



Phase II Geoenvironmental Site Assessment
Oldham Road, Manchester

Reference: 12-730-R2-2
Date: 5th February 2021



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Oldham Road
Manchester
M4 5FU

Prepared for:

Mulbury City



Report Ref: 12-730-R2-2
Date Issued: 5th February 2021

E3P

Taylor Road
Trafford Park
Urmston
M41 7JQ

+ 44 (0) 161 707 9612
<https://e3p.co.uk/>

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	12-730		
VERSION	Version 1	Version 2	
REMARKS	Draft for Comment	Final	
DATE	8 th December 2020	5 th February 2021	
PREPARED BY	N Sellars	N Sellars	
QUALIFICATIONS	MSci (Hons), FGS	MSci (Hons), FGS	
SIGNATURE			
CHECKED BY	A Smith	A Smith	
QUALIFICATIONS	BSc (Hons), FGS, MEnvSc, CEnv	BSc (Hons), FGS, MEnvSc, CEnv	
SIGNATURE			
AUTHORISED BY	A Edgar	A Edgar	
QUALIFICATIONS	BSc, MSc, AIEMA, MEnvSc, CEnv	BSc, MSc, AIEMA, MEnvSc, CEnv	
SIGNATURE			

EXECUTIVE SUMMARY

Site Address	Oldham Road, Manchester, M4 5FU	
Grid Reference	E384700, N398800	
Site Area	0.13 Hectares	
Current Site Use	The subject site is currently occupied by a vacant industrial building (west) and car parking. Two connected brick buildings are present in the western sector of the site. One of the buildings is currently unoccupied, having been previously occupied by clothing manufacturers. The building comprises four storeys and fronts onto Addington Street to the southwest. The second building is occupied by a carpet retailer and comprises a single storey brick building on the corner of Addington Street to the southwest and Chadderton Street to the northwest. Hardstanding, which is utilised for car parking is to the rear and eastern side of the buildings.	
Proposed Development	E3P understands that Mulbury City proposes to develop the subject site for high rise residential end use incorporating the demolition of existing buildings and redevelopment of the site for a 12-storey residential building (Use Class C3) comprising 144 residential units, with ground floor commercial use (Use Class A1, A2, A3, B1, and / or D1 (excluding Places of Worship)), disabled car parking, with highways, landscaping and other associated works.	
Environmental Setting	Drift Geology	Glacial Till - BGS indicate the presence of Clay.
	Bedrock Geology	Chester Formation - Sandstone.
	Faults	None recorded within 250 m of the site.
	Hydrogeology	Superficial – Secondary Undifferentiated Aquifer; and Bedrock – Principal Aquifer.
	Hydrology	There are no surface watercourses within influencing distance of the site (<250 m radius).
	Flood Risk	The site is classified as being unaffected by flooding from rivers (Flood Zone 1).
Site History	The site has been occupied by residential and industrial buildings throughout its mapped history. The terraced housing across the site was gradually removed during the 20th century and replaced by industrial buildings.	
Utility Locations	The utility plans indicate the presence of service infrastructure for BT, Cadent Gas Ltd, United Utilities and Electricity NW are present immediately adjacent to the site.	
Landfill Sites and Ground Gases	No present or historic landfill sites are recorded within 250 m of the site.	
Radon	Unaffected – No special precaution required.	
Coal Mining/Land Stability	The site is not located within an area deemed to be at risk from ground instability arising from historic coal mining activities.	
Brine Workings	The site is not located within an area deemed to be at risk from ground instability arising from historic brine pumping activities and/or salt extraction.	
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential development have been identified within influencing distance of the subject site.	



SITE INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising mechanically excavated trial pits, window sample probeholes and a cable percussion borehole with rotary follow on. Selected window sample and cable percussion borehole locations were fitted with environmental monitoring installations to enable gas and groundwater monitoring.
Ground Conditions	Made Ground – 0.00 m bgl to 2.50 m bgl Made Ground deposits were encountered within all exploratory hole locations to depths of between 1.00m and 2.50m bgl. The depth of the Made Ground could not be proven in TP102 due to instability. Made Ground deposits vary across the site comprising of both brown sandy gravel and firm brown to black gravelly clay with frequent cobbles of brick and sandstone. Timber and pipes were also noted in the Made Ground in TP101 and TP102. The greatest depths of Made Ground have been encountered in the south east of the site where old basement structures have been infilled. Further basement are likely anticipated underlying the existing structures. DRIFT – 1.00 m bgl to >26.00 m bgl Drift deposits were encountered to a proven depth of 26.00m bgl and were fairly consistent across the site, comprising a firm low strength to very stiff very high strength brown slightly gravelly CLAY with gravel of sandstone and mudstone. Soft very low strength CLAY was identified in WS103 at 1.30 m bgl. SAND and GRAVEL was identified in CP101 between 21.00 to 23.00 m bgl.. SOLID – 26.00 m bgl to >32.00 m bgl A red brown SANDTONE was recorded at 26.00m bgl to a proven termination depth of 32.00m bgl. GROUNDWATER Groundwater level monitoring has recorded groundwater at depth of between 0.60m bgl and 1.13m bgl.



CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of elevated heavy metals and non-volatile PAHs. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH can be mitigated through the capping of the material by the structure or hardstand, alternatively the installation of a suitable cover system in any landscaping and public open space to remove the potential for direct exposure to impacted soils. The concentration of total mercury at WS101 and TP101 is below the target values for methyl and inorganic mercury, however further analysis is required to confirm the concentrations of elemental mercury. During remediation and enabling works, further samples should be submitted for speciated mercury analysis to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a localised hotspot for off-site disposal. Alternatively, if it is proven that there is no elemental mercury and no vapour risk exists, the soils can be retained on site if placed in an area of low sensitivity (such as beneath hardstand) or a clean cover system in areas of soft landscaping.
Controlled Waters	The site is not considered to pose an unacceptable level of risk to controlled waters.
Ground Gas	Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1, suggesting no gas protection measures will be required. However, the final ground gas regime will be confirmed following the completion of the ground gas monitoring programme.
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation. Current indications suggest that barrier pipe will be required.



GEOTECHNICAL ASSESSMENT

Underground Obstructions	Significant concrete and brick obstructions have been encountered within the Made Ground, indicative of relict foundations from the former buildings. These features pose a constraint and will require grubbing out in their entirety to facilitate the installation of piled foundations.
Allowable Bearing Pressure	The underlying natural clay drift deposits have been assessed as being stiff high strength to very stiff very high strength with a net allowable bearing pressure (ABP) in the order of 150–340 kN/m² at depths of between 5.00–17.00 m bgl, this likely increases with depth. The upper horizons of weathered bedrock at a depth >26.00 bgl offer an ABP in excess of 350kN/m² (based on SPT data). The sandstone at a depth of between 26.50-36.90m bgl recorded a strength of between 5.3-6.6 (MPa) which equates to 5300-6600 kN/m².
Foundation Options	The Made Ground and underlying natural deposits are not considered a suitable target founding stratum. In respect of the proposed development; E3P consider it feasible to construct the proposed residential apartment blocks utilising piled foundations set within the very stiff cohesive soils or underlying bedrock. The final foundation solution will be dependent on the structural loadings, elevation and should be designed by a suitably qualified structural engineer with detailed designs from a specialist piling contractor.
Building Floor Slabs	A ground bearing slab will be viable, but it will need to be constructed on a granular sub-base with the thickness designed by a structural engineer to ensure that settlement tolerances are taken into consideration.
Heave Precautions	As the clay is deemed to be Medium Volume Change Potential, if a ground floor slab is constructed with a cast in-situ suspended floor slab, an engineered design will be required for the heave precautions.
Soakaway Drainage	The presence of shallow groundwater, deep Made Ground deposits and underlying natural drift deposits would likely preclude the use of soakaway drainage systems in this instance.
Sulphate Assessment	The soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005). Elevated sulphate concentrations meeting Class DS-4, AC-3s were noted within the Made Ground deposits in TP101 and elevated concentrations meeting Class DS-3, AC-2s were noted in the Made Ground in TP102.
CBR Design %	It is considered that the shallow Made Ground soils can be re-engineered in accordance with Class 1 (a-c) material under favourable climatic conditions to achieve a CBR of 5%. Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods; however, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade. Where any compressible ground is present beneath proposed roads, adopted drainage infrastructure and hard stand consideration must be given to the potential for consolidation which will induce unacceptable degrees of total and differential settlement at the surface.



