REDSTART

Rhondda Fach Active Travel Route

Ground Investigation Report (Phases 3, 4 & 5)

July 2023

Project No: GC/3569 Doc Ref: GC3569-RED-74-ATR-RP-D-0005 Rev: P01

Rhondda Cynon Taf County Borough Council

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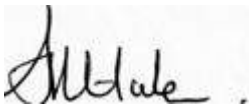
APPROVER	Andrew Hale		12/07/2023

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1. Introduction

1.1 Scope and Objective of the Report

Redstart have been commissioned by Rhondda Cynon Taf County Borough Council (RCT), to prepare a Ground Investigation Report (GIR) for Rhondda Fach Active Travel Route (RFATR).

The purpose of this Ground Investigation Report is to provide a geotechnical assessment of the ground and groundwater conditions for use in the detailed design of the proposed works. It provides a geotechnical evaluation of the information, which is compliant with BS EN 1997-2 – Eurocode 7 (Ref. 1).

This report has been prepared in accordance with the requirements of the Design Manual for Road and Bridges (DMRB) and specifically CD622: Managing Geotechnical Risk (Ref. 2). This guidance sets out the procedures to be followed and certificates to be used during the process of planning and reporting of ground investigations to ensure that the geotechnical risks to such projects are correctly identified and managed.

This report should be read in conjunction with the following documents:

1. Preliminary Sources Study Report, Ref: GC3596-RED-74-ATR-RP-D-0001 (Ref. 3), Redstart.
2. Coal Mining Risk Assessment, Ref: GC3596-RED-74-ATR-RP-D-0002 (Ref. 4), Redstart.
3. Rhondda Fach Active Travel Route (Phases 3, 4 & 5) – Ground Investigation, Factual Report, Report No. G23011. Jackson Geo Services, April 2023 (Ref. 5).

The principal objectives of this GIR are as follows:

- Evaluate the available PSSR and ground investigation (GI) information.
- Provide a description of the ground and groundwater conditions and their implication on the proposed scheme.
- Develop the site wide geotechnical material parameters for use in the design of earthworks, drainage and pavement construction; and
- Identify the associated geotechnical risks and provide a Geotechnical Risk Register applicable for the delivery of the scheme.

1.2 Description of the Project and Site

Works are being considered to create a route facilitating walking and cycling for regular, “purposeful”, short distance journeys made by individuals to key facilities and destinations, as a realistic alternative to making the same journeys by car.

The study area lies between Maerdy and Pontygwaith, between approximate Ordnance Survey National Grid reference (OSNGr) SS (2)97571, (1)98398 in the north, and ST (3)01023, (1)94640 in the south. The scheme is located upon a length of former mineral railway/tramway on the eastern side of the Afon Rhondda Fach and includes several links to the wider community on the western side of the river, collectively referred to as Phases 3, 4 and 5.

The route is to be surfaced by a bituminous pavement and three bridges are included in the scheme proposal. A new river bridge is to be located at SS (2)98938, (1)97735. Two footbridges are to be replaced, located at (OSNGr) SS (2)99402, (1) 97615 (sub-station footbridge) and ST (3)00622, (1)96219 (leisure centre footbridge).

Details of the proposal are shown on the following drawings provided by RCT, which are presented to the rear of this report:

- P187-00-80-02-P06 Phasing Plan.
- P187-00-85-23 Phase 3 General Arrangement.
- P187-00-85-24 Phase 4 General Arrangement.
- P187-00-85-25 Phase 5 General Arrangement.

1.3 Geotechnical Category of Project

Based on the latest appraisal of the scheme following ground investigation data obtained, and assessment of the ground risk involved, it is considered that the scheme should be categorised as follows (as defined in CD622):

- Geotechnical Category 2: For the scheme as a whole.

Within CD622, Geotechnical Category 2 is defined as:

'Projects which include conventional types of geotechnical structures, earthworks and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading conditions. Designs for Category 2 should normally include quantitative geotechnical data and analysis to ensure that the fundamental requirements are satisfied. Routine procedures for field and laboratory testing and for design and execution may be used.'

2. Existing Information

2.1 Introduction

The purpose of this section is to summarise the available information relevant to the geotechnical elements of the proposed scheme. Where appropriate this information will be used in the later sections of this report as supplementary information to assist in the evaluation of the ground conditions and aid the identification of geotechnical constraints and hazards that could impact on the scheme.

The information reviewed as part of this assessment is summarised below:

- Preliminary Sources Study Report, Ref: GC3596-RED-74-ATR-RP-D-0001 (Ref. 3), Redstart.
- Coal Mining Risk Assessment, Ref: GC3596-RED-74-ATR-RP-D-0002 (Ref. 4), Redstart
- Rhondda Fach Active Travel Route (Phases 3, 4 & 5) – Ground Investigation, Factual Report, Report No. G23011. Jackson Geo Services, April 2023 (Ref. 5).
- Geology of Britain Viewer, British Geological Survey (BGS) (Ref. 6); and
- Groundsure Enviro + Geo Insight Report for the scheme (Report GSIP-2021-12370-8592, dated 13th December 2021), (Ref. 7).

Reference should be made to the original reports and documents for full details.

2.2 Geological Maps and Memoirs

The British Geological Survey (BGS) information consulted for this report included:

- British Geological Survey (Drift), Sheet 248, Pontypridd, 1:50,000 scale, 1975 (Ref. 8)
- British Geological Survey website – Geology of Britain Viewer including borehole scans (Ref. 6).

The available information summarised in Table 2.0 shows the geological units that were anticipated to be encountered during the ground investigation fieldwork.

Table 2.0 Strata Anticipated

Geological Unit		Comments
Artificial Deposits	Made Ground	Associated with the existing railway infrastructure and colliery spoil tips.
Natural Superficial Deposits	Landslide Deposits	Reclaimed landslide deposits from the Feb 2020 Llanwonno Upper Tip failure.
	Alluvium	Associated with the Afon Rhondda Fach. Expected to comprise a wide range of material sizes from clay to cobbles.

Geological Unit		Comments
	Glaciofluvial Deposits	Glacial meltwater deposits, mostly coarse-grained sediments.
	Glacial Till	These materials are expected to comprise a wide range of sizes from clay to boulders.
Solid Geology	Rhondda Member	Green-grey, lithic arenites ("Pennant sandstones") with thin mudstone/siltstone and seatearth interbeds and mainly thin coals. The base of the Member is placed at the base of the No.2 Rhondda Coal.
	South Wales Upper Coal Measures Formation	Predominantly grey (productive) coal-bearing mudstone/siltstone and minor grey, fossiliferous mudstones. The geological plan indicates the route does not cross any subcrops of coal seams.

The No.2 Rhondda seam outcrops around (OSNGr) ST (3)00737, (1)96172 in Phase 5 (approx. 120 m ESE of the leisure centre footbridge) and ST (3)00673, (1)96138 in Phase 4 leisure centre link (approx. 100 m SSE of the leisure centre footbridge), so is anticipated to be present with little rock cover immediately south of its outcrop.

A fault intersects the Phase 4 ATR at Station Road Bridge (Blaenllechau) and cuts across Phase 5 of the ATR several hundred metres either side of the Tylorstown Leisure Centre at approx. (OSNGr) ST (3)00900, (1)96091 (where coincidentally a spring is present at the edge of the ATR) and ST (3)01286, (1)95516.

2.3 Aerial Photographs (Old and Recent)

Recent aerial photographic coverage was viewed on Google maps and is presented within the PSSR.

2.4 Land Use and Soil Survey Information

Details of the historical development of the site is provided within the PSSR. Based on the current information, the findings of the PSSR are still applicable.

2.5 Archaeological and Historical Investigations

The historical development of the site is summarised in the PSSR. No archaeological studies have been undertaken.

2.6 Existing Ground Investigations

Several reports have been produced by Redstart in response to the Tylorstown Landslide initiated during the Storm Dennis event in February 2020 and the subsequent Phase 2/3 remedial works.

2.6.1 Tylorstown Landslip – Factual Report on Ground Conditions, Intégral Géotechnique, May 2020 (Ref. 9).

In 2020, Intégral Géotechnique attended the site of a recent colliery spoil tip landslip located immediately upstream of Tylorstown Leisure Centre, to characterise the material forming the landslip debris toe. Six trial pits were excavated on the eastern side of the river, to depths of between 1.5 and 3.0 m. The deposits were found to typically comprise a thin crust of desiccated material consisting of loose grey silty sandy gravel (between approx. 0.1 and 0.2 m thick). This

lay over (very loose) dark grey or grey-brown variably silty variably sandy fine to coarse gravel with variable cobble and boulder content, or a locally soft grey-brown sandy gravelly clay / silt with variable cobble and boulder content. The coarse constituents (i.e. gravel, cobbles and boulders) comprised variable proportions of mudstone, coal and sandstone.

Seven samples were sent for laboratory analysis of a range of contaminants. Waste Classification Reports prepared by Redstart, using the HazWaste Online method, showed that all samples would be classed as non-hazardous waste.

The material was subsequently removed and placed at River Receptor Site B (RRS-B), at the southern extent of Phase 4.

2.6.2 *Tylorstown Phase 3. River Receptor Site A: Preliminary Sources (Desk) Study Report. Redstart. November 2020 (Ref. 10).*

The report identified the presence of two infilled mine shafts, effectively splitting River Receptor Site A (RRS-A) into two separate River Receptor Sites (A1 and A2).

This report provided background information and a preliminary environmental risk assessment for the potential storage of the Tylorstown landslip materials at River Receptor Site A1 (RRS-A1) and River Receptor Site A2 (RRS-A2), immediately adjacent to Phase 4 south of Station Road, Blaenllechau.

Ferndale Colliery formerly occupied the sites, along with ancillary works including a sawmill, a smithy and railway.

The contamination potential for the site was determined to be low.

Buried utilities noted as running across the site included a sewer, gas main and water main.

2.6.3 *Tylorstown Phase 3. River Receptor Site B: Preliminary Sources (Desk) Study Report. Redstart. November 2020 (Ref 11).*

This report provided background information and a preliminary environmental risk assessment for the potential storage of the Tylorstown landslip materials at RRS-B.

The report identified the sites former use as railway sidings, with two historical mine adits on the hillside above.

The contamination potential for the site was determined to be low to very low.

Buried utilities noted included a water main running parallel with the site.

2.6.4 *Tylorstown Phase 3. River Receptor Site A: Permanent Landscaping. Geo-environmental Interpretative Report. September 2022 (Ref. 12).*

This report included details of site investigations undertaken by Intégral Géotechnique (Ref. 13, 14, 15) comprising 12 trial pits and one borehole at RRS-A1 and a further five trial pits at RRS-A2, with supplementary surface water sampling.

Within RRS-A1, one area of borderline PAH impacted soil was identified with a further location found to contain a PAH hotspot. Minor quantities of asbestos fibres were detected in soils across both sites. Mitigation measures for the BaP hotspot were discussed, with Local Authority agreement necessary to finalise details.

Soil leachate testing determined trace concentrations (although some technical exceedances) of contaminants which represented a low risk to groundwater and surface water receptors.

2.6.5 *Tylorstown Phase 3. River Receptor Site B: Permanent Landscaping. Geo-environmental Interpretative Report. September 2022 (Ref. 16).*

This report includes details of a site investigations undertaken by Intégral Géotechnique (Ref. 14) in July 2020 comprising six machine excavated trial pits. This investigation found the site to be uncontaminated for the proposed development.

Further ongoing assessments of the deposited landslip material at RRS-B resulted in two rounds of sampling by trial pitting, in September 2020 (in Ref. 17) and November 2020 (in Ref. 18). A borehole was also formed adjacent to RRS-B as part of a November 2020 investigation (in Ref. 19). The translocated slip material was uncontaminated and displayed mainly low levels of leaching although a few samples had marginal exceedances of dissolved manganese. Groundwater was found to be impacted slightly by copper, although at lower concentrations than the water discharging from a mine adit directly above the site.

2.7 Consultation with Statutory Bodies and Agencies

Consultation with statutory bodies has been carried out during the PSSR assessment, the findings of the PSSR are still applicable.

2.8 Flood Records

The Groundsure reports and Natural Resources Wales (NRW) flood maps indicate that the site is susceptible to flooding from rivers, lying within Flood Zone 3 (having a 1 in 100 chance of flooding each year).

2.9 Contaminated Land

A contaminated land assessment has been undertaken to assess the potential risks posed to human health and controlled water receptors at the development site. Further information has been outlined in Section 6 of this report.

2.10 Environmental Information

Information obtained from the Groundsure Report includes details of floodplain and flood warning areas, surface and groundwater, waste and landfill locations, and industrial activities in the immediate environment.

3. Field and Laboratory Studies

3.1 Introduction

This section of the report discusses the investigations undertaken for the proposed scheme, including walkover surveys and ground investigation.

3.2 Walkover Survey

Site walkover surveys were undertaken by geotechnical engineers from Redstart and are presented in the PSSR.

3.3 Geomorphological/Geological Mapping

Not used.

3.4 Ground Investigation

3.4.1 Description of fieldworks

A ground investigation (GI) was designed by Redstart, and the GI works carried out by Jackson Geo Services, between 20th February and 15th March 2023 with an additional phase of work carried out on the 19 June 2023. Prior to the exploratory holes being undertaken, a PAS 128 type B utility survey was carried out.

The boreholes were formed using light cable percussive techniques. The machine excavated trial pits were undertaken using either a wheeled or tracked excavator. Inspection pits were hand excavated.

A summary of the exploratory holes is presented in the table below.

Table 3.0 – Summary of Exploratory Holes Phase 3

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
IP312	Hand excavated inspection pit	1.00	Made Ground	No Groundwater
TP301S	Machine excavated trial pit	1.00	Made Ground	No Groundwater Blue tape exposed, possible water services.
TP302	Machine excavated trial pit	1.80	Made Ground	No Groundwater
TP303S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP304	Machine excavated trial pit	3.00	Made Ground	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
TP305S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP306	Machine excavated trial pit	1.80	Made Ground	No Groundwater
TP307	Machine excavated trial pit	0.85	Glacial Till	Groundwater at 0.75 m
TP308	Machine excavated trial pit	1.70	Made Ground	Groundwater at 1.70 m
TP309	Machine excavated trial pit	2.50	Made Ground	No Groundwater
TP310S	Machine excavated trial pit	1.00	Made Ground	Groundwater at 0.70 m
TP311	Hand excavated inspection pit	1.05	Made Ground	Hand Excavated No Groundwater
TP313	Machine excavated trial pit	2.00	Glacial Till	No Groundwater
TP314	Machine excavated trial pit	1.50	Glacial Till	No Groundwater

Table 3.1 – Summary of Exploratory Holes Phase 4

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
BH401	Cable percussive drilling	4.50	Glacial Till	No Groundwater Standpipe installed with response zone between 2.00 and 4.50 mbgl.
BH402	Cable percussive drilling	1.60	Glacial Till	No Groundwater Exploratory hole BH402 refused at 1.60 m. The position was moved approximately 1.00 m south and drilled as BH402A.
BH402A	Cable percussive drilling	1.60	Glacial Till	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
BH403	Cable percussive drilling	4.00	Made Ground	No Groundwater
BH404	Cable percussive drilling	4.30	Glacial Till	No Groundwater Standpipe installed with response zone between 1.00 and 3.50 mbgl.
BH405	Cable percussive drilling	4.50	Made Ground	No Groundwater
IP401	Hand excavated inspection pit	0.55	Made Ground	No Groundwater
IP402	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP403	Hand excavated inspection pit	0.70	Made Ground	No Groundwater
IP404	Hand excavated inspection pit	1.00	Colliery Spoil	No Groundwater
IP405	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP406	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP407	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP408	Hand excavated inspection pit	0.70	Made Ground	No Groundwater
IP409	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP410	Hand excavated inspection pit	0.80	Made Ground	No Groundwater
TP401	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP402	Machine excavated trial pit	2.10	Glaciofluvial Deposits	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
TP403	Machine excavated trial pit	2.80	Glacial Till	No Groundwater
TP403S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP404	Machine excavated trial pit	2.80	Glacial Till	No Groundwater
TP405S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP406	Machine excavated trial pit	2.60	Glacial Till	No Groundwater
TP407S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP408	Machine excavated trial pit	3.00	Glaciofluvial Deposits	No Groundwater
TP409	Machine excavated trial pit	3.00	Glaciofluvial Deposits	No Groundwater
TP410S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP411	Machine excavated trial pit	2.90	Glaciofluvial Deposits	No Groundwater
TP412S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP413S	Machine excavated trial pit	0.60	Made Ground	Exploratory hole TP413S was unstable at 0.60 m. It was backfilled, moved and re-excavated as TP413SA. No Groundwater
TP413SA	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP414	Machine excavated trial pit	1.80	Made Ground	No Groundwater
TP415S	Machine excavated trial pit	1.00	Made Ground	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
TP416	Machine excavated trial pit	3.00	Glaciofluvial Deposits	No Groundwater
TP417S	Machine excavated trial pit	1.20	Glacial Till	No Groundwater
TP418	Machine excavated trial pit	2.50	Glacial Till	No Groundwater
TP419S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP420	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP421S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP422	Machine excavated trial pit	3.00	Made Ground	Damp @ 3.0 mbgl
TP423S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP424	Machine excavated trial pit	2.80	Glacial Till	Damp @ 2.8 mbgl
TP425S	Machine excavated trial pit	0.45	Made Ground	Exploratory hole TP425S encountered a metal pipe at 0.50 m. It was backfilled, moved and re-excavated as TP425SA. No Groundwater
TP425SA	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP426	Machine excavated trial pit	3.00	Glacial Till	No Groundwater
TP427S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP428	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP429S	Machine excavated trial pit	1.10	Made Ground	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
TP430	Machine excavated trial pit	2.30	Made Ground	Damp @ 2.3 mbgl
TP431S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP432	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP433	Machine excavated trial pit	2.20	Made Ground	No Groundwater
TP434S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP435S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP436	Machine excavated trial pit	3.00	Glacial Till	No Groundwater
TP437S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP438	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP439S	Machine excavated trial pit	1.00	Glacial Till	No Groundwater
TP440	Machine excavated trial pit	3.00	Glacial Till	No Groundwater
TP441S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP442	Machine excavated trial pit	3.00	Made Ground	No Groundwater

Table 3.2 – Summary of Exploratory Holes Phase 5

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
IP501	Hand excavated inspection pit	0.30	Made Ground	Groundwater at 0.15 m

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
IP502	Hand excavated inspection pit	0.40	Made Ground	Groundwater at 0.4 m
IP503	Machine excavated trial pit	1.00	Made Ground	No Groundwater
IP504	Machine excavated trial pit	0.20	Made Ground	Groundwater at 0.2 m
IP505	Machine excavated trial pit	0.50	Made Ground	No Groundwater
IP506	Hand excavated inspection pit	0.30	Made Ground	Groundwater at 0.3 m
IP507	Hand excavated inspection pit	0.50	Weathered South Wales Upper Coal Measures	No Groundwater
IP508	Hand excavated inspection pit	0.60	Made Ground	No Groundwater
IP509	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP501S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP502	Machine excavated trial pit	2.00	Glacial Till	Groundwater at 1.9 m
TP503S	Machine excavated trial pit	0.90	Made Ground	No Groundwater
TP505	Machine excavated trial pit	3.00	Made Ground	No Groundwater
TP505S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP506S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP507	Machine excavated trial pit	3.00	Made Ground	No Groundwater

Exploratory Hole ID	Method	Completed Depth (mbgl)	Termination Strata	Notes
TP508S	Machine excavated trial pit	1.00	Made Ground	No Groundwater
TP509	Machine excavated trial pit	3.00	Glacial Till	No Groundwater
TP510S	Machine excavated trial pit	0.90	Possible Made Ground	No Groundwater
TP511	Machine excavated trial pit	2.20	Glacial Till	No Groundwater
TP512S	Machine excavated trial pit	0.50	Made Ground	No Groundwater
TP513	Machine excavated trial pit	3.00	Made Ground	Damp @ 3.0 mbgl
TP514S	Machine excavated trial pit	0.10	Made Ground	Groundwater @ 0.1 mbgl

The locations of the exploratory holes are presented on Drawings: GC3569-RED-75-XX-DR-C-7511-7517 C01, Exploratory Hole Location Plan (7 sheets), in the rear of this report.

3.4.2 Ground Investigation Factual Report

The Jackson Geo Services Factual Ground Investigation Report is presented in Appendix A.

3.4.3 Results of In-situ Tests

The results of the in-situ testing, including Standard Penetration Tests (SPT's), soakaway infiltration and tests to determine California Bearing Ratio are included in the Jackson Geo Services Factual Report and are presented in Appendix A.

These results are summarised and cross-referenced in later sections of this report.

3.5 Drainage Studies

Soakaway infiltration tests were undertaken in 34 No. locations respectively in general accordance with BRE Digest 365 guidelines. The results of these tests can be found within the Jackson Geo Services Factual Report on the ground investigation (Appendix A) and are discussed in later sections of this GIR.

