.5m below existing ground levels and encounter groundwater, then excavation instability could be significant, especially in any bands of sand.

Any surface or groundwater inflow into shallow temporary excavations will likely drain themselves, as indicated by the preliminary soakaway testing undertaken. Where excavations are required to remain open for medium to

long periods and extend beyond the investigation depths explored (such as the proposed attenuation drainage basin), groundwater levels may be encountered which may require further consideration.

Due to the presence of cobbles within the River Terrace Deposits shoring may be required to stabilise excavations and reduce over break, this will be required where battering is not appropriate. Some difficulty in managing the lateral extents of excavations may be encountered and require consideration, due to the 'pulling' out and disturbance of larger, in-situ cobbles.

7.3 Foundation Options

The proposed buildings are located over the northern area of site, around the location of exploratory holes WS101, WS104 and WS105, where Made Ground was encountered down to depths of between 0.7m and 0.8m bgl. The Made Ground is not a suitable founding stratum so any foundations should extend through the Made Ground and into the underlying granular River Terrace Deposits.

Traditional shallow foundations should be suitable for the site, where an allowable bearing pressure of at least 125kPa is available for the granular gravel material.

Due to the limited investigation depth of the GI undertaken, it is advised that additional trial pitting is undertaken to greater depths in order to confirm the continuation of the River Terrace Deposits to beyond the depth of the zone of influence of the foundation, which is taken to be around two times the width of the foundation. Based on a 0.6m wide footing at a depth of 0.8m, then the depth of granular material should be proven to beyond 2m bgl.

7.4 Floor Slabs

The area of proposed structures are shown to be underlain by up to 0.9m of Made Ground, and NHBC guidelines recommended that a suspended floor slab is used where the thickness of Made Ground exceeds 0.6m. However as the Made Ground appears to vary between 0.2m and 0.9m in thickness and is granular in nature and is underlain by natural granular deposits, then it is recommended that the Made Ground is either excavated out down to the natural granular subgrade or re-compacted in order to support a ground bearing floor slab, otherwise a suspended floor slab should be used.

7.5 Earthworks

The proposed levels have not been determined at this stage of the project, but significant level changes are not anticipated, and any cut and fill activities are likely to be minor and will likely be limited to the area of the proposed attenuation drainage basin and excavation of shallow soils founding levels for pavement construction.

From the 5 no. PSD tests, the soil materials have been compared to the requirements of the Specification for Highways Works, Series 600 – Earthworks - Manual of Contract Documents for Highways Works, Volume 1, and the material can be classified as a Class 1A (well graded granular material), Class 2A/B (wet cohesive/dry cohesive material), and 2C (stoney cohesive material). The Class 1A relates to samples from River Terrace Deposits from TP01 and Made Ground from WS01. These 2A/B/C classifications are from River Terrace Deposits from WS02, TP02, and TP04, and are due to a >15% fines content from samples collected.

Compaction testing was carried out on 1 no. sample within the granular superficial deposits ("*silty/clayey fine to coarse SAND"),* from a sample taken from TP04, which, due to the fines content, is classified as a Class 2A/B material, and therefore may not represent the gravel soils which occupy the majority of the site.

This test was conducted using a 2.5kg rammer and the results are summarised in the table below and plotted on the compaction curve in the figure below.

Table 15. Summary of Compaction Results

Hole ID	Depth bgl (m)	Report*	Initial Natural MC (%)	OMC (%)	Max Dry Density (Mg/m³)	Degree of Compaction based on Natural Moisture Content (%)
TP04	0.90	SD – Sand	19	12	1.87	93%

Note: SD –Superficial Deposit soils

A table summarising the findings is presented above, the OMC required for maximum compaction was 12% in the test undertaken. Initial moisture contents of the tests were determined as 19% (sand).

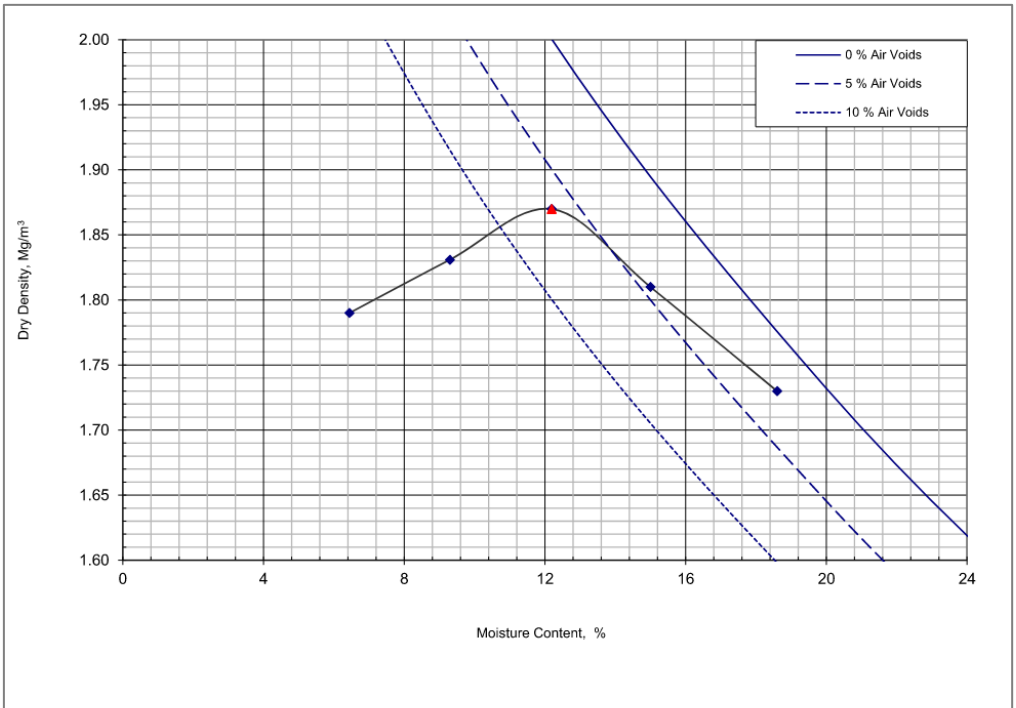
Based on the above result, the sand material tested was wet of its optimum moisture content and can be compacted to around 93% of its maximum dry density (MDD) at its natural moisture content. Some form of moisture treatment may be required in order to reduce the moisture content in order for it to be compacted to 95% of its MDD.

The sandy gravel material can be used as general fill and placed in accordance with the Series 600 Earthworks specification, and if carried out to a method specification should be compacted in accordance with Tab 6/4 Method 2 for general fill uses).

The soils sample tested was taken from the trial pit positioned to target the original attenuation basin area (TP04). This trial pit was relocated during the GI due to access constraints, and therefore this sample does not represent soils in the originally proposed attenuation area, which are likely to comprise a gravel rather than a sand. It is understood that a finalised attenuation basin area has not been determined.

These conditions are at the time of testing, which was during the winter months, in-situ conditions on site are variable and therefore should any earthworks be required, then construction stage testing should confirm the moisture content at the time of excavation.