Cut/Fill	It is assumed that site levels will remain close to present for the proposed residential apartments, however, a programme of enabling works will be required to removal buried obstructions.
Civil Engineering Excavations	Due to the depth and variability of the Made Ground and likelihood of trench collapse, it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: <i>Waste Classification – Guidance on the classification and assessment of waste</i> .

RECOMMENDATIONS

Based on the findings of the geoenvironmental site assessment, the following additional works are recommended to be completed in due course:

- ✳ Further investigation upon demolition of the existing site structures,
- ✳ Further assessment and delineation of mercury hotspots,
- ✳ Remediation & Enabling Works Strategy;
- ✳ Further geotechnical testing to determine the settlement characteristics for ground bearing floor slab (upon completion of the reduced level dig) and pavement design;
- ✳ Foundations to be designed by suitably qualified Structural Engineer; and
- ✳ Geotechnical Earthworks Compaction Specification (Infrastructure).



Table of Contents

EXECUTIVE SUMMARY	2
1. INTRODUCTION	9
1.1. Background	9
1.2. Proposed Development	9
1.3. Objectives	11
1.4. Limitations	11
1.5. Confidentiality	11
2. GROUND INVESTIGATION	12
2.1. Phase I Desk Study Summary	12
2.2. General Overview	13
2.3. In-Situ Standard Penetration Testing (SPT)	14
2.4. Laboratory Analysis	14
3. GROUND AND GROUNDWATER CONDITIONS	15
3.1. Summary of Ground Conditions	15
3.2. Made Ground	15
3.3. Drift Deposits	15
3.4. Solid Geology	16
3.5. Groundwater	16
3.6. Visual and Olfactory Evidence of Contamination	16
3.7. Soil Consistency	16
3.8. Side Stability and Ease of Excavation	16
3.9. Consolidation	19
3.10. Soil Plasticity	19
3.11. pH and Sulphate	20
3.12. Ground Gas	21
3.13. Investigation Rationale	21
3.14. Monitoring Methodology	21
4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	23
4.1. Human Health Risk Assessment	23
4.2. Controlled Waters Risk Assessment	27
4.3. Ground Gas	31
4.3.1. Sources of Ground Gas	31
4.3.2. Groundwater	31
4.3.3. Gas Flow	32
4.3.4. Gas Concentrations	32
4.3.5. Gas Assessment	32
4.4. Potable water supply	33
4.5. Conceptual Site Model	34
5. GEOTECHNICAL ASSESSMENT	37
5.1. Proposed Development	37
5.2. Summary of Ground Conditions	37
5.3. Site Preparation	37
5.4. Foundation Conditions and Assessment of Potential Bearing Capacities	38
5.5. Ground Floor Slabs	39
5.6. Heave Precautions	39
5.7. Highways Construction	40
5.8. Drainage	40
5.9. Concrete Durability	41
5.10. Excavations	41
5.11. Further Works	42
5.12. Construction Activity and Inspection	42



5.13. GEOTECHNICAL RISK REGISTER	43
6. CONCLUSIONS AND RECOMMENDATIONS	45
6.1. Contaminated Land Assessment.....	45
6.2. Geotechnical Assessment	46
APPENDIX I LIMITATIONS	47
APPENDIX II GLOSSARY	49
APPENDIX III DRAWINGS	52
APPENDIX IV PHOTOGRAPHS	54
APPENDIX V E3P EXPLORATORY HOLE LOGS.....	58
APPENDIX VI CHEMICAL TESTING RESULTS.....	59
APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA.....	60
APPENDIX VIII GEOTECHNICAL TESTING RESULTS	62

DRAWING LIST

12-730-R1-001	Site Location Plan
12-730-R1-002	Proposed Development Plan
12-730-R1-003	Historical Features Plan
12-730-R1-004	Site Features Plan
12-730-R1-005	Exploratory Hole Location Plan
12-730-R1-006	Depth of Made Ground Plan
12-730-R1-010	Conceptual Site Model
12-730-R1-018	Contamination Exceedances Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Scott Hughes Design Ltd, on behalf of their client (Mulbury City), to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of land off Oldham Road, Manchester; herein referred to as the site.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed development for a proposed high-rise residential development.

The scope of work includes the following elements:

- ✳ Design of suitable intrusive ground investigation;
- ✳ Window sample probeholes with, and construction of, environmental monitoring installations;
- ✳ Deep cable percussive borehole with groundwater monitoring installation;
- ✳ Deep rotary borehole to obtain rock cores of the bedrock strata;
- ✳ Mechanically excavated trial pits and trial trenches;
- ✳ In-situ geotechnical testing;
- ✳ Chemical and geotechnical laboratory analysis;
- ✳ Groundwater monitoring and sampling;
- ✳ Ground gas monitoring;
- ✳ Contamination risk assessment and conceptual site model;
- ✳ Geotechnical assessment and interpretation; and
- ✳ Factual and interpretive reporting.

