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Project

**Land to the Rear 22-34, Goldney Avenue, Warmley, Bristol, BS30 5JG
Phase II Geoenvironmental Assessment Report**

Client:

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Land to the Rear 22-34, Goldney Avenue, Warmley, Bristol, BS30 5JG Phase II Geoenvironmental Assessment Report

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EXECUTIVE SUMMARY

SITE INFORMATION & SETTING	
Report Purpose	This report, Phase II Geoenvironmental Assessment, has been established following the completion of the various Phase I Geoenvironmental Assessment report completed by Obsidian Environmental Ltd.
Client	This report has been provided for M & A Commercials (Bristol) Limited, 30-31 St James Place, Mangotsfield, Bristol, BS16 9JB.
Site Name & Location	Land to the Rear of 22 to 34, Goldney Avenue, Warmley, South Gloucestershire, BS30 5JG.
Proposed Development	The proposed residential development is for six two-storey dwellings, as per Planning Permission – P19/18713/F .

PHASE I SUMMARY REVIEW	
Historical setting of the site	Early maps provided by Groundsure (see Phase I Report – Ref: OE/1702/1058/R1, dated January 2024), show site development as general disturbed ground presumed from former mining activities. It should be noted that the known mine entry never appeared on the historical maps. The initial area, detailed on the earliest historical map (1882), through to the 1960s is an undeveloped area of land. On the 1963 to 1966 map small sheds/garages are noted on the northern area of the site. They are then removed by 1986 and three rows of pcc units is shown for the first time. The three rows remained until circa 2019 when one row was demolished (central section) to allow the original mine entry to be exposed.
Geoenvironmental conditions	From the Phase I Assessment there is <1% of homes locally that have radon ground gas issues, and for a new residential developments radon gas mitigation measures are not required.
Coal Authority	<p>A Coal Mining Report was issued from the Coal Authority, Ref: 51001959235001 (2019), with a further report commissioned from Bristol Coal Mining Archives Limited, dated 20 February 2019 (Ref: 55373).</p> <p>There have been five coal seams worked beneath the site between 1870 and 1880, at depths between 153 and 235m below ground level. There is a perceived significant risk of unrecorded shallow mining beneath the site.</p> <p>There is a former mine entry at the site, that has been exposed, following a Permit application to the Coal Authority. The mine entry has yet to receive a new cap.</p> <p>An application was made for a Permit from the Coal Authority (Ref: 17858, dated 22 March 2019) for the investigation of the location of the mine entry. The mine shaft/adit was exposed following the demolition of the middle row of original pcc garages at the site – see Figure OE/1702/938/LR1/F101 – Proposed Location of New Cap. The design details of the proposed cap, designed by Rise Structural Engineers, has previously been agreed with the Coal Authority, under Permit 17858. The cap has yet to be constructed.</p> <p>A second Permit (27952, dated 12 February 2024) has been granted for a shallow mining site investigation using open hole rotary boreholes to circa 30.0 to 35.0m bgl at three locations. The proposed works will be completed in March 2024, and reported within an addendum report (R4) to the Coal Authority and the Local Authority.</p>

PHASE II GEOENVIRONMENTAL ASSESSMENT PHASE I AREA	
PHASE II GROUND INVESTIGATION	
Obsidian Ground Investigation	Six Window Sample holes (WS1 to WS6 inclusive) were drilled across the site; with three boreholes installed with ground gas and groundwater monitoring points. SPTs were completed at various depths within each borehole. The window sample holes were drilled after the commencement of the demolition works of the centre section of the garages.

		Three rotary open holes are to be drilled to intercept shallow mining conditions if present on the site to 30.0 to 35.0m bgl – scheduled March 2024.
Geology & Ground Conditions Encountered		<p>The geology of the site is shown on the 1:50,000 scale British Geological Survey map, obtained and interpreted by Groundsure. This indicates that the Superficial deposits consist, below a veneer of Made Ground, of Alluvium described as a sequence of Clays, Sands and Gravels, above bedrock deposits of MUDSTONE and possibly SILTSTONE and SANDSTONE. The bedrock is from the Bolsovian sub-age (Diamantina) of Westphalian origins. The formation is circa 310 million years old.</p> <p>At the southern area of the site, the vegetation has been cleared and there is a veneer of Topsoil, black silty, sandy clay, of 0.1 to 0.15m thickness. Below this is a dark brown clay matrix and rock fill (northern area, with crushed brick and concrete inclusions – angular gravel to a maximum of 0.9m depth. Natural slightly sandy light brown/orange CLAY - The upper levels commence as soft to firm deposits but become stiff and very stiff with depth, generally below 2.0m bgl.</p> <p>At Window Sample borehole WS6 a band of Mudstone Gravel was intercepted, at 3.0 to 3.5m bgl. It was not noted in any of the other boreholes.</p> <p>Two general Coal seams deposits were intercepted, with the Coal found at 2.8 to 3.0m (WS3, WS5 and WS6) and 4.4 to 4.9m bgl (WS3). All deposits were unworked and the Coal intact at all locations.</p> <p>The initial very weathered MUDSTONE deposits were presented as CLAY.</p> <p>Weathered MUDSTONE bedrock - The Window Sample boreholes all terminated on very weak MUDSTONE – refusal. SPTs were completed at this point of refusal and N values of 50+ were recorded.</p> <p>Atterberg Tests have been completed on two samples of the Natural CLAYS where the proposed foundations will be excavated. The samples were defined as having a low potential for shrinkage/swelling characteristics and as such do not require any mitigation.</p>
Groundwater Encountered		Groundwater/water strikes was not intercepted within any of the window sample boreholes.
Ground Installations	Gas	Three of the Window Sample boreholes (WS1, WS3 and WS6) were installed with ground gas and groundwater monitoring points. Ground gas monitoring – a minimum of four rounds is proposed, with at least one measurement on a falling pressure when Atmospheric Pressure (AP) is at or below 1000mbars. The results of the ground gas measurements and assessment will be issued as an addendum to this Phase II report.

PHASE III GEO-ENVIRONMENTAL ASSESSMENT & CONCLUSIONS		
Conclusions of Contamination Assessment	Generic Risk Assessment	<p>Assessment of Results – Heavy Metals - There were two samples where there are elevated levels of heavy metals (cadmium, lead, and zinc), when reviewed against the maximum allowable levels for Residential with plant uptake.</p> <p>Assessment of results - Speciated Petroleum Hydrocarbons (TPH) –There were speciated results for carbon banding above the maximum allowable levels for Residential with plant uptake.</p> <p>Assessment of results – Speciated Polycyclic Aromatic Hydrocarbons (PAH) - There were speciated results for PAH above the maximum allowable levels for Residential with plant uptake.</p> <p>Asbestos screen – All samples were tested for the presence of Asbestos. Sample WS2 at 0.5m bgl was found to contain Chrysotile fibres (cement bonded asbestos). A value of <0.001 was not exceeded.</p>
Guidance on Ground Gas Protection		From a single round (R1) of the ground gas measurements at the site methane and carbon dioxide were very low, with low flows, when atmospheric pressure was 1015mbars. Currently, gas mitigation measures have yet to be determined.
Proposed Mitigation Measures		Based on the results from the initial round of ground gas monitoring, radon gas and ground gas mitigation measures are not required for new structures at the site.

PHASE II GEOTECHNICAL CONCLUSIONS	
Obstructions	There were no obstructions noted during the Phase II window sample borehole works.
Groundworks & Earthworks	<p>Excavations to 3.0m depth should be suitable with conventional soil excavating machinery, although pneumatic tools are likely to be required to break out existing foundations and masonry obstructions if present.</p> <p>Spoil resulting from excavations in the Made Ground and natural CLAYS will not be suitable for reuse as structural fill and is likely to have to be relocated/recovered or disposed off-site at a suitable licensed landfill.</p> <p>It is unlikely that shallow excavations will encounter groundwater.</p>
Foundations	Traditional strip footing/trench foundations are considered appropriate. Bearing directly onto the stiff CLAY at circa 2.0 to 2.5m bgl.
Ground Floor Slabs	All ground floor slabs should be suspended with a suitable void constructed beneath.

SUDS - Soakaways	In-situ percolation tests were not completed at the site due to the nature and competency of the Made Ground and Natural CLAY soils. Hence, a SUDs solution of soakaways directly constructed within the ground are not an option. Other solutions should be explored.
Buried Concrete	There does not appear to be any special requirements for concrete below ground foundations. within onsite soils – as per an assessment with BRE Special Digest 1. The soils across the site, including the existing Made Ground, have a Design Sulphate Class of DS1 and an ACEC class of AC-1 as outlined in <i>BRE Special Digest 1:2005</i> .
Waste Management	Any excavated Made Ground soils removed from the site should be designated as waste and relocated to a soil recycling centre or within a licensed landfill. Copies of all Duty of Care Consignment Notes should be collated within the Site File in accordance with the CDM Regulations 2015.
Invasive Species	Invasive species such as Japanese Knotweed (JKW) and Himalayan Balsam were not noted during a site inspection during the Phase II Assessment Works. However, there were a number of stands of Buddleia, which should be carefully removed off site for disposal. A further inspection for the presence of invasive weeds should be undertaken in the spring in the start of the growing season.
Influence of Trees – Desiccation of Clays	There were no semi-mature or mature trees on the site prior to the demolition/site clearance works.

REMEDIAL STRATEGY	
Remedial Strategy	<p>Detailed below is a list of Remedial requirements to deliver the site for the commencement of the construction works for the new houses.</p> <p>RS.1 The agreed shallow mining assessment to be completed and the results forwarded to the Coal Authority, and a copy to the South Gloucestershire Council Planning Department – (scheduled March 2024).</p> <p>RS.2 The stockpiles of concrete on site should be sampled and tested for potential contamination by asbestos fibres before removal off site.</p> <p>RS.3 The existing asbestos cladding to the remaining block of garages should be carefully removed by a licensed asbestos contractor and removed off site to a licensed landfill.</p> <p>RS.4 Elevated heavy metals were found at WS4 (0.45m bgl) and WS5 (0.4m bgl). The two areas should be treated as Hot Spots and the Made Ground removed at those locations to an off-site recovery facility. Samples should be taken at the base and sides of the excavations for chemical testing. The holes should be infilled with clean imported suitable soils. Additional sampling from trial pits in the area around each Hot Spot should also be completed as part of the Validation of the Hot Spots.</p> <p>RS.5 The Ground gas measurements to continue in order to establish the gas regime at the site, and if required, suitable gas mitigation measures be designed and incorporated within the ground floor slabs at all new houses.</p> <p>RS.6 The existing garage bases and sides should be carefully removed off the site, following the removal of the asbestos clad rooves, for crushing and screening off site for reuse.</p> <p>RS.7 The agreed reinforced concrete cap should be constructed as soon as possible.</p> <p>RS.8 A Verification/Validation report of the proposed Remedial Strategy Items listed above should be completed and forwarded to the Local Authority Planning Department/Contaminated Land Officer for review and agreement.</p>

FUTURE CONSIDERATIONS	
Uncertainties & Limitations	Obsidian Environmental Ltd (Obsidian) has prepared this report in accordance with the instruction from M & A Commercial (Bristol) Limited. Obsidian shall not be responsible for any use of this report or its contents for any other purpose other than that for which it was prepared and provided.
Further Works	<p>The shallow mining investigation to be completed in March 2024, and reported with an addendum report (Ref: OE/1702/1058/R4).</p> <p>Ground gas assessment to be completed as an addendum report, (Ref: OE/1702/1058/R3). Verification and Validation reports will be required as part of the proposed Remedial Strategy, to allow full discharge of the associated geo-environmental planning Conditions.</p>

1.0 INTRODUCTION

1.1 Instruction

Obsidian Environmental Ltd (The Foundry Business Centre, Marcus Street, Birkenhead, Wirral, CH41 1EU) was commissioned by Mr Mark Chapman, joint landowner and Director of M & A Commercials (Bristol) Limited (30-31 St James Place, Mangotsfield, Bristol, BS16 9JB), to undertake a Phase II Geoenvironmental Assessment on a site known as – Land to the Rear of 22-34 Goldney Avenue, Warmley, South Gloucestershire, BS30 5JG, on 15 November 2023.

1.2 Scope of Works

The objectives of the investigation were to determine the sub-surface conditions in respect of:

- Foundations for proposed structures.
- Design guidance for access road and car park construction.
- Foundations for boundary retaining walls.
- Contamination assessment to consider potential significant pollutant linkages arising from the historic site use.
- Gas monitoring to consider risk of gas migration from the Made Ground and potential shallow mines..
- Shallow coal mining investigation/assessment

1.3 Limitations

All information, comments and opinions given in this report are based on the ground conditions encountered during the site work and on the results of laboratory and field tests performed during the investigation. However, subsoils are inherently variable and hidden from view such that no investigation can be exhaustive to the extent that all soil conditions are revealed. Conditions may therefore be present beneath the site that were not apparent in the data reviewed as part of this assessment. In particular, it should be noted that groundwater levels vary due to seasonal and other effects and may at times differ to those measured during the investigation.

2.0 PHASE 1 REVIEW

2.1 Introduction

A Phase I Geoenvironmental Assessment of the site prior to the commencement of the intrusive site investigation, works was completed by Obsidian Environmental Ltd and is reported below::

Phase I Geoenvironmental Assessment
Ref: OE/1702/1058/R1, dated January 2024.

The main aspects establish during the Desk Study are summarised below.

2.2 Site Location and Description

The site is located within 5km of the centre of the City of Bristol, at approximate National Grid Reference 367296E, 173274N. A site location plan is presented as OE/1702/938/R1/F01. It is regular in shape, a rectangle, with a slight tapering at the southern end, and covers an area of approximately 0.17ha (0.42 acres)..

In the northern area of the site there remains two of three original rows of pcc garage units. The central row has been demolished. The southern area to the south, that shares a boundary wall with the local church and grave yard has been cleared of vegetation. The site is bound to the north and an industrial/commercial operation, to the east by residential properties – rear of 22-34 Goldney Avenue, to the south by the church yard, and to the west by ancient woodland.

Previously, circa 2019, one length of the original garages was carefully demolished to allow the ground floor slabs to be excavated. This was to expose a known former coal mine entry (shaft/adit) on the site. A Permit from the Coal Authority was obtained to allow an intrusive investigation in the location of the mine entry, as it was marked beneath the garage bases – see Section 2.6 for further details. The adit remains uncapped.

2.3 Geology

The geology of the site is shown on the 1:50,000 scale British Geological Survey map, obtained and interpreted by Groundsure.

This indicates that the Superficial deposits consist, below a veneer of Made Ground, thence Alluvium described as a sequence of Clays, Sands and Gravels, above bedrock deposits of MUDSTONE and possibly SILTSTONE and SANDSTONE. The bedrock is from the Bolsopian sub-age (Diamantina) of Westphalian origins. The formation is circa 310 million years old.