Figure 10: Compaction Curve – GSTL Lab



Compaction Point	1	2	3	4	5							
Moisture Content	6.4	9.3	12	15	19							
Bulk Density	1.91	2.00	2.10	2.08	2.05							
Dry Density	1.79	1.83	1.87	1.81	1.73							

7.6 Protection of Buried Concrete

BRE-SD1 concrete aggressivity testing was carried out on 4 no. samples within the River Terrace Deposit (Superficial Deposits) and 1 no. sample of Made Ground. The results are shown in the table below:

Table 16: Summary of BRE-SD1 Concrete Sulphate Class Assessment

Hole ID	Depth (mbgl)	pH	2:1 Water Soluble Sulphate (mg/l)	Acid Soluble Sulphate (%)	Total Sulphur (%)	Total Potential Sulphate (SO4%)	DS Class	ACEC Class
Made Ground								
WS01	0.6	7.5	37	0.07	0.03	0.09	DS-1	AC-1
Superficial Deposits								
WS01	0.9	7.4	12	0.03	0.01	0.03	DS-1	AC-1
WS04	0.6	6.5	13	0.06	0.02	0.06	DS-1	AC-1
WS05	0.75	7.2	12	0.05	0.02	0.06	DS-1	AC-1
TP04	0.7	6.4	<10	0.03	<0.01	<0.03	DS-1	AC-1

Oxidisable sulphates were below 0.3% so pyrite is assumed to be absent and the classification has been based on the results of the water soluble sulphate test results alone (all below <500mg/kg).

Based on the design sulphate class, characteristic value of pH and assessment of groundwater mobility, and with reference to table C1 of BRE Special Digest: 2005, the ACEC class for each soil types are presented below. Soils have been assumed as brownfield, groundwater has been assumed to be mobile within both the Made Ground and River Terrace Deposit soils.

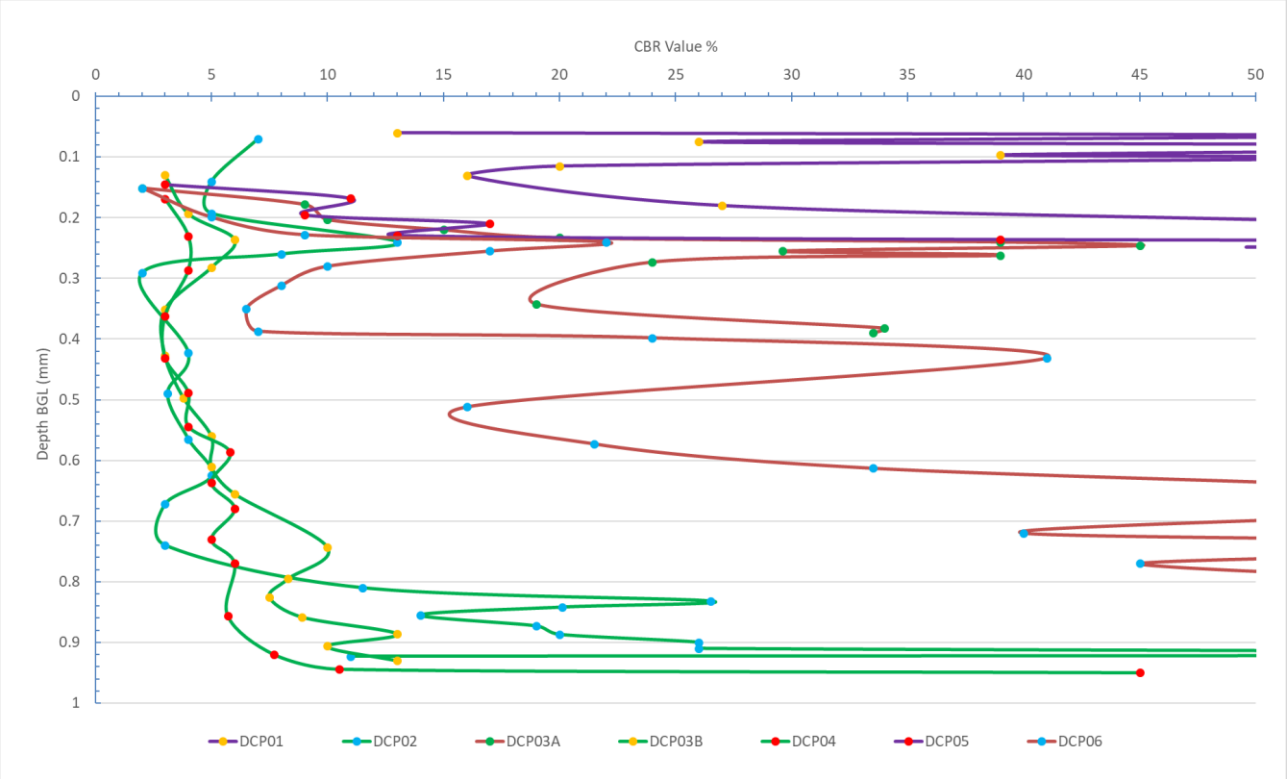
Concrete placed within the various materials has the following concrete Design Sulphate (DS) Class and Aggressivity Chemical Environment for Concrete (ACEC) Class:

- Made Ground – DS1 AC-1;
- Superficial Deposits – DS1 AC-1;

7.7 Pavement Design

TRL dynamic cone penetration (DCP) tests were carried out at six locations (7 tests across the site, to maximum depths of 0.95mbg), in order to obtain a correlated CBR value. DCP3A refused shallow and was retested adjacent, as DCP03B. The number of blows and amount of penetration was used to correlate the California Bearing Ratio (CBR). This correlation was conducted in accordance with the Interim Advice Note 73/06 Revision 1 (2009), design Guidance for Road Pavement Foundations (Draft HD25). The derived CBR vs depth graph is presented in the figure below.

Figure 11: CBR vs Depth correlated from DCP Testing (Green – River Terrace Sands, Red – River Terrace Gravels, Purple – Made Ground)



The DCP locations indicate three materials which make up then shallow site soils, River Terrace Deposit Sands, River Terrace Deposit Gravels and Made Ground.

When taking into account a topsoil strip of around 300mm under any proposed pavements, then the CBR of the likely formation level was generally observed to be around to be 3% to 5% in the looser sands which are expected to cover the eastern area. This is based upon the more conservative and consistent results obtained from DCP02, DCP03B, and DCP04, which are seemingly not influenced by large gravels and cobbles acting as obstructions during the tests. The spikes in CBR values shown in the figure above are likely caused by these gravel and cobble obstructions present within the Made Ground and River terrace Deposit gravels which indicate higher and more variable CBR values.

As such, a preliminary design CBR value of **3%** can be assumed from preliminary design of the subgrade material where sand granular material is present and a preliminary design CBR value of **6%** can be assumed where gravels are present (assuming stripping of any topsoil and Made Ground), where a Performance Design Approach can be adopted for the site. Where Made Ground is present at subgrade levels more variable ground conditions should be expected, although the results indicate a Performance Design Approach can be adopted providing material is compacted. The Site Zonation Plan presented in **Appendix C,** indicates these different areas.