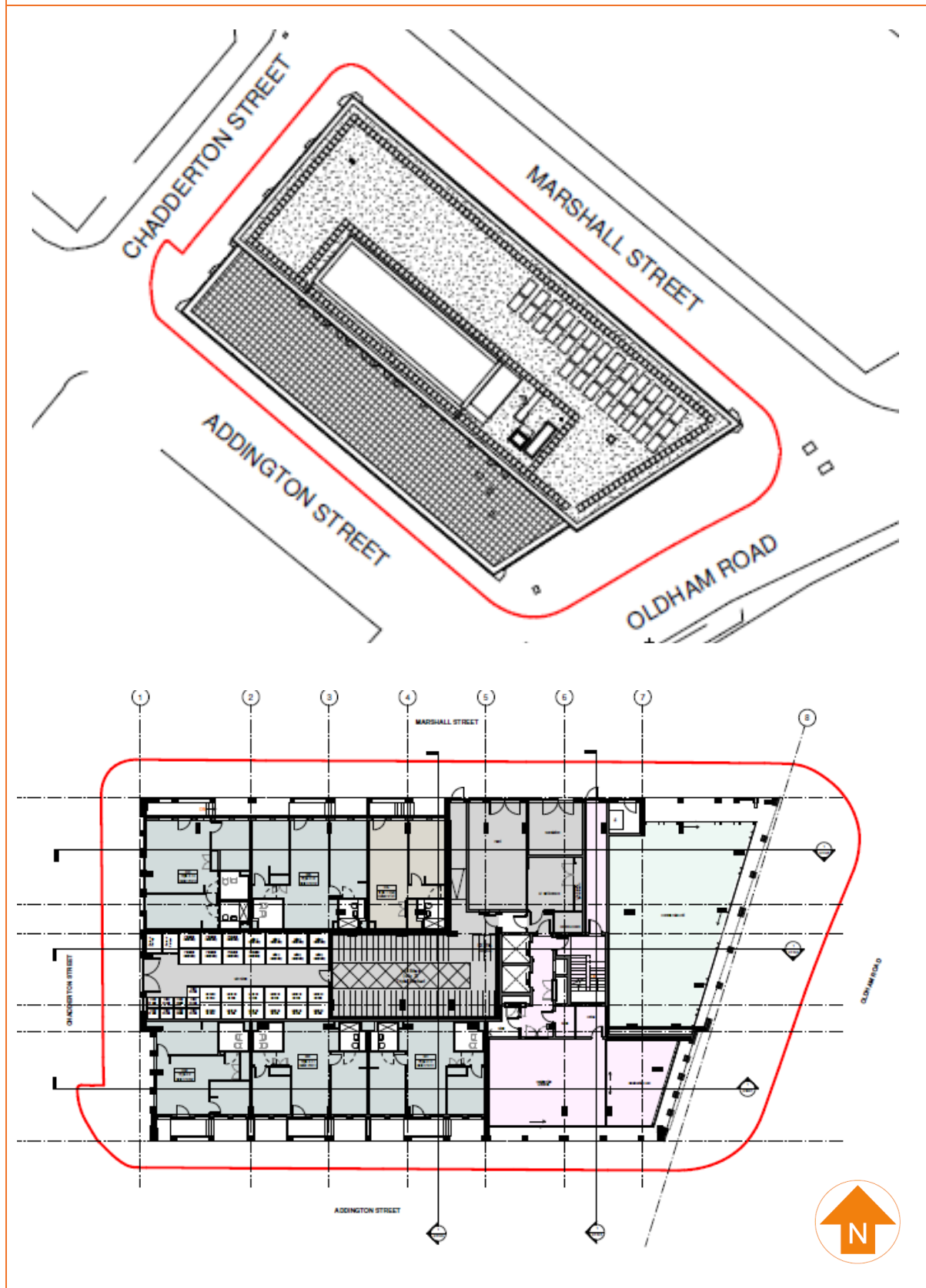
1.2. PROPOSED DEVELOPMENT

E3P understands that Mulbury City proposes to develop the subject site for high rise residential end use. This will include demolition of existing buildings and redevelopment of the site for a 12-storey residential building (Use Class C3) comprising 144 residential units, with ground floor commercial use (Use Class A1, A2, A3, B1, and / or D1 (excluding Places of Worship)), disabled car parking, with highways, landscaping and other associated works.

A snapshot of the Proposed Development Layout is presented in Figure 1.1 below and Appendix III.



FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

-  Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
-  Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
-  Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
-  Provide recommendations regarding future works required.

1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. GROUND INVESTIGATION

2.1. PHASE I DESK STUDY SUMMARY

E3P has previously completed a Phase I Geo-Environmental Assessment (Ref: 12-730-R1-1) dated November 2019. The pertinent point from the desk study report are summarised below:

- ✳ *The existing buildings may support protected species such as bats. A habitat assessment may be required.*
- ✳ *No invasive plant species were identified during the site walkover;*
- ✳ *No Above Ground Storage Tanks (AST) or Underground Storage Tanks (UST) were observed at the site during the preliminary site walkover.*
- ✳ *ACM may be present within the fabric of the existing building; however, no evidence of ACM was noted during the site walkover. ACM in the underlying Made Ground cannot be discounted.*
- ✳ *There is no equipment identified which may contain PCBs within the site boundary.*
- ✳ *No landfill sites are identified within 250m of the site.*
- ✳ *The closest Licensed Waste Management Facility is associated with end of life vehicles and is located 65m northeast.*
- ✳ *There are no recorded Registered Waste Treatment or Disposal Sites, or Waste Transfer Sites within 250m of the site.*
- ✳ *There is an active Contemporary Trade Directory Entry identified on the site, associated with clothing and fabric manufacture.*
- ✳ *Historical commercial land uses and Made Ground represent potential localised sources of heavy metal, polycyclic aromatic hydrocarbon (PAH), petroleum hydrocarbon, asbestos, and ground gas.*
- ✳ *Historical commercial land uses on site and Made Ground represent potential sources of mobile hydrocarbon contamination.*
- ✳ *Made Ground associated with historical development represents a potential source of hazardous ground gases.*



2.2. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources summarised in Section 2.1.

The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed between 21st August 2020 and 4th November 2020. The works are summarised in Table 2.1.

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence / Nature of Obstructions	WS101	Window Sample Probehole	2.94	0.50-1.00
	WS102		3.45	1.00–3.00
	WS103		3.45	1.50-3.00
	TP101	Mechanically Excavated Trial Pit	2.70	N/A
	TP102		2.30	N/A
Investigation of deeper soil horizons and depth to Rockhead	CP101	Cable Percussive Borehole / Rotary Open Hole	32.00	N/A

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The cable percussive borehole was advanced to investigate the deeper soil horizons and to obtain samples for geotechnical testing.

The rotary borehole was advanced to determine the depth of bedrock and to obtain samples of the rock for geotechnical testing.

The sampling locations are illustrated in Drawing 12-730-005 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix V.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged and samples of groundwater recovered for chemical analysis.



2.3. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube.

The results are shown in the probehole logs in Appendix V and presented in Table 3.3 and discussed in Section 5.

2.4. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis comprising:

- ✳ Metals.
- ✳ pH, total sulphate, water-soluble sulphate (2:1 extract).
- ✳ Sulphide.
- ✳ Cyanide.
- ✳ Phenols.
- ✳ Total and speciated polycyclic aromatic hydrocarbons (PAHs).
- ✳ Semi Volatile Organic Compounds (SVOC).
- ✳ Volatile Organic Compounds (VOC).
- ✳ Total Organic Carbon (TOC).
- ✳ Asbestos identification.
- ✳ Banded total petroleum hydrocarbon (TPH).

I2 Analytical undertook the analytical work and the testing results are included in Appendix VI and discussed in Section 4.

Selected samples were submitted to PSL Laboratory where the following geotechnical tests were undertaken:

- ✳ Atterberg limits determinations;
- ✳ One-dimensional consolidation tests and
- ✳ Multi-stage triaxial tests.

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 5.



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 3.1.

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)					
	MADE GROUND	FIRM TO VERY STIFF CLAY	STIFF TO VERY STIFF CLAY	SOFT CLAY	SAND AND GRAVEL	BEDROCK
WS101	0.00–1.00	1.00–2.70	–		–	–
WS102	0.00–1.00	1.00–3.45	–		–	–
WS103	0.00–1.30	–	2.00–3.45	1.30–2.00	–	–
TP101	0.00–2.50	2.50–2.70	–		–	–
TP102	0.00–2.30	–	–	–	–	–
CP101	0.00–1.70	1.70–21.00 23.00–26.00	–	–	21.00–23.00	26.00–32.00

3.2. MADE GROUND

Made Ground deposits were encountered within all exploratory hole locations to depths of between 1.00 m and 2.50 m bgl. The depth of the Made Ground could not be proven in TP102 due to instability.

Made Ground deposits vary across the site comprising of both brown sandy gravel and firm brown to black gravelly clay with frequent cobbles of brick and sandstone. Timber and pipes were also noted in the Made Ground in TP101 and TP102. The greatest depths of Made Ground have been encountered in the south east of the site where old basement structures have been infilled.

A Depth of Made Ground Plan is presented as Drawing 12-730-006 in Appendix III.

3.3. DRIFT DEPOSITS

The drift deposits were encountered within all exploratory locations to a proven depth of 26.00m bgl, with the exception of TP102 where the full depth of Made Ground could not be proven.

The drift deposits are fairly consistent across the site and comprise firm low strength to very stiff very high strength brown slightly gravelly CLAY with gravel of sandstone and mudstone.

Soft very low strength CLAY has been identified in WS103 at 1.30 m bgl.

SAND and GRAVEL was identified in CP101 between 21.00 to 23.00 m bgl.



3.4. SOLID GEOLOGY

A weak to moderately weak red brown SANDTONE was recorded at 26.00 m bgl to a proven termination depth of 32.00 m bgl.

3.5. GROUNDWATER

Perched groundwater was noted on the plastic membrane at the base of the concrete slab in TP102 at 0.35 m bgl. No other groundwater strikes were identified during the ground investigation.

Further groundwater level monitoring has identified groundwater at between 0.60 m and 1.13 m bgl.

Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free-phase hydrocarbon product, if present.

These results are summarised in Table 3.8.

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has not been identified during the site investigation, other than the Made Ground deposits.

3.7. SOIL CONSISTENCY

Undrained shear strength values were measured using laboratory undrained triaxial tests.

Results of the testing is presented in Table 3.2 below, which indicate the clay drift deposits are very stiff. Strength test data is generally consistent with the field descriptions.

TABLE 3.2 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
WS101	1.5–2.0	Very stiff brown slightly gravelly sandy CLAY.	205	Very Stiff

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.3 overleaf.

3.8. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be unstable within the Made Ground and TP102 was terminated due to collapse.

The presence of brick and concrete hardcore, historic structures and brick obstructions within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground.

The natural strata was excavated with relative ease.