The BGS website provided details from a borehole 133m from the site at former working colliery. It defines 0.6m below ground level (bgl), thickness of Made Ground – Topsoil - overlying 0.6 to 5.4m bgl of CLAY, which in turn overlies MUDSTONE bedrock confirmed to 6.1m bgl.

2.4 Hydrology and Hydrogeology

Surface water features in the vicinity of the site include at 164m Siston Brook as the only near surface water feature. Due to the proximity the potential risk to this receptor is deemed to be low.

Guidance from the Environment Agency indicates that the site area does not have an Agency Aquifer designation for the Superficial deposits. This is due to the Alluvial soils being probably Clay type materials. At 195m from the site the Superficial deposits are defined as Secondary A - Permeable layers capable of supporting water supplies at a local rather than strategic scale, and

in some cases, forming an important source of base flow to rivers. These are generally, aquifers formerly classified as minor aquifers.

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The bedrock deposits have been designated as Secondary A – Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Groundwater vulnerability at the site is defined under the following Summary Classification: Secondary bedrock aquifer - Medium Vulnerability - Combined classification: Productive Bedrock Aquifer, No Superficial Aquifer.

2.5 Site History

Early maps provided by Groundsure (see Phase I Report – Ref: OE/1702/1058/R1, dated January 2024, show site development as general disturbed ground presumed from former mining activities. It should be noted that the known mine entry never appeared on the historical maps. The initial area was simply open land detailed on the earliest historical map (1882), through to the 1960s. On the 1963 to 1966 map small sheds/garages are noted on the northern area of the site. They are then removed by 1986 and three rows of pcc units is shown for the first time. The current three rows remained until circa 2019 when one row was demolished (central section) to allow the original mine entry to be exposed.

2.6 Coal Mining

A Coal Mining Report was commissioned from the Coal Authority, Ref: 51001959235001 (2019), with a further report commissioned from Bristol Coal Mining Archives Limited, dated 20 February 2019 (Ref: 55373).

There have been five coal seams worked beneath the site between 1870 and 1880, at depths between 153 and 235m below ground level. There is a perceived significant risk of unrecorded shallow mining beneath the site.

An application for a Permit from the Coal Authority (Ref: 17858, dated 22 March 2019) for the investigation of the location of the mine entry. The mine adit was exposed following the demolition of the middle row of original pcc garages at the site – see Figure OE/1702/938/LR/F101 – Proposed Location of New Cap. The design details of the proposed cap, designed by Rise Structural Engineers has previously been agreed with the Coal Authority, under Permit 17858. The cap has yet to be constructed.

A second Permit (27952, dated 12 February 2024) has been granted for a shallow mining site investigation using open hole rotary boreholes to circa 30.0 to 35.0m bgl at three locations. The proposed works will be completed in March 2024, and reported within an addendum report to the Coal Authority.

3,0 SITE INVESTIGATION

3.1 General

An intrusive site investigation, using window samples boreholes, and in-situ Standard Penetration Testing (SPT) was carried out on 15 December 2023. A plan showing the exploratory hole locations is presented as OE/1702/1058/R2/F01.

3.2 Window Sampling

Six window samples, designated WS1 to WS6 inclusive, were advanced to depths between 3.0 and 5.0m below ground level (bgl) using a tracked Terrier Drilling rig.

The window samples retrieved continuous soil samples from the hole which were logged by an onsite engineer. In addition, SPT tests were taken at regular intervals to give an indication of the strength profile of the underlying strata, typically every 1.0m. Representative samples were taken for geotechnical and chemical analysis.

On completion the three holes (WS2, WS3 and WS5) were backfilled with drilling arisings/cement bentonite grout. The three remaining window sample holes (WS1, WS4 and WS6) were fitted with gas and groundwater monitoring standpipes. The standpipes comprised 50mm diameter UPVC riser pipe with screw connectors. The lower part is slotted to allow the free ingress of water and gas. The annulus between the riser pipe and the borehole wall was filled with pea gravel. The remaining annulus was filled with a cement bentonite grout and a lockable stopcock cover was installed at ground level.

A Photofile of the extracted soil cores is collated within Appendix A.

Detailed borehole log sheets of the window samples are collated in Appendix B.

3.3 Rotary Percussive Drilling

It is proposed to use open hole rotary percussive boreholes methodology to assess the site for the potential presence of unknown shallow mining beneath the site.

The Coal Authority have granted a Permit (27352) to allow an intrusive site investigation, comprising three rotary boreholes, designated RBH1, RBH2 and RBH3 inclusive, to circa 30.0 to 35.0m bgl. The proposed works are scheduled for March 2024.

The results of the intrusive shallow mining assessment will be reported in an addendum report, (Ref: OE/1702/1058/R3).

3.4 Sample Collection and Analysis

Environmental sample collection was carried out in accordance with Obsidian Environmental Standard Operating Procedures and BS EN ISO 22475-1:2006.

All soil samples were collected using either clean stainless steel utensils or clean disposable gloves and placed directly into clean containers provided by the laboratory. Samples obtained during the investigation were subjected to a range of geotechnical and geochemical and physical testing at appropriate UKAS accredited laboratories.

Samples were submitted for geotechnical laboratory testing to characterise the engineering properties of the soil. The following testing was scheduled:

-
- Classification tests (Atterberg Limits)
 - Moisture Content

Testing was carried out in accordance with the procedures outlined in BS EN ISO 14688-1:2002, 14688-2:2004 and 14689-1:2003. Geotechnical laboratory test data is presented in Appendix C.

Soil samples were sent for chemical analysis to Alcontrol Geochem laboratories to be analysed for:

- General indicator suite comprising arsenic, boron (water soluble), cadmium, copper, chromium, lead, mercury, nickel, selenium, zinc, total cyanide, free cyanide, phenols, , total sulphur, sulphide, total sulphur, thiocyanate.
- Speciated PAH (polycyclic Aromatic Hydrocarbons)
- Total Petroleum Hydrocarbons (TPH by GRO/EPH includes BTEX/MTBE).
- pH, acid soluble sulphate, soluble sulphate, and total sulphur content in accordance with BRE 1 Special Digest on concrete in aggressive ground conditions.
- Fraction of organic carbon.

The chemical laboratory test results are presented in Appendix D.

4.0 GROUND CONDITIONS

4.1 General

The following table (Table 4.1) provides a summary of the strata encountered and the depth to the base of each stratum in metres encountered in the exploratory holes.

Table 4.1 – Typical Strata,

Depth (m) bgl	Typical Strata
0.0-0.1/0.15	Topsoil
0.15/0.9	Made Ground
0.9/2.0/4.0	CLAY
2.0/2.8	Gravelly CLAY (MUDSTONE)
2.8/3.0 & 4.4/4.9	Coal deposits/seams
3.0/3.7	Weathered MUDSTONE presented as CLAY
3.0/5.25	Weathered MUDSTONE bedrock

Groundwater was not encountered during the investigation, however, two of the monitoring wells at WS1 and WS6 were found to contain water at 0.6 and 1.47m bgl respectively two weeks following the completion of the intrusive site investigation.

4.2 Strata Encountered

Made Ground

At the southern area of the site, the vegetation has been cleared and the area has a veneer of Topsoil, black silty, sandy clay, of 0.1 to 0.15m thickness. Below this is a dark brown clay matrix and rock fill (northern area), with crushed brick and concrete inclusions – angular gravel.

Natural slightly sandy light brown/orange CLAY

The upper levels commence as soft to firm deposits but become stiff and very stiff with depth, generally below 2.0m bgl.

Clayey GRAVEL (MUDSTONE)

At Window Sample boreholes WS6 a band of Mudstone Gravel was intercepted, at 3.0 to 3.5m bgl. It was not noted in any of the other boreholes.

Coal deposits/seams - unworked

Two general Coal seams deposits were intercepted, with the Coal found at 2.8 to 3.0m (WS3, WS5 and WS6) and 4.4 to 4.9m bgl (WS3). All deposits were unworked and the Coal intact at all locations.

Weathered MUDSTONE presented as CLAY

The initial very weathered MUDSTONE deposits presented as CLAY.

Weathered MUDSTONE bedrock

The Window Sample boreholes all terminated on very weak weathered MUDSTONE – refusal. SPTs were completed at this point of refusal and N values of 50+ were recorded.

4.3 Insitu Testing within Window Sample Boreholes

Within each window sample borehole Standard Penetration Tests (STPs) were completed every 1.0m depth progressed. The results have been tabulated in Table 4.2 below:

Table 4.2 – In-Situ Standard Penetration Test Results

Location	Depth (m bgl)	SPTs	N-Values	Strata	Comments
WS1	1.0 to 1.45	1, 1, 2, 2, 2 & 2	8	CLAY	4-8 - Soft
WS1	2.0 to 2.45	4, 5, 6, 6, 7 & 7	26	CLAY	15-30 - Stiff
WS1	3.0 to 3.45	4, 4, 4, 7, 8 & 9	30	Gravelly CLAY	15-30 - Stiff
WS1	4.15 to 4.6	8, 10, 11, 12, 14 & 50/25 blows	50+	Weathered MUDSTONE	0-80 – Vey weak rock
WS2	1.0 to 1.45	1, 2, 2, 1, 2 & 3	8	CLAY	4-8 - Soft
WS2	2.0 to 2.45	3, 4, 5, 5, 5 & 6	21	CLAY	15-30 - Stiff
WS2	3.0 to 3.45	5, 3, 4, 5, 6 & 6	21	CLAY	15-30 - Stiff
WS2	4.0 to 4.45	5, 6, 7, 7, 7 & 8	29	CLAY	15-30 - Stiff
WS2	4.8 to 5.25	10, 12, 13, 13, 14 & 10/20 blows	50+	Weathered MUDSTONE	0-80 – Vey weak rock
WS3	1.0 to 1.45	1, 1, 2, 4, 4, & 4	14	CLAY	8-15 - Firm
WS3	2.0 to 2.45	3, 4, 4, 6, 6 & 7	23	CLAY	15-30 - Stiff
WS3	3.0 to 3.45	5, 5, 6, 7, 7 & 8	28	Weathered MUDSTONE	0-80 – Vey weak rock
WS3	4.0 to 4.45	6, 6, 6, 7, 8 & 8	30	Weathered MUDSTONE	0-80 – Vey weak rock
WS3	5.0 to 5.45	5, 7, 9, 8, 11, & 13	41	Weathered MUDSTONE	0-80 – Vey weak rock
WS4	1.0 to 1.45	1, 2, 3, 4, 4 & 4	15	CLAY	8-15 - Firm
WS4	2.0 to 2.45	5, 6, 5, 6, 5 & 5	21	CLAY	15-30 - Stiff
WS4	2.9 to 3.35	10, 13, 14, 20 & 20/20 blows	50+	Weathered MUDSTONE	0-80 – Vey weak rock
WS5	1.0 to 1.45	2, 4, 4, 3, 4 & 4	15	CLAY	8-15 - Firm
WS5	2.0 to 2.45	4, 5, 4, 4, 4 & 5	17	Weathered MUDSTONE	0-80 – Vey weak rock
WS5	3.0 to 3.45	6, 6, 7, 9, 12 & 22/40 bows	50+	Weathered MUDSTONE	0-80 – Vey weak rock
WS6	1.0 to 1.45	1, 3, 3, 4, 4 & 5	16	CLAY	15-30 - Stiff
WS6	2.0 to 2.45	3, 3, 4, 5, 6 & 5	20	CLAY	15-30 - Stiff
WS6	3.0 to 3.45	4, 6, 6, 8, 9 & 11	34	Weathered MUDSTONE GRAVEL	0-80 – Vey weak rock
WS6	3.9 to 4.35	8, 9, 12, 16 & 22/50 blows	50+	Weathered MUDSTONE	0-80 – Vey weak rock

5.0 GEOTECHNICAL ASSESSMENT

5.1 Introduction

It is understood that the proposed development comprises six new residential properties. Detailed below are considerations of the geotechnical aspects of the proposed development.

5.2 Earthworks

Any areas of particularly poor quality, i.e. wet, soft, loose etc, should be removed from beneath all proposed building and hardstanding areas, and the deficit made good with suitable compacted granular fill to an engineering specification. Excavations to 2.0 to 3.0m depth should be suitable with conventional soil excavating machinery, although pneumatic tools are likely to be required to break out existing foundations and masonry obstructions.

Spoil resulting from excavations in the Made Ground and CLAYs will not generally be suitable for reuse as structural fill and is likely to have to be disposed of at a suitable licensed recovery facility off site.

It is likely that shallow excavations will encounter groundwater. Should this happen excavations can be kept dry by pumping from a conveniently located sump to a nearby sewer. If this is required, a temporary discharge licence will be required from the water authority.

Temporary excavations in the Made Ground may not stand unsupported in the short term at gradients of 1 in 2 and therefore may require shoring. The presence of groundwater will increase pit side instability. Excavations below approximately 1m depth will require sheeting and shoring for personnel to enter safely.

5.3 Foundation Design

Taking account of the strata revealed by this investigation it is recommended that traditional strip, footing and/or deep trench fill is adopted for the proposed development. Bearing directly on the stiff to very stiff CLAY at circa 2.0 to 2.5m bgl – see Table 4.2 above for classification of stratum.

At the intensities of loading given above, total settlements should not exceed 25mm with differential settlements between adjacent pad footings of approximately half this value. The above values are based on a fresh cut formation for foundation level. If the formation is left exposed to the weather for a period of time further excavation will be required until material to the strength in the table above is exposed.

All foundation formations should be inspected and approved by a suitably qualified geotechnical engineer. Any 'soft' spots where exposed should be excavated and replaced with suitably compacted engineering fill.

Atterberg Tests have been completed on two samples of the Natural CLAYs where the proposed foundations will be located. The samples were defined as having a low potential for shrinkage/swelling characteristics and as such do not require any mitigation. A copy of the geotechnical test results has been collated with Appendix C.

5.4 Floor Slabs

The use of suspended floor slabs is recommended so that a void can be constructed beneath if ground gas mitigation measures are required – to be reviewed in Addendum report – Ground Gas Monitoring (Ref: OE/1702/1058/R3). The formation should be inspected and approved; any

'soft' spots should be excavated and replaced with suitably compacted engineering fill. The formation should be proof rolled as appropriate.

5.5 Roads and Pavements

For pavements, parking, and hardstanding areas, based on the current and previous investigations, a general design CBR of 2% can be assumed. Further testing carried out when formation level has been reached may increase the design CBR. Incorporation of a geogrid at the base of the capping would reduce the required thickness of capping and therefore reduce the volume of imported engineering fill.