Although not encountered within the GI, where localised soft spots are encountered with a CBR value of less than 2%, improvement works are likely to be required. Improvement works should be carried out in accordance with DMRB IAN 73/06 Rev 1 Chapter 5. In summary, consideration may be given to the following potential remedial techniques:

- excavation and re-engineering or replacement of weaker soils;
- the inclusion of geosynthetic reinforcement within the unbound layers of the capping and sub-grade;
- where cohesive soils are present and they are deemed suitable for treatment with hydraulic binders;
- to employ modification and/or stabilisation techniques on the formation; and
- where granular soils are present, de-watering and re-engineering the formation.

Notwithstanding, any site investigation can, by its very nature, only sample the soils at discrete locations within the site. Variability is inevitable and this should be included for in the design of the works.

7.8 Soakaway Design

Based upon the development proposals (Ref: *Visitor Hub Master Plan, Neath Port Talbot CBC, Lower Pontneddfechan, Hiraeth, Drawing No. 2151 SK210, dated 05/2022*), the possible surface water drainage options include attenuation drainage in the central and southern areas, and possibly infiltration via soakaways and/or discharge into the existing river immediately to the east, running south to the River Neath.

Soakaways were undertaken in TP02, and TP04 at depths of 1.25m and 1.00m bgl respectively, with the base of the pits within the granular River Terrace Deposits. The soakaway tests originally targeted the areas of proposed drainage in the central southern area, and near the proposed buildings in the north, near TP02. However, the attenuation basin location (TP104) was moved east, to near the track, to minimise surface disturbance as set out in the legal agreements, and therefore does not accurately target the originally proposed attenuation basin area, which was left un-investigated.

Due to legally agreed restrictions, requiring careful plant movement to minimise surface damage, test pits were not able to be promptly filled and/ or refilled. The tests took between 18 and 53 minutes for the required 75% drop of water level (the BRE:365 guidance requirement), required for an infiltration rate to be calculated, and gave values of between 1.47E-04 and 3.70E-05 m/sec, indicating free draining soils able to provide a good infiltration medium for permeable SUDS surfaces. Slower rates relating to the test in the area of TP04, which was located at lower site elevations in the southeast area, closer to the river.

Based on these results, soakaways and attenuation basins may be considered a suitable drainage option for the proposed site, although it is recommended that soakaways are undertaken in accordance with BRE:365 guidance ensuring 3 cycles are undertaken, and the likely groundwater levels are accounted for, in order for the drainage strategy to be finalised. As the use of an infiltration basin is proposed near the edge of a Flood Zone 2/3, groundwater can be expected at or close to surface at times which may have implications for proposed levels or construction of the attenuation, and some form of groundwater monitoring is expected to be required.

The base depth of the proposed attenuation pond in the south of the site is not known, and although groundwater was not encountered it is expected to be at similar levels as that of the adjacent river and further testing at the proposed levels is recommended to confirm suitability.

8 FURTHER WORK

Due to the restrictions enforced on the initial phase of ground investigation (GI) works, a number of limitations are present in the site ground conditions, the following additional GI recommendations should confirm the suitability of the adoption of a shallow foundation solution, and to satisfy the planning application in respect to a drainage strategy.

- Additional trial pitting up to 3.5m bgl; including
- Soakaway testing (to proposed drainage basin depths) to BRE365 (3 full cycles); and
- Deeper groundwater monitoring in the area of proposed attenuation to determine groundwater levels.

These excavations should only investigate the areas of proposed development (structures and attenuation areas) to target the ground conditions within the zone of influence below the likely shallow foundation solutions, and to confirm the absence of groundwater likely to affect the viability of the drainage solution. Trial pits should extend to levels at least 1m below any proposed attenuation base levels.

Where any attenuation drainage is proposed, deeper excavations or a deeper borehole is recommended to determine groundwater levels which are expected to rise and fall with fluvial flooding of the nearby river, and, at times, are anticipated to be at near ground level associated with the adjacent flood zone. This is likely to impact the drainage design and levels.

Additionally, an updated site specific Radon Report should be obtained to confirm the radon requirements for any proposed buildings, as the current designation is based upon superseded dataset and guidance (Section 6.3.3).

9 GEOTECHNICAL RISK REGISTER

A Geotechnical Risk Register is a method of identifying hazards which may arise during the construction phase of works based on the data currently obtained for the site. The register is a work in progress and as further information arises, it should be updated in order to quantify the risk. At this stage, the aspects covered by the register are attributed to Cost and Health and Safety, although as site works commence, programme may become a prominent factor.

A Ground Risk Register that was started at the commencement of the ground investigation is contained within **Appendix F.**

10 References

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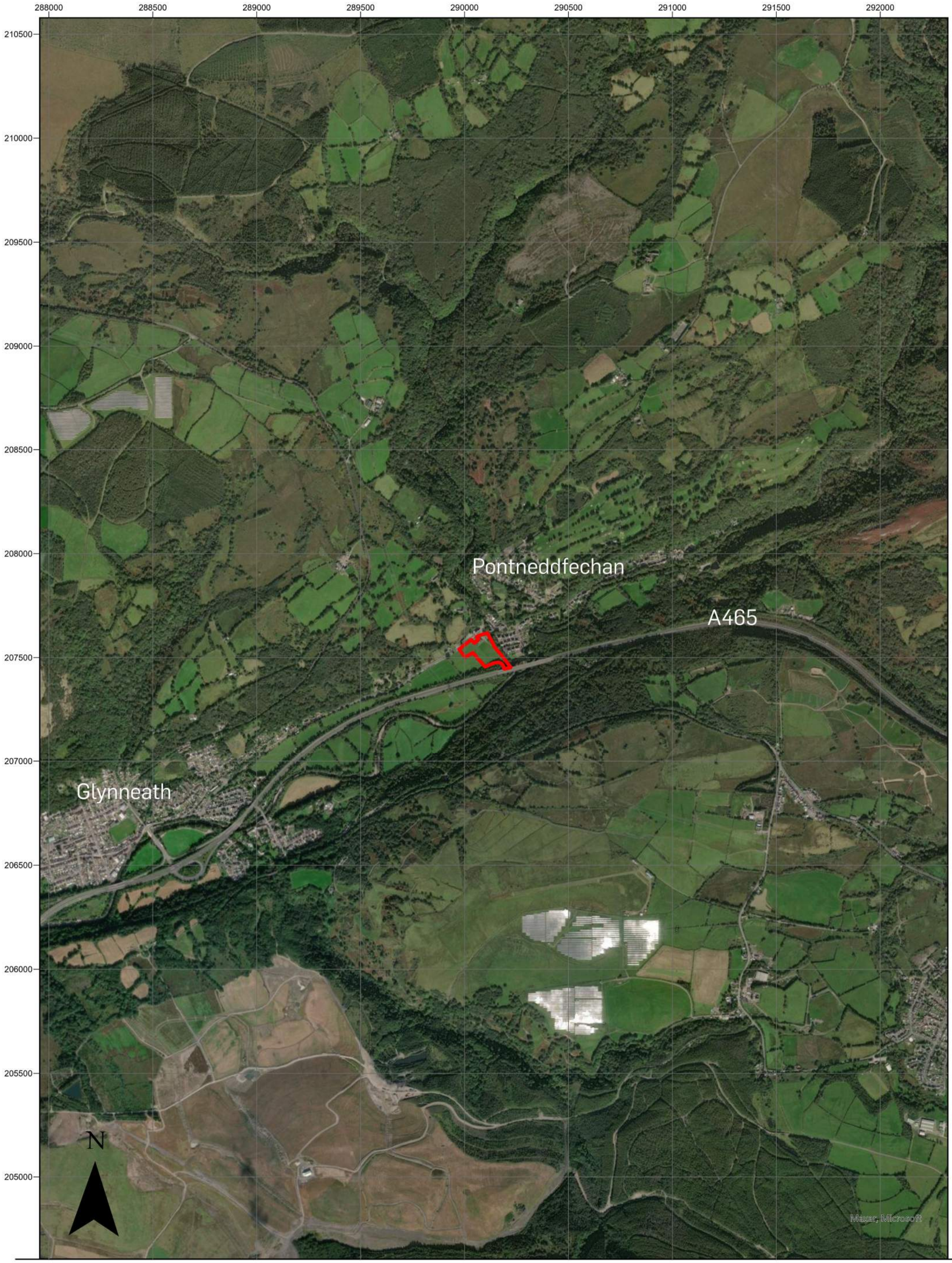
APPENDIX A: SITE LOCATION PLAN