3.6 Geophysical Surveys

No geophysical surveys were undertaken in connection with the production of this report.

3.7 Pile Tests

No pile testing was undertaken as part of the recent GI works.

3.8 Other Field Work

No other field work was carried out as part of the GIR.

3.9 Laboratory Investigation

The following laboratory tests were carried out on soil samples recovered during the ground investigation. Geotechnical testing was carried out by Geotechnical Site & Testing Laboratories in accordance with BS1377:1990, Parts 1 to 8, unless otherwise stated, and is summarised the table below.

Table 3.3: Summary of Geotechnical Laboratory Testing

Laboratory Test	No. of tests
Moisture Content	40
Liquid / plastic limits	39
Particle Size Distribution by wet sieve	121
CBR on recompacted sample	22

Environmental laboratory testing was carried out by Eurofins Chemtech Environmental and is summarised the table below.

Table 3.4: Summary of Environmental Laboratory Testing

Laboratory Test	No. of tests
Suite E – Soils Contamination Suite	141
Suite G – Soils Leachate Suite	43
Suite D – SD1 Brownfield Site (Pyrite Present)	13
BRESD1 Reduced Suite	15
Loss on ignition	44

3.9.1 Geotechnical Testing

Copies of the geotechnical test results are included within the Jackson Geo Services Factual Ground Investigation Report within Appendix A of this report.

3.9.2 Contamination Testing

Copies of the contamination test results are included within the Jackson Geo Services Factual Ground Investigation Report within Appendix A of this report.

4. Ground Summary

4.1 Made Ground

4.1.1 Phase 3

The Made Ground materials encountered within Phase 3 can sensibly be split along a line taken by the stream valley originating at Blake Street Car Park and Riverside Footbridge, into its northern and southern parts.

4.1.1.1 Phase 3 North

Within the northern parts of Phase 3, trial pits TP301S to TP306 encountered Made Ground throughout, to a maximum proven depth in TP304 of 3.0 metres below ground level (mbgl). The trial pits show Made Ground composed of layers, each containing variable proportions of colliery spoil, river gravel and demolition rubble, which indicate the ground has been repeatedly reworked and mixed.

4.1.1.2 Phase 3 South

In the southern part of Phase 3, on the reprofiled colliery tip above the existing riverside track, trial pits typically encountered colliery spoil (siltstone, sandstone, coal and clinker), which was mixed with rounded sandstone clasts at depth. This material did not appear to extend beyond a great depth, terminating at 1.0 mbgl in both TP313 and TP314.

TP301S at the very southern extent of Phase 3 contained material more similar to that encountered in the northern parts of Phase 3, containing mixed lithologies.

4.1.2 Phase 4

Due to its length and complexity, Phase 4 has been broken down into several distinct areas, which are geographically and/or materially similar.

4.1.2.1 Missing Bridge

The south-west side of the river was investigated by a cable percussive borehole and a trial pit situated within 4.0 m of each other. Borehole BH401 records of a total thickness of 1.50 m of Made Ground, composed of firm to stiff gravelly slightly sandy clay. However, trial pit TP401 records a different sequence of Made Ground strata; 0.3 m of Made Ground as described in BH401, underlain by a sandy silty gravel of coal clinker and coke (presumably from railway engine steam ovens) between 0.3 and 0.6 mbgl. This is further underlain by a soft gravelly clay with a high cobble content and brick, metal and glass fragments, extending between 0.6 and 3.0 mbgl.

On the north-eastern side of the river, a 0.2 m thickness of soft brown gravelly clay was recorded (essentially topsoil) in trial pit TP402, with no Made Ground recorded within the adjacent borehole BH402.

4.1.2.2 Missing Bridge to Substation Footbridge

Made Ground was recorded in all trial pits (TP403 to TP408) between the missing bridge and substation bridge. Trial pit TP404 was undertaken in the line of a former tram/railway. This pit recorded 0.25 m of limestone ballast, and a sub-base of stiff sandy gravelly silt, between 0.25

and 0.6 mbgl (whereupon shallow natural ground was encountered). The remaining pits found colliery spoil and clinker mixed with bricks and cobbles of rounded to subrounded sandstone extending to a minimum proven depth of 1.70 m, and a maximum proven depth of 2.30 m.

4.1.2.3 Substation Footbridge

BH403 and TP409 were undertaken on the northern side of the river and determined a 0.6 m thick surface layer of silty/clayey sand with some gravel of sandstone, mudstone, coal, and clinker. A second, underlying, layer comprised firm/stiff sandy gravelly clay, extending from 0.6 to between 1.8 mbgl (TP409) and 2.0 mbgl (BH403). A third, distinct, layer of Made Ground was encountered in both exploratory holes that comprised silty sandy gravel of sandstone, mudstone, and coal. This third layer was found between 1.8 and 2.20 mbgl in TP409, but is recorded as extending more deeply in BH403, from 2.0 to 4.0 mbgl (at termination). The fourth and last layer of Made Ground, recorded in TP409 only, lay between depths of 2.2 and 2.8 mbgl and comprised stiff silty sandy clay with gravel of sandstone, mudstone and coal and cobbles of sandstone.

On the southern side of the river, TP444 and BH404 recorded similar strata, Made Ground, to a depth of 3.8 mbgl. This material was a dense black silty sandy gravel/gravelly sand of mudstone, sandstone, coal, clinker, and brick with occasional cobbles.

4.1.2.4 South Side of Substation Footbridge

The western part of this length of path (TP441S and TP436) appears to lie on colliery spoil type materials, black silty sand / gravel of mudstone, coal, clinker, sandstone, and brick with cobbles, proven to a maximum depth of 2.8 mbgl in TP436.

The central part of this area has a granular near surface layer: described in TP437S as a sandy gravel of limestone and brick to 0.3 mbgl and in TP438 as a colliery spoil type material to 0.5 mbgl. This initial layer was underlain by a cohesive soil, described as stiff orange-brown sandy silt/clay with gravel, to a maximum proven depth of 1.1 mbgl in TP438. Beneath this cohesive material TP438 found more colliery spoil extending beyond the base of the trial pit, greater than 3.0 mbgl.

The eastern area had thinner Made Ground soils, which were more cohesive in nature. TP439 describes slightly sandy silt with gravel to 0.35 mbgl. TP440 describes firm brown clay with sand/gravel to 1.1 mbgl, sandwiching a thin colliery spoil layer between 0.4 and 0.7 mbgl.

4.1.2.5 Substation Footbridge to Taff Street

TP410S, TP411 and to TP412S encountered three different Made Ground profiles.

TP410S in the west recorded a gravelly sandy silt containing colliery spoil type constituents to 0.4 mbgl. This was underlain by cobbles and boulders of sandstone, with some slightly silty slightly sandy gravel matrix, extending beyond 1.0 mbgl.

TP411 recorded a typical railway track bed profile, limestone gravel ballast to 0.1 mbgl, underlain by slightly silty sand with gravel of mudstone, clinker and coal, extending to 0.5 mbgl.

TP412S recorded silty sandy (ashy) gravel of mudstone, siltstone, sandstone, coal, brick with occasional sandstone and mudstone cobbles to its termination at 1.0 mbgl.

4.1.2.6 Rear of Taff Street

Inspection pits IP404 to IP409, undertaken on the unsurfaced access track to the rear of Taff Street (former railway), extended to depths of between 0.6 and 1.0 mbgl. Made Ground was identified to the base of each of the pits and was typically described as silty sandy gravel with

medium cobble content comprising mudstone, siltstone, coal, clinker, brick, limestone, and sandstone.

North of Station Road bridge, slightly different strata was encountered in IP410. An initial 0.3 m thick sandy silt with gravel and low cobble content, overlies soft sandy clay with gravel and low cobble content from 0.3 to 0.6 mbgl.

4.1.2.7 Ferndale Colliery

Trial pits TP413S to TP421 were undertaken, in addition to a historical site investigation, at the site of the former Ferndale Colliery. Shallow ground forming the site platform typically comprises a 3.0 m thick layer of colliery spoil, which in places possesses intact masonry and concrete slabs associated with the below ground sections of the old colliery building foundations/basements. Generally, the Made Ground comprises black and dark grey clayey sandy fine to coarse gravel of typical colliery spoil constituents as well as varying proportions of demolition rubble. The base of the Made Ground was not always proven in the shallow trial pits. However, the base of layer was proven at shallow depths in TP416 TP417(S) and TP418, between 0.6 and 1.1 mbgl. In other locations the base was not proven within 4.00 m of ground level and BH01 undertaken by Integral Geotechnique in 2020 at approximately GR ST 00135 97080 (adjacent to the river) recorded 7.0 m of Made Ground, described as black and brown sand and gravel.

4.1.2.8 Ferndale Colliery to Leisure Centre Footbridge

Within the dismantled railway between TP422 and TP427S, colliery spoil material mixed with a little clinker was encountered. The base of the Made Ground was not always proven in the shallow trial pits. However, the base of the Made Ground was proven at shallow depths in TP424 and TP426 at between 1.7 and 1.4 mbgl respectively. In other locations the base was not proven within 3.00 m of ground level. TP427(S) encountered thin layers of limestone gravel within a shallow trial pit, which are likely to be ballast from the adjacent disused sidings (beneath current River Receptor Site-B).

4.1.2.9 Leisure Centre Footbridge

Due to the presence of the water main, no deep intrusive works were possible at the northern footbridge abutment. However, a historical boring for a water well approx. 15 m north of the abutment was obtained. This hole recorded 2.0 m of Made Ground (black sand and gravel) over natural (brown clay and gravel) to 5.0 mbgl.

Two exploratory holes, TP428 and BH405, were undertaken several metres south-west of the southern bridge abutment. Made Ground was proven to 4.5 m (the base of BH405) that comprised dense to very dense silty sand/gravel with cobbles of mudstone, sandstone, coal and clinker, with the occasional metal and brick fragment.

4.1.2.10 Leisure Centre Footbridge to Leisure Centre

Between the Leisure Centre footbridge and Tylorstown Leisure Centre is an area known as Banana Tip. Here, trial pits TP428 to TP434S all encountered colliery spoil to their base, which is greater than 3.0 mbgl in places. The colliery spoil was typically recorded as silty sandy gravel with cobbles composed of mudstone (burnt in places), siltstone, sandstone, coal, and occasional brick fragments.

4.1.3 Phase 5

Made Ground was recorded in all trial pits and was composed of (except for IP507) a black silty sandy gravel or gravelly sand with or without cobbles. The constituent material was a mix of colliery spoil (likely crusher run and washery discard), steam ash and clinker and small proportion of demolition rubble. Inspection pit IP507 recorded a soft slightly gravelly slightly silty clay topsoil containing glass brick, limestone, and sandstone. The depth of Made Ground varied across the area being proven at 0.8 mbgl in TP502, 0.45 mbgl in IP507, 1.0 mbgl in TP509, and 0.8 mbgl in TP511, as anticipated from the adjacent railway cuttings and quarries. In other areas, away from cuttings, the Made Ground was deeper, extending to depths exceeding 3.00 mbgl in TP505, TP507 and TP513.

4.2 Natural Superficial Deposits

4.2.1 Phase 3

Within the central and southern parts of Phase 3, natural soil (glacial till) was encountered at the ground surface in trial pit TP307, and 1.0 mbgl in TP313 and TP314. It was recorded as both a stiff to firm silt/clay with sand, gravel, cobbles, and boulders in its upper part and as a granular soil with increasing depth, containing similar constituents.

Table 4.0 – Summary of Natural Superficial Strata Encountered at Phase 3

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP307	0.0	0.85
TP313	1.00	2.00
TP314	0.25	1.50

4.2.2 Phase 4

Due to its length and complexity, Phase 4 has been broken down into several distinct areas, which are geographically and/or materially similar.

4.2.2.1 Missing Bridge

Natural superficial deposits were recorded as summarised in Table 4.1 below.

Table 4.1 – Summary of Natural Superficial Strata Encountered at Phase 4 Missing Bridge

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
BH401	1.50	4.50
BH402	0.00	1.60
BH402A	0.00	1.60
TP402	0.20	2.10

The south-west side of the missing bridge was investigated by a cable percussive borehole and a trial pit situated within 4.0 m of each other. Borehole BH401 records glacial till below 1.50 mbgl extending to greater than 4.5 mbgl, where chiselling provided no further significant penetration. The stratum was recorded as stiff becoming very stiff slightly sandy silt with gravel and low, becoming medium, cobble content. However, trial pit TP401 does not record any natural strata only Made Ground. However, below 0.6 mbgl, the Made Ground is atypical of the local Made Ground and is described as soft gravelly clay with a high cobble content and brick, metal, and glass fragments, extending to 3.0 mbgl: it is considered likely that this is material is reworked superficial soil.

On the north-eastern missing bridge abutment location, glacial till was also recorded in BH401 as very dense slightly sandy silt with gravel and cobble, changing to very dense cobbles and boulders from 1.50 mbgl, where the borehole could not advance by chiselling. In the adjacent trial pit TP402, a similar sequence was observed described as a slightly clayey slightly silty sand with gravel and medium cobble content to 1.2 mbgl. From 1.2 to 2.10 mbgl a slightly clayey sandy gravel with low cobble content and boulders was proven.

4.2.2.2 Missing Bridge to Substation Footbridge

Superficial deposits were recorded as summarised in Table 4.2 below.

Table 4.2 – Summary of Natural Superficial Strata Encountered at Phase 4 Missing Bridge to Substation Footbridge

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP403	1.40	2.80
TP404	0.60	2.80
TP406	2.30	2.60

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP408	1.70	3.00

Superficial soils were recorded in the trial pits (although not in the shallower soakaway pits TP403S, TP405S and TP407S) between the missing bridge and substation bridge. The buried upper surface of the stratum gradually dropped in elevation by 10 m (234 to 224 mAOD) between the two bridge sites. The material was generally described as a stiff sandy clay with gravel, with cobbles and boulder content increasing with depth.

4.2.2.3 Substation Footbridge

At the sub-station footbridge site, superficial deposits were recorded as summarised in Table 4.3 below.

Table 4.3 – Summary of Natural Superficial Strata Encountered at Phase 4 Substation Footbridge

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
BH404	3.80	4.30
TP409	2.80	3.00

Trial pit TP409 was undertaken on the northern side of the river and encountered a stiff sandy gravelly clay at 2.8 mbgl (222.68 mAOD).

On the southern side of the river, BH404 encountered stiff to very stiff sandy gravelly silt with cobbles at a similar elevation (222.81 mAOD).

4.2.2.4 South Side of Substation Footbridge

Superficial deposits were recorded as summarised in Table 4.4 below.

Table 4.4 – Summary of Natural Superficial Strata Encountered at Phase 4 South Side of Substation Footbridge

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP436	2.80	3.00
TP439S	0.35	1.00
TP440	1.10	3.00

Trial pit TP436 in the northern part of this section, close to Sub-Station Footbridge recorded natural superficial deposits as firm sandy gravelly clay at 2.80 mbgl (225.18 mAOD).

Trial pits TP439S and TP 440, both in cutting along the north-western part of this section, recorded shallow natural superficial deposits described as stiff sandy gravelly clay/silt with

cobbles and boulders. At 1.70 mbgl in TP440 the strata changed to become a granular material, described as a sandy gravel with cobbles.

4.2.2.5 Substation Footbridge to Taff Street

Natural superficial deposits were recorded in TP411 only along this section, which were described as firm to stiff slightly gravelly very sandy clay, between 0.5 and 2.0 mbgl, becoming a slightly clayey gravelly sand with cobbles and boulders below 2.0 mbgl.

4.2.2.6 Rear of Taff Street

No superficial deposits were recorded along this length of the ATR, which was mainly investigated through shallow hand excavated pits.

4.2.2.7 Ferndale Colliery

Superficial deposits were recorded as summarised in Table 4.5 below.

Table 4.5 – Summary of Natural Superficial Strata Encountered at Phase 4 Ferndale Colliery

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP416	1.10	3.00
TP417S	0.60	1.20
TP418	0.70	2.50

Historical investigations were undertaken by Integral Geotechnique in 2020. Several trial pits were undertaken along the north-eastern edge of the ATR, which recorded a variable depth to the natural superficial deposits of between 1.5 to 2.7 mbgl. The strata were generally described as an initial upper layer of soft grey green sandy clay (approx. 1.0 m thickness), underlain by a sandy gravel with cobbles. BH01 along the south-western edge of the ATR did not record natural deposits to its full depth of 7.0 mbgl: because this borehole was drilled without any sampling undertaken the drillers descriptions may not be strictly accurate.

Trial pits TP416 to TP418 recorded shallow depths to natural strata, between 0.6 and 1.1 mbgl. The strata encountered was variable, ranging from soft gravelly sandy silt to a stiff sandy very gravelly clay with cobbles and boulders.

4.2.2.8 Ferndale Colliery to Leisure Centre Footbridge

Superficial deposits were recorded as summarised in Table 4.6 below.

Table 4.6 – Summary of Natural Superficial Strata Encountered at Phase 4 Ferndale Colliery to Leisure Centre Footbridge

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
TP424	1.70	2.80
TP426	1.40	3.00

In TP424 a soft sandy gravelly clay was recorded from 1.7 to 2.8 mbgl, whereupon large boulders of sandstone were encountered.

Trial pit TP226 encountered slightly clayey gravel with medium cobble content between 1.4 and 2.7 mbgl, beneath this soft silty sandy clay was recorded to the base of the pit (3.0 mbgl).

4.2.2.9 Leisure Centre Footbridge

Due to the presence of the DC/WW water main, no deep intrusive works were possible at the northern footbridge abutment. However, a historical boring for a water well approx. 15 m north of the abutment was obtained. Within this borehole the drillers recorded 2.0 m of Made Ground (black sand and gravel) over natural soils (brown clay and gravel) to 5.0 mbgl.

4.2.2.10 Leisure Centre Footbridge to Leisure Centre

No natural superficial deposits were encountered in the Banana Tip area.

4.2.3 Phase 5

Natural deposits were not encountered widely during the investigation into the Phase 5 area, Table 4.7 below summarises these locations.

Table 4.7 – Summary of Natural Superficial Strata Encountered at Phase 5

Exploratory Hole ID	Encountered Depth (mbgl)	Completed Depth (mbgl)
IP507	0.45	0.50
TP502	0.80	2.00
TP509	1.00	3.00
TP511	0.80	2.20

Hand excavated inspection pit IP507 recorded a thin 0.05 m thick layer of soft clayey sandy slightly gravelly silt between 0.45 and 0.50 mbgl which was interpreted on the log sheet as weathered rock.

Trial pit TP502 recorded a firm sandy gravelly clay with low cobble content at 0.8 mbgl.

Trial pit TP509 found the strata below 1.0 mbgl to be stiff sandy gravelly clay with a high cobble content and boulders.

Trial pit TP511 encountered stiff sandy gravelly silt with medium/low cobble content and boulders at 0.8 mbgl.

4.3 Bedrock

Bedrock was encountered in the Phase 5 area only. Within TP503S rock was recorded at 0.89 mbgl but no description or samples of the rock were provided or obtained. In Inspection pit IP507, weathered rock was recorded but the less weathered strata were not penetrated by hand digging tools.

5. Ground Conditions and Material Properties

5.1 Made Ground

5.1.1 Classification

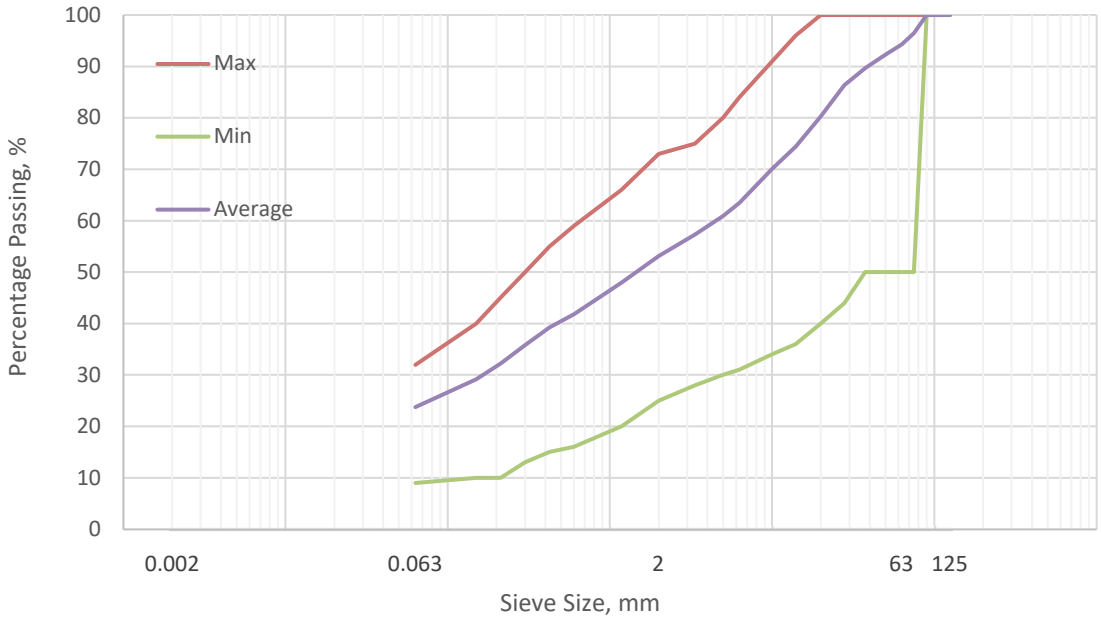
Particle size distribution (PSD) tests were carried out on a total 92 No samples of the Made Ground.