The formation will degrade on exposure to wet weather and therefore it should be covered as soon as possible following exposure with 150mm of compact granular fill.

5.6 Drainage

Soakage testing has not been carried out as part of this investigation. The results of the Window Sampling intrusive site investigation confirm that the site is underlain by predominantly CLAY over MUDSTONE, and are generally impermeable, and hence, and will not provide a SUDs solution to the storm water drainage at the site. Alternative options should be explored.

5.7 BRE Sulphate Analyses

Samples were tested for sulphate suites as outlined in *BRE Special Digest 1, Concrete in Aggressive Ground:2005*, during the site investigation works carried out by CBGE.

The soils across the site, including the existing Made Ground, have a Design Sulphate Class of DS-1 and an ACEC class of AC-1 as outlined in *BRE Special Digest 1:2005*. There is no requirement for specialist concrete for foundations within the Natural soils at the site.

6.0 ENVIRONMENTAL ASSESSMENT

6.1 Analytical Results – Soils

6.1.1 Heavy Metals - The measured concentrations of contaminants have been used to assess the degree of potential soil contamination, when reviewed against the most sensitive end use, based on current guidance – **Residential with plant uptake**. The Human Health Risk Assessment Criteria adopted are collated within Appendix E.

The following table (Table 6.1) details the results for metals compared against the LQM/CIEH/S4ULs Human Health Risk Assessment. (NATHANIAL, C.P, M^CCAFFREY, C. ASHMORE, M. CHENG, Y. GILLET, A. HOOKER, and P. OGDEN, R.C., 2015. Generic Assessment Criteria for Human Health Risk Assessment. Land Quality Press. Nottingham. (ISBN 0-9547474-3-7) where available and Category 4 Screening Values and widely adopted SGV values (Soil Guideline Values) have been used for the assessment. A copy of the Chemical Assessment Criteria (soils) used in this report have been collated within Appendix F, with the Chemical Testing results collated within Appendix D.

Where individual chemical determinants were found to be elevated when reviewed against current maximum allowable levels they are denoted in red/bold.

Table 6.1 – Results of the heavy metals found within soils (based on 1% SOM)

Compound	SGV or GAC (Residential) mg/kg	WS1 A (0.3m bgl)	WS1 B (1.8m bgl)	WS2 A (0.5m bgl)	WS3 A (0.2m bgl)	WS4 A (0.45 m bgl)	WS5 A (0.4m bgl)	WS6 B (1.8m bgl)
Arsenic	20	11	5	20	13	14	19	1
Barium	1400	379	192	326	147	243	298	79
Beryllium	1.7	<0.5	1.2	0.8	0.8	1.2	1.3	0.9
Boron (ws)	290	<1.0	<1.0	<1.0	<1.0	1.7	1.4	<1.0
Cadmium	1	0.5	<0.5	1.0	0.7	1.6	1.8	<0.5
Chromium	130	8	30	11	16	21	20	15
Copper	111	4	22	38	37	62	73	23
Lead	200	27	27	123	132	214	297	19
Mercury		<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Molybdenum		<1	<1	<1	<1	<1	<1	<1
Nickel	50	7	20	16	17	27	22	29
Selenium	35	<1	<1	<1	<1	<1	<1	<1
Vanadium	210	8	38	7	24	31	31	17
Zinc	330	55	56	266	132	352	464	80

Assessment of results – Heavy Metals

As can be seen in Table 6.1 above the results show that two samples, WS4/A (0.45m bgl) and WS5/A (0.4m bgl), where the results are above the maximum allowable levels for Residential – with plant uptake. Elevated heavy metals were Cadmium, Lead and Zinc.

6.1.2 Speciated Total Petroleum Hydrocarbons

The measured concentrations of contaminants have been used to assess the degree of potential soil contamination, when reviewed against current guidance – **Residential with plant uptake**.

The following table (Table 7.2) shows the results for speciated TPH compared either against the LQM/CIEH/S4ULs Human Health Risk Assessment. (NATHANIAL, C.P, M^CCAFFREY, C. ASHMORE, M. CHENG, Y. GILLET, A. HOOKER, and P. OGDEN, R.C., 2015. Generic Assessment Criteria for Human Health Risk Assessment. Land Quality Press. Nottingham. (ISBN 0-9547474-3-7) where available and Category 4 Screening Values and widely adopted SGV values have been used for the assessment.

The results have been tabulated within Table 6.2 below:

Table 6.2 - Results of the speciated Petroleum Hydrocarbons (TPH) in soils (based on 1% SOM)

Compound	GAC (Residential) mg/kg	WS1A (0.3m bgl)	WS1B (1.8- 2.0m bgl)	WS2A (0.5m bgl)	WS3A (0.2m bgl)	WS4A (0.45m bgl)	WS5A (0.4m bgl)	WS6B (1.8m bgl)
Aliphatic								
EC 5-6	42	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EC> 6-8	100	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EC> 8-10	27	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
EC> 10-12	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
EC> 12-16	1,100	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
EC> 16-21	65,000	2	<1.0	1.0	<1.0	3	<1.0	<1.0
EC> 21-35	65,000	10	<1.0	55	6	18	8	<1.0
Total Aliphatic		20	<1.0	76	6	24	9	<1.0
Aromatic	70							
EC 5- 7(benzene)	130	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EC> 7-8 (toluene)	34	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EC>8-10	74	2	<1.0	2	<1.0	1	<1.0	<1.0
EC<10-12	140	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
EC<12-16	260	<1.0	<1.0	4	2	4	3	<1.0
EC<16-21	1,100	2	<1.0	7	6	6	5	<1.0
EC<21-35	1,100	7	<1.0	21	15	18	15	<1.0
Total Aromatics		14	<1.0	51	24	31	23	<1.0
Total Aliphatic & Aromatic		34	<1.0	127	30	55	32	<1.0

Assessment of results.

As can be seen in Table 6.2 there are no speciated TPH results above the maximum allowable levels for Residential – with plant uptake.

6.1.3 Polycyclic Aromatic Hydrocarbons (16 US EPA Speciated PAH) based on 1% SOM.

The measured concentrations of contaminants have been used to assess the degree of potential soil contamination, when reviewed against current guidance – **Residential without plant uptake.**

The following table (Table 6.3) shows the results for speciated PAH compared either against the LQM/CIEH/S4ULs Human Health Risk Assessment. (NATHANIAL, C.P, M^cCAFFREY, C. ASHMORE, M. CHENG, Y. GILLET, A. HOOKER, and P. OGDEN, R.C., 2015. Generic Assessment Criteria for Human Health Risk Assessment. Land Quality Press. Nottingham. (ISBN 0-9547474-3-7) where available and Category 4 Screening Values and widely adopted SGV values have been used for the assessment.

Table 6.3 - Results for speciated PAH in soils

Compound	GAC (Residential – with plant uptake) mg/kg	WS1 A (0.3m bgl)	WS1B (1.8- 2.0m bgl)	WS2 A (0.5m bgl)	WS3 A (0.2m bgl)	WS4 A (0.45 m bgl)	WS5 A (0.4m bgl)	WS6 A (1.8m bgl)
Acenaphthene	210	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	170	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	2400	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene	7.2	0.08	<0.04	0.06	0.08	<0.04	0.11	<0.04
Benzo(a)pyrene	1.5	0.09	<0.04	0.06	0.07	<0.04	0.09	<0.04
Benzo(b)fluoranthene	2.6	0.11	<0.05	0.1	0.12	<0.04	0.13	<0.04
Benzo(ghi)perylene	320	0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	77	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Chrysene	15	0.09	<0.06	0.08	0.12	<0.06	0.13	<0.06
Dibenzo(ah)anthracene	0.24	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Fluoranthene	280	<0.08	<0.08	0.11	0.15	<0.08	0.24	<0.08
Fluorene	170	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indenol(123-ed) pyrene	27	0.07	<0.03	0.05	0.05	<0.03	0.07	<0.03
Naphthalene	2.3	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Phenanthrene	95	<0.03	<0.03	0.06	0.1	<0.03	0.11	<0.03
Pyrene	620	0.08	<0.07	0.1	0.13	<0.07	0.19	<0.07
Total PAH		0.58	<0.08	0.62	0.82	<0.08	1.07	<0.08

Assessment of results - Speciated Polycyclic Aromatic Hydrocarbons (PAH) – As can be seen there are no elevated speciated PAH in any of the samples.

6.1.4 Other Chemical Determinants

pH – 7.43 to 8.93 – considered within neutral range (7.0 to 9.0).

Sulphate - <0.01 to 0.06gm/l – within acceptable range

Sulphur - 103 to 589mg/kg – within acceptable range.

Sulphide - <5mg/kg – at the limit of detection

Cyanide free - <1.0mg/kg – at the limit of detection

Cyanide total - <1.0mg/kg – at the limit of detection

Phenols - <0.2 - at the limit of detection

Mineral oil - <10 to 27/mg/kg - within acceptable range

Asbestos screening – Not-detected in all samples with the exception of sample WS2/A – fibres found, but stage II test confirmed as <0.001, which is acceptable.

6.2 Ground Gas Monitoring Results

One round of ground gas monitoring have been completed prior to the issue of this report:

28/12/2023 – Atmospheric Pressure – 1015mbars.

All results to be advised in an addendum report. The monitoring results are presented in Appendix F – Round R1. The maximum results to date (as detailed above) have been tabulated below in Table 6.4:

Table 6.4 – Interim Ground Gas Monitoring Results R1 – 28 December 2023

Measurement	WS1	WS4	WS6
Time	11:35	11:50	12:20
Carbon Dioxide %	2.2	7.6	0.1
Methane %	0.0	0.0	0.0
Oxygen %	20.5	17.1	22.4
Carbon Monoxide %	0.0	0.0	0.0
Balance %	77.5	77.5	77.5
Peak Flow l/hr	0.1	0.0	0.0
Steady Flow l/hr	-0.1	-0.1	-0.1
Atmospheric Pressure mbars	1015	1015	1015
Temperature	5°	5°	5°
Weather	Sunny	Sunny	Sunny
Water level (M) bgl	0.6m bgl	Dry	1.47m bgl

It should be noted that it is proposed that three rounds of ground gas monitoring are completed at the site. One round of measurements will be taken when Atmospheric Pressure will be at or below 1000mbars when ambient pressure levels are falling. This will provide a worst case for the potential design of ground gas mitigation works.

6.3 Radon

Radon Gas was reported in the Phase I Geoenvironmental Assessment as <1% of homes in the site vicinity were above the action level. Therefore, radon protection measures are not required for the construction of new dwellings or extensions at the site.

6.4 Invasive Weeds

During the site reconnaissance in December 2023, invasive species such as Japanese Knotweed (JKW) were not noted on the site. A further inspection should be undertaken in the Spring at the start of the growing season as a final check. Buddleigh stands were noted on the site and should be carefully excavated and removed from the site for disposal and/or composting at a recognised facility prior to the start of any construction works.

6.5 Former Mine Entry on the Site

In 2019, the middle line of former pcc garages at the site were demolished and part of the reinforced concrete slabs of designated units excavated and removed off site. The partial removal was to establish and expose the location of a former mine entry. The mine shaft/adit was found (circa 1.8m diameter) and the old, damaged cap removed to expose a backfilled pit – circa 0.5m below the underside of the cap. The pit was backfilled to the surface to make it safe. The backfill and original infilling has been monitored regularly to assess if the area has been any settlement of the fill within the shaft/adit – none reported.

A Permit for the Works described above had been granted by the Coal Authority (17858, dated 22 March 2019). The capping design has been agreed with the Coal Authority (5.6 x 5.6 x 0.45m – in reinforced concrete) was designed by RISE Structural Engineers – Bristol – in August 2019. It has yet to be constructed but must be prior to the construction of the houses.

7.0 FINAL CONCEPTUAL MODEL

7.1 Introduction

A Preliminary Conceptual Model was constructed as part of the Phase I Geoenvironmental Assessment for the site (Ref: OE/1702/1058/R1, dated January 2024).

The site characterisation attempts to identify potential previous and existing site sources of contamination. The conceptual model links the identified sources likely to cause significant possibility of significant harm via pathways to identified critical receptors. The conceptual model is therefore based on a number of identified source-pathway-receptor scenarios. For land to be classified as contaminated a significant pollutant linkage will need to be identified which will include each component of the conceptual model. The absence or removal of a source or interception of a pathway will 'break' the pollutant linkage.

7.2 Final Conceptual Model

The conceptual model is characterised by identification of the following:

- On-site sources, which may impact on-site receptors via plausible pathways.
- On-site source, which may impact off-site receptors via plausible pathways.
- Off-site sources, which may impact on-site receptors via plausible pathways.

The change of land use will require assessment of the new site development layout within the context of introducing new exposure pathways. The planning regime will require assessment of the site to ensure the new development will not be classed as contaminated land under the definition provided by the Part 2A of the Environment Act 1990 as defined in the Environment Protection Act 1995.

The Contaminated Land Legislative Background is presented in Appendix G.

The Final Conceptual Model is presented in Table 7.1 over leaf. The table presents the source, pathway, and receptors in tabular form. Mitigation is provided as required.

Table 7.1 Conceptual Model – Risk Assessment

Item	Sources	Potential Contaminates	Potential Risks	Pathways	Receptors	Linkage, without Mitigation	Likelihood Significant Pollutant Linkage	Mitigation
1	Leaks/spills from parking of vehicles at the site - hydrocarbons	Residual diesel, petrol fuels, lubricants, and oils.	Migration onto the site through soils beneath tarmac surfacing – front gardens to new properties.	Through Made Ground and existing drains.	Groundworkers, Utility companies, & Landscape workers. Construction workers and Residents	Yes	Low	WS2 Hot Spot removal
2	Made Ground soils at the site from historical sources – heavy metals, hydrocarbons etc.	Heavy metals and hydrocarbons	Percolation of contaminates through Made Ground soil and leaching of contaminates to groundwater	Directly through permeable Made Ground and Natural soils. Former drains and services not removed during original site clearance and any new works within the ground - foundations, and general excavations etc.	Groundworkers, Utility companies, & Landscape workers. Construction workers Residents and the general Public	Yes	Very Low	Removal of Hot Spot at WS2
3	Ground Gas & Mine Gases	Made Ground and presence of exposed shallow mining worked/voids.	Migration of gases above ground.	Local geology	New houses.	Yes	Medium	Ground & Mine gas membrane.
4	Cement bonded asbestos roof cladding to existing garages remaining on the site.	Chrysotile asbestos	Release of fibres during removal/demolition of garage blocks.	Through the air	Site workers and local residents	Yes	Medium	Removal of asbestos sheets by a licensed specialist contractor prior to construction.
5	Stockpiles of demolished pcc garages – reinforced concrete and soils.	Chrysotile asbestos	Release of fibres during removal/demolition of garage blocks.	Through the air	Site workers and local residents	Yes	Low to Medium	Sampling & testing prior to relocation of site for crushing and screening for reuse.
6	Leaks/spills from new car parking and hardstanding areas - hydrocarbons	Residual diesel, petrol fuels, lubricants, and oils.	Percolation of contaminates through soil and leaching of contaminates to groundwater	Directly through permeable Natural soils.	Groundworkers, Utility companies, & Landscape workers. Construction workers Residents and the general Public	Yes	Very Low	None required

8.0 REMEDIATION STRATEGY

8.1 Introduction

Detailed below is a review of the site conditions established from the intrusive site investigation and associated geotechnical and chemical testing of retrieved samples from the Made Ground and Natural soils at the site. Based on the findings there are remedial treatments required to allow the construction of the proposed new houses to commence.