PROJECT: Waterfalls Country Centre
TITLE: Site Location Plan
CLIENT: Andrew Scott Ltd
PROJECT REF: 23158
DRAWING NO: 23158-JCE-XX-XX-DR-SLP-001 **REV:** P01

Revision Referencing
P = Preliminary A = Approval T = Tender C = Construction

Rev	Date	Description	By	Apvd
P1	05.02.2024	Preliminary Issue	DW	IS

Jubb
Bristol, Cardiff, Plymouth, Winchester
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jubb.uk.com
+44(0)117 922 6266

APPENDIX B: PROPOSED SITE DEVELOPMENT PLAN

SK 213.1 BLOCK ROOF PLAN ARRANGEMENT
SCALE 1:100 @ A1, 1:200 @ A3

PRELIMINARY

Hiraeth.

2151 SK 213 Rev.

NEATH PORT TALBOT CBC
LOWER PONTNEDDFECHAN

SKETCH
VISITOR HUB MASTERPLAN

Scale **1:100 @ A1 , 1:200 @ A3** Date **05/22**

02920351645 | office@hiraetharchitecture.co.uk
The Maltings | East Tyndall St | Cardiff | CF24 5EA

do not scale from this drawing | all dimensions to be verified on site | notify architect of all discrepancies | copyright Hiraeth architecture

SK 210.1 VISITOR HUB MASTER PLAN
SCALE 1:500 @ A1, 1:1000 @ A3

PRELIMINARY

Hiraeth.

2151 SK 210 Rev.

NEATH PORT TALBOT CBC
LOWER PONTNEDDFECHAN

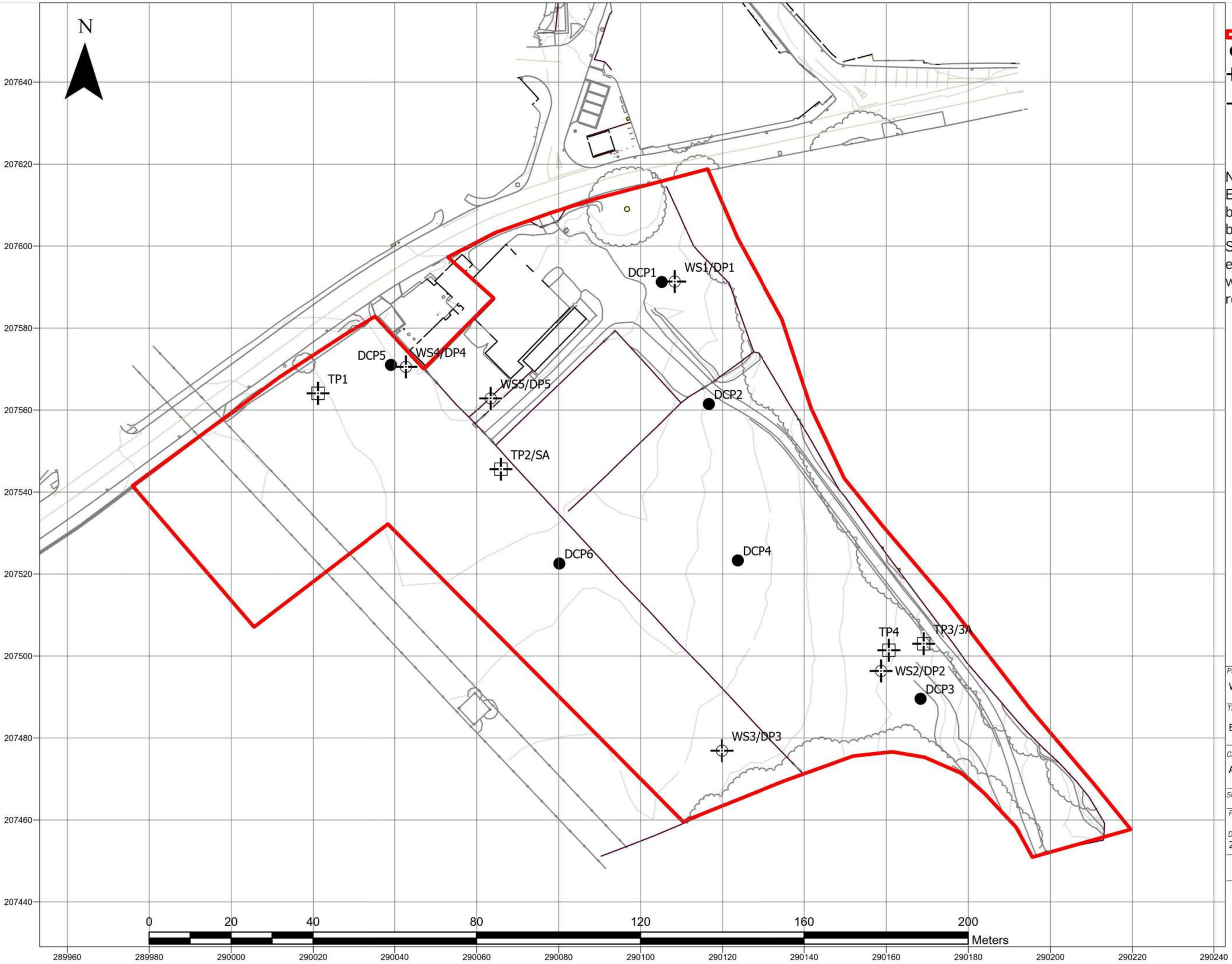
SKETCH
VISITOR HUB MASTERPLAN

Scale **1:500 @ A1 , 1:1000 @ A3** Date **05/22**

02920351645 | office@hiraetharchitecture.co.uk
The Maltings | East Tyndall St | Cardiff | CF24 5EA

do not scale from this drawing | all dimensions to be verified on site | notify architect of all discrepancies | copyright Hiraeth architecture

APPENDIX C: EXPLORATORY HOLE LOCATION PLAN AND SITE ZONATION PLAN



Legend

- Site Boundary
- DCP
- TP
- WS

Note:
Exploratory hole locations based upon measuring out by ESP.
Surveying out of exploratory hole locations was not possible due to return access restrictions.