14 No. PSD tests were undertaken on material from the Phase 3 area, between the depths of 0.2 and 2.0 mbgl (average 0.60 mbgl). The results are summarised in Table 5.0 and Figure 5.0.

Table 5.0 – Summary of Sample Grading Proportions in Phase 3 Made Ground

	No of Samples	Min %	Max %	Average %
Cobbles	14	0	50	5.6
Gravel	14	23	75	40.7
Sand	14	14	42	29.5
Silt / Clay	14	9.7	32.5	24.2

Figure 5.0 – Grading Envelope in Phase 3 Made Ground



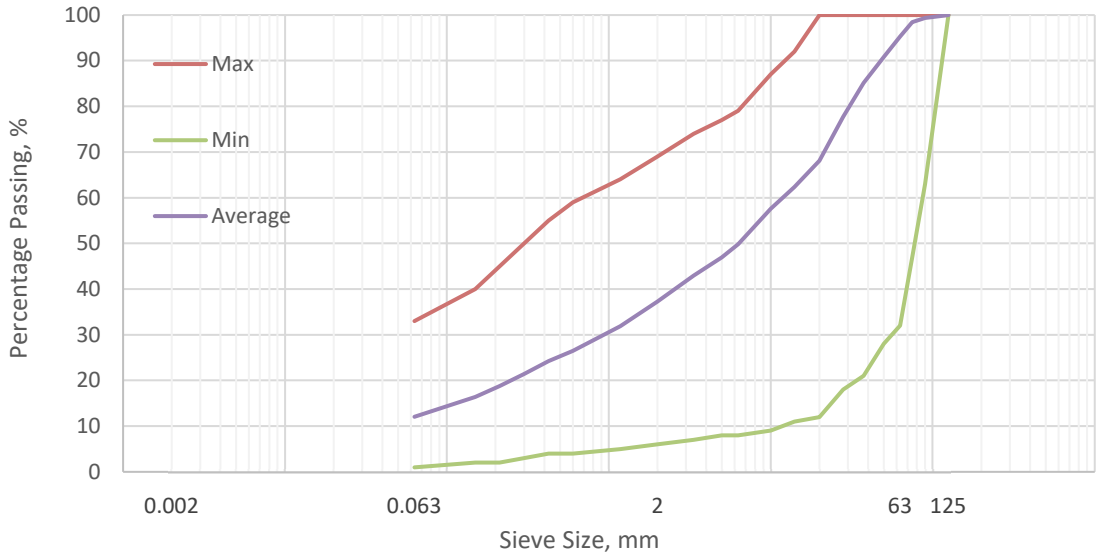
The PSD test results provide a typical description for these materials as a very clayey/silty, sandy gravel.

A total of 66 No. PSD tests were undertaken on material from the Phase 4 area, between the depths of 0.0 and 3.5 mbgl (average 0.85 mbgl). The results are summarised in the Table 5.1 and Figure 5.1.

Table 5.1 – Summary of Sample Grading Proportions in Phase 4 Made Ground

	No of Samples	Min %	Max %	Average %
Cobbles	65	0	68	4.6
Gravel	65	26	85	57.6
Sand	65	4	47	25.1
Silt / Clay	65	1.5	33.3	12.6

Figure 5.1 – Grading Envelope in Phase 4 Made Ground



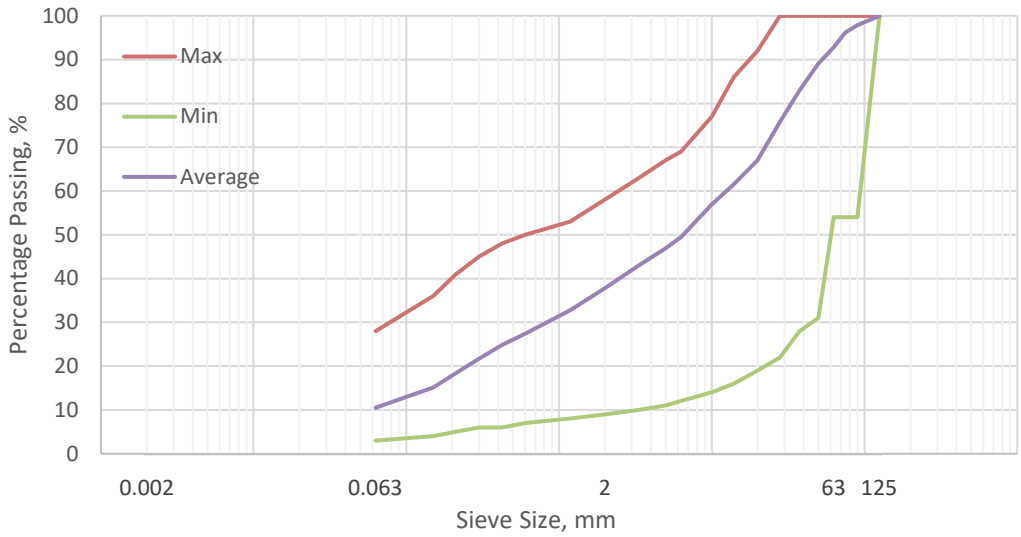
The PSD test results give a typical soil description for these materials as a very clayey/silty, sandy gravel.

22 No. PSD tests were undertaken on material from the Phase 5 area, between the depths of 0.2 and 1.0 mbgl (average 0.45 mbgl). The results are summarised in Table 5.2 and Figure 5.2.

Table 5.2 – Summary of Sample Grading Proportions in Phase 5 Made Ground

	No of Samples	Min %	Max %	Average %
Cobbles	22	0	45	7
Gravel	22	33	69	54.5
Sand	22	7	50	27.5
Silt / Clay	22	3	28.2	11

Figure 5.2 – Grading Envelope in Phase 5 Made Ground



The grading for Phase 5 proved to be very similar to that of Phase 4.

A total of 24 No. moisture content and Atterberg limits results are available for the Made Ground.

9 No. test results from Phase 3 are presented in Table 5.3.

Table 5.3 – Moisture Content and Atterberg Limits in Phase 3 Made Ground

Hole ID	Depth, mbgl	Moisture Content, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %
TP303S	0.4	21	41	20	21
TP304	1.0	13	39	15	24
TP305S	0.6	21	44	20	24
TP306	0.6	19	40	17	23
TP308	0.2	16	41	17	24
TP309	1.0	19	46	18	28
TP309	2.0	16	40	14	26
TP310S	0.4	16	39	18	21
TP311	0.3	16	43	17	26

Plotted against the A-Line all samples are classified as clay of intermediate plasticity.

The 12 No. test results from Phase 4 and are presented in Table 5.4.

Table 5.4 – Moisture Content and Atterberg Limits in Phase 4 Made Ground

Hole ID	Depth, mbgl	Moisture Content, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %
BH401	0.6	28	54	21	33
BH403	0.6	17	41	16	25
IP410	0.4	18	38	17	21
TP401	0.7	38	51	26	25
TP401	2.9	20	45	17	28
TP401	1.9	18	39	16	23
TP416	1.0	28	46	22	24
TP437S	0.8	13	41	17	24
TP438	0.65	20	40	17	23
TP439S	0.2	9	32	16	16
TP439S	0.8	14	46	16	30
TP440	0.3	29	51	21	30

Plotted against the A-Line 1 No. sample is classified as low plasticity clay, 9 No. samples are classified as intermediate plasticity clay and 2 No. samples are classified as high plasticity clay.

3 No. test results from Phase 5 and are presented in Table 5.5.

Table 5.5 – Moisture Content and Atterberg Limits in Phase 5 Made Ground

Hole ID	Depth, mbgl	Moisture Content, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %
TP502	1	23	41	20	21
TP511	1	11	40	16	24
TP513	1	44	52	26	26

Plotted against the A-Line, 2 No. samples are classified as intermediate plasticity clay and 1 No. sample is classified as high plasticity clay.

5.1.2 Standard Penetration Test Results

Standard Penetration Tests (SPT's) were carried out within Made Ground within BH403, BH404 and BH405.

A test undertaken at 1.2 mbgl in BH403 recorded the lowest 'N' value of 10, within a sandy gravelly clay. The strata then changed to a to medium dense becoming very dense with depth silty sandy gravel: an 'N' value of 13 was recorded at 2.0 mbgl and 'N' values of greater than 50 were recorded in 3 No. further tests, at depths of between 3.0 to 4.0 mbgl.

BH404 and BH45 both encountered a dense becoming very dense sandy silty gravel with increasing cobble and boulder content: with depth: 'N' values of between 39 and greater than 50 were recorded in 9 No. tests, between 1.2 and 4.5 mbgl.

It should be noted that the presence of cobbles and boulders within the strata may distort the SPT results obtained, therefore the SPT 'N' Value results should be treated with some caution.

5.1.3 Effective Shear Parameters

For granular Made Ground, a characteristic critical state angle of shearing resistance, $\varphi'_{cv,k}$, of 32 degrees and an effective cohesion c' = 0 is considered appropriate.

For cohesive Made Ground, a characteristic critical state angle of shearing resistance, $\varphi'_{cv,k}$, of 28 degrees (friction angle based upon Kenny 1959) and an effective cohesion c' = 2 is considered appropriate.

5.1.4 *California Bearing Ratio*

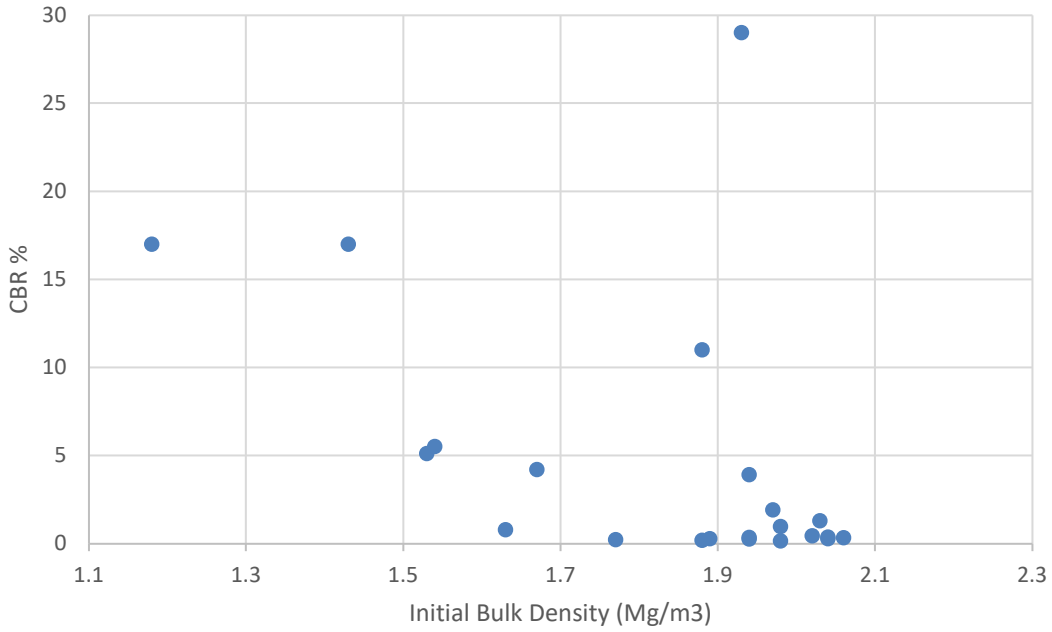
A total of 22 No. laboratory California Bearing Ratio (CBR) tests were undertaken as summarised in Table 5.6.

Table 5.6 – Summary Laboratory CBR in Made Ground

Location	Sample depth (top)	CBR at top %	Moisture Content		Initial Density Mg/m3		Sample Retained >20mm
	mbgl		Initial %	After test %	Bulk	Dry	
IP312	0.3	0.27	16	16	2.04	1.74	60
IP404	0.4	4.2	25	25	1.67	1.33	15
IP405	0.3	5.1	35	38	1.53	1.13	54
IP508	0.3	17	31	37	1.43	1.08	46
IP509	0.3	17	19	25	1.18	0.99	34
TP301S	0.3	0.28	21	21	1.89	1.56	31
TP303S	0.4	0.19	16	18	1.88	1.62	7
TP305S	0.6	0.34	21	24	1.94	1.6	0
TP306	0.6	0.37	18	22	2.04	1.72	9
TP308	0.2	0.15	29	29	1.98	1.53	19
TP308	1.0	0.44	13	13	2.02	1.77	56
TP310S	0.4	0.26	19	23	1.94	1.62	0
TP311	0.3	1.3	15	16	2.03	1.76	0
TP313	0.5	0.32	15	16	2.06	1.79	14
TP410S	0.2	0.21	25	26	1.77	1.41	26
TP415S	0.3	5.5	19	19	1.54	1.29	31
TP421S	0.8	1.9	13	16	1.97	1.74	27
TP430	0.3	29	15	15	1.93	1.67	5
TP431S	0.4	3.9	10	10	1.94	1.76	36
TP432	0.3	11	17	20	1.88	1.61	19
TP501S	0.4	0.97	20	20	1.98	1.65	80
TP510S	0.2	0.79	16	27	1.63	1.4	8

The laboratory CBR tests provide a wide range of CBR values: 14 No. having a CBR greater than 2 %, 2 No. samples with CBR between 2 and 5 %, and 6 No. with a CBR greater than 5 %, the trend however was those samples with the highest sample density to have the lowest CBR value, see Figure 5.3.

Figure 5.3: Laboratory CBR (%) Vs Initial Bulk Density (Mg/m3)



A total of 10 No. Transport Research Laboratory (TRL) Dynamic Cone Penetrometer (DCP) tests were undertaken where full scale CBR (plate load test) were not viable and are summarised in Table 5.7 below.

Table 5.7 – Summary Laboratory TRL DCP tests in Made Ground

Hole ID	CBR % at approx. 0.4 mbgl
IP312	8
IP404	39
IP406	26
IP408	41
IP410	18
IP501	118
IP503	7
IP505	87
IP507	63
IP509	6

The TRL DCP results all have a CBR value greater than 5 %.

51 No. in-situ CBR tests (plate load tests) were undertaken at 30 No. locations, at a depth of 0.3 mbgl, distributed as follows:

- Phase 3 - 4 No. tests at 4 No. locations.
- Phase 4 - 35 No. tests at 20 No. locations.
- Phase 5 - 12 No. tests at 6 No. locations.

The results are presented in Tables 5.8 to 5.10 below.

Table 5.8 – In-situ CBR Testing Summary - Phase 3.

Hole ID	Depth, mbgl	Modulus of Subgrade Reaction (K), MN/m3	Estimated CBR, %
TP301	0.3	34.5	1.1
TP302	0.3	18.1	0.4
TP304	0.3	58.1	2.7
TP309	0.3	20.8	0.4

The in-situ results from Phase 3 show 3 No. tests have a CBR value between 2 and 5 % and No. 1 test provided a CBR less than 2%.

Table 5.9 – In-situ CBR Testing Summary - Phase 4.

Hole ID	Depth, mbgl	Modulus of Subgrade Reaction (K), MN/m3	Estimated CBR, %
TP404	0.3	123.1	9.8
TP404	0.3	349.5	60
TP406	0.3	244.6	32
TP406	0.3	121.4	9.6
TP408	0.3	140.5	12
TP408	0.3	111.6	8.3
TP409	0.3	70.8	3.8
TP409	0.3	120.6	9.5
TP411	0.3	191.3	21
TP411	0.3	401.1	76
TP414	0.3	453.1	94
TP414	0.3	202	23
TP414	0.3	238.3	31
TP416	0.3	665.3	183

Hole ID	Depth, mbgl	Modulus of Subgrade Reaction (K), MN/m3	Estimated CBR, %
TP416	0.3	413.1	80
TP418	0.3	438.8	89
TP420	0.3	283.3	42
TP420	0.3	159	15
TP422	0.3	252.3	34
TP422	0.3	107.5	7.8
TP424	0.3	222.7	27
TP424	0.3	125.3	10
TP426	0.3	244.1	32
TP426	0.3	168.4	17
TP429S	0.3	212.2	25
TP430	0.3	126.3	10
TP432	0.3	194.6	22
TP432	0.3	89.2	5.6
TP433	0.3	364.4	64
TP433	0.3	783.4	242
TP434S	0.3	257.8	35
TP434S	0.3	167	17
TP436	0.3	105.8	7.5
TP438	0.3	92.5	6
TP440	0.3	23	0.5

In the Phase 4 area, 34 No. in-situ CBR test results are greater than 5 %, and only 1 No. test provided a CBR less than 2 %.

Table 5.10 – In-situ CBR Testing Summary - Phase 5.

Hole ID	Depth, mbgl	Modulus of Subgrade Reaction (K), MN/m3	Estimated CBR, %
TP502	0.3	200.5	23
TP502	0.3	290.3	43
TP505	0.3	105.9	7.6
TP505	0.3	338.1	57
TP507	0.3	113.9	8.6
TP507	0.3	224.2	28

Hole ID	Depth, mbgl	Modulus of Subgrade Reaction (K), MN/m3	Estimated CBR, %
TP509	0.3	133.4	11
TP509	0.3	319.3	51
TP511	0.3	67.9	3.5
TP511	0.3	162.6	16
TP513	0.3	335	56
TP513	0.3	402.6	76

In the Phase 5 area, 11 No. in-situ CBR test results are greater than 5 %, and only 1 No. test provided a CBR between 2 and 5%.

It should be noted that frost heave may be anticipated within unburnt colliery spoils and due regard should be given to this when determining the formation depth of the proposed pavement.

5.1.5 Density

A wide variation in the density of the Made Ground material was observed as summarised in Table 5.11 below. It is considered that the density is typically variable given that high proportions of ash and clinker yield low densities whereas ironstone and sandstone rich areas give high values.

Table 5.11 – Density Testing Summary

	No Tests	Min	Max	Average
Bulk Density Mg/m^3	22	1.18	2.06	1.83
Dry Density Mg/m^3	22	0.99	1.79	1.54

5.1.6 Loss on Ignition

A total of 44 No. samples, with coal identified within their engineering description, were selected for loss on ignition (LOI) testing: these samples were from Phase 4 and 5 only.

A minimum value of 5 % and a maximum value of 36 % were returned, with an average value of 18 %. There does not seem to be any pattern of LOI with spatial distribution.

5.2 Natural Superficial Deposits

5.2.1 General

A typical unit weight of 20 kN/m^3 is considered appropriate for the reworked natural soils based upon the guidance given in Figure 1 (above groundwater table) of BS 8002 (Ref. 20) and past experiences in similar materials. Should future design require unit weight values then further confirmatory testing is recommended.

5.2.2 *Classification*

Particle size distribution (PSD) tests were carried out on a total 20 No. samples of natural superficial deposits, between the depths of 0.4 and 2.8 mbgl (average 1.3 mbgl). The results are summarised in Table 5.12 and Figure 5.4.

Table 5.12 – Summary of Sample Grading Proportions in Natural Superficial Soils

	No of Samples	Min %	Max %	Average %
Cobbles	14	0	65	15
Gravel	14	1	70	41.4
Sand	14	6	54	22.5
Silt / Clay	14	4.4	55.8	21.1

The PSD test results shows an extremely wide grading envelope.