8.2 Summary of Site Conditions

The site has a covering of Made Ground soils – Topsoil and general clay fill with imported rock fill and crushed brick and concrete fragments – up 0.9m in depth. Below this is a Natural soft to firm to stiff CLAY to depths of circa 3.0m, which in turn overlies weathered very weak MUDSTONE bedrock, proved to a maximum of 5.0m bgl. There are two discrete Coal seams at 2.8 to 3.0m (WS3, WS5 and WS6) and 4.4 to 4.9m bgl (WS3). All deposits were unworked and the Coal intact at all locations.

The northern area of the site has two rows of the original pcc garages, with asbestos clad rooves (cement bonded asbestos – chrysotile) remaining. The original central block has been removed previously. The southern area of the site has been cleared of vegetation with an exposed covering of Topsoil.

A mine entry is located on the site, which remains uncapped, although the Coal Authority has agreed the proposed structural design of the proposed new cap.

8.3 Remediation Strategy

Detailed below is a list of Remedial requirements to deliver the site for the commencement of the construction works for the new houses.

RS.1 The agreed shallow mining assessment to be completed and the results forwarded to the Coal Authority, and a copy to the South Gloucestershire Council Planning Department – (scheduled March 2024).

RS.2 The stockpiles on site should be sampled and tested for potential contamination by asbestos fibres before removal off site.

RS.3 The existing asbestos roof cladding to the remaining block of garages should be carefully removed by a licensed asbestos contractor and removed off site to a licensed landfill.

RS.4 Elevated heavy metals were found at WS4 (0.45m bgl) and WS5 (0.4m bgl). The two areas should be treated as Hot Spots and the Made Ground removed (at a radius of 2.0m) at those locations for an off-site recovery facility. Samples should be taken at the base and sides of the excavations for chemical testing. The holes should be infilled with clean imported suitable soils. Additional sampling from trial pits in the area around each Hot Spot should also be completed as part of the Validation of the Hot Spots.

RS.5 The Ground gas measurements to continue in order that the gas regime at the site is accurately established, and if required, suitable gas mitigation measures can be designed and incorporated within the ground floor slabs at all new houses.

RS.6 The existing garage bases and sides should be carefully removed off the site, following the removal of the asbestos roof cladding, for crushing and screening off site for reuse.

RS.7 The agreed reinforced concrete cap should be constructed as soon as possible.

RS.8 A Verification/Validation report or the proposed Remedial Strategy Items listed above should be completed and forwarded to the Local Authority Planning Department/Contaminated Land Officer for review and agreement.

9.0 CONCLUSIONS & RECOMMENDATIONS

9.1 Introduction

Detailed below are the Conclusions and Recommendations drawn from the intrusive site investigation (window sampling) and associated geotechnical and chemical testing and assessment.

9.2 Conclusions

- C.1 An existing mine entry has been exposed on the site and is ready to receive a new reinforced concrete cap should be constructed, previously agreed with the Coal Authority.
- C.2 The site has covering of Made Ground soils across the site, to a maximum depth of 0.9m. Excavated MG soils should not be used as engineering fill at the site.
- C.3 Underlying the MG is soft to firm to stiff Natural CLAY. At circa 2.0 to 2.5m the CLAY provides a suitable competent stratum for the construction of traditional strip footing/trench fill foundations. Excavated CLAY soils should not be used as engineering fill at the site.
- C.4 The Natural CLAY intern overlies weathered very weak MUDSTONE bedrock, proved to a maximum of 5.0m bgl. N-Values at the top of the MUDSTONE was 50+.
- C.5 There are two discrete Coal seams at 2.8 to 3.0m (WS3, WS5 and WS6) and 4.4 to 4.9m bgl (WS3). All deposits were unworked and the Coal intact at all locations.
- C.6 There are two remaining blocks of original garages remaining on the site. The roofs are clad in cement bonded asbestos (chrysotile).
- C.7 Chemical testing of on-site soils – MG and Natural Clays – have been completed, there are elevated heavy metals (cadmium, lead, and zinc) found within the Made Ground at WS4 and WS5. There does not appear to be any hydrocarbon or non-metal contamination at the site.
- C.8 Atterberg tests have been completed on the Natural CLAYs found at the site and has been defined as low potential for shrink/swelling characteristics.
- C.9 There is no requirement for specialist concrete at the site for foundations, based on the results of the BRE Special Digest 1 testing regime.
- C.10 A suspended ground floor slab should be constructed, with a void formed beneath to accommodate ground gas mitigation measures if required. Ground gas measurements continuing – to be reported in an addendum report (Ref: OE/1702/1058/R3).
- C.11 During the site reconnaissance in December 2023, invasive species such as Japanese Knotweed (JKW) were not noted on the site. A further inspection should be undertaken in the Spring at the start of the growing season as a final check. Budleigh stands were noted on the site and should be carefully excavated and removed from the site for disposal and/or composting at a recognised facility prior to the start of any construction works.

9.3 Recommendations

- R.1 The shallow mining assessments to be completed.

-
- R.2 The existing mine entry to be capped as per the agreement with the Coal Authority.
- R.3 The Remedial Strategy as detailed in Section 8.2 should be implemented.
- R.4 This report, together with the proposed Ground Gas Monitoring Report (R3), and shallow mining investigation report (R4) should be forwarded to South Gloucestershire Council Planning Department/Contaminated Land Officer for review and Discharge of current relevant Planning Conditions.

10.0 REFERENCES

10.1 Introduction

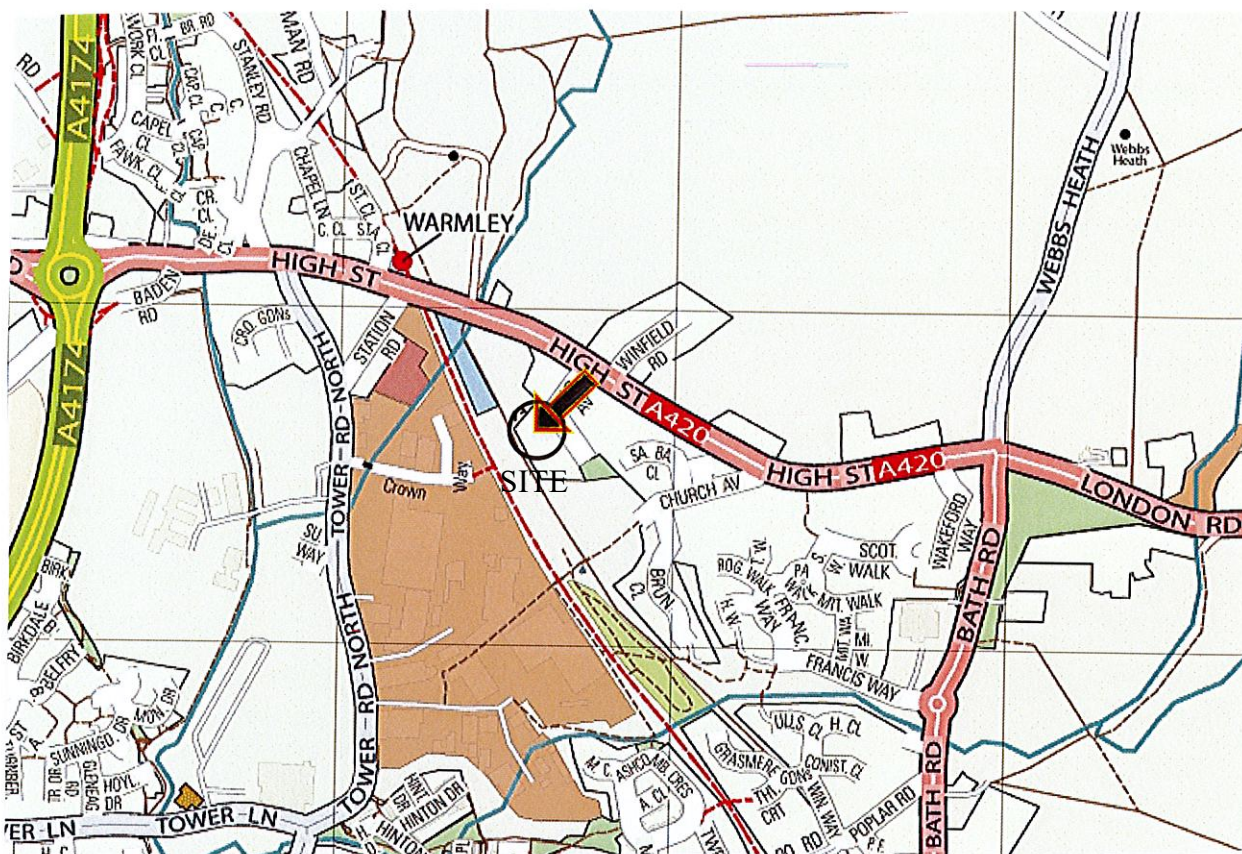
Detailed below are a list of reference documents used within this Phase II Geoenvironmental Assessment:

10.2 References

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- The LQM/CIEH S4ULs for Human Health Risk Assessment.

FIGURES

OE/1702/938/LR1/F01	-	Site Location Plan
OE/1702/938/LR1/F02	-	Coal Authority Site Plan – Mine Entry
OE/1702/938/LR1/F101	-	Proposed Location of New Cap
OE/1702/1058/R1/F01	-	Proposed Site Development Plan
OE/1702/1058/R1/F02	-	Site Investigation Location Plan



Obsidian Environmental Ltd
The Foundry Business Centre
Marcus Street
Birkenhead
Wirral
CH41 1EU
Tel: 01516457571

www.obsidianenvironmental.co.uk

Project:
Land behind 22-34, Goldney Avenue,
Warmley, Bristol, BS30 5JG
Investigation of Adit

Title:
Site Location Plan

Drawn:
LS

Checked:
LS


Client:
M & A Commercial (Bristol)
Ltd


Drawing No.
OE/1702/938/LR1/F01

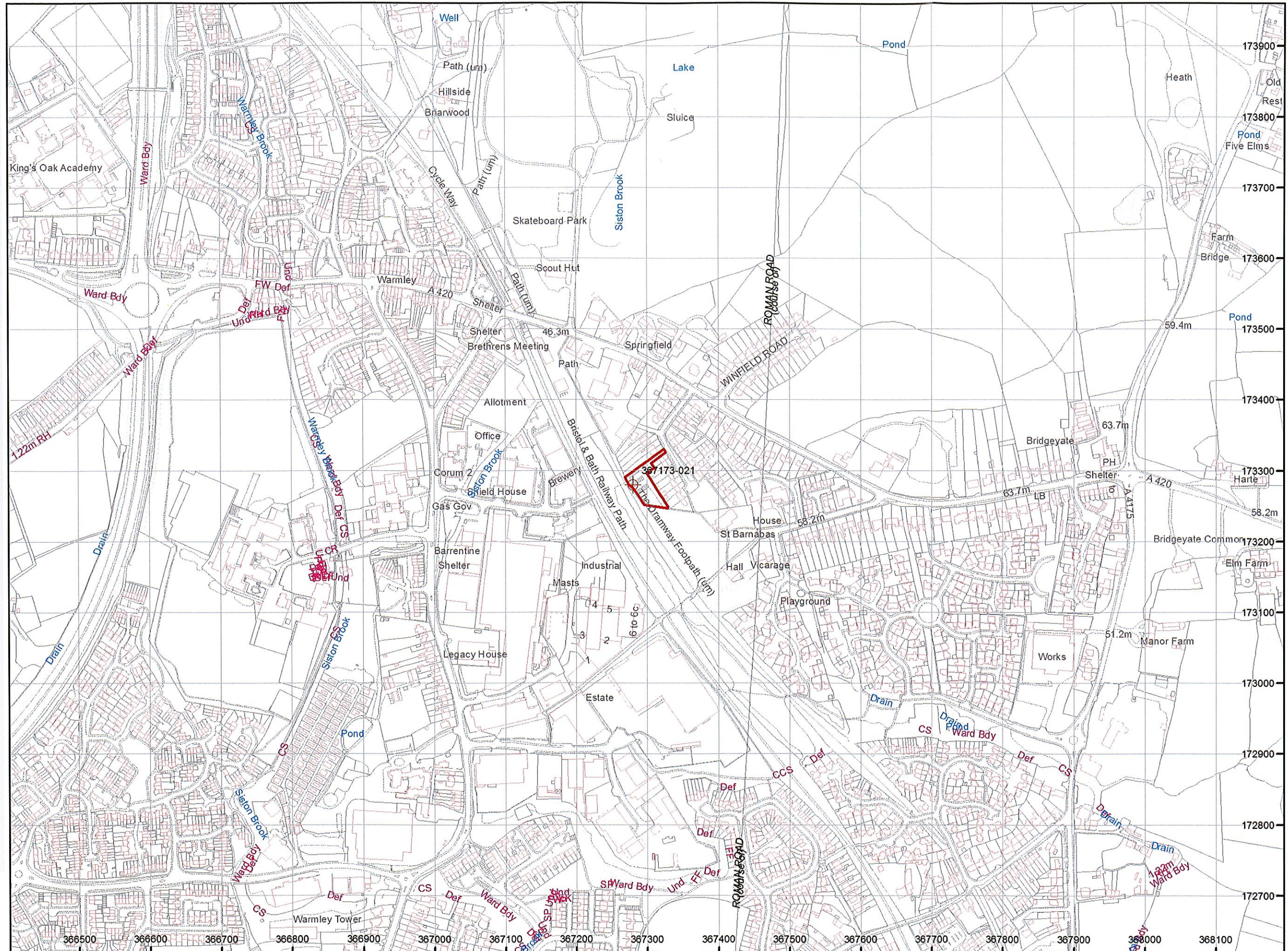
Scale
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Date
01/06/2019