TABLE 3.3 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/ SPT "N" VAL UE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTEN CY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS101	1.2	Gravelly CLAY	7	6.87	N/A	Low Strength	Firm	34.34	70.61
	2	Gravelly CLAY	20	18.27	N/A	High Strength	Very Stiff	91.35	187.82
	2.5	Gravelly CLAY	50	44.41	N/A	Very High Strength	Very Stiff	222.04	456.52
WS102	1.2	Gravelly CLAY	5	4.91	N/A	Low Strength	Firm	24.53	50.44
	2	Gravelly CLAY	20	18.27	N/A	High Strength	Very Stiff	91.35	187.82
	3	Gravelly CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00
WS103	1.2	Gravelly CLAY	4	3.92	N/A	Very Low Strength	Soft	19.62	40.35
	2	Gravelly CLAY	13	11.88	N/A	Medium Strength	Stiff	59.38	122.09
	3	Gravelly CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00
CP101	1.2	Silty CLAY	9	8.83	N/A	Medium Strength	Stiff	44.16	90.78
	3	Gravelly Sandy CLAY	23	20.00	N/A	High Strength	Very Stiff	100.01	205.62
	4	Gravelly Sandy CLAY	24	20.28	N/A	High Strength	Very Stiff	101.38	208.44
	5	Gravelly Sandy CLAY	18	14.93	N/A	Medium Strength	Stiff	74.67	153.51
	6.5	Gravelly Sandy CLAY	27	22.04	N/A	High Strength	Very Stiff	110.21	226.60



Oldham Road, Manchester

Phase II Geoenvironmental Site Assessment

February 2021

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/ SPT "N" VAL UE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTEN CY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
	8	Gravelly Sandy CLAY	28	22.67	N/A	High Strength	Very Stiff	113.33	233.00
	11	Gravelly Sandy CLAY	33	25.52	N/A	High Strength	Very Stiff	127.60	262.35
	12.5	Gravelly Sandy CLAY	32	23.38	N/A	High Strength	Very Stiff	116.90	240.34
	14	Gravelly Sandy CLAY	38	26.32	N/A	High Strength	Very Stiff	131.62	270.60
	15.5	Gravelly Sandy CLAY	50	32.93	N/A	Very High Strength	Very Stiff	164.67	338.56
	17	Gravelly Sandy CLAY	50	31.39	N/A	Very High Strength	Very Stiff	156.95	322.68

NOTES

* The Allowable Bearing Pressure (ABP) should be considered indicative.



3.9. CONSOLIDATION

An undisturbed sample of the natural clay was submitted for oedometer analysis. The results are provided in Table 3.4.

TABLE 3.4 OEDOMETER CONSOLIDATION RESULTS

LOCATION	DEPTH (m)	SAMPLE TYPE	MOISTURE CONTENT (%)	OEDOMETER CONSOLIDATION		
				PRESSURE RANGE (kPa)	M _v (m ² /MN)	C _v (m ² /year)
WS101	1.5-2.0	Liner	19	0-30	Swelling	Swelling
				30-60	0.139	29.972
				60-120	0.104	28.127
				120-240	0.094	7.276
				240-30	0.084	1.152

When considered at overburden pressure with an additional load of 110 kPa the coefficient of volume compressibility (M_v) ranged from 0.084 m²/MN up to 0.139 m²/MN. The material is considered to be low to medium compressibility.

The rate at which settlement is likely to occur is determined by the coefficient of consolidation (C_v). As shown in Table 3.4, the coefficient ranges from 1.152 m²/yr to 29.972 m²/yr. The rate at which settlement will occur is potentially increased by the presence of sand within the Glacial Till and it is likely that settlement will occur over a period of months to years.

3.10. SOIL PLASTICITY

The liquid and plastic limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average plasticity index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth.

E3P typically only consider a soil to be shrinkable if the proportion finer than 63 µm is > 35%.

PI results are compared against guidance given in the NHBC standards, Chapter 4.2 (revised January 2014), which advocates the use of modified plasticity index (I'_p), defined as:

$$I'_p = I_p \times (\% < 425 \mu\text{m}/100)$$

In other words, if PI is 30%, but the soil contains 80% < 425 µm, then I'_p = 30 × 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425 µm sieve is routinely reported by testing labs.

E3P apply engineering judgement where PI results are spread over a range of classifications. Consideration is given to the average values for each particular soil type (differentiate between residual soil and alluvium), the number of results in each class and the actual values.

The Atterberg limits determinations, summarised in Table 3.5, show the clay to be of moderate plasticity.



TABLE 3.5 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS101	1.2	24	22	48	26	93	24	Medium
WS102	1.2	19	21	46	25	92	23	Medium
WS103	1.2	19	19	42	23	96	22	Medium

The results of the Atterberg limits testing confirmed that the soils would be deemed to be Medium Volume Change Potential in accordance with the classification system utilised by the LABC/NHBC industry guidance.

3.11. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.6), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

Elevated sulphate concentrations meeting Class DS-4, AC-3s were noted within the Made Ground deposits in TP101 and elevated concentrations meeting Class DS-3, AC-2s were noted in the Made Ground in TP102.

TABLE 3.6 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	1.8	3.5	8.5	DS-4, AC-3s
TP102	0.6	1.7	8.3	DS-3, AC-2s
TP102	2.3	2.2	11	DS-3, AC-2s
WS101	1.8	0.098	7.5	DS-1, AC-1s
WS102	0.8	0.05	8.4	DS-1, AC-1s
WS102	1.8	0.041	8.4	DS-1, AC-1s
WS103	1.9	0.038	8.2	DS-1, AC-1s



3.12. GROUND GAS

A ground gas assessment has been completed in accordance with guidance provided within CIRIA 665 – *Assessing risk posed by hazardous ground gases to buildings*.

3.13. INVESTIGATION RATIONALE

The ICSM has identified that the underlying Made Ground may represent a potential source of ground gas generation. Based on the identification of these sources, E3P has determined that the site represents a low ground gas source generation potential.

Within the context of the proposed residential end use and ground gas generation potential, the gas assessment requires that six visits are required over three months, with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2, which indicates that for low gas hazard sites (Made Ground with limited degradable material, organic clay of limited thickness) and a high sensitivity development, nominal well spacing should be between 25 m and 50 m.

TABLE 3.7 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Made Ground	0.50–1.00
WS102	Natural Drift Deposits	1.00–3.00
WS103	Natural Drift Deposits	1.50–3.00

3.14. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) were measured using a calibrated infra-red gas analyser (GFM435) with gas flow rates were measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 60 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 3.8.



TABLE 3.8 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	06/10/20	0.1	0.1	-0.00101	0.4	0.4	-0.00404	20	1002	Rising	-1.01	0.50-1.00	1.12	0.60
	22/10/20	0.1	0.1	-0.00076	0.3	0.3	-0.00228	20.1	1001	Rising	-0.76		1.11	0.64
	06/11/20	0.1	0.1	-0.00026	0.4	0.4	-0.00104	19.9	1009	Falling	-0.26		1.11	0.60
	19/11/20	0.1	0.1	0.00151	0.5	0.5	0.00755	19.5	1020	Rising	1.51		1.10	0.53
	10/12/21	0.1	0.1	0.00098	0.4	0.4	0.00392	19.6	1015	Falling	0.98		1.1	0.5
	08/01/21	0.1	0.1	0.00134	0.5	0.5	0.0067	19.3	1014	Rising	1.34		1.1	0.56
WS102	06/10/20	Well Destroyed / Not Serviceable										1.00-3.00	N/A	N/A
	22/10/20												N/A	N/A
	06/11/20												N/A	N/A
	19/11/20												N/A	N/A
	10/12/21													
	08/01/21													
WS103	06/10/20	0.1	0.1	0.00824	0.5	0.5	0.0412	19.4	1002	Rising	8.24	1.50-3.00	2.93	0.94
	22/10/20	0.1	0.1	0.00731	0.6	0.6	0.04386	19.2	1001	Rising	7.31		2.94	0.95
	06/11/20	0.1	0.1	0.00434	0.4	0.4	0.01736	19.6	1009	Falling	4.34		2.93	1.10
	19/11/20	0.1	0.1	0.0001	0.2	0.2	0.0002	19.6	1020	Rising	0.10		2.94	1.13
	10/12/21	0.1	0.1	0.00052	0.3	0.3	0.00156	19.5	1015	Falling	0.52		2.93	1.09
	08/01/21	0.1	0.1	0.00026	0.3	0.3	0.00078	19.4	1014	Rising	0.26		2.94	1.02



4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

The results of this comparison have been summarised within Table 4.1.



TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A RESIDENTIAL END USE WITHOUT PLANT UPTAKE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	40	7	74	TP101 1.8 m	1	Further Action
Cadmium	mg/kg	85	7	0.6	N/A	1	No Further Action
Chromium (VI)	mg/kg	6	7	<4.0	N/A	1	No Further Action
Lead	mg/kg	200	7	690 610 530 440	TP101 1.8 m TP102 0.6 m WS102 0.8 m TP102 2.3 m	1	Further Action
Mercury	mg/kg	1.2	7	4.7 1.3	TP101 1.8 m WS101 1.8 m	3	Further Action
Nickel	mg/kg	180	7	41	N/A	1	No Further Action
Selenium	mg/kg	430	7	3.3		1	
Copper	mg/kg	7100	7	140		1	
Zinc	mg/kg	40000	7	280		1	
Cyanide – Total	mg/kg	791	7	8		1	
Phenols – Total	mg/kg	210	7	9.5		1	
Asbestos	Fibres	NFD	3	NAD		3	
Naphthalene	mg/kg	2.3	7	0.82		4	
Acenaphthylene	mg/kg	2900	7	2.7		2	
Acenaphthene	mg/kg	3000	7	0.24		1	
Fluorene	mg/kg	2800	7	0.63		1	
Phenanthrene	mg/kg	1300	7	2.4		2	
Anthracene	mg/kg	31000	7	11		2	
Fluoranthene	mg/kg	1500	7	11		2	
Pyrene	mg/kg	3700	7	11		2	
Benzo(a)Anthracene	mg/kg	11	7	7.3		2	
Chrysene	mg/kg	30	7	4.8		2	
Benzo(b)Fluoranthene	mg/kg	3.9	7	11 5.7	TP101 1.8 m WS102 0.8 m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	110	7	2.5	N/A	2	No Further Action
Benzo(a)Pyrene**	mg/kg	3.2	7	5.1 4.9	WS102 0.8 m TP101 1.8 m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	45	7	3.8	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.31	7	1.4 0.62	TP101 1.8 m WS102 0.8 m	2	Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Benzo(ghi)Perylene	mg/kg	360	7	4.6	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	7	<1.0	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	7	<0.1		4	
TPH C8-C10 (aliphatic)*	mg/kg	27	7	<0.1		4	
TPH C10-C12 (aromatic)*	mg/kg	250	7	5.2		4	
TPH C12-C16 (aromatic)*	mg/kg	1800	7	18		4	
TPH C16-C21 (aromatic)*	mg/kg	1900	7	87		1	
TPH C21-C35 (aromatic)*	mg/kg	1900	7	410		1	

Notes

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; NFD = no fibres detected.

Referring to Table 4.1, the results of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

- ☛ Lead;
- ☛ Arsenic;
- ☛ Total mercury;
- ☛ Benzo(b)Fluoranthene;
- ☛ Benzo(a)Pyrene; and
- ☛ Dibenzo(a,h)Anthracene

No asbestos has been identified in the any soil samples submitted for analysis.

No VOCs were identified above the limit of detection in the soils submitted for chemical analysis.

In relation to these exceedances, the following can be determined:

- ☛ The main exposure pathways based on the Tier I exceedances are:
 - Soil ingestion;
 - Vapour inhalation (indoor); and
 - Dermal contact and ingestion.

With the exception of marginally elevated total mercury in the natural drift deposits in WS101, the exceedances for all determinants are associated with Made Ground deposits.



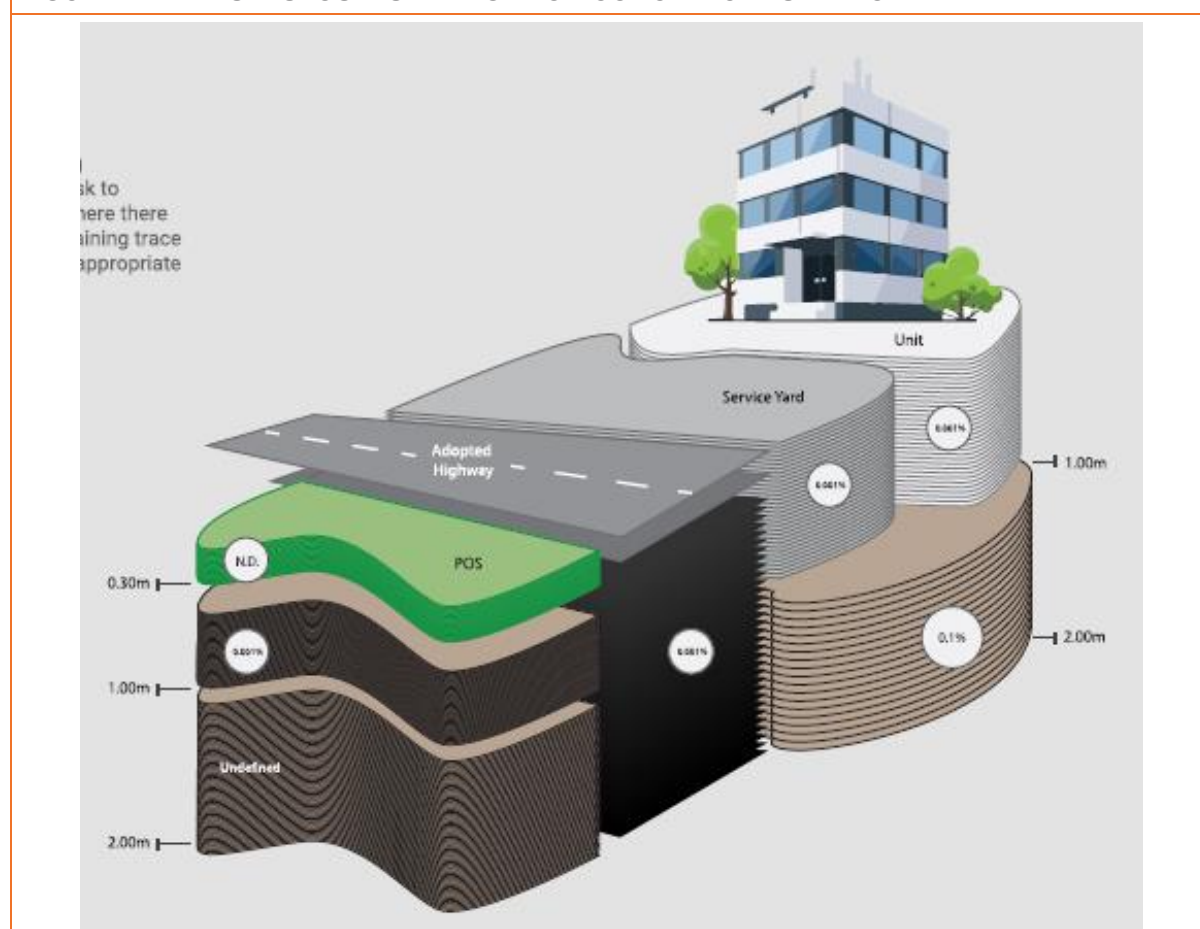
HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH can be mitigated through the capping of the material by the structure or hardstand, alternatively the installation of a suitable cover system in any landscaping and public open space to remove the potential for direct exposure to impacted soils.

The concentration of total mercury at TP101 and WS101 are below the target values for methyl and inorganic mercury, however further analysis is required to confirm the concentration of elemental mercury. During remediation and enabling works, further samples should be submitted for speciated mercury analysis to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a localised hotspot for off-site disposal. Alternatively, if it is proven that there is no elemental mercury and no vapour risk exists, the soils can be retained on site if placed in an area of low sensitivity (such as beneath hardstand) or a clean cover system in areas of soft landscaping.