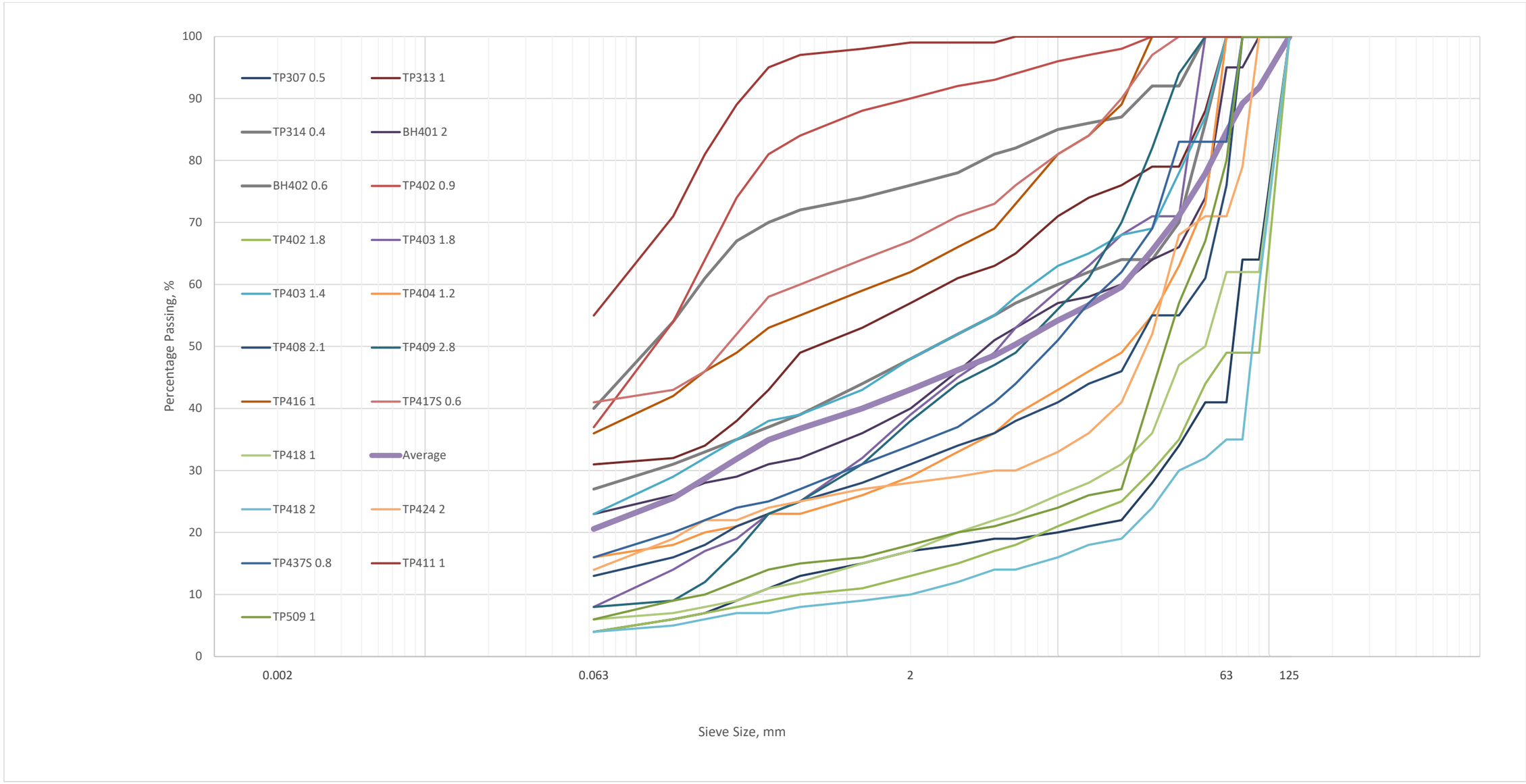
There are 15 No. moisture content and Atterberg limits results available for the natural superficial deposits, and these are presented in Table 5.13.

Table 5.13 – Moisture Content and Atterberg Limits in Natural Superficial Soils

Hole ID	Depth, mbgl	Moisture Content, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %
TP307	0.5	26	46	20	26
TP313	1	19	37	16	21
TP314	0.4	15	38	17	21
BH401	2	17	46	18	28
BH402	0.6	41	58	26	32
TP403	1.4	16	39	15	24
TP404	1.2	13	42	17	25
TP408	2.1	12	39	17	22
TP409	2.8	8.9	32	16	16
TP411	1	29	49	23	26
TP417S	0.6	31	55	26	29
TP418	2	20	33	16	17
TP424	2	22	46	20	26
TP509	1	8.8	36	15	21
IP507	0.4	27	45	20	25

Plotted against the A-Line, 1 No. sample is classified as low plasticity clay, 12 No. samples are classified as intermediate plasticity clay and 2 No. samples are classified as high plasticity clay.

Figure 5.4 – Grading Envelope in Natural Superficial Materials



5.2.3 Standard Penetration Test

Standard Penetration Tests (SPT) were carried out within the natural superficial soils within BH401 and BH402 and toward the base of BH404. All the material was described as glacial till, a dense becoming very dense / stiff becoming very stiff gravelly sandy silt with increasing cobble and boulder content with depth.

A test undertaken at 1.5 mbgl in BH401 recorded the lowest 'N' value of 26, this increased to an 'N' of 44 at 2.0 mbgl and greater than 50 in 3 No. further other tests at depths up to 4.5 mbgl.

Within BH402 and BH402A, 'N' values of greater than 50 were recorded in 3 No. tests between 1.2 and 1.6 mbgl.

A singe test was undertaken in BH404 at 4.0 mbgl which recorded an 'N' Value of greater than 50.

It should be noted that the presence of cobbles and boulders within the strata may distort the SPT results obtained, therefore the SPT 'N' Value results should be treated with some caution. Based on Table 10 of BS5930:2015+A1:2020 (Ref. 21), the results of the testing suggest that in terms of relative density the material is 'medium dense' becoming 'very dense' with depth.

5.1 Groundwater

5.1.1 General

Groundwater was observed in Phase 3 area in TP307 (at 0.75 mbgl), TP308 (at 1.70 mbgl) and TP310S (at 0.70 mbgl).

Groundwater was not encountered with the Phase 4 exploratory holes but was recorded in historical borehole positions adjacent to River Receptor Sites A and B at 3.72 mbgl and 3.16 mbgl, respectively. Groundwater was encountered in the form of a seepage at approximately 1.2 mbgl in TP01, a fast inflow at approximately 2.0 mbgl at TP07, and a seepage below approximately 2.0 mbgl in TP08. During the current ground investigation, water was emanating as a moderately strong spring from the toe of the slope of River Receptor site A, at approximate grid reference ST 00150 97050. A groundwater monitoring standpipe was installed in borehole BH401 to a depth of 4.50 mbgl and BH404 to 3.50 mbgl, where the borehole terminated, having refused progress due to hard strata. The standpipes were monitored but found to be dry.

Within Phase 5 water was recorded in trial pits IP501 (at 0.15 mbgl), IP502 (at 0.4 mbgl), IP504 (at 0.2 mbgl), IP506 (at 0.3 mbgl), TP502 (at 1.9 mbgl) and TP514S (at 0.1 mbgl).

These results are tabulated in Table 5.14 overleaf.

Table 5.14 – Groundwater Encountered

Hole ID	Depth Encountered, mbgl	Description
IP501	0.15	
IP502	0.4	
IP504	0.2	
IP506	0.3	
TP303S	0.4	Perched water at 0.4mbgl
TP307	0.85	
TP308	1.7	
TP310S	0.7	Perched water
TP422	2.95	Damp
TP424	2.78	Damp
TP502	2	
TP514S	0.1	

It should be remembered that groundwater levels are subject to seasonal, diurnal and other effects and may at times differ to those measured during the investigation.

5.1.2 Infiltration Testing

Large scale infiltration testing was performed in No. 34 trial pits, see Tables 5.15, 5.16 and 5.17 for summaries of the test results.

- No. 4 tests were undertaken in Phase 3 area.
- No. 24 tests were undertaken in Phase 4 area.
- No. 6 tests were undertaken in Phase 5 area.

The tests were undertaken in general accordance with BRE Digest 365 guidelines. For this scheme, the excavated trial pits were installed with a 50mm diameter HDPE perforated vertical pipe to the base of the pit and a 'TD-Diver' groundwater level measuring and recording instrument installed. The pit was then quickly filled with clean water and the test was commenced with water levels recorded at set intervals until at least 75 % of the pit volume had reduced. Where the water reduced sufficiently, the pit was refilled on two further occasions, and the test repeated. A number of tests were left over a 24 hr period where outflow rate was slow.

Table 5.15 – Summary of Infiltration Testing Phase 3

Exploratory Hole ID	Depth of Test Pit (mbgl)	Test No	Infiltration Rate m/sec	Lowest Infiltration Rate m/sec	Strata
TP301S	1.0	1	5.23E-04	4.29E-04	Made Ground
		2	4.45E-04		
		3	4.29E-04		
TP303S	1.0	1	Intersected Groundwater Unable to Drain	-	Made Ground
TP305S	1.0	1	Slow Test Unable to complete in 24 Hours	-	Made Ground
TP310S	1.0	1	Intersected Groundwater Unable to Drain	-	Made Ground

Table 5.16 – Summary of Infiltration Testing Phase 4

Exploratory Hole ID	Depth of Test Pit (mbgl)	Test No	Infiltration Rate m/sec	Lowest Infiltration Rate m/sec	Strata
IP405	0.6	1	2.26E-04	8.60E-05	Made Ground
		2	8.60E-05		
		3	8.80E-05		
IP407	0.6	1	1.40E-05	4.26E-06	Made Ground
		2	8.61E-06		
		3	4.26E-06		
IP409	0.6	1	Intersected Groundwater Unable to Drain	-	Made Ground
TP403S	1.0	1	4.02E-05	2.34E-05	Made Ground
		2	3.06E-05		
		3	2.34E-05		
TP405S	1.0	1	2.24E-04	4.97E-05	Made Ground
		2	1.35E-04		
		3	4.97E-05		
TP407S	1.0	1	2.42E-04	8.63E-05	Made Ground
		2	1.39E-04		
		3	8.65E-04		
TP410S	1.0	1	1.46E-05	1.46E-05	Made Ground
		2	Void Test		
		3	4.13E-05		
TP412S	1.0	1	4.94E-05	3.01E-05	Made Ground
		2	4.29E-05		
		3	3.01E-05		
TP413SA	1.0	1	3.21E-05	1.81E-05	Made Ground
		2	1.90E-05		
		3	1.81E-05		
TP415S	1.0	1	9.03E-05	9.03E-05	Made Ground
TP417S	1.0	1	5.55E-06	2.76E-06	Natural Superficial Deposits (Glacial Till)
		2	2.76E-06 Test Ran over 24 hrs		
TP419S	1.0	1	1.36E-04	5.55E-05	Made Ground

Exploratory Hole ID	Depth of Test Pit (mbgl)	Test No	Infiltration Rate m/sec	Lowest Infiltration Rate m/sec	Strata
		2	5.55E-05		
		3	6.59E-05		
TP421S	1.0	1	2.04E-04	4.17E-05	Made Ground
		2	4.54E-05		
		3	4.17E-05		
TP423S	1.0	1	4.26E-05	1.27E-05	Made Ground
		2	1.32E-05		
		3	1.27E-05		
TP425SA	1.0	1	2.12E-04	2.12E-04	Made Ground
		2	2.82E-04		
TP427S	1.0	1	1.44E-05	1.44E-05	Made Ground
		2	1.58E-05		
		3	1.74E-05		
TP429S	1.0	1	3.61E-06	3.28E-06	Made Ground
		2	3.83E-05		
		3	3.28E-05		
TP413SA	1.0	1	3.21E-05	1.81E-05	Made Ground
		2	1.90E-05		
		3	1.81E-05		
TP431S	1.0	1	Draining too Fast to Fill Test Pit	-	Made Ground
TP434S	1.0	1	Slow Test Unable to complete in 24 Hours		
TP435S	1.0	1	6.19E-05	2.72E-05	Made Ground
		2	4.27E-05		
		3	2.72E-05		
TP437S	1.0	1	8.15E-05	1.83E-05	Made Ground
		2	3.89E-05		
		3	1.83E-05		
TP439SA	1.0	1	Slow Test Unable to complete in 24 Hours	-	Natural Superficial Deposits (Glacial Till)
TP441S	1.0	1	1.32E-05	9.73E-0	Made Ground
		2	1.85E-05		
		3	9.73E-06		

Table 5.17 – Summary of Infiltration Testing Phase 5

Exploratory Hole ID	Depth of Test Pit (mbgl)	Test No	Infiltration Rate m/sec	Lowest Infiltration Rate m/sec	Strata
IP506	0.6	1	6.78E-05	1.76E-05	Made Ground
		2	2.16E-05		
		3	1.76E-05		
TP501S	1.0	1	Slow Test Unable to complete in 24 Hours	-	Made Ground
TP505S	1.0	1	1.56E-04	4.18E-05	Made Ground
		2	6.78E-05		
		3	4.18E-05		
TP506S	1.0	1	4.23E-05	3.10E-05	Made Ground
		2	1.48E-05		
		3	Void Test		
TP508S	1	1	6.22E-05	2.18E-05	Made Ground
		2	3.88E-05		
		3	2.18E-05		
TP512S	1	1	1.47E-06	-	Made Ground
		2	Slow Test unable to complete in 24 hrs		

5.2 Chemistry

5.2.1 Aggressivity of the ground

The requirement for protecting concrete from aggressive ground is determined from BRE Special Digest 1: Concrete in Aggressive Ground, 2005 (Ref. 22).

Testing results are summarised in Tables 5.18, 5.19 and 5.20 overleaf.

Table 5.18 – Phase 3 Test Results

No of samples	Values	pH	Sulphate (2:1 water soluble) mg/l SO_4	Total Suphur %
27	Max	8.9	69	1.2
27	Min	6.4	10	0.031
27	Average	7.8	31	0.34

Table 5.19 – Phase 4 Test Results

No of samples	Values	pH	Sulphate (2:1 water soluble) mg/l SO_4	Total Suphur
78	Max	9.1	980	1.2
78	Min	5.7	10	0.025
78	Average	7.9	24	0.32

Table 5.20 – Phase 5 Test Results

No of samples	Values	pH	Sulphate (2:1 water soluble) mg/l SO_4	Total Suphur
11	Max	8.3	12	0.24
11	Min	5.8	10	0.028
11	Average	7.6	10	0.15

Based on the testing results an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1 and a Design Sulphate Class DS-1 class is given as appropriate for this brownfield site. There may be an expectation for higher sulphate results due to the potential presence of iron pyrites in the mudstones, which represent a significant proportion of the composition of the Made Ground / colliery soil in this area. Consequently, a higher specification of concrete could be considered, if limited amount and hence cost is envisaged. Inspection pit IP410 at the southern end of Taff Street, is an outlier to the general population (980 mg/l water soluble sulphate) by an order of magnitude.

5.2.2 Material Re-use and Disposal

If any form of excavation is required, then the designer has a duty to determine whether any of the materials encountered could be hazardous.

Any material removed from site will be subject to waste management regulations and these should be adhered to. The following section provides information on waste classification for disposal purposes and options for recycling.

It is recommended that a site waste management plan is implemented, and it should include for the potential re-use of excavated material. Waste is to be treated prior to off-site disposal, sorting excavated soils for re-usable elements satisfies this environmental requirement.

The HazWasteOnline hazardous waste classification tool has been applied to 119 No. soil samples across Phases 3, 4 and 5. The results of the assessment are presented in Appendix B and indicate that the soils are not Hazardous for waste disposal purposes with the exception of one sample from TP311 taken at 0.68 mbgl. This sample tested hazardous for zinc and HP 14: Ecotoxic which is very toxic to aquatic life with long lasting effects. There is no evidence to why this concentration of zinc is present at this location and further investigation is recommended.

The European Waste Catalogue (EWC) has been consulted to determine the appropriate waste code for arisings from construction of the ATR.

Waste soil that does not contain hazardous substances is typically given a waste code of 17 05 04 soil and stones other than those mentioned in 17 05 03 (i.e. those mirror entries containing hazardous substances).

Colliery spoil material can also be assigned a waste code 19 12 09 (i.e. mineral wastes from the mechanical treatment of waste, for example sorting/crushing).

Track ballast can be assigned a waste code 17 05 08.

These soils are likely to be suitable for re-use as engineered fill either with or without some form of treatment, screening and crushing. This will depend on cobble and boulder content.

6. Contaminated Land Assessment

6.1 Soil Chemical Testing

A total of 116 No. soil samples were tested as a part of the ground investigation works undertaken. The sample depths were between 0.1 and 2.0 mbgl, but generally between 0.2 and 0.6 mbgl.

Soil samples were tested for a range of Contaminants of Concern (CoC), with the results screened against current Generic Assessment Criteria (GAC) for Public Open Space or POS (parks), a conservative assumption based upon the intended use of the site. The AC used are those for POS (parks) end use and for all determinants other than lead, the values have been taken from the LQM/CIEH Suitable for Use Levels (S4uLs), utilising a Soil Organic Matter (SOM) content of 1%, again another conservative assumption.

The methodology for the derivation of the GAC values is presented in 'The LQM/CIEH S4ULs for Human Health Risk assessment' * (Ref. 23 - The LQM/CIEH S4ULs for Human Health Risk Assessment. Paul Nathanial, Caroline McCaffrey, Andy Gillett, Richard Ogden and Judith Nathanial. 2015. Land Quality Press. Nottingham) with the exception of lead which in the absence of other authoritative guidance is that presented in SP1010 (Ref. 24 - SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report (Revision 2). Contaminated Land: Applications in Real Environments (CL:AIRE). 24th September 2014).

A screening of all the results obtained for the ground investigation looking at human health risk has been completed and is presented in Appendix C.

The results show that none of the determinants in the 11 No. samples from Phase 3 were found to exceed the GAC.

Of the 78 No. samples tested from Phase 4, No 4 samples were found to contain one or more determinands that exceeded the GAC, as follows:

- TP403 @ 0.2 mbgl
  - Lead 2300 mg/kg (GAC 1300 mg/kg)

- IP410 @ 0.2 mbgl
  - Benzo[b]fluoranthene 14 mg/kg (GAC 13 mg/kg)
  - Dibenz[ah]anthracene 2.3 mg/kg (GAC 1.1 mg/kg)

- IP410 @ 0.5 mbgl
  - Benzo[b]fluoranthene 16 mg/kg (GAC 13 mg/kg)
  - Dibenz[ah]anthracene 4.3 mg/kg (GAC 1.1 mg/kg)

- TP413SA @0.5 mbgl
  - Dibenz[ah]anthracene 1.8 mg/kg (GAC 1.1 mg/kg)

Of the 27 No. samples tested from Phase 5, No 1 sample was found to contain three determinands that exceeded the GAC, as follows:

- TP506S @ 0.2 mbgl
  - Benzo[a]pyrene 12 mg/kg (GAC 11 mg/kg)
  - Benzo[b]fluoranthene 14 mg/kg (GAC 13 mg/kg)
  - Dibenz[ah]anthracene 2.3 mg/kg (GAC 1.1 mg/kg)

In addition, all of the samples were screened for asbestos 'presence' or 'absence'; none of which detected any asbestos fibres in the soil.

6.2 Leachate Testing

A total of 38 No. soil leachate samples were tested from the samples collected as a part of the ground investigation works undertaken (screened results included in Appendix D). These results were screened against the relevant environmental quality standards (EQS) and drinking water standards (DWS).

Several samples have laboratory detection limits at a concentration higher than the corresponding AC. It is conservatively assumed that these samples recorded a value matching the limit of detection when preparing the screening tables. Specialised laboratory testing would be required to improve these detection limits to meet the required standards.

- pH is in exceedance of the DWS in 1 No. sample (DWS = 6.5-9.5)
  - Maximum pH of 4.1 in TP406 @ 0.6 mbgl
- Boron is in exceedance of the DWS in 1 No. sample (DWS = 1000 ug/l)
  - Maximum of 1100 ug/l in TP428 @ 0.6 mbgl
- Cadmium* exceeds the EQS (0.08 ug/l) in all samples, although the limit of detection was not exceeded in any of the samples tested.
- Copper* exceeds the EQS (1.0 ug/l) in 18 No. samples (approximately half), to a maximum of 6.5 ug/l.
- Lead* exceeds the EQS (1.2 ug/l) in 3 No. samples, to a maximum of 3.0 ug/l.
- TPH was present above detection limits in 3 No. samples
  - 1100 ug/l in TP408 @ 1.0 mbgl
  - 550 ug/l in IP406 @ 0.5 mbgl
  - 230 ug/l in BH401 @ 1.0 mbgl
- PAH species were not present above detection limits

*Cadmium, copper and lead should be assessed using the UK Technical Advisory Group Metal Bioavailability Assessment Tool (m-BAT) to determine their bioavailable concentrations as this may find the bioavailable fraction of each contaminant to be below levels of concern.

6.3 Contamination Risk Assessment

The qualitative ground contamination Preliminary Risk Assessment, presented in the Preliminary Sources (desk) Study, is updated based upon the ground investigation, leachate testing and soil chemical testing.

Table 6.0 – Risk Matrix Categories

N.B. – High Likelihood with Minor Severity has been modified from CIRIA C552 from Low / Moderate to Low Risk in NHBC RandD66.

		Potential Severity			
		Severe	**Medium**	**Minor**	**Negligible**
Probability of Risk	High Likelihood	Very High	High	Moderate	Low / Moderate*
	Likely	High	Moderate	Low / Moderate	Low
	Low Likelihood	Moderate	Low / Moderate	Low	Very Low
	Unlikely	Low / Moderate	Low	Very Low	Very Low

Table 6.1 overleaf details the risk categorisation for each identified potentially significant pollutant linkage.