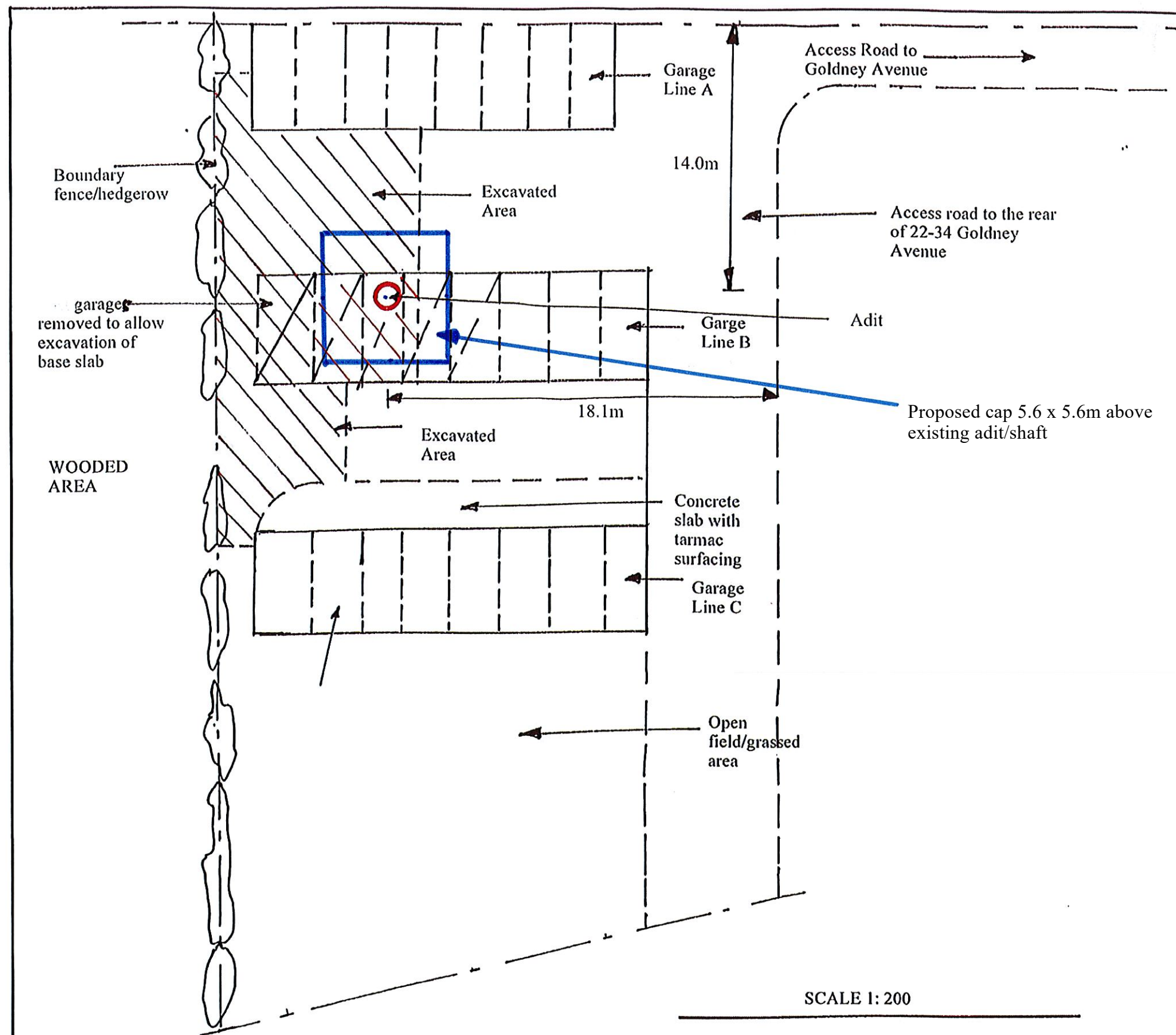
Key

Approximate position of the enquiry boundary shown 

Disused mine shaft 



0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com



NOTES:



Total excavated area for location of adit = 140m².



1.5m diameter adit/shaft

Project:

Land behind 22-34, Goldney Avenue, Warmley, Bristol, BS30 5JG

Title:

Location of proposed cap at former garage area

Client:

M & A Commercials (Bristol) Limited

Project No:

OE/1702/938

Date:

November 2019

Drawn By:

JW

Checked By:

LS

Scale:

As shown

DWG No:

OE/1702/938/F101

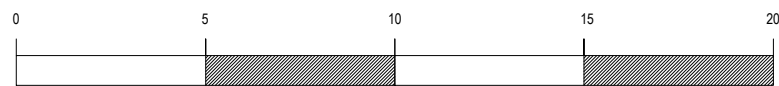
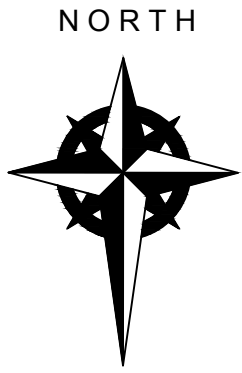


OBSIDIAN
ENVIRONMENTAL

Obsidian Environmental Ltd
The Foundry Business Centre
Marcus Street
Birkenhead
Wirral

CH41 1EU
Tel: 01516457571

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- Denotes proximity light
- Denotes Permeable paviers
- Denotes grated soakaways
- Denotes foul drain runs
- Denotes storm drain runs

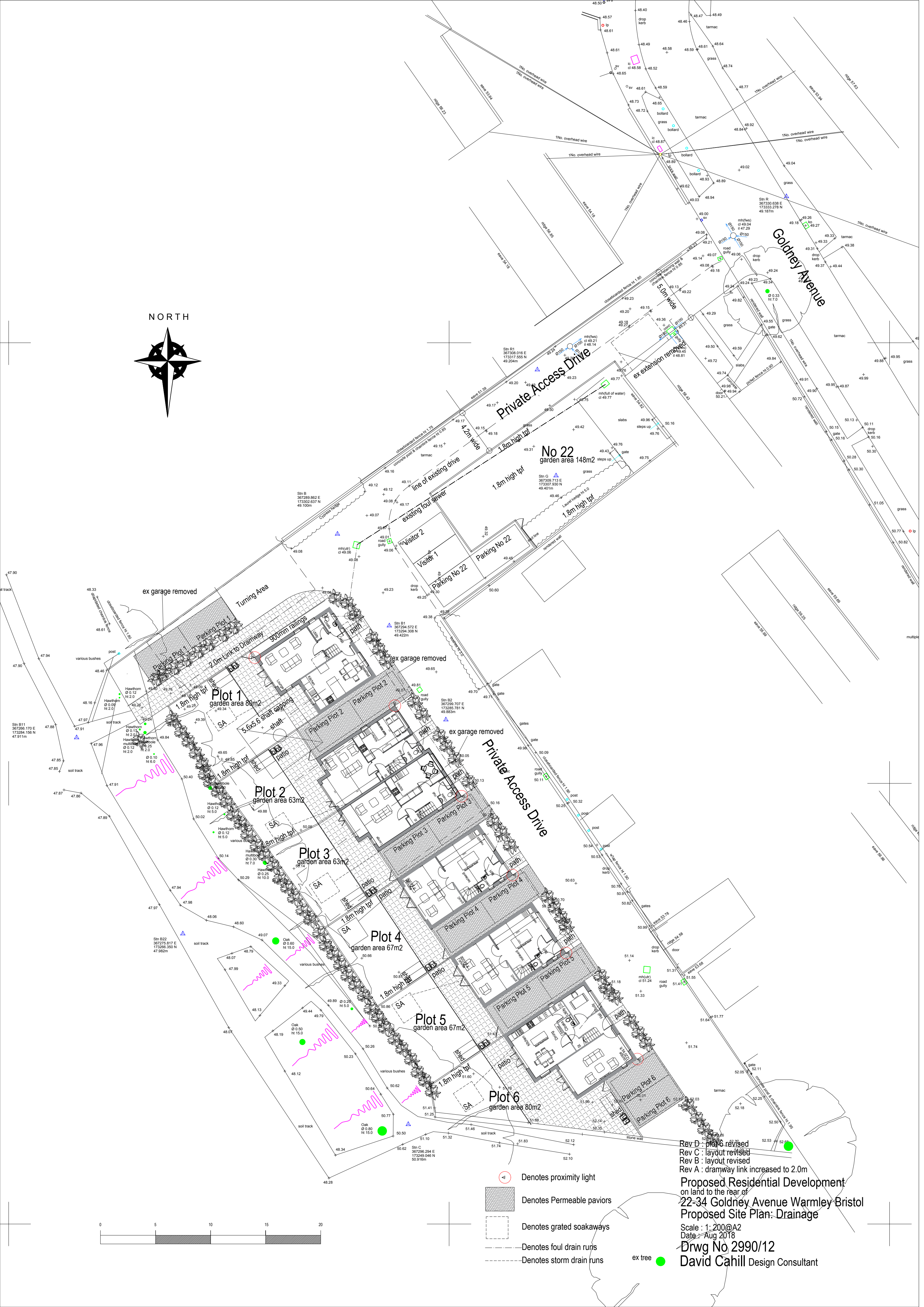
Rev D : plot 6 revised
Rev C : layout revised
Rev B : layout revised
Rev A : dramway link increased to 2.0m

Proposed Residential Development
on land to the rear of
22-34 Goldney Avenue Warmley Bristol
Proposed Site Plan: Drainage

Scale : 1:200@A2
Date : Aug 2018

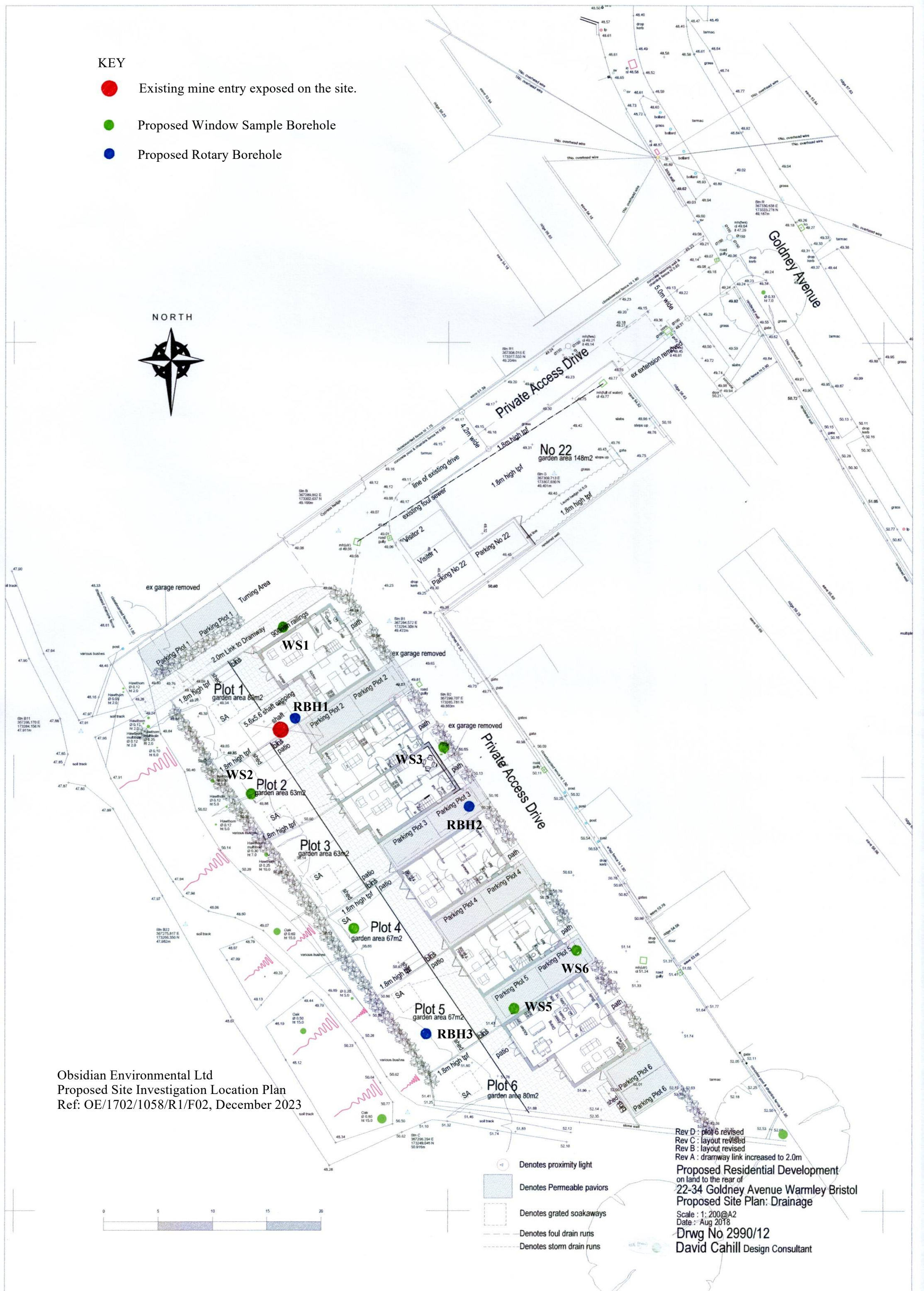
Drwg No 2990/12

David Cahill Design Consultant



KEY

- Existing mine entry exposed on the site.
- Proposed Window Sample Borehole
- Proposed Rotary Borehole



Obsidian Environmental Ltd
Proposed Site Investigation Location Plan
Ref: OE/1702/1058/R1/F02, December 2023

Rev D: plot 6 revised
Rev C: layout revised
Rev B: layout revised
Rev A: driveway link increased to 2.0m
Proposed Residential Development
on land to the rear of
22-34 Goldney Avenue Warmley Bristol
Proposed Site Plan: Drainage
Scale: 1:200@A2
Date: Aug 2018
Drwg No 2990/12
David Cahill Design Consultant

APPENDICES

APPENDIX A	-	Site Investigation Photofile
APPENDIX B	-	Window Sample Borehole Logs
APPENDIX C	-	Geotechnical Testing Results
APPENDIX D	-	Chemical Testing Results
APPENDIX E	-	Chemical Assessment Criteria
APPENDIX F	-	Ground Gas Measurements/Monitoring
APPENDIX G	-	Contaminated Land & Waste Legislation