PROJECT:
Waterfalls Country Centre

TITLE:
Exploratory Hole Location Plan

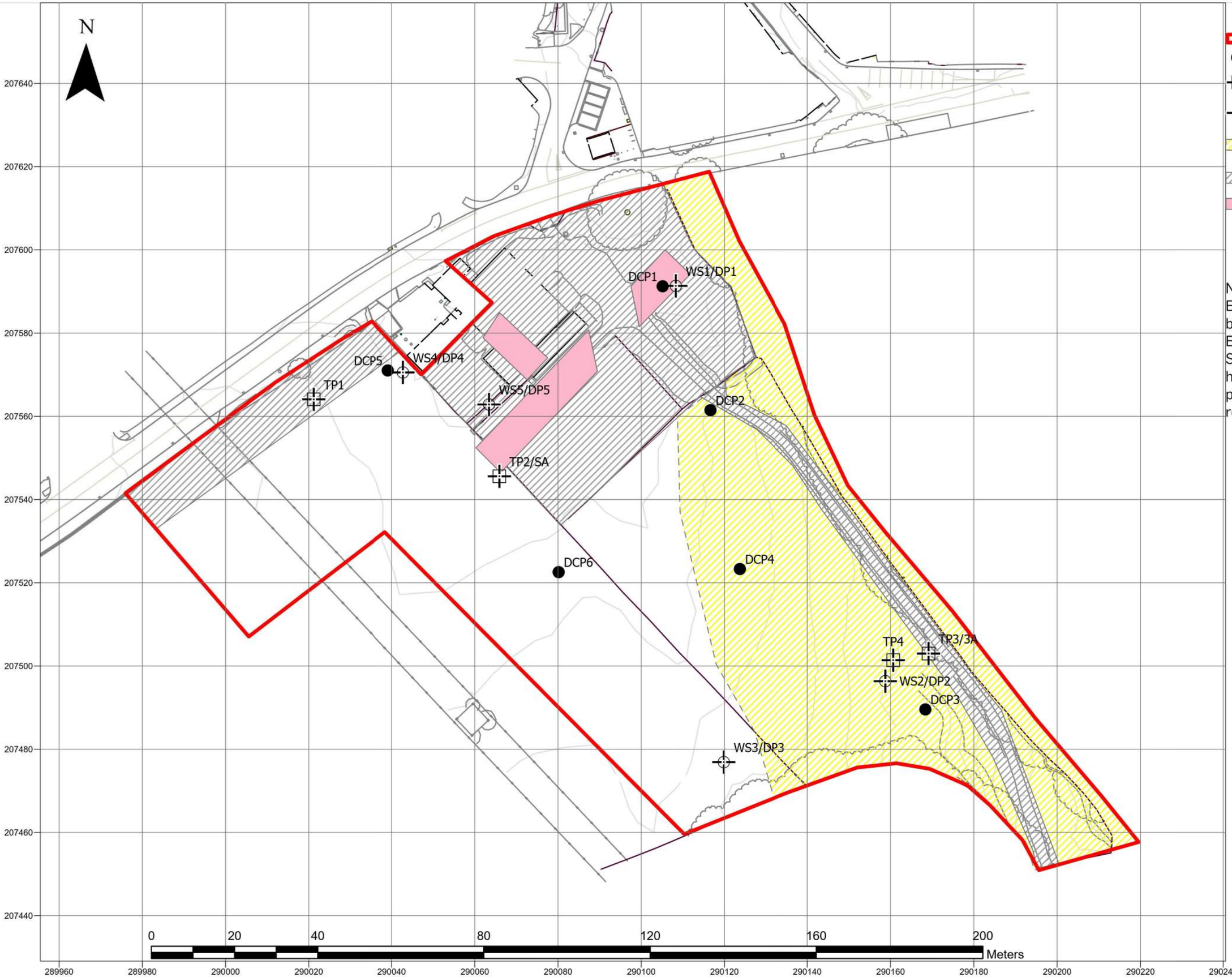
CLIENT:
Andrew Scott Ltd

SCALE: 1:835

PROJECT REF:
23158

DRAWING NO: REV:
23158-JUBB-XX-XX-DR-001-1

Bristol, Cardiff, Plymouth, Winchester
St James Court, St James Parade, Bristol, BS1 3LH
jubb.uk.com
+44 (0) 117 922 6266



Legend

- Site Boundary
- DCP
- TP
- WS
- Area Potentially Underlain by Loose Sand
- Areas Underlain By Made Ground
- Proposed Buildings

Note:
Exploratory hole locations based upon measuring out by ESP.
Surveying out of exploratory hole locations was not possible due to return access restrictions.

PROJECT:
Waterfalls Country Centre

TITLE:
Site Zonation Plan and Proposed Buildings Layout

CLIENT:
Andrew Scott Ltd

SCALE: 1:835

PROJECT REF:
23158

DRAWING NO: *REV:*
23158-JUBB-XX-XX-DR-002-1

Jubb

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APPENDIX D: CONTAMINATION RISK ASSESSMENT METHODOLOGY AND DEFINITIONS

CONTAMINATION ASSESSMENT METHODOLOGY

The DEFRA and Environment Agency Contaminated Land Report 11 (CLR11) 'Model Procedures for the Management of Land Contamination' provides a technical framework for structured decision making about land contamination.

A1. Definition of Risk

CLR11 defines risk as "a combination of probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence".

A2. The Concept of the 'Pollutant Linkage'

In the context of contaminated land, there are three essential elements to any risk:

- a **contaminant (or source)** – a substance that is in, on or under land and has the potential to cause harm or cause pollution of controlled waters.
- a **receptor** - humans, ecological system, water body or property.
- a **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist separately; however, they create a risk only where they are linked together forming a **pollutant linkage**.

A3. Conceptual Site Models

A conceptual site model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

For all potential pollutant linkages identified, the *consequence* and *probability* of occurrence is qualitatively assessed, and a *risk* assigned.