Table 6.1 – Qualitative Risk Assessment

Potential Sources of Contamination	Potential Receptor	Potential Pathway	Probability of risk being realised	Consequence of risk being realised	Risk	Justification / Comments
S1: Former Collieries (with shafts, smithies, saw mill, engine house, etc)	R1: Current Site Users	P1: Particulate / dust / fibre inhalation P2: Vapour inhalation P3: Direct dermal contact P4: Ingestion	Unlikely	Minor	Very Low	Public access to the site is limited and likely constrained to members of the public out walking. Dry conditions and bare soils required for dust generation, most likely at RRS-A1 and RRS-A2 if natural regeneration of vegetation is slow.
	R2: Construction workers / contractors		Low likelihood	Medium	Low / Moderate	A PAH hotspot and limited asbestos fibres have been confirmed at RRS-A1. There is the potential for hydrocarbons to be present as hotspots from spillage during colliery operations to pose toxicity. Also, heavy metals from the smithy operations.
	R3: Future end-users		Unlikely	Minor	Very Low	Similar situation to current site users, but with more hardstanding cover to break pathways.
	R4: Adjacent residential properties		Unlikely	Medium	Low	There are limited number of properties within significant distance of the colliery site, mainly Fir Street but also Taff Street, which lies on the opposite side of Station Street.
	R5: Afon Rhondda Fach	P5: Leaching P6: Groundwater Migration	Likely	Minor	Low / Moderate	A thicker mass of colliery material would theoretically have slightly greater leaching potential. This downward draining water may reach the groundwater table and then migrate to the river.
	R6: Secondary A Aquifer		Low likelihood	Medium	Low / Moderate	
	R7: Adjacent buildings	P7: Migration of mine gas and leachate	Unlikely	Medium	Low	Potential for explosive atmospheres to migrate to nearby buildings. This is unlikely without significant material changes to the environment.
	R8: Water supply pipes	P8: Attack of iron water supply pipe	Unlikely	Medium	Low	Petroleum hydrocarbons potentially associated with the engine house can permeate PVC water pipes, although reported Welsh Water sites are clay and iron.
S2: Former Tramway,	R1: Current Site Users		Unlikely	Negligible	Very Low	Levels of contamination unlikely to be high enough to trigger human health toxicity.

Potential Sources of Contamination	Potential Receptor	Potential Pathway	Probability of risk being realised	Consequence of risk being realised	Risk	Justification / Comments
Railway line and sidings	R2: Construction workers / contractors	P1: Particulate / dust / fibre inhalation P2: Vapour inhalation P3: Direct dermal contact P4: Ingestion	Low likelihood	Minor	Low	Construction workers may encounter some minor soil contamination when undertaking groundworks.
	R3: Future end-users		Unlikely	Negligible	Very Low	Similar situation to current site users.
	R4: Adjacent residential properties		Unlikely	Negligible	Very Low	Contamination capable of migrating at levels of concern not expected.
	R5: Afon Rhondda Fach	P5: Leaching P6: Groundwater Migration	Unlikely	Minor	Very Low	Time since track removed suggests any potential source would be greatly diminished.
	R6: Secondary A Aquifer		Unlikely	Minor	Very Low	
S3: On-site colliery spoil	R1: Current Site Users	P1: Particulate / dust / fibre inhalation P2: Vapour inhalation P4: Ingestion	Unlikely	Minor	Very Low	The current deposits are all well vegetated, decreasing the potential for contaminant particulate migration.
	R2: Construction workers / contractors		Low likelihood	Medium	Low	Construction workers may encounter some contamination when undertaking groundworks.
	R3: Future end-users		Unlikely	Minor	Very Low	Similar situation to current site users.
	R4: Adjacent residential properties		Unlikely	Medium	Low	Potential for materials with a high organic content to produce ground gas capable of migrating to neighbouring properties.
	R5: Afon Rhondda Fach	P5: Leaching P6: Groundwater Migration	Likely	Medium	Moderate	There is the potential for contaminants to leach into the unconfined aquifer and then migrate to the Afon Rhondda Fach. However, given the predominance of colliery soil in the river valley or close to it then background elevation in heavy metals is likely.
	R6: Secondary A Aquifer		Low likelihood	Minor	Low	There is the potential for contaminants to leach into unconfined aquifers. However, there is no abstraction

Potential Sources of Contamination	Potential Receptor	Potential Pathway	Probability of risk being realised	Consequence of risk being realised	Risk	Justification / Comments
						in the area, but the gravels will provide baseflow to the Afon Rhondda Fach.
	R7: Adjacent buildings	P7: Migration of ground gas and leachate	Unlikely	Medium	Low	Potential for methane generated by decomposition of organic matter to form explosive atmospheres.
	R8: Water supply pipes	P8: Attack of water supply pipes	Unlikely	Medium	Low	Low pH could attack iron or steel water pipes.
S4: Off-site colliery spoil	R1: Current Site Users	P1: Particulate / dust / fibre inhalation	Unlikely	Minor	Very Low	The off-site deposits are all well vegetated, decreasing the potential for contaminant particulate migration.
	R2: Construction workers / contractors	P2: Vapour inhalation	Unlikely	Medium	Low	There is the potential for explosive or asphyxiant gases to accumulate in excavations.
	R3: Future end-users		Unlikely	Minor	Very Low	Similar situation to current site users.
S5: Off-site mine adits	R1: Current Site Users	P1: Particulate / dust / fibre inhalation	Unlikely	Minor	Very Low	The principal risk comes from mine gas, which has a limited impact if it cannot accumulate in a confined space.
	R2: Construction workers / contractors	P2: Vapour inhalation	Unlikely	Medium	Low	It is unlikely that a pathway exists, down gradient, for explosive or asphyxiant gases to accumulate in excavations.
	R3: Future end-users		Unlikely	Minor	Very Low	Similar situation to current site users.
	R6: Secondary A Aquifer	P6: Groundwater migration (several adits lie above the site and mine water discharge may enter the aquifer, pass through site and emerge into surface water course)	Low likelihood	Medium	Low / Moderate	For the main part, it is not known if the adits are dry or wet or whether discharge are ferruginous or not. However, there are no adits within the development site boundary and any adjacent adits that have historically been discharging to ground / groundwater / watercourses and should have been picked up by NRW if causing a nuisance. In the case of RSS-B, the adit discharges were measured and found to have lower concentrations of metallic elements than the adjacent river.

Potential Sources of Contamination	Potential Receptor	Potential Pathway	Probability of risk being realised	Consequence of risk being realised	Risk	Justification / Comments
S6: Refuse tips and former quarries (some potentially infilled)	R1: Current Site Users	P1: Particulate / dust / fibre inhalation P2: Vapour inhalation	Unlikely	Negligible	Very Low	Tips and infilled quarries are now vegetated. Historically quarries were occasionally filled with waste that would be capable of producing ground gas, however the most likely fill material is colliery spoil.
	R2: Construction workers / contractors		Low likelihood	Minor	Low	Tip and quarry fill may be capable of producing leachate or gases which could migrate to the site and be encountered during ground works. However, it is unlikely that a pathway exists, down gradient, for explosive or asphyxiant gases to accumulate in excavations.
	R3: Future end-users		Unlikely	Negligible	Very Low	Similar situation to current site users.
	R6: Secondary A Aquifer	P5: Leaching P6: Groundwater Migration	Low likelihood	Medium	Low / Moderate	Leachable contaminants and landfill leachate, if present, may impact on aquifers beneath the development site.
S7 & S8: Electricity transformers (PBC's) and Leaking Fuel Tanks	R1: Current Site Users	P2: Vapour inhalation P3: Direct dermal contact P4: Ingestion	Unlikely	Negligible	Very Low	If leaks are present, levels of contamination are unlikely to be high enough to trigger human health toxicity in proposed end use.
	R2: Construction workers / contractors		Low likelihood	Minor	Low	Construction workers may encounter some localised contamination when undertaking groundworks.
	R3: Future end-users		Unlikely	Negligible	Very Low	Similar situation to current site users.
	R5: Afon Rhondda Fach	P6: Groundwater Migration	Low likelihood	Medium	Low / Moderate	Potential for leaking Hydrocarbon fuels / PCBs to mobilise to aquifer and river.
	R6: Secondary A Aquifer		Low likelihood	Medium	Low / Moderate	

7. Geotechnical Risk Register

A review of the geotechnical risks associated with the scheme has been undertaken.

The degree of risk is determined by combining the probability and impact assessments: **Probability (P) x Impact (I) = Risk Rating (R)**

Probability (P)	
Very Likely	5
Likely	4
Probable	3
Unlikely	2
Negligible	1

X

Impact (I)		Increase in duration or project cost
Very High	5	>20%
High	4	5% to 20%
Medium	3	2% to 5%
Low	2	0.5% to 2%
Very Low	1	<0.5%

=

Risk Rating (R)	Probability (P)					
Impact (I)		1	2	3	4	5
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Key

Unacceptable	
Early Attention	
At least regular attention	

The register lists the anticipated geotechnical and geo-environmental hazards associated with the works and the potential consequences of those hazards at this stage in the project. The risk before control of the hazard has been assessed as has the anticipated risk following the proposed mitigation measure.

The current risk register is detailed in the following Table.

No	Geotechnical Hazard	Potential Consequence	Risk Before Control			Mitigation Measures	Risk After Control		
			P	I	R		P	I	R
1	Weak, soft, or compressible ground, including inconsistent superficial deposits and Made Ground materials (beneath pavement).	Excessive settlement or differential settlement. Subgrade deformation. Deeper excavations and/or ground improvement work. Remedial work. Increased cost and delays.	4	3	12	Ground Investigation identified high CBR value across the majority of the site. Supervision during GI & construction. Excavation of local soft/loose deposits and infilling with compacted engineered fill.	2	2	4
2	Shrinking and swelling soils.	Damage to pavement.	2	2	4	Limited high Plasticity clay identified during ground investigation. Where encountered, design to mitigate damage.	2	1	2
3	Frost susceptible soils.	Frost heave damaging pavement.	3	3	9	Colliery spoil potentially susceptible to frost heave.	3	3	9
4	Rock at shallow depth.	Change in design levels (costly excavation/ raising adjacent levels). Settlements at transition between hard and soft strata. Difficulty in excavation for drainage / soakaways.	3	3	9	Some rock identified within near surface during ground investigation of Phase 5, this may influence drainage deign.	3	2	6
5	Service trenches.	Longitudinal soft spots.	3	3	9	No GI at service trench locations due to WW/DC restrictions. Identification during construction works and bridging soft spots beneath pavement.	1	3	3
6	Buried water main and sewer.	Easement reducing Ground Investigation extents and increasing risk of construction unknowns/difficulty.	5	3	15	Work with DC\WW to gain access. Utilise alternative Ground Investigation methods/non-intrusive methods.	3	3	9
7	High groundwater levels.	Soakaway drainage not suitable.	3	3	9	Ground Investigation determined groundwater not impacting soakaway design depth.	1	1	1
8	High groundwater levels.	Flooding of excavations during construction.	2	2	4	Ground Investigation determined groundwater not impacting shallow excavations. Appropriate pumping during construction.	1	2	2

No	Geotechnical Hazard	Potential Consequence	Risk Before Control			Mitigation Measures	Risk After Control		
			P	I	R		P	I	P
9	Contaminated land.	Risk to construction staff. Delays in Ground Investigation and Construction. Potential remedial works.	4	4	16	Ground investigation determined low risk to construction staff and site users	1	4	4
10	Aggressive ground / groundwater.	Attack of structural concrete.	3	3	9	Ground investigation determined pH and sulphates and low risk to structural concrete.	1	3	3
11	Mining induced ground instability.	Settlement and cracking of structures. Easements affecting design.	2	3	6	Coal Mining Risk Assessment undertaken, and a low risk determined.	1	3	3
17	Japanese Knotweed.	Risk of disruption to asphalt surfacing.	2	3	6	Appropriate survey and remedial works / early and advanced treatment where required.	2	2	4
18	Trees along the route	Risk of root disruption to surfacing over time	2	3	6	Appropriate survey and remedial works / early and advanced removal where required.	2	2	4

8. References

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22. BRE Special Digest 1 Concrete in Aggressive Ground. 3rd Edition. 2005. Building Research Establishment

23. The LQM/CIEH S4ULs for human Health Risk Assessment. Paul Nathanial, Caroline McMaffrey, Andy Gilett, Richard Ogden and Judith Nathanial. 2015 Land Quality Pres. Nottingham.

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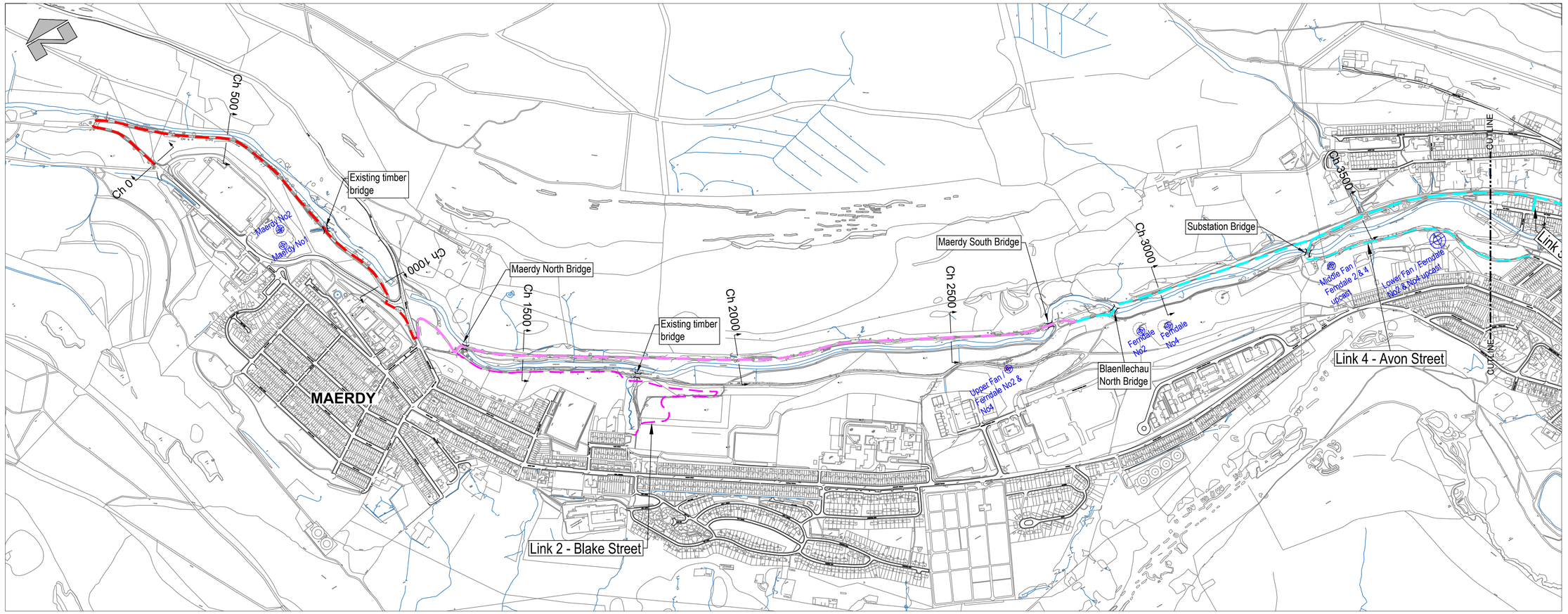
REDSTART

Drawings



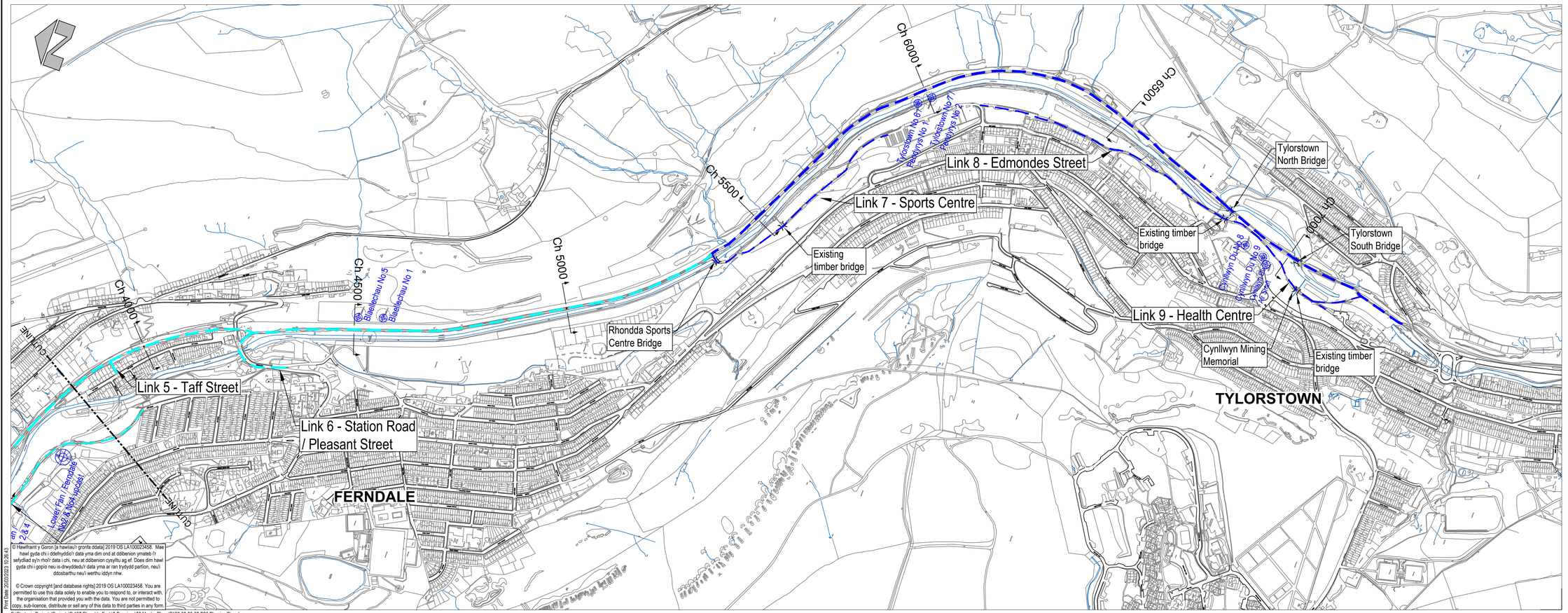
Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

Ferndale No4 — Approximate location of mine shafts. Awaiting further information from the Coal Authority including exclusion zones, existing treatment and levels.

Bridge Location

At preliminary design stage, a number of assumptions have been made. Ongoing surveys and ground investigation works may have an impact on the preliminary design and whether Welsh Active Travel Standards can be achieved.



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- Ferndale Community School Link removed from Phase 3	RG	20/03/2023	P06
-Leisure Centre Link removed from Phase 4 and added to Phase 5	RG	31/01/2023	P05
- Phase 3 amended	RG	25/01/2023	P04
- Anticipated dates of planning submissions removed. Anticipated dates of planning submissions added	RG	12/05/2022	P03
Phasing changed: Phase 1a is now Phase 1 Phase 1b split into Phases 2 & 3 Phase 2 is now Phase 4 Phase 3 is now Phase 5	RG	24/02/2022	P02
Additional notes added	LK	27/01/2022	P01
Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

Cleient/ Client

Rhondda Cynon Taf
County Borough Council

Prosiect/ Project

Rhondda Fach
Active Travel Route

Teitl y Llun/ Dwg Title

Phasing Plan

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:5,000	Jan '22
Rhif y Llun/ Dwg No.		Adolygiad/ Revision
P187-00-80-02		P06
Paratowyd gan/ Prepared by: LK	Gwirwyd gan/ Checked by: RG	Cymeradwywyd gan/Approved by: RG

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FFYNIANT, DATBLYGU, A GWASANAETHAU RHENG-FLAEN

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Start of Rhondda Fach Active Travel Route - Phase 2. Refer to drawing P187-00-85-22 for Phase 2 General Arrangement.

Proposed 3m wide active travel route, comprised of permeable paving, fin drain, 0.5m to 1m wide grassed verges and embankments of 1(V):2(H) to existing ground levels.

Existing wooden footbridge

Proposed route diversion and new box culvert to allow continuation of existing stream output.

Wetland area colloquially known as "dog pond".

Unnamed watercourse

CUTLINE 1

CUTLINE 2

Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed verge and embankment
- Proposed timber post and four rail fence

Location Plan
Scale 1:12,500

Manylion Adolygiad/Revision Details | Gan/By | Dyddiad/Date | Adolygiad/Revision

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Active Travel Route

Teitl y Llun/ Dwg Title
Phase 3
General Arrangement
Sheet 1 of 2

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-23 (01)	P00

Paratowyd gan/ Prepared by:	Gwiriwyd gan/ Checked by:	Cymeradwywyd gan/Approved by:
JS	RG	

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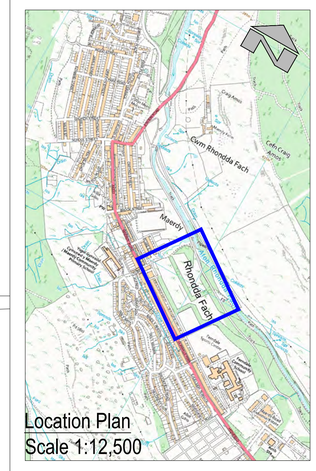
Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed verge and embankment
- Proposed timber post and four rail fence



Location Plan
Scale 1:12,500

Existing wooden footbridge

Proposed 3m wide active travel route, comprised of permeable paving, fin drain, 0.5m to 1m wide grassed verges and embankments of 1(V):2(H) to existing ground levels.