Asbestos has not been identified in the soils analysed to date and no visual signs of ACM were encountered during the ground investigation. However, if any asbestos is identified in the soils during remediation works, impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1 below.

FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Notes

ND None Detect

0.001% Soils may contain $\leq 0.001\%$ asbestos using composite testing to ensure there is no potential risk to human health. This value is present within areas where there may be a short term low level exposure of soils containing trace asbestos fibres by construction workers where an appropriate level of asbestos management is employed (dust suppression)

0.1% Soils at a depth of $>1.00\text{m}$ bgl may contain $<0.1\%$ asbestos using composite testing where they will not be likely to be disturbed in the future and will therefore be in an area of low sensitivity. Risk assessment completed in accordance with Asbestos JIWG risk assessment tools.

Undefined- this will be dependent upon soils encountered during earthworks, which may be placed at these depths to ensure no potential risk to human health.



Chemical analysis of the natural clay drift deposits (other than WS101) suggests that these soils are likely to be acceptable for use as subsoil within any proposed landscaped areas; however, further chemical validation samples will be required to confirm this.

There are no suitable sources of topsoil available on the site.

If sub-soil is to be removed from site, a U1 Exemption or a CL:AIRE MMP for the direct transfer of naturally occurring soils will be required.

If any material is removed for off-site disposal a WM-3 waste classification will be required.

4.2. CONTROLLED WATERS RISK ASSESSMENT

The site sensitivity with respect to controlled waters is summarised within Table 4.2.

TABLE 4.2 CONTROLLED WATERS SENSITIVITY PROFILE

RISK PROFILE	DISCUSSION	SENSITIVITY RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not located within a Groundwater Source Protection Zone.	Low
Distance to the Closest Groundwater Abstraction Point	The closest groundwater abstraction is a potable supply, located 937m west of site.	Low
Aquifer Classification in Superficial Drift Deposits	Glacial Till across most of the site is classified as a Secondary Aquifer - undifferentiated.	Low
Aquifer Classification in Bedrock	Underlying bedrock is classified as a Principal Aquifer.	High
Viability for Anthropogenic Soil in Direct Contact with Aquifer (Drift or Bedrock)	Variable Made Ground with low-level (predominantly low-solubility) hydrocarbon impact is present in the near surface. Significant depths of cohesive drift deposits in excess of 26.0 m are present overlying the bedrock.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	There are no surface watercourses within influencing distance (<250m) of the site.	Low
SUMMARY The ICSM developed within the context of the site setting has only identified a single viable pollutant linkage, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer. However, the overall sensitivity of this receptor is reduced given the presence of a significant thickness of low permeability drift deposits and the absence of any groundwater abstraction from the principal aquifer within 900m of the site.		

To further refine the ICSM, E3P has undertaken an initial qualitative assessment of the soil data analysis to assess the potential for a source of separate-phase or dissolved-phase contamination originating from either a defined on-site source or from impacted soils.

This assessment is summarised in Table 4.3.



TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of TPH C5 to C6 that might otherwise be indicative of VOC impact
Total VOC > 1 mg/kg	
Total SVOC > 1 mg/kg	Concentrations either below or only slightly elevated above the laboratory LOD
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD
C10-C12 > 10 mg/kg	All concentrations are less than 10 mg/kg.
C12-C16 > 50 mg/kg	All concentrations are less than 50 mg/kg.
Phenols > 2 mg/kg	Total phenols are 9.5 mg/kg in TP101 at 1.8 m bgl.
Naphthalene > 2 mg/kg	The most soluble SVOC (naphthalene) has not been identified at concentrations greater than 2 mg/kg
Total PAH > 10 mg/kg	Concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected in TP101 at 1.8 m bgl.
PCB > 1 mg/kg	No potential sources of PCB have been identified
Heavy metals > 500 mg/kg	Concentrations of lead are above 500 mg/kg in TP101, TP102 and WS102.

In due consideration of the ICSM, which has identified a potential pollutant linkage associated with the migration towards the underlying principal aquifer, E3P has undertaken a Tier I controlled waters risk assessment.

The Tier I assessment has included a comparison of leachate analysis from the Made Ground in WS103 to drinking water standards in the first instance and in absence of environmental quality standards (EQS).

These are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}	DWS 3,4,5	N		MC	LOC. OF EX	ASSESSMENT
		AA		L	GW			
Inorganics								
Arsenic	µg/l	50	10	1	0	5.7	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	1	0	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	1	0	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	1	0	1.3	N/A	No Further Action
Copper	µg/l	1	2000	1	0	9	N/A	No Further Action
Total Cyanide	µg/l	1	50	1	0	2	N/A	No Further Action
Lead	µg/l	1.2	10	1	0	6.8	N/A	No Further Action
Mercury	µg/l	–	1.0	1	0	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	1	0	1.5	N/A	No Further Action
Selenium	µg/l	–	10	1	0	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	1	0	11	WS103 0.8m	Further Action
pH	6–9			1	0	7.9	N/A	No Further Action
PAH								
Naphthalene	µg/l	2	10*	1	0	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1		1	0	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*		1	0	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*		1	0	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	0.00017*		1	0	<0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*		1	0	<0.01	N/A	No Further Action
Benzo(ghi)pyrene	µg/l	0.00017*		1	0	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063		1	0	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4		1	0	<0.01	N/A	No Further Action
TPH-Aromatic								
TPH C5-C6 (benzene)	µg/l	10	1	1	0	<1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	74	700	1	0	<1.0	N/A	No Further Action
TPH C8-C10 (ethyl benzene)	µg/l	20	300	1	0	<1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	500	1	0	<10	N/A	No Further Action
TPH C12-C16	µg/l	2	90 ⁵	1	0	<10	N/A	No Further Action
TPH C16-C35	µg/l	50#	90 ⁵	1	0	<10	N/A	No Further Action



DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}	DWS 3,4,5	N		MC	LOC. OF EX	ASSESSMENT
		AA		L	GW			
TPH Aliphatic								
TPH C5-C6	µg/l	—	15000	1	0	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	—	15000	1	0	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	—	300	1	0	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	—	300	1	0	<10	N/A	No Further Action
TPH C12-C16	µg/l	—	300	1	0	<10	N/A	No Further Action
TPH C16 – C21	µg/l	—	300**	1	0	<10	N/A	No Further Action
TPH C21-C35	µg/l	—	300**	1	0	<10	N/A	No Further Action

Notes

Solubility <0.01µg/l

AA – Annual Average

* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
5. WHO Guidelines for Drinking Water Quality. Third edition (2004)

CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that the data exceeds the EQS value for Zinc. No DWS is available for Zinc, therefore to be conservative, the value has been compared to the EQS standard. The exceedance is marginal of 11 ug/l compared to the standard of 10.9 ug/l.

Given that there are no potable abstractions within 900m and the site is underlain by low-permeability, cohesive glacial till deposits to circa 26.0 m bgl, which will afford protection to the underlying principal aquifer, there is considered to be a low risk to controlled waters and the wider environ as no complete pollutant linkage can be determined.

Based on the above, there is considered to be no unacceptable level of risk to the controlled water receptors.



4.3. GROUND GAS

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings* (2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

CIRIA C665 and NHBC Report No 10627-R01 provide assessments for carbon dioxide and methane based upon gas screening values (GSVs) utilising flow rates and concentrations. The site-based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{\text{concentration (by vol)}}{100} \times \text{flowrate (1 / hr)}$$

The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted.

The thresholds for GSVs based upon NHBC and CIRIA guidance are provided within Table 4.5.

TABLE 4.5 RESIDENTIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH CIRIA C665 AND NHBS REPORT NO 10627-R01 – RESIDENTIAL END USE

CIRIA – NO SUBFLOOR VOID		NHBC – SUBFLOOR VOID		
CLASSIFICATION	GSV (METHANE AND CARBON DIOXIDE)	CLASSIFICATION	GSV (METHANE)	GSV (CARBON DIOXIDE)
CS1	< 0.07	Green	< 0.13	< 0.76
CS2	< 0.70	Amber 1	< 0.63	< 1.60
CS3	< 3.5	Amber 2	< 1.60	< 3.10
CS4	< 15	Red	> 1.60	> 3.10
CS5	< 70	N/A	N/A	N/A
CS6	> 70	N/A	N/A	N/A

4.3.1. SOURCES OF GROUND GAS

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

- ✳ Made Ground deposits to a proven depth of 2.50m.