APPENDIX A - Site Investigation Photofile



Photo OE/1702/1058/R2/P01 – Commencing surface Window Sample WS1



Photo OE/1702/1058/R2/P02 – WS1 Core 0.0 to 1.0m bgl



Photo OE/1702/1058/R2/P03 – WS1 Core 0.0 to 0.5m bgl



Photo OE/1702/1058/R2/P04 – WS1 Core 0.5 to 1.0m bgl



Photo OE/1702/1058/R2/P05 – WS1 Core 1.0 to 2.0m bgl



Photo OE/1702/1058/R2/P06 – WS1 Core 1.5 to 2.0m bgl



Photo OE/1702/1058/R2/P07 – WS1 Core 1.6 to 2.0m bgl



Photo OE/1702/1058/R2/P08 – WS1 Core 2.0 to 3.0m bgl



Photo OE/1702/1058/R2/P09 – WS1 Core 2.7 to 3.0m bgl



Photo OE/1702/1058/R2/P10 – WS1 Core 2.3.0 to 3.0m bgl



Photo OE/1702/1058/R2/P11 – Commencing surface Window Sample WS2



Photo OE/1702/1058/R2/P12 – WS2 Core 0.0 to 1.0m bgl



Photo OE/1702/1058/R2/P13 – WS2 Core 0.0 to 0.4m bgl



Photo OE/1702/1058/R2/P14 – WS1 Core 0.7 to 1.0m bgl



Photo OE/1702/1058/R2/P15 – WS2 Core 0.8 to 1.0m bgl



Photo OE/1702/1058/R2/P16 – WS2 Cores 0.0 to 5.0m bgl



Photo OE/1702/1058/R2/P17 – WS2 Core 1.0m bgl



Photo OE/1702/1058/R2/P18 – WS2 Core 1.0 to 1.3m bgl



Photo OE/1702/1058/R2/P19 - Commencing surface Window Sample WS3



Photo OE/1702/1058/R2/P20 – WS3 Core 0.0 to 1.0m bgl



Photo OE/1702/1058/R2/P21 – WS3 Core 0.6 to 0.8m bg



Photo OE/1702/1058/R2/P22 – WS3 Core 0.6 to 0.9m bgl



Photo OE/1702/1058/R2/P23 – WS3 Core 0.8 to 1.0m bgl



Photo OE/1702/1058/R2/P24 – WS3 Core 0.8m bgl



Photo OE/1702/1058/R2/P25 – WS3 Core 1.0 to 2.0m bgl



Photo OE/1702/1058/R2/P26 – WS3 Core 1.0 to 1.6m bgl



Photo OE/1702/1058/R2/P26 – WS3 Core 1.6 to 2.0m bgl



Photo OE/1702/1058/R2/P28 – WS3 Core 2.2 to 2.8m bgl



Photo OE/1702/1058/R2/P29 – WS3 Core 2.0 to 2.4m bgl



Photo OE/1702/1058/R2/P30 – WS3 Core 2.0 to 2.2m bgl



Photo OE/1702/1058/R2/P31 – WS3 Core 3.0 to 4.0m bgl



Photo OE/1702/1058/R2/P32 – WS3 Core 3.0 to 3.5m bgl



Photo OE/1702/1058/R2/P33 – WS3 Core 3.4 to 3.9m bgl



Photo OE/1702/1058/R2/P34 – WS3 Core 3.7 to 4.0m bgl



Photo OE/1702/1058/R2/P35 – WS3 Core 4.0 to 5.0m bgl



Photo OE/1702/1058/R2/P36 – WS3 Core 4.0 to 4.6m bgl



Photo OE/1702/1058/R2/P37 – WS3 Core 4.6 to 5.0m bgl



Photo OE/1702/1058/R2/P38 – WS3 Core 4.5 to 4.9m bgl



Photo OE/1702/1058/R2/P39 – WS3 Core 4.8 to 5.0m bgl



Photo OE/1702/1058/R2/P40 – Commencing surface Window Sample WS4



Photo OE/1702/1058/R2/P41 – WS4 Core 0.0 to 0.3m bgl



Photo OE/1702/1058/R2/P42 – WS4 Core 0.4 to 0.6m bgl



Photo OE/1702/1058/R2/P43 – WS4 Core 0.7 to 1.0m bgl



Photo OE/1702/1058/R2/P44 – WS4 Cores 0.0 to 3.0m bgl



Photo OE/1702/1058/R2/P45 – WS4 Core 1.0 to 1.3m bgl



Photo OE/1702/1058/R2/P46 – WS4 Core 1.2 to 1.6m bgl



Photo OE/1702/1058/R2/P47 – WS4 Core 1.6 to 2.0m bgl



Photo OE/1702/1058/R2/P48 – WS4 Core 1.8 to 2.0m bgl



Photo OE/1702/1058/R2/P49 – WS4 Core 2.2 to 2.4m bgl



Photo OE/1702/1058/R2/P50 – WS4 Core 2.0 to 2.4m bgl



Photo OE/1702/1058/R2/P51 – WS4 Core 2.4 to 3.0m bgl



Photo OE/1702/1058/R2/P52 – WS4 Core 2.4 to 2.6m bgl



Photo OE/1702/1058/R2/P53 – WS4 Cores 0.0 to 3.0m bgl



Photo OE/1702/1058/R2/P54 – WS4 Core 2.8 to 3.0m bgl



Photo OE/1702/1058/R2/P55 – WS4 Core 3.0 to 3.3m bgl



Photo OE/1702/1058/R2/P56 – WS4 Core 3.0 to 3.3m bgl



Photo OE/1702/1058/R2/P57 – WS4 Core 3.3 to 3.5m bgl



Photo OE/1702/1058/R2/P58 – WS4 Cores 0.0 to 4.0m bgl



Photo OE/1702/1058/R2/P59 – Commencing surface Window Sample WS5



Photo OE/1702/1058/R2/P60 – WS5 Core 0.0 to 0.4m bgl



Photo OE/1702/1058/R2/P61 – WS5 Core 0.1 to 0.6m bgl



Photo OE/1702/1058/R2/P62 – WS5 Core 1.0 to 1.4m bgl



Photo OE/1702/1058/R2/P63 – WS5 Core 1.4 to 1.6m bgl



Photo OE/1702/1058/R2/P64 – WS5 Core 2.6 to 2.9m bgl



Photo OE/1702/1058/R2/P65 – WS5 Core 2.7 to 3.0m bgl



Photo OE/1702/1058/R2/P66 – WS5 Core 2.9 to 3.0m bgl



Photo OE/1702/1058/R2/P67 – WS5 Core 2.8 to 3.0m bgl



Photo OE/1702/1058/R2/P68 – Commencing surface Window Sample WS6



Photo OE/1702/1058/R2/P 69– WS6 Core 0.0 to 1.0m bgl



Photo OE/1702/1058/R2/P70 – WS6 Core 0.5 to 1.0m bgl



Photo OE/1702/1058/R2/P71 – WS6 Core 0.4 to 0.7m bgl



Photo OE/1702/1058/R2/P72 – WS6 Core 0.7 to 1.0m bgl



Photo OE/1702/1058/R2/P73 – WS6 Core 0.45 to 0.7m bgl



Photo OE/1702/1058/R2/P74 – WS6 Core 1.0 to 1.3m bgl



Photo OE/1702/1058/R2/P75 – WS6 Core 1.5 to 2.0m bgl



Photo OE/1702/1058/R2/P76 – WS6 Core 1.5 to 1.9m bgl



Photo OE/1702/1058/R2/P77 – WS6 Core 2.8 to 3.0m bgl



Photo OE/1702/1058/R2/P78 – WS6 Core 3.4 to 1.0m bgl



Photo OE/1702/1058/R2/P79 – WS6 Core 3.2 to 3.8m bgl



Photo OE/1702/1058/R2/P80 – WS6 Core 3.2 to 3.6m bgl



Photo OE/1702/1058/R2/P81 – WS6 Core 1.0 to 4.0m bgl

APPENDIX B - Window Sample Borehole Logs

WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project		Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley				Bore Hole No			
Job No		Date		Ground Level m Site Datum 10.0m		Coordinates E N		WS1	
OE/1702/1058		15/12/2023							
Contractor								Sheet	
South Wales Ground Testing Ltd								1 of 1	

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
	WS1A			10.00		0.50	Made Ground (MG) - Mix of rock and clay fill, with traces of black ash. Sample WS1/A at 0.3m bgl	
1.0				9.50			Natural soils - Firm light brown/grey slightly sandy CLAY. SPT at 1.0 to 1.45m bgl - 1, 1, 2, 2, 2 & 2 - N = 8	
2.0						2.50	Light brown/grey slightly sandy CLAY becoming soft at 1.6m bgl. Sample WS1/B at 1.8 to 2.0m bgl Light brown/grey slightly sandy CLAY becoming firm at 2.0m bgl. SPT at 2.0 to 2.45m bgl - 4, 5, 6, 6, 7 & 7 - N = 26	
3.0				7.00		0.70	Grey very stiff very gravelly CLAY at 3.0m bgl SPT at 3.0 to 3.45m bgl - 4, 4, 4, 7, 6, 8 & 9 - N = 30	
4.0				6.30			At 3.7m bgl grey weathered MUDSTONE - refused - end of Window Sample WS SPT 4.15 to 4.6m bgl - 8, 10, 11, 12, 14 & 50/25 - N = 50+	
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								

				GENERAL REMARKS	
				No water strike	

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
--	--	--	--------------------

WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley				Bore Hole No WS2	
Job No OE/1702/1058	Date 15/12/2023	Ground Level m Site Datum 10.0m	Coordinates E N		Sheet 1 of 1
Contractor South Wales Ground Testing Ltd					

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
	WS2A			10.00		0.90	Made Ground (MG) - Scrub vegetation over rock fill, with tarmac and ash inclusions. Sample WS2/A at 0.5m bgl	
1.0				9.10			Natural strata - Soft to firm becoming stiff with depth, orange slightly sandy CLAY SPT at 1.0 to 1.45m bgl = 1, 2, 2, 1, 2 & 3 - N = 8	
2.0						3.10	Becoming very stiff at 2.0m bgl SPT at 2.0 to 2.45m bgl = 3, 4, 5, 5, 5 & 6 - N = 21	
3.0							SPT at 3.0 to 3.45m bgl - 5, 3, 4, 5, 6, & 6 - N = 21	
4.0							SPT at 4.0 to 4.45m bgl - 5, 6, 7, 7, 7 & 8 - N = 29	
				6.10		0.40	Grey, dry fissured CLAY - possible very weathered MUDSTONE.	
				5.70		0.40	Coal seam - unworked. SPT at 4.8 to 5.25m bgl - 10, 12, 13, 13, 14 & 10/20 blows. - N = 50+	
5.0				5.30		0.40	Refused at 4.8m - weathered Very weak MUDSTONE	
				4.90			End of Window Sample WS2 at 4.8m bgl.	
6.0								
7.0								
8.0								
9.0								
10.0								

GENERAL REMARKS No water strike.	
-------------------------------------	--

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
--	--	--	--------------------

WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley				Bore Hole No WS3
Job No OE/1702/1058	Date 15/12/2023	Ground Level m Site Datum 10.0m	Coordinates E N	
Contractor South Wales Ground Testing Limited				Sheet 1 of 1

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
	WS3A			10.00		0.50	Made Ground (MG) - Topsoil (silty, sandy, clay), and black and orange mixed clay fill. Sample WS3/A taken at 0.3m bgl	
1.0				9.50		2.50	Natural strata - Orange soft slightly silty, sandy CLAY SPT at 1.0 to 1.45m bgl - 1, 1, 2, 4, 4 & 4 - N = 14 Becoming firm at 1.0m bgl	
2.0							SPT at 2.0 to 2.45m bgl - 3, 4, 4, 6, 6 & 7 - N = 23 Becoming fissured very firm CLAY at 2.8m bgl	
3.0				7.00		1.75	Grey weathered very weak MUDSTONE SPT at 3.0 to 3.45m bgl - 5, 5, 6, 7, 7 & 8 - N = 28	
4.0							SPT at 4.0 to 4.45m bgl - 6, 6, 7, 7, 8 & 8 - N = 30	
5.0				5.25		0.15	Coal seam - unworked	
				5.10		0.55	SPT at 5.0 to 5.45m - 5, 7, 9, 8, 11 & 13 - N = 41	
				4.55			End of Window Sample borehole at 5.45m bgl.	
6.0								
7.0								
8.0								
9.0								
10.0								

		GENERAL REMARKS	
		No water strike	

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
--	--	--	--------------------

WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley				Bore Hole No WS4
Job No OE/1702/1058	Date 15/12/2023	Ground Level m Site Datum 10.0m	Coordinates E N	
Contractor South Wales Ground Testing Limited				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
	WS4A			10.00		0.10	Made Ground (MG) - Black silty, sandy, clay - Topsoil.		Steel cover
				9.90		0.50	MG - Dark brown clay fill with crushed brick and concrete inclusions. Sample WS4/A at 0.4m bgl		valve & bung
1.0				9.40		0.40	Natural strata - Orange firm slightly sandy CLAY. SPT at 1.0 to 1.45m bgl - 1, 2, 3, 4, 4 & 4 - N = 15		0.5m plain pipe
				9.00		0.50	Grey firm to stiff CLAY.		slotted pipe with gravel pack
2.0				7.50		0.50	Orange stiff CLAY SPT at 2.0 to 2.45m bgl - 5, 6, 5, 6, 5 & 5 - N = 21		
				8.00		1.35	Orange/grey very stiff weathered very weak mudstone. SPT at 2.9 to 3.35m bgl - 10, 13, 14, 20 & 20/20blows - N = 50+		
3.0				6.65			Refusal and end of Window Sample WS4 borehole at 4.45m bgl.		
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									

				GENERAL REMARKS No water strike	
--	--	--	--	------------------------------------	--

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
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WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley					Bore Hole No WS5
Job No OE/1702/1058	Date 15/12/2023	Ground Level m Site Datum 10.0m	Coordinates E N		
Contractor South Wales Ground Testing Limited				Sheet 1 of 1	

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
	WS3A			10.00		0.10	Made Ground (MG) - Topsoil - silty sandy clay.	
				9.90		0.50	MG - Black clayey fill, with crushed brick and concrete inclusions. Sample WS5/A at 0.3m bgl	
1.0				9.40		1.40	Natural strata - Orange soft to firm CLAY SPT at 1.0 to 1.45m bgl - 2, 4, 4, 3, 4 & 4 - N = 15 At 1.3m bgl - thin band of grey weathered MUDSTONE gravel	
2.0				8.00		0.80	Grey friable MUDSTONE clayey GRAVEL SPT at 2.0 to 2.45m bgl - 4, 5, 4, 4, 4 & 5 - N = 17	
3.0				7.20		0.10	Coal seam - unworked	
				6.75		0.45	Grey weathered very weak MUDSTONE SPT at 3.0 to 3.45m bgl - 6, 6, 7, 9, 12 & 22/40 blows	
4.0				6.30			Refused at 3.0m bgl - end of Window Sample WS5.	
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								

		GENERAL REMARKS No water strike	
--	--	------------------------------------	--

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
--	--	--	--------------------

WINDOW SAMPLE LOG

info@obsidianenvironmental.co.ukOBSIDIAN
ENVIRONMENTAL

Project Phase II Geoenvironmental Assessment - Land behind 22-34 Goldney Avenue Warmley				Bore Hole No WS6
Job No OE/1702/1058	Date 15/12/2023	Ground Level m Site Datum 10.0m	Coordinates E N	
Contractor South Wales Ground Testing Limited				Sheet 1 of 1

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
				10.00		0.10	Made Ground (MG) - Topsoil - black silty sandy clay.	Steel cover
				9.90		0.20	MG - Dark brown clayey fill with discrete brick and concrete fragments	Valve & bung
				9.70			Natural strata - Firm becoming stiff orange CLAY.	0.5 plain pipe
1.0	WS6A					2.50	Window Sample WS6/A at 1.0 to 1.2m bgl Stiff CLAY at 2.0m bgl SPT at 1.0 to 1.45m bgl - 1, 3, 3, 4, 4 & 5 - N = 16	slotted pipe with gravel pack
2.0							SPT at 2.0 to 2.45m bgl - 3, 3, 4, 5, 6 & 5 - N = 20	
3.0				7.20		0.20	Coal seam - unworked	
				7.00		0.50	Grey weathered MUDSTONE GRAVEL SPT at 3.0 to 3.45m bgl - 4, 6, 6, 8, 9 & 11 - N = 34	
				6.50		0.85	Grey weathered very weak MUDSTONE SPT at 3.9 to 4.35m - 8, 8, 12, 16, 22/50 blows - N = 50+	
4.0				5.65			Refused at 3.9m bgl - end of Window Sample WS6 at 4.35m bgl.	
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								

GENERAL REMARKS No water strike			
------------------------------------	--	--	--

All dimensions in metres Scale 1:10	Client M&A Commercials (Bristol) Ltd	Method/ Plant used window sample rig	Logged by LS
--	--	--	--------------------

APPENDIX C - Geotechnical Testing Results

Envirolab
Housesteads,
Off Stockport Road,
Hattersley,
SK14 3QU

F.A.O.