Connection between Phase 3 Primary Route and Blake Street and Ferndale Community School Links

Proposed 2.5m wide active travel route, comprised of permeable paving, fin drain, 0.5m to 1m wide grassed verges and embankments of 1(V):2(H) to existing ground levels.

Proposed active travel link between Blake Street and rear lane of Richard Street

Afon Rhondda Fach

Drain

Outfall

CUTLINE 2

Issues Pipeline

RICHARD STREET

Club

Club

295.0m

297.9m

298.6m

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Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

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Active Travel Route

Teitl y Llun/ Dwg Title
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General Arrangement
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P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-23 (02)	P00

Paratowyd gan/ Prepared by:	Gwiriwyd gan/ Checked by:	Cymeradwywyd gan/Approved by:
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Pipeline

Ch 0

Proposed turning head

Proposed turning head

Proposed 4m wide bridge - 'Blaenllechau North'

Ch 100

Ch 200

Start of Rhondda Fach Active Travel Route - Phase 2. Refer to drawing P187-00-85-22 for Phase 2 General Arrangement.

Proposed fin drain outlet

Pipeline

CUTLINE 1

E 298900
N 197700

Ch 200

Ch 300

Sinks

Ch 400

Ch 500

3m

Proposed fin drain outlet

CUTLINE 1

Afon Rhondda Fach

CUTLINE 2

E 299200
N 197700

Tie-in to existing steps

Ch 600

Ch 700

Ch 800

3m

Removable bollard to prevent unauthorised access

3m wide Active Travel Act compliant route widens to 4m to allow vehicular access to Taff Street rear lane.

Ch 900

Proposed fin drain outlet

CUTLINE 2

E 299500
N 197600

Afon Rhondda Fach

Pipeline

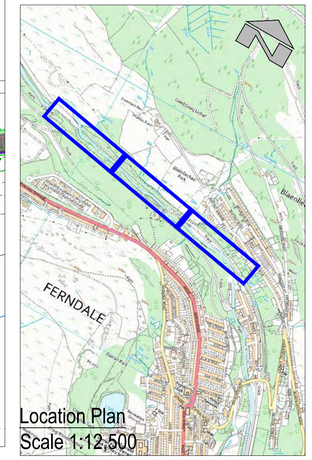
DW

LONG ROW

E 299800
N 197600

Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed full carriageway construction
- Proposed verge and embankment
- Proposed fin drain
- Proposed connection pipe
- Proposed timber post and four rail fence
- Mineshaft



Location Plan
Scale 1:12,500

Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

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Active Travel Route

Teitl y Llun/ Dwg Title

Phase 4
General Arrangement
Sheet 1 of 3

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-24 (01)	P00

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JS	RG	

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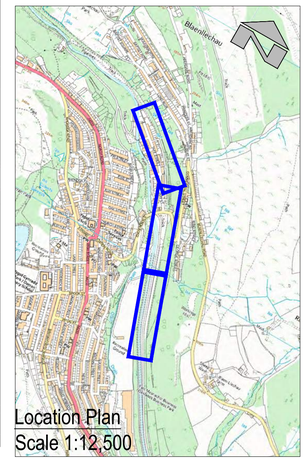
Ch 900
Ch 1000
Ch 1100
Ch 1200
Ch 1300
Ch 1400
Ch 1500
Ch 1600
Ch 1700
Ch 1800
Ch 1900
OUTLINE 3
OUTLINE 4
OUTLINE 5
OUTLINE 6
TAFF STREET
Sinks
SM
4m wide Taff Street rear lane
Community Gardens - existing amenity area, used and maintained by local residents with the agreement of the existing landowner Railway Paths Limited.
Boomerang House
Bristol House
Pumping Sta
Additional drainage survey information required at the rear of Taff Street to inform drainage design
Sloping masonry
Dismantled Railway
216.7m
Location of proposed pump track - awaiting details
Proposed fin drain outlet
Removable bollard to prevent unauthorised access
Afon Rhondda Fach
Drain
Ferndale No5 Coal Ref: 300196-006
Ferndale No4 Coal Ref: 300196-002
Unnamed Coal Ref: 300196-007
3m
Sloping Masonry
Path (um)

Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed full carriageway construction
- Proposed verge and embankment
- Proposed fin drain
- Proposed connection pipe
- Proposed timber post and four rail fence
- Mineshaft



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Active Travel Route

Teitl y Llun/ Dwg Title
Phase 4
General Arrangement
Sheet 2 of 3

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-24 (02)	P00

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JS	RG	

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Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed full carriageway construction
- Proposed verge and embankment
- Proposed fin drain
- Proposed connection pipe
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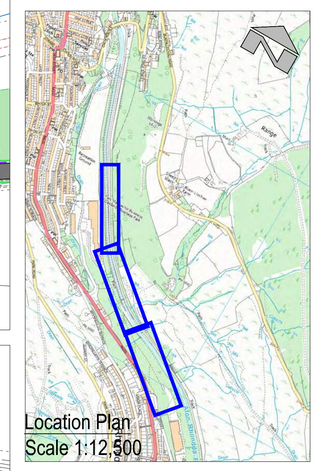

Location Plan
Scale 1:12,500

Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

Cleient/ Client

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Prosiect/ Project

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Active Travel Route

Teitl y Llun/ Dwg Title

Phase 4
General Arrangement
Sheet 3 of 3

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-24 (03)	P00

Paratowyd gan/ Prepared by:	Gwiriwyd gan/ Checked by:	Cymeradwywyd gan/Approved by:
JS	RG	

RHONDDA CYNON TAF
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FRONTLINE SERVICES

PROSIECTAU STRATEGOL/ STRATEGIC PROJECTS
Tŷ Sardis/Sardis House, Heol Sardis/Sardis Road, Pontypridd, CF37 1DU
Ffôn/Tel: 01443 425001 Ffacs/Fax: 01443 490414

Print Date:13/03/2023 12:41:54

\\ADRCTESGNAS\offices\Strategic Projects\Projects\P-187 Rhondda Fach\2 Drawings\85 Highways\P187-00-85-24 Phase 4 General Arrangement.dwg

Start of Rhondda Fach Active Travel Route - Phase 4. Refer to drawing P187-00-85-24 for Phase 4 General Arrangement.

Issues

Sloping masonry

CUTLINE 1

Afon Rhondda Fach

Cwm Rhondda Fach

CUTLINE 1

Afon Rhondda Fach

E 301000
N 196000

CUTLINE 2

Post

SM

Afon Rhondda Fach

E 301200
N 196800

Path (um)

Proposed fin drain outlet

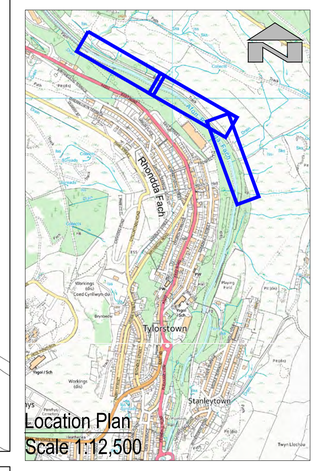
CUTLINE 2

CUTLINE 3

FB

Key

- Existing unbound gravel path
- Existing surfaced path
- Proposed 3m wide permeable surfaced footpath
- Proposed verge and embankment
- Proposed fin drain
- Proposed connection pipe
- Mineshaft



Location Plan
Scale 1:12,500

Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

Cleient/ Client

Rhondda Cynon Taf
County Borough Council

Prosiect/ Project

Rhondda Fach
Active Travel Route

Teitl y Llun/ Dwg Title

Phase 5
General Arrangement
Sheet 1 of 2

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Data
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-25 (01)	P00

Paratowyd gan/ Prepared by:	Gwiriwyd gan/ Checked by:	Cymeradwywyd gan/Approved by:
JS	RG	

RHONDDA CYNON TAF

RHONDDA CYNON TAF
GWASANAETHAU RHENG-FLAEN

RHONDDA CYNON TAF
FRONTLINE SERVICES

PROSIECTAU STRATEGOL/ STRATEGIC PROJECTS
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Ffôn/Tel: 01443 425001 Ffacs/Fax: 01443 490414

Print Date:13/03/2023 12:44:40

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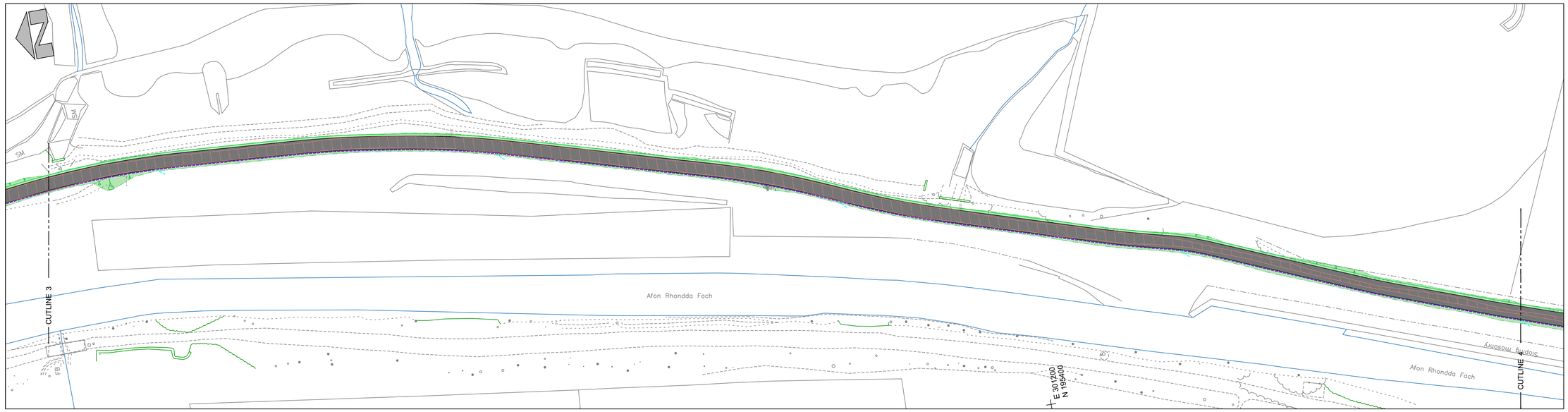

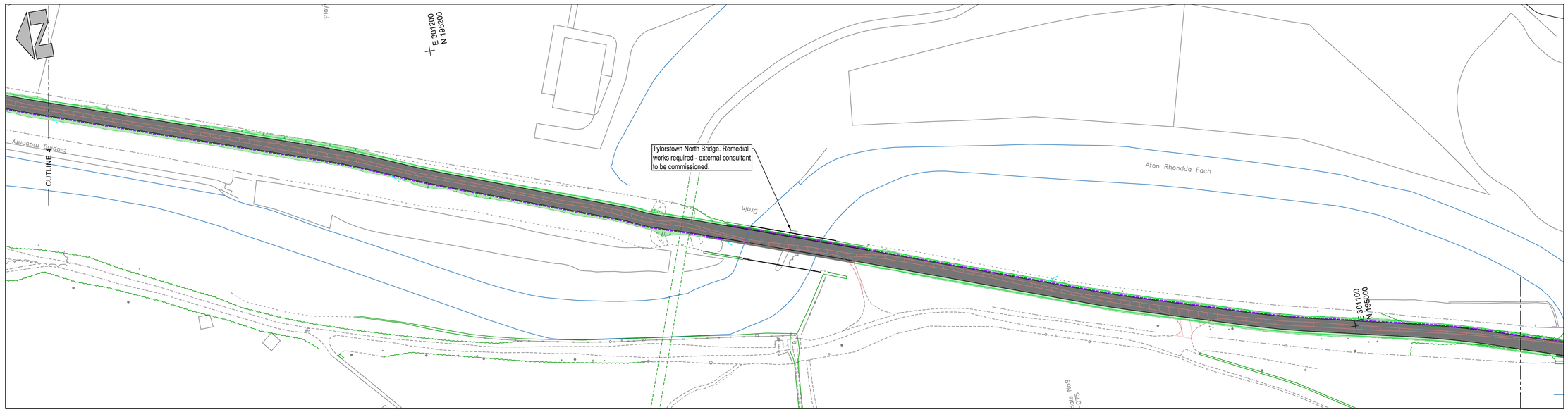

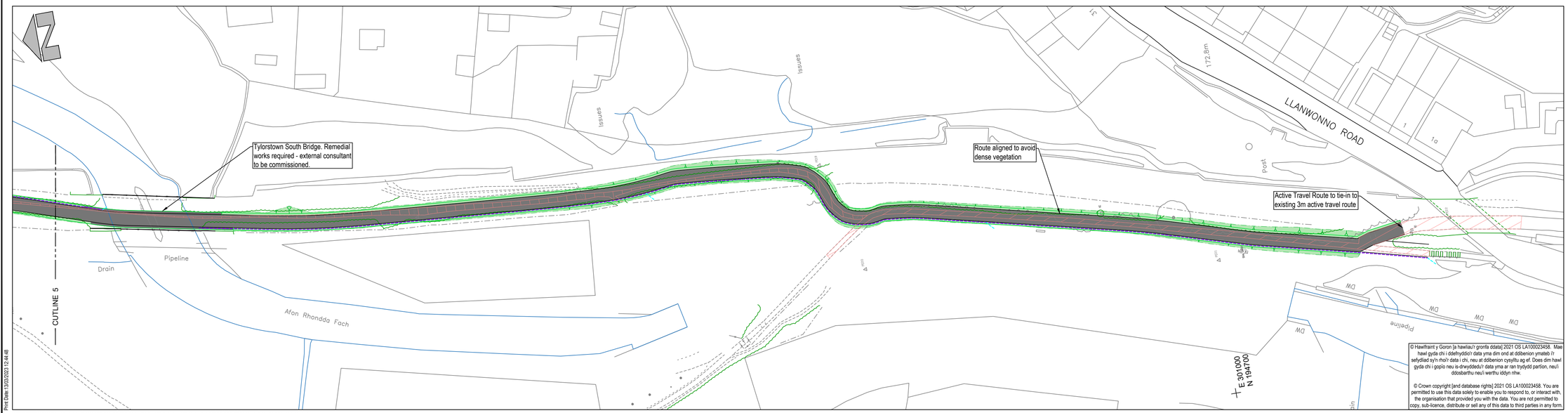

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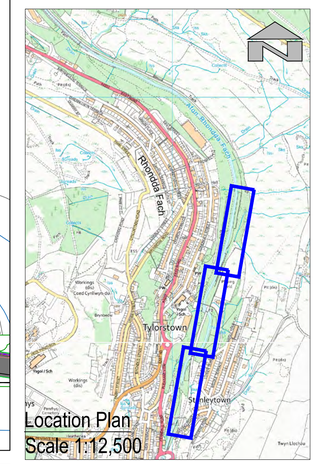

Manylion Adolygiad/Revision Details	Gan/By	Dyddiad/Date	Adolygiad/ Revision

Cleient/ Client

Rhondda Cynon Taf
County Borough Council

Prosiect/ Project

Rhondda Fach
Active Travel Route

Teitl y Llun/ Dwg Title

Phase 5
General Arrangement
Sheet 2 of 2

Rhif y Prosiect/ Project No.	Graddfa/ Scale @ A1	Dyddiad/ Date
P187	1:500	Mar '23

Rhif y Llun/ Dwg No.	Adolygiad/ Revision
P187-00-85-25 (02)	P00

Paratowyd gan/ Prepared by:	Gwiriwyd gan/ Checked by:	Cymeradwywyd gan/Approved by:
JS	RG	

RHONDDA CYNON TAF
GWASANAETHAU RHENG-FLAEN

RHONDDA CYNON TAF
FRONTLINE SERVICES

PROSIECTAU STRATEGOL/ STRATEGIC PROJECTS
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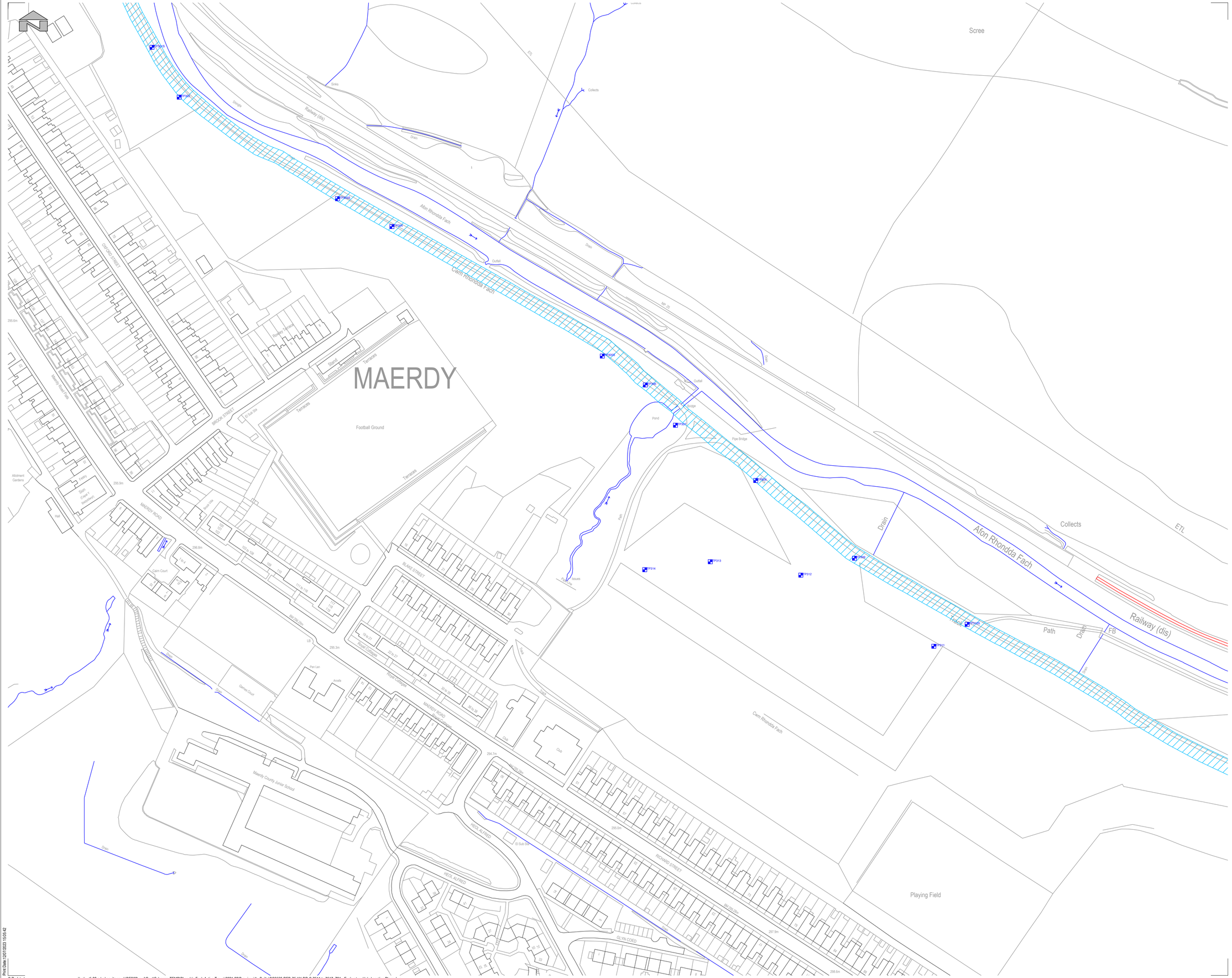

NOTES

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3. A NON-INTRUSIVE PAS 128 TYPE B SURVEY (TO QL-BP3) IS REQUIRED AT EACH EXPLORATORY HOLE LOCATION.

KEY

- PROPOSED BOREHOLE
- PROPOSED TRIAL PIT
- PROPOSED INSPECTION PIT
- INDICATIVE DCWW EXCLUSION ZONE (SUPPLIED BY RCT)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

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- UNKNOWN BURIED SERVICES IN THE AREA.