A4. The Tiered Risk Assessment Approach

CLR11 presents a tiered approach to risk:

Tier 1 *Preliminary risk assessment (PRA)*
The purpose of the preliminary risk assessment is to develop an initial conceptual model of the site and to establish whether or not there are potentially unacceptable risks. If potential risks are identified the initial conceptual model is developed in subsequent tiers of the risk assessment process.

Tier 2 *Generic quantitative risk assessment (GQRA)*
The purpose of the generic quantitative risk assessment is to establish whether generic assessment criteria and assumptions are appropriate for assessing the risks and, if so, to apply them to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed quantitative risk assessment is required.

Tier 3 *Detailed quantitative risk assessment (DQRA)*
The purpose of the detailed quantitative risk assessment is to establish and use more detailed site specific information and criteria to decide whether there are unacceptable risks. It may be used as the sole method of quantitative assessments of risks, or it may be used to refine earlier assessments using generic assessment criteria.

B. RISK ASSESSMENT DEFINITIONS

B1. General

The following classification and definition of risk assessment has been based on that set out in NHBC and EA Publication R&D 66 – Guidance on the Safe Development of Housing on Land Affected by Contamination (2008).

The key to the classification is that the designation of risk is based upon the consideration of both:

a) **the magnitude of the potential consequence (i.e. severity)**, which considers both the potential severity of the hazard, and the sensitivity of the receptor**.**

b) **the magnitude of probability (i.e. likelihood)**, which considers both the presence of the hazard, the receptor, and the integrity of the pathway.

B2. Classification of Consequence

Classification	Definition	Examples
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to "significant harm". Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.

** For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.*

B3. Classification of Probability

Only applies if there is a possibility of a pollutant linkage being present.

Classification	Definition	Examples
High likelihood	There is pollutant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.	a) *Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.* b) *Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50*
Likely	There is pollutant linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	a) *Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.* b) *Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.*
Low likelihood	There is pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	a) *Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.* b) *Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.*
Unlikely	There is pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.	a) *Elevated concentrations of toxic contaminants are present below hard standing.* b) *Light industrial unit <10 yrs. old containing a double-skinned UST with annual integrity testing results available.*

Note: A pollution linkage must first be established before probability is classified. If there is no pollution linkage, then there is no potential risk. If there is no pollution linkage, then there is no need to apply tests for probability and consequence.

For example, if there is surface contamination and a major aquifer is present at depth, but this major aquifer is overlain by an aquiclude of significant thickness then there is no pollution linkage and the risks to the major aquifer are not assessed. The report should identify both the source and the receptor but state that because there is no linkage there are no potential risks.

B4. The Classification of Risk

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

B5. Description of the Classified Risks

Very high risk
There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.

High risk
Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.

Moderate risk
It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.

Low risk
It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.

Very low risk
It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

No potential risk
There is no potential risk if no pollution linkage has been established.

B6. Definitions

Term	Definition
Hazard	A property or situation which in certain circumstances could lead to harm. The properties of different hazards must be assessed in relation to their potential to affect the various receptors.
Risk	A combination of the probability or frequency of the occurrences of a defined hazard AND the magnitude of the consequences of that occurrence.
Probability	The mathematical expression of the chance of a particular event in a given period of time [e.g. probability of 0.2 is equivalent to 20% or a 1 in 5 chance].
Impact	The adverse effects (or harm) arising from a defined hazard which impairs the quality of the environment or human health in the short or longer term.
Pollution linkage	An identified pathway is capable of exposing a receptor to a contaminant and that contaminant is capable of harming the receptor.

APPENDIX E: HAZWASTE CLASSIFICATION REPORT

HazWasteOnline™

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

WDZ9O-ZKKCB-2AA9P

Job name

Waterfalls Country Centre

Description/Comments

Project

23158

Site

Waterfalls Country Centre

Classified by

Name:
Philip Webber
Date:
04 Jan 2024 10:59 GMT
Telephone:
01752 222200

Company:
Jubb Consulting Engineers Ltd
Unit 1 Ensign House
Parkway Court
Marsh Mills
PL6 8LR

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification: -

Course	Date
Hazardous Waste Classification	50% complete

Purpose of classification

2 - Material Characterisation

Address of the waste

Waterfall Country **Post Code** N/A

SIC for the process giving rise to the waste

41201 Construction of commercial buildings

Description of industry/producer giving rise to the waste

General construction activities

Description of the specific process, sub-process and/or activity that created the waste

General construction activities

Description of the waste

Made Ground

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01	0.60	Non Hazardous		3
2	WS02	0.60	Non Hazardous		5
3	WS03	0.10	Non Hazardous		7
4	WS04	0.10	Non Hazardous		9
5	WS05	0.30	Non Hazardous		11
6	TP04	0.20	Non Hazardous		13

Related documents

#	Name	Description
1	General Brownfield Soils	waste stream template used to create this Job

Report

Created by: Philip Webber

Created date: 04 Jan 2024 10:59 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	15
Appendix B: Rationale for selection of metal species	16
Appendix C: Version	16

Classification of sample: WS01

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
WS01		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.60 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		15	mg/kg	1.32	19.805	mg/kg	0.00198 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.2	mg/kg	1.285	0.257	mg/kg	0.00002 %		
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		18	mg/kg	1.462	26.308	mg/kg	0.00263 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	28	mg/kg	1.56	43.675	mg/kg	0.0028 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.05	mg/kg	1.353	<0.0677	mg/kg	<0.00000677 %		**<LOD**
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		27	mg/kg	1.126	30.399	mg/kg	0.00304 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		23	mg/kg	1.579	36.328	mg/kg	0.00363 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		81	mg/kg	1.245	100.822	mg/kg	0.0101 %		
11		pH			PH		7.5	pH		7.5	pH	7.5 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
			205-912-4	206-44-0									
19	•	pyrene				0.03	mg/kg		0.03	mg/kg	0.000003 %		
			204-927-3	129-00-0									
20		benzo[a]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				0.03	mg/kg		0.03	mg/kg	0.000003 %		
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				0.04	mg/kg		0.04	mg/kg	0.000004 %		
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		**<LOD**
				TPH									
										Total:	0.0255 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS02

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
WS02		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.60 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		9.4	mg/kg	1.32	12.411	mg/kg	0.00124 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.1	mg/kg	1.285	<0.129	mg/kg	<0.00001 %		**<LOD**
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		11	mg/kg	1.462	16.077	mg/kg	0.00161 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	38	mg/kg	1.56	59.273	mg/kg	0.0038 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.05	mg/kg	1.353	<0.0677	mg/kg	<0.00000677 %		**<LOD**
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		20	mg/kg	1.126	22.518	mg/kg	0.00225 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		13	mg/kg	1.579	20.533	mg/kg	0.00205 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		56	mg/kg	1.245	69.704	mg/kg	0.00697 %		
11		pH			PH		6.7	pH		6.7	pH	6.7 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-912-4	206-44-0									
19	•	pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-927-3	129-00-0									
20		benzo[a]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		**<LOD**
				TPH									
										Total:	0.0193 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS03