4.3.2. GROUNDWATER

Groundwater levels have been recorded at depths of between of 0.60 m bgl (WS101) and 1.13m bgl (WS103) to date.

No significant fluctuations have been recorded.



4.3.3. GAS FLOW

During the monitoring a positive flow was noted in both wells at rates of between 0.10-8.24 l/hr. The measure of the positive flow in WS103 has significantly reduced over the monitoring period (t0 date) and was last recorded at 0.10l/hr on the fourth visit.

Negative flows were recorded in WS101 on three occasions. Negative flows may be indicative of back pressure from wind being greater than the active flow from the wells.

4.3.4. GAS CONCENTRATIONS

No elevated concentrations of methane have been recorded during the initial monitoring visits.

Carbon dioxide concentrations were recorded within the monitoring wells at concentrations ranging from 0.3% v/v to 0.6% v/v.

4.3.5. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV).

The GSVs for the monitoring positions are summarised in Table 4.6.

TABLE 4.6 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CH ₄ (% v/v)	GSV (l/hr)	MAX CO ₂ (% v/v)	GSV (l/hr)	CLASSIFICATION
WS101	0.1	0.00151	0.4	0.00755	Green
WS102	-	-	-	-	-
WS103	0.1	0.00824	0.6	0.04386	Green

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1 and it is considered that gas protection measures will not be required, however, this is an interim assessment and will be confirmed on completion of the full gas monitoring programme.



4.4. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework. The assessment is made with reference to the UK Water Industry Research (UKWIR) publication "Guidance on the selection of Water Supply Pipes to be used in Brownfield Sites"

TABLE 4.7 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	<0.1
Total BTEX And MTBE	0.1	<0.1
Total SVOCs (Excluding PAH and those substances marked with an *)	2	<2.0
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	22.8
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	537
Phenols (From SVOC Analysis)*	2	<2.0
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	<2.0
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	Yes – TP101 1.8 m bgl for TPH C10-C40.	
Is free product present in soil and groundwater?	None	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No heavy end hydrocarbon impact or low solubility PAH has been identified within Made Ground.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	Currently unknown.	
Will soils be imported to site as part of any future earth works	Currently unknown. The importation of materials may affect the WIR Risk Assessment which should be updated after completion.	

Notes - Pipe line depth normally between 0.75m–1.35m

Based on the assessment of current site conditions it is likely that barrier pipe will be required at the proposed development.

A full UKWIR assessment will be required on completed of the remedial and enabling works.



4.5. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.8 has been prepared for the site.

TABLE 4.8 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, Non-volatile PAH	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors	Likely	High	LOW
Discussion: Heavy metals and non-volatile PAH identified throughout Made Ground between depths of 0.60 m and 2.30 m bgl. Recommendation: The Made Ground will likely be capped beneath the proposed structure or hardstand, however, a cover system to any landscaped areas will be required to prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						
PL4	Mercury (Made Ground)	Inhalation of vapours.	Future site users. Off-site receptors.	Low Likelihood	Moderate	TBC
Assessment: Marginally elevated total mercury has been identified in the Made Ground in TP101 and in the natural drift in WS101. Recommendation: Mercury speciation analysis is required to determine if a vapour risk has been identified. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a hotspot for removal off-site. Alternatively, if it is proven that there is no elemental mercury, placement of material in an area of non-sensitivity will be sufficient.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Methane, carbon dioxide (Made Ground)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Low likelihood	Moderate	LOW
Assessment: Monitoring completed to date suggests Characteristic Situation 1. Recommendation: Completion of ground gas monitoring and precautionary CS2 measures due to deep Made Ground.						
PL5	Mobile contaminants (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (principal aquifer).	Likely	Moderate	LOW
Assessment: This comparison indicates that the data exceeds the EQS value for Zinc. Given that there are no potable abstractions within 900 m and the site is underlain by low-permeability, cohesive glacial till deposits to circa 26.0 m bgl which will afford protection to the underlying principal aquifer, there is considered to be a low risk to controlled waters and the wider environ as no complete pollutant linkage can be determined. Recommendation: No further assessment is required.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Likely	Moderate	Low
Assessment: The soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005). Elevated sulphate concentrations meeting Class DS-4, AC-3s were noted within the Made Ground deposits in TP101 and elevated concentrations meeting Class DS-3, AC-2s were noted in the Made Ground in TP102.						
Recommendation: Concrete should be designed in accordance with the chemical testing results.						
PL7	Organic contaminants such as hydrocarbons (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Likely	Moderate	LOW
Assessment: Elevated concentrations of TPH C10-C40 have been identified at the pipeline depth.						
Recommendation: Based on the assessment of current site conditions, barrier pipe is likely to be required for the proposed development. This will need to be confirmed through a UKWIR assessment post remediation						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
Assessment: Contamination has been encountered within shallow Made Ground across the site which may be taken up by flora in soft landscaping.						
Recommendation: Installation of a clean cover system within areas of soft landscaping to prevent plant uptake of contaminants.						

Main exposure pathways: PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants



5. GEOTECHNICAL ASSESSMENT

5.1. PROPOSED DEVELOPMENT

E3P understands that Mulbury City proposes to develop the subject site for high rise residential end use. This will include demolition of existing buildings and redevelopment of the site for a 12-storey residential building (Use Class C3) comprising 144 residential units, with ground floor commercial use (Use Class A1, A2, A3, B1, and / or D1 (excluding Places of Worship)), disabled car parking, with highways, landscaping and other associated works.

5.2. SUMMARY OF GROUND CONDITIONS

Made Ground

Made Ground deposits were encountered within all exploratory hole locations to depths of between 1.00m and 2.50m bgl. The depth of the Made Ground could not be proven in TP102 due to instability.

Made Ground deposits vary across the site comprising of both brown sandy gravel and firm brown to black gravelly clay with frequent cobbles of brick and sandstone. Timber and pipes were also noted in the Made Ground in TP101 and TP102. The greatest depths of Made Ground have been encountered in the south east of the site where old basement structures have been infilled.

Drift

Drift deposits were encountered to a proven depth of 26.00m bgl and were fairly consistent across the site, comprising a firm low strength to very stiff very high strength brown slightly gravelly CLAY with gravel of sandstone and mudstone. Soft very low strength CLAY was identified in WS103 at 1.30 m bgl.

SAND and GRAVEL was identified in CP101 between 21.00 to 23.00 m bgl.

Solid Geology

A red brown SANDTONE was recorded at 26.00m bgl to a proven termination depth of 32.00m bgl.

Groundwater

Groundwater level monitoring has recorded groundwater at depth of between 0.60m bgl and 1.13m bgl.

5.3. SITE PREPARATION

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual of Contract Documents for Highway Works (MCHW)*. This should include the following:

- ✿ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✿ Demolition of all existing buildings and removal of all concrete and asphalt hardstanding.
- ✿ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✿ Buried structures and old foundations/basements have been encountered on site. These should be excavated from below the proposed development footprint with the resulting void backfilled.



5.4. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe allowable bearing pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum.

The results of this assessment are summarised in Table 5.1

TABLE 5.1 SUMMARY OF ABPS

COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Firm CLAY	1.20	25–34	50–71
Stiff to Very Stiff CLAY	2.00–5.00	44–217	99–447
Stiff to Very Stiff CLAY	5.00–17.00	75–165	154–339
Soft CLAY (WS103)	1.20	20	40

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying stiff to very stiff glacial clays or sandstone bedrock.

The underlying natural clay drift deposits have been assessed as being stiff high strength to very stiff very high strength with a net allowable bearing pressure (ABP) in the order of 150–340 kN/m² at depths of between 5.00–17.00 m bgl, this likely increases with depth. The upper horizons of weathered bedrock at a depth >26.00 bgl offer an ABP in excess of 350kN/m² (based on SPT data).