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

Rev	Dwn	Chkd	Appd	Description	Date
C01	RS			As Built	18/05/2023

Purpose of Issue
CR - As Construction Records

Classification
Confidential

Client
Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 1 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.: GC/3569
Date: 12/07/2023

Drawing Identifier: GC3569-RED-75-XX-DR-C-7511
Project - Originator - Zone - Level - File Type - Role - Number
Revision: C01

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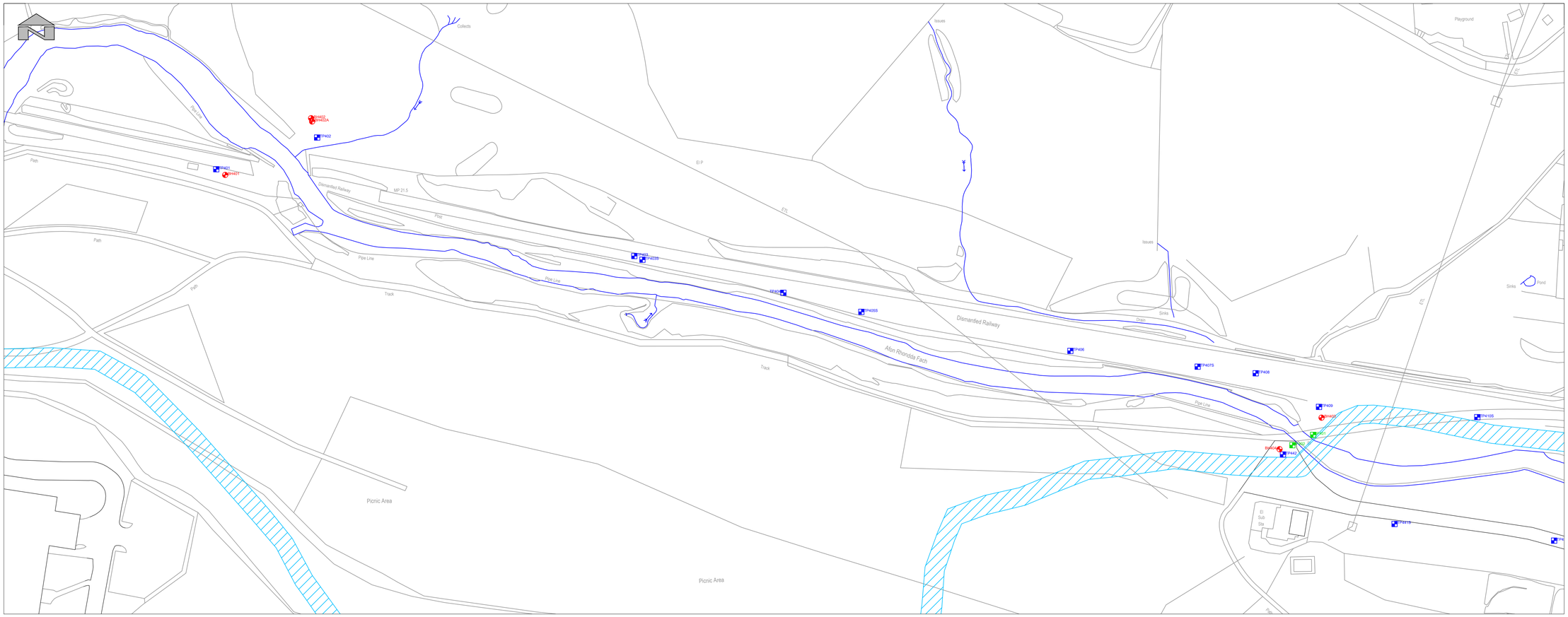

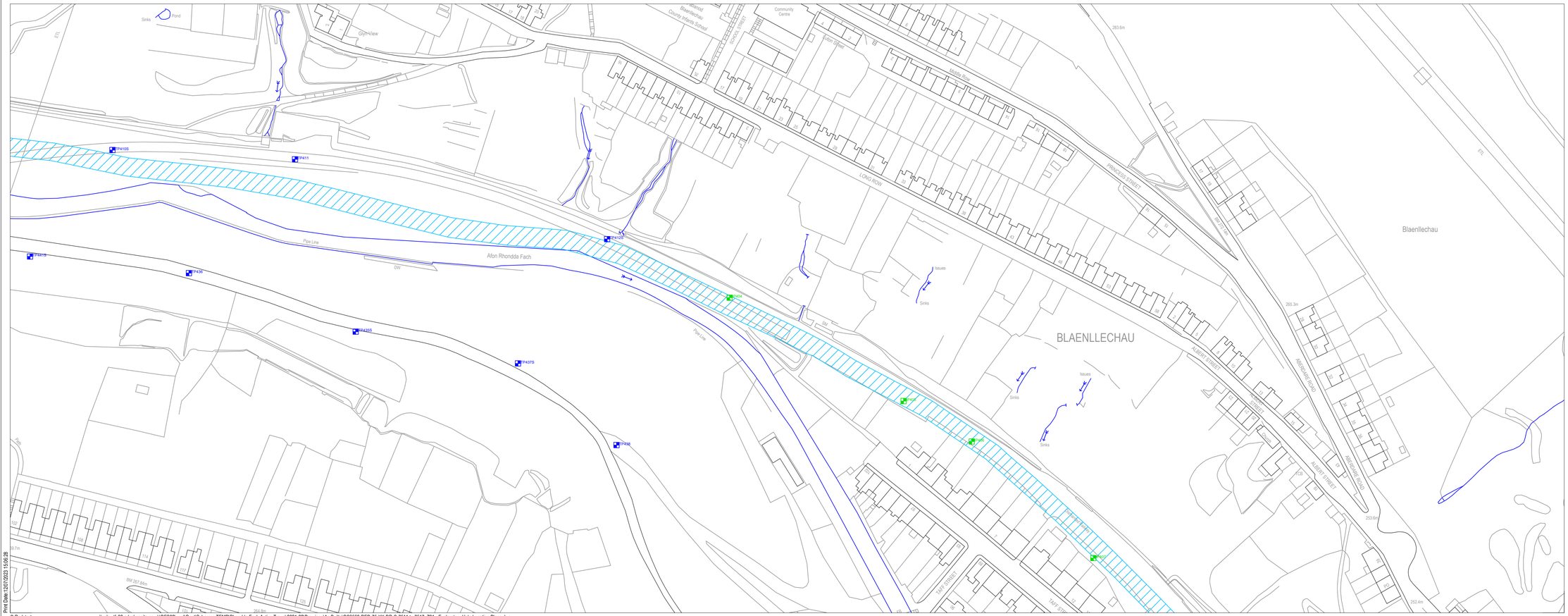

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Purpose of Issue
CR - As Construction Records

Classification
Confidential

Client
Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 2 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.	Date
GC/3569	12/07/2023

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
GC3569-RED-75-XX-DR-C-7512

Revision C01

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C01	RS			As Built	18/05/2023

Purpose of Issue
CR - As Construction Records

Classification
Confidential

Client
Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 3 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.: GC/3569
Date: 12/07/2023

Drawing Identifier (Project - Originator - Zone - Level - File Type - Role - Number): GC3569-RED-75-XX-DR-C-7513
Revision: C01

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Client
Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 4 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.	Date
GC/3569	12/07/2023

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
GC3569-RED-75-XX-DR-C-7514

Revision
C01

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Purpose of Issue
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Classification
Confidential

Client
Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 5 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.: GC/3569
Date: 12/07/2023

Drawing Identifier (Project - Originator - Zone - Level - File Type - Role - Number): GC3569-RED-75-XX-DR-C-7515
Revision: C01

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Rev	Drwn	Chk'd	App'd	Description	Date
C01	RS			As Built	18/05/2023

Purpose of Issue
CR - As Construction Records

Classification
Confidential

Client
Rhondda Cynon Taf County Borough Council

Project
Rhondda Fach Active Travel Route Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole Location Plan (Sheet 6 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No. GC/3569
Date 12/07/2023

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
GC3569-RED-75-XX-DR-C-7516
Revision C01

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Rhondda Cynon Taf
County Borough Council

Project
Rhondda Fach Active Travel Route
Phases 3, 4 & 5

Drawing
Proposed Exploratory Hole
Location Plan (Sheet 7 of 7)

Scale @ A1	Drawn	Checked	Approved
1:1,000	RS	AR	AR

Project No.	Date
GC/3569	12/07/2023

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
GC3569-RED-75-XX-DR-C-7517

Revision
C01

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APPENDIX A
Jackson Geo Services Ground Investigation Report

APPENDIX B

HazWasteOnline Waste Classification

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.

TWCU4-GNBWC-V5P2Y

Job name

RFATR Phase 3, 4 & 5

Description/Comments

Project

RFATR Phase 3, 4 & 5

Site

Meardy to Tylorstown

Classified by

Name:
Alan Rosier
Date:
24 Apr 2023 11:46 GMT
Telephone:
02920 803500

Company:
Capita Property and Infrastructure Ltd (Wales)
St David's House
Pascal Close
Cardiff
CF3 0LW

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	09 Jun 2016
3 year Refresher overdue	-

Purpose of classification

2 - Material Characterisation

Address of the waste

Maerdy to Tylorstown **Post Code** N/A

SIC for the process giving rise to the waste

Description of industry/producer giving rise to the waste

Creation of asphalt suraced multi use Active Travel Route

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

Excavation of soils for construction.

Description of the waste

Mix of Colliery spoil, railway and natural soils.

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	#4932703298940001-20/02/2023-0.00	0.00-0.20	Non Hazardous		6
2	#4932703298940002-20/02/2023-0.60	0.60-0.70	Non Hazardous		12
3	#4932703298940004-20/02/2023-2.00	2.00-2.20	Non Hazardous		18
4	#9968141629330001-20/02/2023-0.20	0.20-0.30	Non Hazardous		24
5	#9968141629330003-20/02/2023-0.60	0.60-0.70	Non Hazardous		30
6	#5198502235660001-20/02/2023-0.20	0.20-0.30	Non Hazardous		36
7	#5198502235660004-20/02/2023-0.60	0.60-0.70	Non Hazardous		42
8	#7913717291260001-20/02/2023-0.20	0.20	Non Hazardous		48
9	#5905012076670001-20/02/2023-0.20	0.20	Non Hazardous		54
10	#5905012076670003-20/02/2023-1.00	1.00	Non Hazardous		60
11	1-21/02/2023-0.20	0.20-0.30	Non Hazardous		66
12	2-21/02/2023-0.6	0.6-0.7	Non Hazardous		72
13	3-21/02/2023-0.9	0.9-1.0	Non Hazardous		78
14	1-21/02/2023-0.2	0.2-0.3	Non Hazardous		84
15	1-21/02/2023-0.60	0.60-0.7	Non Hazardous		90
16	2-21/02/2023-0.20	0.20-0.30	Non Hazardous		96
17	4-21/02/2023-0.60	0.60-0.70	Non Hazardous		102
18	#7434870781100001-22/02/2023-0.20	0.20-0.30	Non Hazardous		108
19	#1702583563370001-22/02/2023-0.00	0.00-0.30	Non Hazardous		114
20	#5631250061840003-22/02/2023-0.50	0.50-0.60	Non Hazardous		120
21	#4761458204470001-22/02/2023-0.20	0.20-0.30	Non Hazardous		126
22	#4761458204470003-22/02/2023-0.50	0.50-0.60	Non Hazardous		132
23	#6970605895360001-22/02/2023-0.20	0.20-0.30	Non Hazardous		138
24	#6970605895360003-22/02/2023-0.60	0.60-0.70	Non Hazardous		144
25	#6970605895360006-22/02/2023-1.70	1.70-1.80	Non Hazardous		150
26	#9925812580570001-22/02/2023-0.20	0.20-0.30	Non Hazardous		156
27	#9925812580570003-22/02/2023-0.60	0.60-0.70	Non Hazardous		162
28	#9925812580570006-22/02/2023-1.80	1.80-2.00	Non Hazardous		168
29	#0617809742970001-22/02/2023-0.20	0.20-0.30	Non Hazardous		174
30	#0617809742970003-22/02/2023-0.60	0.60-0.70	Non Hazardous		180
31	#9431972377650001-22/02/2023-0.20	0.20-0.30	Non Hazardous		186
32	#9431972377650005-22/02/2023-1.00	1.00-1.10	Non Hazardous		192
33	#6209595918740001-22/02/2023-0.20	0.20-0.30	Non Hazardous		198
34	#6209595918740003-22/02/2023-0.60	0.60-0.70	Non Hazardous		204
35	3-22/02/2023-0.60	0.60	Non Hazardous		210
36	8-23/02/2023-2.00	2.00	Non Hazardous		216
37	#7457265391680001-23/02/2023-0.20	0.20-0.30	Non Hazardous		222
38	#7457265391680003-23/02/2023-0.50	0.50-0.55	Non Hazardous		228

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
39	#4164423441580001-23/02/2023-0.20	0.20-0.30	Non Hazardous		234
40	#4164423441580003-23/02/2023-0.50	0.50-0.60	Non Hazardous		240
41	#6695659838930001-23/02/2023-0.20	0.20-0.30	Non Hazardous		246
42	#9480533236380001-23/02/2023-0.20	0.20-0.30	Non Hazardous		252
43	#2882366898870001-23/02/2023-0.20	0.20-0.30	Non Hazardous		258
44	#8414448601370001-23/02/2023-0.20	0.20-0.30	Non Hazardous		264
45	#8414448601370003-23/02/2023-0.60	0.60-0.70	Non Hazardous		270
46	#7571723464660001-23/02/2023-0.20	0.20-0.30	Non Hazardous		276
47	#7571723464660004-23/02/2023-1.00	1.00-1.10	Non Hazardous		282
48	1-24/02/2023-0.2	0.2-0.3	Non Hazardous		288
49	3-24/02/2023-0.6	0.6-0.7	Non Hazardous		294
50	4-24/02/2023-1.0	1.0-1.1	Non Hazardous		300
51	#9020240338980001-27/02/2023-0.20	0.20-0.30	Non Hazardous		306
52	#7938343797770001-27/02/2023-0.20	0.20-0.30	Non Hazardous		312
53	#7938343797770004-27/02/2023-0.90	0.90-1.00	Non Hazardous		318
54	#1099647433070001-27/02/2023-0.20	0.20-0.30	Non Hazardous		324
55	#3025748405140001-27/02/2023-0.20	0.20-0.30	Non Hazardous		330
56	#7303888237700001-27/02/2023-0.50	0.50-0.60	Non Hazardous		336
57	#2774055512970001-27/02/2023-0.20	0.20-0.30	Non Hazardous		342
58	#2774055512970004-27/02/2023-1.00	1.00-1.10	Non Hazardous		348
59	#8626101076880001-27/02/2023-0.20	0.20-0.30	Non Hazardous		354
60	#8887896057620001-28/02/2023-0.20	0.20-0.30	Non Hazardous		360
61	#7067705824520001-28/02/2023-0.20	0.20-0.30	Non Hazardous		366
62	#7067705824520003-28/02/2023-0.60	0.60-0.70	Non Hazardous		372
63	#8988393796120001-28/02/2023-0.20	0.20-0.30	Non Hazardous		378
64	#0690697776470001-28/02/2023-0.20	0.20-0.30	Non Hazardous		384
65	#0690697776470003-28/02/2023-0.60	0.60-0.70	Non Hazardous		390
66	#6803414596610001-28/02/2023-0.20	0.20-0.30	Non Hazardous		396
67	#3818181759580002-01/03/2023-0.50	0.50-0.60	Non Hazardous		402
68	#8686958550780001-01/03/2023-0.20	0.20-0.30	Non Hazardous		408
69	#5384819649790001-01/03/2023-0.20	0.20-0.30	Non Hazardous		414
70	#5384819649790003-01/03/2023-0.60	0.60-0.70	Non Hazardous		420
71	#9705225019560001-01/03/2023-0.20	0.20-0.30	Non Hazardous		426
72	#9672271897850010-01/03/2023-0.10	0.10-0.20	Non Hazardous		432
73	#9672271897850003-01/03/2023-0.60	0.60-0.70	Non Hazardous		438
74	#9672271897850006-01/03/2023-2.00	2.00-2.10	Non Hazardous		444
75	#9898500731150001-02/03/2023-0.20	0.20-0.30	Non Hazardous		450

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
76	#9898500731150003-02/03/2023-0.50	0.50-0.60	Non Hazardous		456
77	#1039692759990001-02/03/2023-0.20	0.20-0.30	Non Hazardous		462
78	#1039692759990003-02/03/2023-0.50	0.50-0.60	Non Hazardous		468
79	#0506286644610003-02/03/2023-0.50	0.50-0.60	Non Hazardous		474
80	#1268434450610002-02/03/2023-0.20	0.20-0.30	Non Hazardous		480
81	#1268434450610005-02/03/2023-2.00	2.00-2.10	Non Hazardous		486
82	#8109142327720002-02/03/2023-0.20	0.20-0.30	Non Hazardous		492
83	#6908382138650001-02/03/2023-0.20	0.20-0.30	Non Hazardous		498
84	#9188472032150001-02/03/2023-0.20	0.20-0.30	Non Hazardous		504
85	#3267850518810001-02/03/2023-0.20	0.20-0.30	Non Hazardous		510
86	2-02/02/2023-0.6	0.6	Non Hazardous		516
87	#5714959393110001-06/03/2023-0.20	0.20-0.30	Non Hazardous		522
88	#4845413032370001-06/03/2023-0.20	0.20-0.30	Non Hazardous		528
89	#2930299566550001-06/03/2023-0.20	0.20	Non Hazardous		534
90	#5535887086540001-06/03/2023-0.20	0.20	Non Hazardous		540
91	#7616894001880001-06/03/2023-0.20	0.20	Non Hazardous		546
92	2-06/03/2023-0.6	0.6	Non Hazardous		552
93	9-06/03/2023-2.0	2.0	Non Hazardous		558
94	#9575854353390001-09/03/2023-0.2	0.2-0.3	Non Hazardous		564
95	#3390941211660001-09/03/2023-0.1	0.1-0.2	Non Hazardous		570
96	#9508465705200001-09/03/2023-0.2	0.2-0.3	Non Hazardous		576
97	#1016333671750001-09/03/2023-0.2	0.2-0.3	Non Hazardous		582
98	#2639037735120001-09/03/2023-0.2	0.2	Non Hazardous		588
99	#5060141931770001-09/03/2023-0.2	0.2	Non Hazardous		594
100	#5060141931770002-09/03/2023-0.6	0.6	Non Hazardous		600
101	#6281795430120001-09/03/2023-0.2	0.2	Non Hazardous		606
102	#8372512635940001-09/03/2023-0.2	0.2	Non Hazardous		612
103	#8918905811800001-09/03/2023-0.2	0.2-0.3	Non Hazardous		618
104	#8918905811800004-09/03/2023-0.5	0.5-0.6	Non Hazardous		624
105	#5908180789970001-10/03/2023-0.20	0.20	Non Hazardous		630
106	#7537939533360001-10/03/2023-0.20	0.20	Non Hazardous		636
107	#7537939533360004-10/03/2023-0.60	0.60	Non Hazardous		642
108	#7492992522880001-10/03/2023-0.20	0.20	Non Hazardous		648
109	#677844196872001-10/03/2023-0.20	0.20-0.30	Non Hazardous		654
110	#6369314010420002-10/03/2023-0.50	0.50-0.60	Non Hazardous		660
111	TP311-3-14/03/2023-0.68	0.68	Hazardous	HP 14	666
112	#1502135568990004-13/03/2023-0.6	0.6	Non Hazardous		672
113	#5573091290680002-13/03/2023-0.2	0.2	Non Hazardous		678

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
114	#5573091290680004-13/03/2023-0.6	0.6	Non Hazardous		684
115	#3526289576440001-13/03/2023-0.2	0.2	Non Hazardous		690
116	#0443344004650001-13/03/2023-0.2	0.2	Non Hazardous		696
117	#9741191966320001-13/03/2023-0.2	0.2	Non Hazardous		702
118	#5815098139360001-13/03/2023-0.2	0.2	Non Hazardous		708
119	#2590826299310001-14/03/2023-0.20	0.20	Non Hazardous		714

Related documents

#	Name	Description
1	HWOL_23-10089-20230414 113641.hwol	Eurofins Chemtest .hwol file used to populate the Job
2	Example waste stream template for contaminated soils	waste stream template used to create this Job

Report

Created by: Alan Rosier

Created date: 24 Apr 2023 11:46 GMT

Classification of sample: TP311-3-14/03/2023-0.68

Hazardous Waste
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample name:
TP311-3-14/03/2023-0.68
Sample Depth:
0.68 m
Moisture content:
9.7%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 03 * (Soil and stones containing hazardous substances)

Hazard properties

HP 14: Ecotoxic "waste which presents or may present immediate or delayed risks for one or more sectors of the environment"

Hazard Statements hit:

Aquatic Chronic 1; H410 "Very toxic to aquatic life with long lasting effects."