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS03
Sample Depth:
0.10 m

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		56	mg/kg	1.32	73.938	mg/kg	0.00739 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	1.3	mg/kg	1.285	1.671	mg/kg	0.00013 %		
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		14	mg/kg	1.462	20.462	mg/kg	0.00205 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	180	mg/kg	1.56	280.767	mg/kg	0.018 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.09	mg/kg	1.353	0.122	mg/kg	0.0000122 %		
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		41	mg/kg	1.126	46.161	mg/kg	0.00462 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		14	mg/kg	1.579	22.113	mg/kg	0.00221 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		89	mg/kg	1.245	110.78	mg/kg	0.0111 %		
11		pH			PH		5.2	pH		5.2	pH	5.2 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				0.04	mg/kg		0.04	mg/kg	0.000004 %		
			205-912-4	206-44-0									
19	•	pyrene				0.04	mg/kg		0.04	mg/kg	0.000004 %		
			204-927-3	129-00-0									
20		benzo[a]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				0.03	mg/kg		0.03	mg/kg	0.000003 %		
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				0.03	mg/kg		0.03	mg/kg	0.000003 %		
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		**<LOD**
				TPH									
										Total:	0.0468 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS04

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
WS04		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.10 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		31	mg/kg	1.32	40.93	mg/kg	0.00409 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.9	mg/kg	1.285	1.157	mg/kg	0.00009 %		
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		11	mg/kg	1.462	16.077	mg/kg	0.00161 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	46	mg/kg	1.56	71.751	mg/kg	0.0046 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.05	mg/kg	1.353	<0.0677	mg/kg	<0.00000677 %		**<LOD**
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		33	mg/kg	1.126	37.154	mg/kg	0.00372 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		11	mg/kg	1.579	17.374	mg/kg	0.00174 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		92	mg/kg	1.245	114.514	mg/kg	0.0115 %		
11		pH			PH		6.8	pH		6.8	pH	6.8 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				0.1	mg/kg		0.1	mg/kg	0.00001 %		
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				0.2	mg/kg		0.2	mg/kg	0.00002 %		
			205-912-4	206-44-0									
19	•	pyrene				0.15	mg/kg		0.15	mg/kg	0.000015 %		
			204-927-3	129-00-0									
20		benzo[a]anthracene				0.04	mg/kg		0.04	mg/kg	0.000004 %		
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				0.09	mg/kg		0.09	mg/kg	0.000009 %		
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				0.06	mg/kg		0.06	mg/kg	0.000006 %		
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				58	mg/kg		58	mg/kg	0.0058 %		
				TPH									
										Total:	0.0335 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because Not flammable as this concentration

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0058%)

Classification of sample: WS05

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS05
Sample Depth:
0.30 m

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		4.9	mg/kg	1.32	6.47	mg/kg	0.000647 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.1	mg/kg	1.285	0.129	mg/kg	0.00001 %		
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		16	mg/kg	1.462	23.385	mg/kg	0.00234 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	19	mg/kg	1.56	29.636	mg/kg	0.0019 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.05	mg/kg	1.353	<0.0677	mg/kg	<0.00000677 %		**<LOD**
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		15	mg/kg	1.126	16.888	mg/kg	0.00169 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		6.5	mg/kg	1.579	10.267	mg/kg	0.00103 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		52	mg/kg	1.245	64.725	mg/kg	0.00647 %		
11		pH			PH		8.5	pH		8.5	pH	8.5 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				0.1	mg/kg		0.1	mg/kg	0.00001 %		
			205-912-4	206-44-0									
19	•	pyrene				0.08	mg/kg		0.08	mg/kg	0.000008 %		
			204-927-3	129-00-0									
20		benzo[a]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				0.07	mg/kg		0.07	mg/kg	0.000007 %		
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				33	mg/kg		33	mg/kg	0.0033 %		
				TPH									
										Total:	0.0177 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because Not flammable as this concentration

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0033%)

Classification of sample: TP04

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
TP04		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.20 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		26	mg/kg	1.32	34.328	mg/kg	0.00343 %		
2		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.5	mg/kg	1.285	0.643	mg/kg	0.00005 %		
3		chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		13	mg/kg	1.462	19	mg/kg	0.0019 %		
4		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1	mg/kg	1.923	<1.923	mg/kg	<0.000192 %		**<LOD**
5		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	27	mg/kg	1.56	42.115	mg/kg	0.0027 %		
6		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.05	mg/kg	1.353	<0.0677	mg/kg	<0.00000677 %		**<LOD**
7		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		32	mg/kg	1.126	36.028	mg/kg	0.0036 %		
8		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		23	mg/kg	1.579	36.328	mg/kg	0.00363 %		
9		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<0.5	mg/kg	1.405	<0.703	mg/kg	<0.0000703 %		**<LOD**
10		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		93	mg/kg	1.245	115.758	mg/kg	0.0116 %		
11		pH			PH		6.5	pH		6.5	pH	6.5 pH		
12		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
13		acenaphthylene		205-917-1	208-96-8		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
14		acenaphthene		201-469-6	83-32-9		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
15		fluorene		201-695-5	86-73-7		<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
16	•	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			201-581-5	85-01-8									
17	•	anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			204-371-1	120-12-7									
18	•	fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-912-4	206-44-0									
19	•	pyrene				0.04	mg/kg		0.04	mg/kg	0.000004 %		
			204-927-3	129-00-0									
20		benzo[a]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-033-00-9	200-280-6	56-55-3									
21		chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-048-00-0	205-923-4	218-01-9									
22		benzo[b]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-034-00-4	205-911-9	205-99-2									
23		benzo[k]fluoranthene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-036-00-5	205-916-6	207-08-9									
24		benzo[a]pyrene; benzo[def]chrysene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-032-00-3	200-028-5	50-32-8									
25	•	indeno[123-cd]pyrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-893-2	193-39-5									
26		dibenz[a,h]anthracene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
27	•	benzo[ghi]perylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		**<LOD**
			205-883-8	191-24-2									
28	•	TPH (C6 to C40) petroleum group				22	mg/kg		22	mg/kg	0.0022 %		
				TPH									
										Total:	0.0294 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because Not flammable as this concentration

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0022%)

Appendix A: Classifier defined and non GB MCL determinands

- **chromium(III) oxide (worst case)** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **pH** (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

- **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

- **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

- **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

- **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

- **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Worst case species based on hazard statements

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case species based on hazard statements

lead {lead chromate}

Worst case species based on hazard statements

mercury {mercury dichloride}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements

zinc {zinc oxide}

Most likely to occur in oxides form in soils.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2023.356.5870.10868 (22 Dec 2023)
HazWasteOnline Database: 2023.356.5870.10868 (22 Dec 2023)

This classification utilises the following guidance and legislation:
WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
14th ATP - Regulation (EU) 2020/217 of 4 October 2019
15th ATP - Regulation (EU) 2020/1182 of 19 May 2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
GB MCL List - version 1.1 of 09 June 2021
GB MCL List v2.0 - version 2.0 of 20th October 2023