Final Test Report - 2281836 / 1

Site: Obisdian Goldberg Avenue

Job Number: 2281836

Originating Client: Envirolab

Originating Reference: 23/12619

Date Sampled: Not Given

Date Scheduled: 03/01/2024

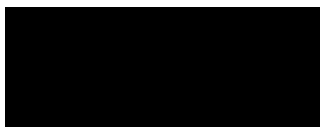
Date Testing Started: 05/01/2024

Date Testing Finished: 12/01/2024

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Tim Robinson
Quality Supervisor

Report Issue Date: 15/01/2024

Page: 2

Results reported relate only to the samples tested.



Final Test Report - 2281836 / 1

Site: Obisdian Goldberg Avenue

Job Number: 2281836

Originating Client: Envirolab

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

This test report shall not be reproduced, except in full and only with the written permission of Ian Farmer Associates Ltd.

Samples will be retained for 28 days from date of issue of the final test report before being disposed of, unless we receive written instruction to the contrary.

Report End

Report Issue Date: 15/01/2024

APPENDIX D

Chemical Testing Results

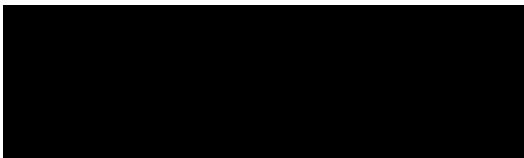
FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 23/12619
Issue Number: 1
Date: 15 January, 2024

Client: Obsidian Environmental Ltd
The Foundry Business Centre
Marcus Street
Birkenhead
Wirral
UK
CH41 1EU

Project Manager: Leon Stanger
Project Name: Goldney Avenue, Warmley
Project Ref: OE/1702/1058
Order No: OE/1702/1058/LS/277
Date Samples Received: 20/12/23
Date Instructions Received: 20/12/23
Date Analysis Completed: 15/01/24

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 23/12619

Client Project Name: Goldney Avenue, Warmley

Client Project Ref: OE/1702/1058

Lab Sample ID	23/12619/1	23/12619/2	23/12619/3	23/12619/4	23/12619/5	23/12619/6	23/12619/7	Units	Limit of Detection	Method ref
Client Sample No	A	B	A	A	A	A	A			
Client Sample ID	WS1	WS1	WS2	WS3	WS4	WS5	WS6			
Depth to Top	0.30	1.8	0.50	0.30	0.40	0.30	1.0			
Depth To Bottom		2.0					1.2			
Date Sampled	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23			
Sample Type	SOLID	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D			
Sample Matrix Code	7	3	3	3	3	3	3			
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	8.93 ^U	7.58	8.42	7.87	7.46	7.43	5.99	pH	0.01	A-T-031s
pH BRE _D ^{M#}	-	7.58	-	-	-	-	5.99	pH	0.01	A-T-031s
Ammonium NH4 BRE (water sol 2:1) _D	-	<1.00	-	-	-	-	<1.00	mg/l	1	A-T-033s
Chloride BRE, SO4 equiv. (water sol 2:1) _D ^{M#}	-	<7	-	-	-	-	16	mg/l	7	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1) _D	-	<0.4	-	-	-	-	<0.4	mg/l	0.4	A-T-026s
Sulphate (water sol 2:1) _D ^{M#}	0.01 ^U	0.06	<0.01	<0.01	<0.01	<0.01	0.03	g/l	0.01	A-T-026s
Sulphate BRE (water sol 2:1) _D ^{M#}	-	60	-	-	-	-	32	mg/l	10	A-T-026s
Sulphate BRE (acid sol) _D ^{M#}	-	0.03	-	-	-	-	<0.02	% w/w	0.02	A-T-028s
Sulphur (total) _D	575	103	589	131	413	405	97	mg/kg	50	A-T-024s
Sulphur BRE (total) _D	-	0.01	-	-	-	-	<0.01	% w/w	0.01	A-T-024s
Magnesium BRE (water sol 2:1) _D	-	14	-	-	-	-	3	mg/l	1	A-T-SOLMETS
Cyanide (free) _A ^{M#}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sFCN
Cyanide (total) _A ^{M#}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Thiocyanate _A	<5	<5	<5	<5	<5	<5	<5	mg/kg	5	A-T-041s
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Sulphide _A	<5	<5	<5	<5	<5	<5	<5	mg/kg	5	A-T-043-s
Total Organic Carbon _D ^{M#}	2.32 ^U	0.12	5.92	2.23	6.08	5.96	0.51	% w/w	0.03	A-T-032s
Arsenic _D ^{M#}	11 ^U	5	20	13	14	19	1	mg/kg	1	A-T-024s
Barium _D	379	192	326	147	243	298	79	mg/kg	1	A-T-024s
Beryllium _D	<0.5	1.2	0.8	0.8	1.2	1.3	0.9	mg/kg	0.5	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0 ^U	<1.0	<1.0	<1.0	1.7	1.4	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.5 ^U	<0.5	1.0	0.7	1.6	1.8	<0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	4 ^U	22	38	37	62	73	23	mg/kg	1	A-T-024s
Chromium _D ^{M#}	8 ^U	30	11	16	21	20	15	mg/kg	1	A-T-024s
Lead _D ^{M#}	27 ^U	27	123	132	214	297	19	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	0.17	A-T-024s
Molybdenum _D ^{M#}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Nickel _D ^{M#}	7 ^U	20	16	17	27	22	29	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Vanadium _D ^{M#}	8 ^U	38	17	24	31	31	17	mg/kg	1	A-T-024s
Zinc _D ^{M#}	55 ^U	56	266	132	352	464	80	mg/kg	5	A-T-024s
Mineral Oil (>C10-C40) _A	27	<10	25	<10	14	<10	<10	mg/kg	10	A-T-007s

Envirolab Job Number: 23/12619

Client Project Name: Goldney Avenue, Warmley

Client Project Ref: OE/1702/1058

Lab Sample ID	23/12619/1	23/12619/2	23/12619/3	23/12619/4	23/12619/5	23/12619/6	23/12619/7	Units	Limit of Detection	Method ref
Client Sample No	A	B	A	A	A	A	A			
Client Sample ID	WS1	WS1	WS2	WS3	WS4	WS5	WS6			
Depth to Top	0.30	1.8	0.50	0.30	0.40	0.30	1.0			
Depth To Bottom		2.0					1.2			
Date Sampled	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23			
Sample Type	SOLID	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D			
Sample Matrix Code	7	3	3	3	3	3	3			
(1.02) Item 2.4.4 Point Liquid & Plastic Limit by Cone Penetrometer _A [#]	-	Appended	-	-	-	-	Appended			Subcon IFA
(1.01) Item 1a Moisture Content of Soil (Oven Dried Method) _A [#]	-	Appended	-	-	-	-	Appended			Subcon IFA

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Lab Sample ID	23/12619/1	23/12619/2	23/12619/3	23/12619/4	23/12619/5	23/12619/6	23/12619/7	Units	Limit of Detection	Method ref
Client Sample No	A	B	A	A	A	A	A			
Client Sample ID	WS1	WS1	WS2	WS3	WS4	WS5	WS6			
Depth to Top	0.30	1.8	0.50	0.30	0.40	0.30	1.0			
Depth To Bottom		2.0					1.2			
Date Sampled	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23			
Sample Type	SOLID	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D			
Sample Matrix Code	7	3	3	3	3	3	3			
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil [#]	NAD	NAD	Chrysotile	NAD	NAD	NAD	NAD			A-T-045
Asbestos Matrix (visual) _o	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _o	-	-	Loose Fibres	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _o	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _o	-	-	<0.001	-	-	-	-	% w/w	0.001	A-T-054

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Client Sample No	A	B	A	A	A	A	A			
Client Sample ID	WS1	WS1	WS2	WS3	WS4	WS5	WS6			
Depth to Top	0.30	1.8	0.50	0.30	0.40	0.30	1.0			
Depth To Bottom		2.0					1.2			
Date Sampled	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23			
Sample Type	SOLID	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D			
Sample Matrix Code	7	3	3	3	3	3	3			
PAH-16MS										
Acenaphthene _A ^{MF}	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{MF}	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{MF}	<0.02 ^U	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{MF}	0.08 ^U	<0.04	0.06	0.08	<0.04	0.11	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{MF}	0.09 ^U	<0.04	0.06	0.07	<0.04	0.09	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{MF}	0.11 ^U	<0.05	0.10	0.12	<0.05	0.13	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{MF}	0.06 ^U	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{MF}	<0.07 ^U	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{MF}	0.09 ^U	<0.06	0.08	0.12	<0.06	0.13	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{MF}	<0.08 ^U	<0.08	0.11	0.15	<0.08	0.24	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{MF}	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{MF}	0.07 ^U	<0.03	0.05	0.05	<0.03	0.07	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{MF}	<0.03 ^U	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{MF}	<0.03 ^U	<0.03	0.06	0.10	<0.03	0.11	<0.03	mg/kg	0.03	A-T-019s
Pyrene _A ^{MF}	0.08 ^U	<0.07	0.10	0.13	<0.07	0.19	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A	0.58 ^U	<0.08	0.62	0.82	<0.08	1.07	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 23/12619

Client Project Name: Goldney Avenue, Warmley

Client Project Ref: OE/1702/1058

Lab Sample ID	23/12619/1	23/12619/2	23/12619/3	23/12619/4	23/12619/5	23/12619/6	23/12619/7	Units	Limit of Detection	Method ref
Client Sample No	A	B	A	A	A	A	A			
Client Sample ID	WS1	WS1	WS2	WS3	WS4	WS5	WS6			
Depth to Top	0.30	1.8	0.50	0.30	0.40	0.30	1.0			
Depth To Bottom		2.0					1.2			
Date Sampled	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23	15-Dec-23			
Sample Type	SOLID	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D	SOIL - D			
Sample Matrix Code	7	3	3	3	3	3	3			
TPH UKCWG with Clean Up										
Alii >C5-C6 _A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Alii >C6-C8 _A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Alii >C8-C10 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Alii >C10-C12 _A ^{MF}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Alii >C12-C16 _A ^{MF}	<1 ^U	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Alii >C16-C21 _A ^{MF}	2 ^U	<1	1	<1	3	<1	<1	mg/kg	1	A-T-055s
Alii >C21-C35 _A ^{MF}	10 ^U	<1	55	6	18	8	<1	mg/kg	1	A-T-055s
Alii >C35-C44 _A	7	<1	20	<1	4	1	<1	mg/kg	1	A-T-055s
Total Aliphatics _A	20	<1	76	6	24	9	<1	mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2	<1	2	<1	1	<1	<1	mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	<1	4	2	4	3	<1	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{MF}	2 ^U	<1	7	6	6	5	<1	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{MF}	7 ^U	<1	21	15	18	15	<1	mg/kg	1	A-T-055s
Aro >C35-C44 _A	3	<1	15	<1	1	<1	<1	mg/kg	1	A-T-055s
Total Aromatics _A	14	<1	51	24	31	23	<1	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C44) _A	34	<1	127	30	55	32	<1	mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01 ^U	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Report Notes

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received within the same delivery, will be disposed of **six weeks** after the initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of **six months** after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and Interpretations expressed are outside our scope of accreditation.

The client Sample No, Client Sample ID, Depth to top, Depth to Bottom and Date Sampled are all provided by the client.

A deviating sample report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Key

Superscript "#"	Accredited to ISO 17025
Superscript "M"	Accredited to MCertS
Superscript "U"	Individual result not accredited
None of the above symbols	Analysis unaccredited
Subscript "A"	Analysis performed on as-received Sample
Subscript "D"	Analysis performed on the dried sample, crushed to pass 2mm sieve.
Subscript "A"	Analysis has dependant options against results. Details appear in the comments of your Sample receipt
IS	Insufficient Sample for analysis
US	Unsuitable Sample for analysis
NDP	No Determination Possible
NAD	No Asbestos Detected
N/A	Not applicable

Asbestos

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing, and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Assigned Matrix Codes

1	SAND	6	CLAY/LOAM	A	Contains Stones
2	LOAM	7	OTHER	B	Contains Construction Rubble
3	CLAY	8	Asbestos Bulk (Only Asbestos ID accredited)	C	Contains visible hydrocarbons
4	LOAM/SAND	9	Incinerator Ash (some Metals accredited)	D	Contains glass / metal
5	SAND/CLAY			E	Contains roots / twigs

Note: 7,8,9 matrices are not covered by our ISO 17025 or MCertS accreditation, unless stated above.

Soil Chemical Analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH by method A-T-007:

For waters, free and visible oils are excluded from the sample used for analysis, so the reported result represents the dissolved phase only.

Results "with Clean up" indicates samples cleaned up with Silica during extraction.