Because of determinand:

zinc oxide: (compound conc.: 0.292%)

Determinands

Moisture content: 9.7% Wet Weight 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		84 mg/kg	1.32	100.149 mg/kg	0.01 %	✓	
2	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		1.8 mg/kg	2.775	4.511 mg/kg	0.000451 %	✓	
3	boron { diboron trioxide; boric oxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
4	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		9.6 mg/kg	1.142	9.903 mg/kg	0.00099 %	✓	
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		25 mg/kg	1.462	32.995 mg/kg	0.0033 %	✓	
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				<0.5 mg/kg	2.27	<1.135 mg/kg	<0.000113 %		<LOD
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		530 mg/kg	1.126	538.839 mg/kg	0.0539 %	✓	
8	lead { lead compounds with the exception of those specified elsewhere in this Annex }	082-001-00-6			1	670 mg/kg		605.01 mg/kg	0.0605 %	✓	
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.66 mg/kg	1.353	0.807 mg/kg	0.0000807 %	✓	
10	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		89 mg/kg	2.976	239.193 mg/kg	0.0239 %	✓	
11	selenium { nickel selenate }	028-031-00-5	239-125-2	15060-62-5		2.4 mg/kg	2.554	5.535 mg/kg	0.000553 %	✓	
12	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		2600 mg/kg	1.245	2922.339 mg/kg	0.292 %	✓	

#		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									
13		TPH (C6 to C40) petroleum group		TPH		44.5	mg/kg		40.184	mg/kg	0.00402 %	✓	
14		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		603-181-00-X	216-653-1	1634-04-4									
15		benzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-020-00-8	200-753-7	71-43-2									
16		toluene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-021-00-3	203-625-9	108-88-3									
17		ethylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-023-00-4	202-849-4	100-41-4									
18		xylene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
19		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<0.5	mg/kg	1.884	<0.942	mg/kg	<0.0000942 %		<LOD
		006-007-00-5											
20		pH		PH		7.7	pH		7.7	pH	7.7 pH		
21		naphthalene				0.82	mg/kg		0.74	mg/kg	0.000074 %	✓	
		601-052-00-2	202-049-5	91-20-3									
22		acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
			205-917-1	208-96-8									
23		acenaphthene				0.29	mg/kg		0.262	mg/kg	0.0000262 %	✓	
			201-469-6	83-32-9									
24		fluorene				0.34	mg/kg		0.307	mg/kg	0.0000307 %	✓	
			201-695-5	86-73-7									
25		phenanthrene				0.87	mg/kg		0.786	mg/kg	0.0000786 %	✓	
			201-581-5	85-01-8									
26		anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
			204-371-1	120-12-7									
27		fluoranthene				0.18	mg/kg		0.163	mg/kg	0.0000163 %	✓	
			205-912-4	206-44-0									
28		pyrene				0.18	mg/kg		0.163	mg/kg	0.0000163 %	✓	
			204-927-3	129-00-0									
29		benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-033-00-9	200-280-6	56-55-3									
30		chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-048-00-0	205-923-4	218-01-9									
31		benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-034-00-4	205-911-9	205-99-2									
32		benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-036-00-5	205-916-6	207-08-9									
33		benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-032-00-3	200-028-5	50-32-8									
34		indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
			205-893-2	193-39-5									
35		dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		601-041-00-2	200-181-8	53-70-3									
36		benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
			205-883-8	191-24-2									
37		phenol				<0.02	mg/kg		<0.02	mg/kg	<0.000002 %		<LOD
		604-001-00-2	203-632-7	108-95-2									
38		1,1-dichloroethane and 1,2-dichloroethane (combined)				<0.003	mg/kg		<0.003	mg/kg	<0.0000003 %		<LOD
			203-458-1, 200-863-5	107-06-2, 75-34-3									

#		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
39		tetrachloroethylene	602-028-00-4	204-825-9	127-18-4		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
40		carbon tetrachloride; tetrachloromethane	602-008-00-5	200-262-8	56-23-5		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
41		trichloroethylene; trichloroethene	602-027-00-9	201-167-4	79-01-6		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
42		vinyl chloride; chloroethylene	602-023-00-7	200-831-0	75-01-4		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
43		hexachlorobenzene	602-065-00-6	204-273-9	118-74-1		<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
44		thiocyanic acid	615-003-00-8	207-337-4	463-56-9		<5	mg/kg		<5	mg/kg	<0.0005 %		<LOD
45		iron { iron (II) sulfate }	026-003-00-7	231-753-5	7720-78-7		51000	mg/kg	2.72	125271.747	mg/kg	12.527 %	✓	
46		barium { barium oxide }		215-127-9	1304-28-5		1200	mg/kg	1.117	1209.846	mg/kg	0.121 %	✓	
47		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		39	mg/kg	1.785	62.869	mg/kg	0.00629 %	✓	
48		dichlorodifluoromethane		200-893-9	75-71-8		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
49		chloromethane; methyl chloride	602-001-00-7	200-817-4	74-87-3		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
50		bromomethane; methylbromide	602-002-00-2	200-813-2	74-83-9		<0.02	mg/kg		<0.02	mg/kg	<0.000002 %		<LOD
51		chloroethane	602-009-00-0	200-830-5	75-00-3		<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
52		trichlorofluoromethane		200-892-3	75-69-4		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
53		1,1-dichloroethylene; vinylidene chloride	602-025-00-8	200-864-0	75-35-4		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
54		bromochloromethane		200-826-3	74-97-5		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
55		chloroform; trichloromethane	602-006-00-4	200-663-8	67-66-3		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
56		1,1,1-trichloroethane; methyl chloroform	602-013-00-2	200-756-3	71-55-6		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
57		1,1-dichloropropene	602-031-00-0	209-253-3	563-58-6		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
58		1,2-dichloropropane; propylene dichloride	602-020-00-0	201-152-2	78-87-5		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
59		dibromomethane	602-003-00-8	200-824-2	74-95-3		<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
60		bromodichloromethane		200-856-7	75-27-4		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
61		1,3-dichloropropene; [1] (Z)-1,3-dichloropropene [2]	602-030-00-5	208-826-5 [1] 233-195-8 [2]	542-75-6 [1] 10061-01-5 [2]		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
62		trans-1,3-dichloropropene		431-460-4	10061-02-6		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
63		1,1,2-trichloroethane	602-014-00-8	201-166-9	79-00-5		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
64		1,3-dichloropropane		205-531-3	142-28-9		<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
65		dibromochloromethane		204-704-0	124-48-1		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
66		1,2-dibromoethane	602-010-00-6	203-444-5	106-93-4		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<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									
67		chlorobenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-033-00-1	203-628-5	108-90-7									
68	●	1,1,1,2-tetrachloroethane				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
			211-135-1	630-20-6									
69		styrene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-026-00-0	202-851-5	100-42-5									
70		bromoform; tribromomethane				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-007-00-X	200-854-6	75-25-2									
71		bromobenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-060-00-9	203-623-8	108-86-1									
72		1,2,3-trichloropropane				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		602-062-00-X	202-486-1	96-18-4									
73		mesitylene; 1,3,5-trimethylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-025-00-5	203-604-4	108-67-8									
74	●	tert-butylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
			202-632-4	98-06-6									
75		1,2,4-trimethylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		601-043-00-3	202-436-9	95-63-6									
76	●	sec-butylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
			205-227-0	135-98-8									
77		1,3-dichlorbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-067-00-7	208-792-1	541-73-1									
78	●	4-isopropyltoluene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
			202-796-7	99-87-6									
79		1,4-dichlorobenzene; p-dichlorobenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-035-00-2	203-400-5	106-46-7									
80	●	n-butylbenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
			203-209-7	104-51-8									
81		1,2-dichlorobenzene; o-dichlorobenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-034-00-7	202-425-9	95-50-1									
82		1,2-dibromo-3-chloropropane				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		602-021-00-6	202-479-3	96-12-8									
83		1,2,4-trichlorobenzene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
		602-087-00-6	204-428-0	120-82-1									
84	●	hexachlorobutadiene				<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
			201-765-5	87-68-3									
85	●	1,2,3-trichlorobenzene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
			201-757-1	87-61-6									
86		dimethylnitrosoamine; N-nitrosodimethylamine				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		612-077-00-3	200-549-8	62-75-9									
87		2-chlorophenol; [1] 4-chlorophenol; [2] 3-chlorophenol; [3] chlorophenol [4]				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		604-008-00-0	202-433-2 [1] 203-402-6 [2] 203-582-6 [3] 246-691-4 [4]	95-57-8 [1] 106-48-9 [2] 108-43-0 [3] 25167-80-0 [4]									
88		bis(2-chloroethyl) ether				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		603-029-00-2	203-870-1	111-44-4									
89	●	hexachloroethane				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
			200-666-4	67-72-1									
90		nitrosodipropylamine				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		612-098-00-8	210-698-0	621-64-7									
91		nitrobenzene				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		609-003-00-7	202-716-0	98-95-3									
92		3,5,5-trimethylcyclohex-2-enone; isophorone				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
		606-012-00-8	201-126-0	78-59-1									
93	●	2-nitrophenol				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
			201-857-5	88-75-5									
94	●	bis(2-chloroethoxy)methane				<0.5	mg/kg		<0.5	mg/kg	<0.00005 %		<LOD
			203-920-2	111-91-1									

#		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							
95		2,4-dichlorophenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		604-011-00-7	204-429-6	120-83-2							
96		4-chloroaniline				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		612-137-00-9	203-401-0	106-47-8							
97		chlorocresol; 4-chloro-m-cresol; 4-chloro-3-methylphenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		604-014-00-3	200-431-6	59-50-7							
98	●	2-methyl naphthalene				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			202-078-3	91-57-6							
99		4-nitrophenol; p-nitrophenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		609-015-00-2	202-811-7	100-02-7							
100		hexachlorocyclopentadiene				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		602-078-00-7	201-029-3	77-47-4							
101		2,4,6-trichlorophenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		604-018-00-5	201-795-9	88-06-2							
102		2,4,5-trichlorophenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		604-017-00-X	202-467-8	95-95-4							
103	●	2-chloronaphthalene				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			202-079-9	91-58-7							
104	●	dimethyl phthalate				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			205-011-6	131-11-3							
105		2,6-dinitrotoluene				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		609-049-00-8	210-106-0	606-20-2							
106	●	dibenzofuran				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			205-071-3	132-64-9							
107	●	4-chlorophenylphenylether				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			230-281-7	7005-72-3							
108		2,4-dinitrotoluene; [1] dinitrotoluene [2]				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		609-007-00-9	204-450-0 [1] 246-836-1 [2]	121-14-2 [1] 25321-14-6 [2]							
109	●	diethyl phthalate				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			201-550-6	84-66-2							
110		DNOC (ISO); 4,6-dinitro-o-cresol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		609-020-00-X	208-601-1	534-52-1							
111		azobenzene				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		611-001-00-6	203-102-5	103-33-3							
112	●	4-bromophenylphenylether				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			202-952-4	101-55-3							
113		pentachlorophenol				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		604-002-00-8	201-778-6	87-86-5							
114	●	carbazole				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			201-696-0	86-74-8							
115		dibutyl phthalate; DBP				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		607-318-00-4	201-557-4	84-74-2							
116		BBP; benzyl butyl phthalate				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		607-430-00-3	201-622-7	85-68-7							
117		bis(2-ethylhexyl) phthalate; di-(2-ethylhexyl) phthalate; DEHP				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
		607-317-00-9	204-211-0	117-81-7							
118	●	di-n-octyl phthalate				<0.5 mg/kg		<0.5 mg/kg	<0.00005 %		<LOD
			204-214-7	117-84-0							
119		resorcinol; 1,3-benzenediol				<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
		604-010-00-1	203-585-2	108-46-3							
120		m-cresol; [1] o-cresol; [2] p-cresol; [3] mix-cresol [4]				<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
		604-004-00-9	203-577-9 [1] 202-423-8 [2] 203-398-6 [3] 215-293-2 [4]	108-39-4 [1] 95-48-7 [2] 106-44-5 [3] 1319-77-3 [4]							

APPENDIX C
Soil Contaminant Screening

GQRA RFATR P 3, 4 & 5 04/07/2023

	POS park S4UL	No samples	No Exceeding S4UL	Sample Mean
Arsenic	170	116	0	14.2
Beryllium	63	116	0	1.0
Boron	46000	116	0	0.6
Cadmium	532	116	0	0.5
Chromium (III)	33000	116	0	13.5
Chromium (VI)	220	116	0	0.5
Copper	44000	116	0	70.6
Lead (C4SL)	1300	116	1	89.5
Nickel	3400	116	0	30.3
Selenium	1800	116	0	1.0
Vanadium	5000	116	0	20.7
Zinc	170000	116	0	82.9
Aliphatic EC 5-6	95000	116	0	0.0
Aliphatic EC >6-8	150000	116	0	0.1
Aliphatic EC >8-10	14000	116	0	0.1
Aliphatic EC >10-12	21000	116	0	2.5
Aliphatic EC >12-16	25000	116	0	2.6
Aliphatic EC >16-35	450000	116	0	9.1
Aliphatic EC >35-44	450000	116	0	10.0
Aromatic EC 5-7	76000	116	0	0.1
Aromatic EC >7-8	87000	116	0	0.0
Aromatic EC >8-10	7200	116	0	0.0
Aromatic EC >10-12	9200	116	0	7.5
Aromatic EC >12-16	10000	116	0	7.8
Aromatic EC >16-21	7600	116	0	16.5
Aromatic EC >21-35	7800	116	0	21.9
Aromatic EC >35-44	7800	116	0	6.1
Acenaphthene	29000	116	0	0.3
Acenaphthylene	29000	116	0	0.2
Anthracene	150000	116	0	0.4
Benzo[a]anthracene	49	116	0	1.1
Benzo[a]pyrene	11	116	1	0.9
Benzo[b]fluoranthene	13	116	3	1.5
Benzo[ghi]perylene	1400	116	0	0.6
Benzo [k]fluoranthene	370	116	0	0.6
Chrysene	93	116	0	1.8
Dibenz[ah]anthracene	1.1	116	4	0.3
Floranthene	6300	116	0	1.9
Fluorene	20000	116	0	0.3
Indenol[123-cd]pyrene	150	116	0	0.5
Naphthalene	1200	116	0	0.7
Phenanthrene	6200	116	0	1.4
Pyrene	15000	116	0	1.8
Phenol	440	116	0	0.5

APPENDIX D
Leachate Screening

Rhondda Fach Active Travel Route
04/07/2023

Determinand	Type	Units	LOD	DWS	EQS	Min	Max	Avg.	Sample Location:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
									Sample Description:	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.	BGS.
									Sample Type:	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
									Top Depth (m):	1.00	0.80	0.80	0.80	1.00	0.90	0.60	1.00	1.00	0.60	1.00	0.60	0.60	0.60	0.90	0.8	3.00	0.80	0.80	0.80	0.80	0.80	1.00	0.80	0.80	0.80	0.80	0.80	0.80	1.3	3.2	0.5	0.8	0.9	0.8	0.9	0.80	0.90	0.8	0.80	0.80
									Date Sampled:	25-Feb-2023	25-Feb-2023	25-Feb-2023	27-Feb-2023	27-Feb-2023	23-Feb-2023	23-Feb-2023	27-Feb-2023	28-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	24-Feb-2023	27-Feb-2023	27-Feb-2023	27-Feb-2023	27-Feb-2023	27-Feb-2023	27-Feb-2023	01-Mar-2023	01-Mar-2023	01-Mar-2023	02-Mar-2023	02-Mar-2023	02-Mar-2023	02-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023	06-Mar-2023
General																																															
pH	10:1		N/A	5.5-9.5	-	4.1	9.2	7.81	8.6	9.2	8.4	4.1	9.2	8.4	8.3	7.5	6.7	7.9	8.6	8.6	7.4	7.4	7.2	8.3	7.9	7.8	7.2	8	8.3	7.1	7.6	8.6	8.4	8.2	7.7	6	8.5	9	7.9	7.7	7.7	8.4	8.4	8.3	8.1	8.4
Sulphate	10:1	mg/l	1	250	400	1	11	2.79	1.4	1	1.8	1	1	1.5	4.8	2.3	1	13	7.3	1.2	1.3	3.8	2.6	1.3	1	1	6.3	1	2.6	1	2	3.7	1.2	1.2	6.5	1.3	1.3	1	1	1	2.8	1	1	1	22	46
Cyanide (Total)	10:1	mg/l	0.05	0.05	1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Calcium	10:1	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness	10:1	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon Low Level	10:1	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																																														
Aluminium (Dissolved)	10:1	µg/l	5	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Dissolved)	10:1	µg/l	0.2	10	50	0.2	4.8	1.02	0.57	0.61	0.83	1.3	0.21	0.2	0.2	1.7	0.39	0.2	1.8	1.9	0.56	0.53	0.2	1.3	4.8	0.76	1.7	1.2	0.79	0.37	0.38	0.27	0.23	0.82	0.52	0.22	0.52	0.42	0.2	1.3	0.2	0.6	10	1.4	1.2	5.5
Boron (Dissolved)	10:1	µg/l	10	1000	2000	10	1000	10.00	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	340	340	330	20	260	260	1000	770	480	10	10	10	10	10	15	10	10	10	10	10	23
Cadmium (Dissolved)	10:1	µg/l	0.11	5	0.08	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Copper (Dissolved)	10:1	µg/l	0.5	2000	1?	0.5	1.55	0.79	0.5	0.5	0.67	0.5	0.5	0.5	6.5	0.87	0.89	0.68	0.5	0.5	0.86	0.75	0.91	0.5	0.73	0.5	0.5	0.5	0.5	0.5	0.88	0.83	0.66	0.94	0.96	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	8.4
Mercury (Dissolved)	10:1	µg/l	0.05	1	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese (Dissolved)	10:1	µg/l	-	50	123*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Dissolved)	10:1	µg/l	0.5	20	4*	0.5	2.2	0.80	0.5	0.9	0.5	1.7	0.5	0.72	0.5	0.6	0.5	1.8	0.5	0.5	0.56	1.1	0.5	0.77	1.3	1.1	2.2	0.64	0.5	0.83	0.5	0.5	0.5	0.5	1.1	0.5	1.3	0.5	0.5	0.5	0.5	0.5	0.80	2.6	1.3	0.64
Lead (Dissolved)	10:1	µg/l	0.5	1	1.2?	0.5	0.92	0.5	0.5	0.5	0.5	0.5	0.5	0.99	0.5	0.66	0.5	0.74	0.5	0.5	0.63	2.6	0.5	1.1	0.92	0.52	0.5	0.5	0.63	0.5	0.5	0.5	0.5	0.5	0.55	0.5	0.5	0.5	0.5	0.52	0.5	0.5	0.5	0.67	0.5
Antimony (Dissolved)	10:1	µg/l	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Dissolved)	10:1	µg/l	0.5	10	-	0.5	4	1.35	0.5	0.5	0.5	0.5	0.5	2.8	2.3	0.5	0.5	4	1	2	1.9	1	1.8	0.76	0.87	0.5	0.5	0.76	0.85	0.5	0.79	1.2	1.3	1.3	0.85	0.5	1.2	0.5	0.63	1.5	0.71	0.56	1	0.6	1	1.8
Zinc (Dissolved)	10:1	µg/l	2.5	5	10.9*	2.5	8.6	3.32	2.5	3.6	2.7	8.6	2.5	3.2	3.1	2.5	2.5	3.8	2.5	2.5	5.5	4.4	2.5	2.5	2.5	6.1	2.9	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.2	7.9	2.5	6.7	2.5	2.5	3.9	2.5	7.4	9.8	8.6	5.3	2.5
Chromium (Total)	10:1	µg/l	0.5	50	4.7	0.5	4.1	0.77	0.5	0.5	0.5	0.56	0.5	0.5	0.82	4.1	0.5	0.5	0.5	0.5	0.53	0.5	1	0.5	0.5	0.5	0.56	0.5	2.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.66	0.65	2.8
Iron (Dissolved)	10:1	µg/l	-	200	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons																																														
Total Petroleum Hydrocarbons	10:1	µg/l	10	-	-	10	1100	105.88	10	10	10	10	1100	10	550	30	30	30	10	10	10	10	10	10	10	10	10	390	10	30	30	10	10	10	10	10	10	10	230	10	10	10	10	10	10	10	10
Polycyclic Aromatic Hydrocarbons																																														
Acenaphthene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Acenaphthylene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Anthracene	10:1	µg/l	0.1	-	0.1	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benzo[a]anthracene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benzo[a]pyrene	10:1	µg/l	0.1	0.01	0.27	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benzo[b]fluoranthene	10:1	µg/l	0.1	-	0.00017	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benzo[g,h,i]perylene	10:1	µg/l	0.1	-	0.00017	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benzo[k]fluoranthene	10:1	µg/l	0.1	-	0.00017	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chrysene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dibenz(a,h)Anthracene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fluoranthene	10:1	µg/l	0.1	-	0.0063	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fluorene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Indeno(1,2,3-c,d)Pyrene	10:1	µg/l	0.1	-	0.00017	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Naphthalene	10:1	µg/l	0.1	-	2	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Phenanthrene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pyrene	10:1	µg/l	0.1	-	-	0.1	0.1	0.10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Of 16 PAH's	10:1	µg/l	2	-	-	2	2	2.00	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	11	2	2	2	2	2	2	2	2	2
Phenols																																														
Total Phenols	10:1	mg/l	0.03	-	-	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

*bioavailable concentration

Fails against an EQS that represents bioavailable concentration
Fails against DWS
Fails against EQS
Fails both EQS and DWS

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