APPENDIX F: GEOTECHNICAL RISK REGISTER

CATEGORY			RISK ASSESSMENT							CONTROL MEASURES				
REFERENCE No.	CDM – H&S	PROJECT	HAZARD *Record the nature of the hazard.*	CAUSE *Note the conditions that may lead to a hazard causing harm or disruption.*	CONSEQUENCE *List the consequences, should the hazard come into effect*	PROJECT STAGE				CONTROL MEASURES *List those measures that you consider may be put in place to mitigate (reduce) both the likelihood and effect of the risk*	RESIDUAL RISK RATING			METHOD OF COMMUNICATION *List risk communication media additional to this document e.g. drawings.*
						PRE-CONSTRUCTION	CONSTRUCTION	OPERATION & MAINTENANCE	DECOMMISSIONING		LIKELIHOOD	EFFECT	RISK RATING	
1	X		Excavations - Collapse/Instability	Excessive Groundwater/ Rainfall Soft Ground Conditions Cuttings too steep/insufficient support. Shallow groundwater.	Damage to Plant and Equipment Death or Serious Injury		X			Shoring is expected within excavations near road in north and in excavations requiring to be left open long-term or needing to be manned.	L	M	L	Ground Conditions Assessment Report
2	X	X	Contamination – Site Soils	Localised elevated metals encountered.	Human Health Issues Increased Disposal Costs	X	X			Ground investigation identified no soil contamination. No remedial measure are considered necessary.	L	L	L	Ground Conditions Assessment Report
3		X	Aggressive Chemicals (Sulphates)	Sulphate Levels	Degradation of concrete used in the ground. Failure of foundations to meet the required standards.			X		Any concrete placed should be designed with the following: Made Ground – DS-1 AC-1s; and	L	M	L	Sulphate section of Ground Conditions Assessment Report

CATEGORY			RISK ASSESSMENT							CONTROL MEASURES				
REFERENCE No.	CDM – H&S	PROJECT	HAZARD *Record the nature of the hazard.*	CAUSE *Note the conditions that may lead to a hazard causing harm or disruption.*	CONSEQUENCE *List the consequences, should the hazard come into effect*	PROJECT STAGE				CONTROL MEASURES *List those measures that you consider may be put in place to mitigate (reduce) both the likelihood and effect of the risk*	RESIDUAL RISK RATING			METHOD OF COMMUNICATION *List risk communication media additional to this document e.g. drawings.*
						PRE-CONSTRUCTION	CONSTRUCTION	OPERATION & MAINTENANCE	DECOMMISSIONING		LIKELIHOOD	EFFECT	RISK RATING	
										Superficial Deposits – DS1 AC-1s;				
4		X	Groundwater	Shallow groundwater.	Inundation of excavations with groundwater.		X			Ground investigation has not confirmed presence of groundwater (<1.5m bgl), Groundwater may be perched and provide base flow to the River Neath adjacent. Management of groundwater during construction if excavations extend below depths of 1m.	M	M	M	Ground Conditions Assessment Report
5		X	Buried Services	Potential underground services.	Damage to services, plant and site personnel.		X			Obtain underground survey prior to construction.	L	M	L	Service drawings. Constraints plan.
6	X		Foundation failure – Ultimate Limit State (Bearing Capacity Failure)	Unknown loadings Degradation of concrete	Building collapse/ need to rebuild			X		Determine strength of underlying soils in order to obtain bearing capacity. Additional ground	L	M	L	Foundation section of Ground Conditions

CATEGORY			RISK ASSESSMENT							CONTROL MEASURES				
REFERENCE No.	CDM – H&S	PROJECT	HAZARD *Record the nature of the hazard.*	CAUSE *Note the conditions that may lead to a hazard causing harm or disruption.*	CONSEQUENCE *List the consequences, should the hazard come into effect*	PROJECT STAGE				CONTROL MEASURES *List those measures that you consider may be put in place to mitigate (reduce) both the likelihood and effect of the risk*	RESIDUAL RISK RATING			METHOD OF COMMUNICATION *List risk communication media additional to this document e.g. drawings.*
						PRE-CONSTRUCTION	CONSTRUCTION	OPERATION & MAINTENANCE	DECOMMISSIONING		LIKELIHOOD	EFFECT	RISK RATING	
				Insufficient depth of foundations						investigation completed.				Assessment Report
7	X		Serviceability limit state failure (settlement)	High Plasticity Clays and foundations placed on material types of contrasting strength properties.	Cracking/deformation of slabs			X		Ground Investigation to prove granular soils underlie the area of proposed development.	L	M	M	Foundation section of Ground Conditions Assessment Report
8		X	Obstructions subsurface	Subsurface obstructions not anticipated	Unable to excavate through. Increased cost of disposal and earthworks.		X			Determine ground model based on ground investigation results.	L	M	L	Excavations section of Ground Conditions Assessment Report.
9	X		Ground Gases	Build-up of ground gasses in excavations and sub floor voids from natural soils	Risk of explosion		X			Preliminary Low risk of ground gas. Preliminary gas monitoring results indicate low gas risk.	L	L	L	Ground Conditions Assessment Report.

APPENDIX G: LIMITATIONS AND EXCEPTIONS

Limitations and Exceptions

1. The advice given in this report is based on the guidelines available at the time of writing.

2. This investigation was conducted so as to generally comply with the relevant principles and requirements of BS10175: 2011 "Investigation of potentially contaminated sites - Code of Practice" and BS 5930:2015 “Code of Practice for Site Investigations”.

3. The Client is advised that the conditions observed on site by Jubb Consulting Engineers Ltd (JCE) at the time of the investigation or assessment are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance or investigation and they may subsequently have become observable. Ground conditions, including geotechnical properties may vary between points of observation, sampling and testing.

4. Certain areas of site had restricted access or were inaccessible due to the presence of in-use buildings, facilities and live services, as identified in this report. These may require further investigation outside the scope of this present investigation.

5. Comments made relating to land gas or groundwater conditions are based on observations made at the time of an investigation unless otherwise stated. Land gas and groundwater conditions may vary as a result of seasonal or other effects.

6. Ground contamination often exists as small discrete areas of contamination and there can be no certainty that any or all such areas have been located, sampled and/or identified.

7. The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous site investigations and chemical and geotechnical testing laboratories, and which JCE has assumed are correct. Nevertheless, JCE cannot and does not guarantee the authenticity or reliability of the information it has used or cited. JCE can accept no responsibility for inaccuracies within the data supplied by other parties.

8. This report is written in the context of an agreed scope of work between JCE and the Client and should not be used in a different context. In the light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.

9. This report is provided for sole use by the Client and is confidential to them. No responsibility whatsoever for the contents of the report will be accepted to anyone other than the Client.

10. This report is not a specification for works.

11. JCE believes that providing information about limitations is essential to help the Client identify and thereby manage risks.

12. JCE does not provide legal advice and the advice of the Clients’ legal advisors may also be required.

13. JCE retain the copyright in this report and all drawings reproduced in it.