EPH CWG (method A-T-055) from TPH CWG:

EPH CWG results have humics mathematically subtracted through instrument calculation.

Where these humic substances have been identified in any IDs from "TPH CWG with clean up" please note that the concentration is **NOT** included in the quantified results but present in the ID for information.

Electrical Conductivity of water by method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the accreditation range and as such are unaccredited.

Please contact your client manager if you require any further information.

Envirolab Deviating Samples Report

Hattersley Science & Technology Park, Stockport Road, Hattersley, SK14 3QU
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Obsidian Environmental Ltd, The Foundry Business Centre, Marcus Street,
Birkenhead, Wirral, UK, CH41 1EU

Project: Goldney Avenue, Warmley

Clients Project No: OE/1702/1058

Project No: 23/12619

Date Received: 20/12/2023 (am)

Cool Box Temperatures (°C):

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	23/12619/1	23/12619/2	23/12619/3	23/12619/4	23/12619/5	23/12619/6	23/12619/7
Client Sample No	A	B	A	A	A	A	A
Client Sample ID/Depth	WS1 0.30m	WS1 1.8-2.0m	WS2 0.50m	WS3 0.30m	WS4 0.40m	WS5 0.30m	WS6 1.0-1.2m
Date Sampled	15/12/23	15/12/23	15/12/23	15/12/23	15/12/23	15/12/23	15/12/23
A-T-007s	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024
A-T-019s	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023
A-T-022s	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024
A-T-024s	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024	03/01/2024
A-T-026s	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024
A-T-027s	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024
A-T-028s		03/01/2024					03/01/2024
A-T-031s	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024
A-T-032s	04/01/2024	04/01/2024	08/01/2024	04/01/2024	04/01/2024	04/01/2024	04/01/2024
A-T-033s		02/01/2024					02/01/2024
A-T-041s	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024
A-T-042sFCN	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023
A-T-042sTCN	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023
A-T-043-s	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023
A-T-044	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023	22/12/2023
A-T-045	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023	21/12/2023
A-T-050s	08/01/2024	08/01/2024	08/01/2024	08/01/2024	08/01/2024	08/01/2024	08/01/2024
A-T-054			02/01/2024				
A-T-055s	28/12/2023	28/12/2023	28/12/2023	28/12/2023	28/12/2023	28/12/2023	28/12/2023
A-T-SOLMETS		03/01/2024					03/01/2024
Calc-As Recd	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024	02/01/2024

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

APPENDIX E Chemical Assessment Criteria

Maximum Allowable Levels Human Health Risk Assessment Criteria – Residential with plant uptake

Determinant	Residential with plant uptake 1% SOM (mg/kg) LQM/CIEH S4ULs	Criteria
Arsenic	37	LQM/CIEH/S4ULs
Beryllium	1.7	LQM/CIEH/S4ULs
Boron	290	LQM/CIEH/S4ULs
Cadmium	11	LQM/CIEH/S4ULs
Chromium	910	LQM/CIEH/S4ULs
Copper	2400	LQM/CIEH/S4ULs
Mercury	<1	GAC
Molybdenum	4	GAC
Nickel	180	LQM/CIEH/S4ULs
Lead	200	(c4sl)
Selenium	250	LQM/CIEH/S4ULs
Vanadium	410	LQM/CIEH/S4ULs
Zinc	370	LQM/CIEH/S4ULs
SPECIATED TPH CWG		
Aliphatic		
EC 5-6	42	LQM/CIEH/S4ULs
EC> 6-8	100	LQM/CIEH/S4ULs
EC> 8-10	27	LQM/CIEH/S4ULs
EC> 10-12	130	LQM/CIEH/S4ULs
EC> 12-16	1100	LQM/CIEH/S4ULs
EC> 16-21	65000	LQM/CIEH/S4ULs
EC> 21-35	65000	LQM/CIEH/S4ULs
Aromatic		
EC 6-7(benzene)	70	LQM/CIEH/S4ULs
EC> 7-8 (toluene)	130	LQM/CIEH/S4ULs
EC>8-10	34	LQM/CIEH/S4ULs
EC<10-12	74	LQM/CIEH/S4ULs
EC<12-16	140	LQM/CIEH/S4ULs
EC<16-21	260	LQM/CIEH/S4ULs
EC<21-35	1100	LQM/CIEH/S4ULs
BTEX		
Benzene	0.087	LQM/CIEH/S4ULs
Toluene	130	LQM/CIEH/S4ULs
Ethylbenzene	47	LQM/CIEH/S4ULs
Xylenes	56	LQM/CIEH/S4ULs

SPECIATED PAH	mg/kg	
Acenaphthene	210	LQM/CIEH/S4ULs
Acenaphthylene	170	LQM/CIEH/S4ULs
Anthracene	2400	LQM/CIEH/S4ULs
Benzo(a)anthracene	7.2	LQM/CIEH/S4ULs
Benzo(a)pyrene	2.2	LQM/CIEH/S4ULs
Benzo(b)fluorathene	2.6	LQM/CIEH/S4ULs
Benzo(ghi)perylene	320	LQM/CIEH/S4ULs
Benzo(k)fluorathene	77	LQM/CIEH/S4ULs
Chrysene	15	LQM/CIEH/S4ULs
Dibenzo(ah)anthracene	0.24	LQM/CIEH/S4ULs
Fluoranthene	280	LQM/CIEH/S4ULs
Fluorene	170	LQM/CIEH/S4ULs
Indeno(123-ed) pyrene	27	LQM/CIEH/S4ULs
Naphthalene	2.3	LQM/CIEH/S4ULs
Phenanthrene	95	LQM/CIEH/S4ULs
Pyrene	620	LQM/CIEH/S4ULs

VOCs/SVOCs	mg/kg	
Vinyl Chloride	0.0064	LQM/CIEH/S4UIs 2021
Trichloroethene	0.0093	LQM/CIEH/S4UIs 2021
Tetrachloroethene	0.31	LQM/CIEH/S4UIs 2021

2021

APPENDIX F

Ground Gas Monitoring Results

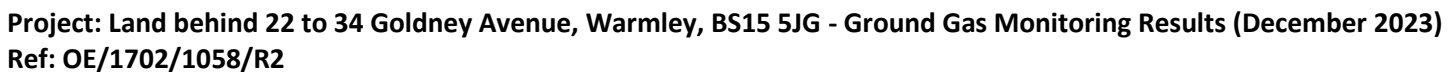


Table 1 – Ground Gas Measurements

[illegible]

Table 2 - Gas Screening Values (GSV) & Characterisation

Location	Date	Highest Recorded Methane or Carbon Dioxide	Peak Flow Value	Calculation	GSV Result	Characteristic Situation
WS1	28/12/2023	2.2	0.1	0.0022	<0.07	1
WS4	28/12/2023	7.7	0.0	0.0	<0.07	1
WS6	28/12/2023	0.1	0.0	0.0	<0.07	1

It should be noted that from the Phase I Geoenvironmental Assessment that Radon Gas in the general area is not elevated and consequently, and Radon Gas Mitigation Measures are not required.

APPENDIX G

Contaminated Land & Waste Legislation

Contaminated Land Regime

Review of Part IIA Requirements

Statutory Framework

Part IIA was inserted into the Environmental Protection Act 1990 (The Act) by section 57 of the Environmental Act 1995. The purpose of The Act is to remove unacceptable risks to human health and the environment due to contaminated land and to bring this land back into beneficial use.

Statutory guidance (DETR Circular 02/2000 Ref 2) was issued to ensure a consistent and logical approach to the identification and remediation of contaminated land across England.

Definition of Contaminated Land

Land will be designated as contaminated if it is in such a condition that significant harm is being caused or there is a significant possibility of such harm being caused to a series of receptors defined in the statutory guidance. The land will also be designated as contaminated if the pollution of controlled waters is being or is likely to be caused.

The assessment of whether significant harm is or is likely to be caused is based on the concept of a pollutant linkage – that is a linkage between a contaminant on the land in question and a receptor, by means of a pathway. In assessing the likelihood of a pollution linkage being present the principles of risk assessment will apply. This will involve the consideration of the likelihood that harm or pollution will occur and what magnitude it will be. If a piece of land is to be designated as contaminated it must be proven that both a pollution linkage exists and that the linkage will result in significant harm or the pollution of controlled waters.

Receptors

The Statutory Guidance defined the receptors that need to be addressed when considering if significant harm or pollution is being caused, these are summarised below:

- Human Health.
- Any ecological system or organism forming part of such a system. The guidance provides a definition of such systems and includes Special Sites of Scientific Interest, National Nature Reserves, Special Protection Areas and Special Areas of Conservation, Ramsar Sites among others.
- Property including crops timber and livestock.
- Property in the form of buildings.

The Local Authority should not consider harm to any receptors that are not included on the list in the Statutory Guidance. For example, harm to ecological systems outside of the designations in the table should be disregarded. Only the receptors, which are likely to be present on and near the site given its current use should be considered. Current use is defined as any use, which is currently being made or is likely to be made that is consistent with the lands existing planning permission.

Pollution of controlled waters is defined as *“the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter”*. The term controlled waters covers

virtually all fresh and saline natural waters up to the UK offshore territorial limit, including rivers, streams, lochs, estuaries, coastal waters and groundwater. Groundwater is defined as any water below the surface of the ground and it therefore includes waters in both the saturated and unsaturated zones.

However, land should not be designated as contaminated land if the substance in question is already present in controlled waters or if its entry has now ceased and it is unlikely that further entry will take place. The above comments refer to legal powers under The Act, however, it should be noted that the site owner has wider responsibilities in common law and statutory nuisance for any adverse effects caused by the contaminated land on a third parties property.

Inspection Strategy

Under section 78B (1) of the Act, the Local Authority has a responsibility to develop an inspection strategy to identify land that merits detailed individual inspection. It is stated that this should be proportionate to the seriousness of the risk and should include some form of prioritisation. The strategy should therefore concentrate on existing evidence that a contaminant is likely to be present on a site and the extent to which receptors, as defined in the guidance, are likely to be exposed to a contaminant as a result of the use of the land or of the geological and hydrogeological features of the area.

This initial phase of inspection will result in the identification of land, which is likely to be contaminated and where a possible pollution linkage exists. The Local Authority must then undertake a detailed inspection of such sites, which could vary from collection of documentary information to an intrusive investigation. However, the land can only be designated as contaminated when a *“scientific and technical assessment of the risks arising from the pollution linkage, according to relevant, appropriate, authoritative and scientifically based guidance on such risk assessment”* has been completed and this assessment indicates that harm, the potential for such harm or pollution is being caused.

Human Health Risk Assessment

The UK Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) have recently published guidance on the assessment of contaminated land from a human health perspective, including “The Contaminated Land Exposure Assessment Model” (CLEA) and “Soil Guideline Values” (SGVs) for selected heavy metals / metalloids. Soil Guideline Values are quoted in a “suitable for use” context, with four guideline values provided for four separate Standard Land Uses.

- Residential with plant uptake.
- Residential without plant uptake.
- Allotments.
- Commercial / Industrial.
- Public Open Space – Residential
- Public Open Space

Soil Guideline Values (SGV) and supporting technical guidance are intended to assist professionals in the assessment of long-term risk to health from human exposure to chemical contamination in soil. There are different SGVs according to land-use (residential, allotments, commercial) because people use land differently and this affects who and how people may be exposed to soil contamination. SGV are 'trigger values' for screening-out low

risk areas of land contamination. They give an indication of representative average levels of chemicals in soil below which the long-term health risks are likely to be minimal. Exceeding an SGV does not mean that remediation is always necessary, although in many cases some further investigation and evaluation of the risk will be carried out.

SGV should not be used where they are not representative of the site under investigation. They do not assess other types of risk to human health such as fire, suffocation, explosion, or short-term and acute exposures. They also cannot be used to assess risks to controlled waters, property, pets and livestock, or ecological receptors.

SGV are available only for a limited number of chemical substances. Reference should be made to the explanatory notes for each element provided in the DEFRA / EA Soil Guideline Value Reports SGV1 – 10 Soil Guideline Values for contamination in soils for specific substances. Phenol Values are subject to soil organic matter content (SOM) as noted above and outlined by the DEFRA / EA Soil Guideline Value Report SGV1 – 8.

In addition to the published SGVs use is made of widely adopted Land Quality Management generic assessment criteria (GACs) for chemical compounds not covered by the published SGVs. The following document and the proposed GAC have been adopted for heavy metals compared either against the LQM/CIEH/S4ULs Human Health Risk Assessment. (NATHANIAL, C.P, M^CCAFFREY, C. ASHMORE, M. CHENG, Y. GILLETT, A. HOOKER, and P. OGDEN, R.C., 2015. Generic Assessment Criteria for Human Health Risk Assessment. Land Quality Press. Nottingham) - (ISBN 0-9547474-3-7), where available and Category 4 screening values.

Waste Management Legislation

Hazardous Waste Regulations – off-site disposal

In order to evaluate the various on-site soils for potential offsite disposal, soils are classified in accordance with the Hazardous Waste Directive (HWD) that enables the provision of a European Waste Catalogue (EWC) Code for use during offsite disposal and a Hazardous or Non-Hazardous Classification. Non-Hazardous material is suitable for disposal in a Non-Hazardous landfill; however disposal to an Inert Landfill requires further Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457–3. Material classed as Hazardous also requires WAC testing to assign a suitable hazardous classification.

It should be noted that WAC testing has not been undertaken at this time. Should offsite disposal of soils that are Hazardous or possibly Inert be required WAC testing should be undertaken by suitably qualified personnel. Further information on sampling and analysis of soils destined for offsite disposal can be provided by It is also recommended that prior to offsite disposal of the soils; the receiving landfill facility should be sent copies of all relevant chemical analysis and written confirmation of acceptance of soils provided.

The Landfill Directive requires that all Hazardous and Non-Hazardous solid waste must be treated prior to offsite disposal to landfill. Treatment can be defined by using the following 'three-point test'. All three criteria must be satisfied for all of the waste to qualify as being treated:

- 1. It must be a physical, thermal, chemical or biological process including sorting.***
- 2. It must change the characteristics of the waste.***
- 3. It must do so in order to:***
 - a. Reduce its volume; or***
 - b. Reduce its hazardous nature; or***
 - c. Facilitate its handling; or***
 - d. Enhance recovery.***

It is recommended that the Made Ground and underlying natural ground should be carefully segregated and stockpiled separately during earthworks and piling operations in order to prevent mixing of the waste streams. Careful segregation at the earliest stage may allow costs saving in offsite disposal costs to be realised. It is recommended that a qualified geoenvironmental/waste engineer undertakes the organisation of the removal of soils from the site in order to ensure that the relevant legislation is adhered to at all stages of the process. Improper management of the process or improper disposal may lead to prosecution by the Environment Agency.