The Unconfined Compressive Strength (UCS) tests indicate that at a depth of between 26.50-36.90mbgl, the sandstone recorded a strength of between 5.3-6.6 (MPa) which equates to 5300-6600 kN/m².

As the proposed building will be 12 No. storeys, the structural loads will necessitate the use of piled foundations. All obstructions would need to be removed as part of the enabling works prior to any piling.

While a detailed assessment of pile depths and bearing capacity is beyond the scope of this report, it is likely that piles would achieve a 'set' within the very stiff clay at circa 15.00m to 25.00 m bgl or within the underlying bedrock at 26.00 m bgl. Consideration of the effects of negative skin friction due to variability on the Made Ground and natural drift strata will be required.

A specialist piling contractor should be contacted to obtain detailed designs and costs for a specialist piling technique and to allow them to reduce the factor of safety based on their extensive pile testing data.



5.5. GROUND FLOOR SLABS

Given the nature of the proposed high-rise residential development it is recommended that a ground bearing floor slab be utilised.

In order to accommodate for differential settlement and slab failure it is recommended further Plate Load Testing is undertaken on the sub-grade following the breaking out of hardstand and reduced level dig to understand settlement characteristics and inform a geotechnical design specification in order to engineer to the required level to support a proposed ground bearing slab.

5.6. HEAVE PRECAUTIONS

The site has been proven to be underlain by clay soils which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within influencing distance of trees as per the NHBC / LABC conjectured zones of influence.

As the clay is deemed to be Medium Volume Change Potential, if a ground floor slab is constructed with a cast in-situ suspended floor slab, an engineered design will be required for the heave precautions.

A summary of heave precautions is presented in Table 5.3 overleaf.



TABLE 5.3 SUMMARY OF HEAVE PRECAUTIONS

		MINIMUM VOID DIMENSION FOR FOUNDATIONS, GROUND BEAMS AND SUSPENDED IN-SITU CONCRETE GROUND FLOORS		MINIMUM VOID DIMENSIONS UNDER PRECAST CONCRETE AND SUSPENDED TIMBER FLOORS
Plasticity Index of Soil	Required Foundation Depth (m)	Thickness of Void Former Against Side of Foundation or Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam and Floor Slab (mm)	Void Dimension (mm)
High Plasticity (> 40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	35	150	300
	1.5–2.0	25	75	
Moderate Plasticity (20–40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	25	100	250
	1.5–2.0	25	50	
Low Plasticity (< 20)	2.0–2.5	N/A	50	200
	> 2.0	No Special Precautions		

5.7. HIGHWAYS CONSTRUCTION

A programme of remediation and enabling works will be required to remediate the proposed road subgrade in accordance with the requirements of the Manual of Contract Documents for Highway Works Volume 1 Specification For Highway Works (Series 600-Earthworks) for a method compaction.

It is considered that the material can be re-engineered using method compaction to achieve a CBR in excess of 3-5% if works are completed in favourable climatic conditions.

Following excavation, the sub formation should be proof rolled and any soft material inspected and removed during favourable climatic conditions to prevent exposure to precipitation.

5.8. DRAINAGE

The presence of a deep Made Ground across the site may result in settlement and would therefore preclude the use of soakaway drainage.

It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

Furthermore, the site is predominantly underlain by likely low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will be limited, and as the lateral continuity of the Made Ground cannot be assured, it is not recommended that soakaways are utilised for disposal of surface water runoff.



5.9. CONCRETE DURABILITY

Based upon the results of the chemical analyses it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE *Special Digest 1* (2005).

Elevated sulphate concentrations meeting Class DS-4, AC-3s were noted within the Made Ground deposits in TP101 and elevated concentrations meeting Class DS-3, AC-2s were noted in the Made Ground in TP102.

5.10. EXCAVATIONS

Trial pits were generally unstable due to deep Made Ground deposits. The boreholes were advanced with relative ease through the natural soils and generally excavations should be feasible as part of future works with normal plant.

Relict foundations and underground obstructions have been encountered which will require grubbing out in their entirety during the reduced level dig for the sub structure works.

Groundwater has been encountered at depths of between 0.60m – 1.13m bgl based on the monitoring completed to date.

Due to the depth and variability of the Made Ground and likelihood of trench collapse it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations. Consideration should be given for the potential for dewatering gravels in the surrounding areas to the subject site that may cause structural damage to buildings sub-structures in close proximity to the site.

TABLE 5.5 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	Yes	Minor water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure.
Shallow Bedrock	No	Shallow bedrock has not been encountered.



5.11. FURTHER WORKS

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

- ✳ Further investigation upon demolition of the existing site structures,
- ✳ Further assessment and delineation of mercury hotspots,
- ✳ Remediation & Enabling Works Strategy;
- ✳ Further geotechnical testing to determine the settlement characteristics for ground bearing floor slab (upon completion of the reduced level dig) and pavement design;
- ✳ Foundations to be designed by suitably qualified Structural Engineer; and
- ✳ Geotechnical Earthworks Compaction Specification (Infrastructure).

5.12. CONSTRUCTION ACTIVITY AND INSPECTION

The following activities and inspections should be incorporated into the site works:

- ✳ Due to the variability of the soils at the site, it is recommended that sufficient allowance is made for the inspection of formations and subformations to foundations and pavement construction.
- ✳ Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.
- ✳ It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.
- ✳ Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.
- ✳ The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).



5.13. GEOTECHNICAL RISK REGISTER

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of Contaminated Soils		Site	TBC	The mercury at TP101 and WS101 may require hotspot removal following the speciation of mercury, resulting the requirement to backfill the resulting voids.
Obstructions		All	100	Site has been subject to significant historical development and subsurface obstructions from relict foundations, basements and slabs remain.
Trench collapse		All	100	Made Ground present beneath the site is likely to be loosely compacted and possibly prone to collapse.
Mature Trees		N/A	N/A	No semi-mature or mature trees within influencing distance of the site, as such, not arboricultural survey is required.
Volume Change Potential Clay		On site	100	The cohesive soils have been assessed to be medium volume change potential and therefore precautions may be required at the site.
Peat		N/A	N/A	None identified.
Running Sands		N/A	N/A	Data searches indicate Low Risk.
Ground Dissolution		N/A	N/A	Data searches indicate No Hazard.
Concrete Design		Site	10	Elevated sulphate concentrations meeting Class DS-4, AC-3s were noted within the Made Ground deposits in TP101 and elevated concentrations meeting Class DS-3, AC-2s were noted in the Made Ground in TP102.
Low-Permeability Ground		Site	100	Soakaways unlikely to be effective in areas where low permeability cohesive deposits are present



POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Services / Sensitive Structures		-	-	Utilities are present throughout the surrounding highways. Piling may not be possible within immediate proximity of any sensitive infrastructure.
Abnormal Foundation Solutions		Site	100	A piled foundation will be required due to the presence of deep Made Ground and obstructions.
Areas Not investigated		Site	30	Relict foundations and obstruction are anticipated beneath the existing structure.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of elevated heavy metals and non-volatile PAHs. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH can be mitigated through the capping of the material by the structure or hardstand, alternatively the installation of a suitable cover system in any landscaping and public open space to remove the potential for direct exposure to impacted soils. The concentration of total mercury at WS101 and TP101 is below the target values for methyl and inorganic mercury, however further analysis is required to confirm the concentrations of elemental mercury. During remediation and enabling works, further samples should be submitted for speciated mercury analysis to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a localised hotspot for off-site disposal. Alternatively, if it is proven that there is no elemental mercury and no vapour risk exists, the soils can be retained on site if placed in an area of low sensitivity (such as beneath hardstand) or a clean cover system in areas of soft landscaping.
Controlled Waters	The site is not considered to pose an unacceptable level of risk to controlled waters.
Ground Gas	Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1, suggesting no gas protection measures will be required. However, the final ground gas regime will be confirmed following the completion of the ground gas monitoring programme.
Potable Water	This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation. Current indications suggest that barrier pipe will be required.



6.2. GEOTECHNICAL ASSESSMENT

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying stiff to very stiff glacial clays or sandstone bedrock.

It is therefore recommended that piled foundations are installed capable of transferring structural loads to competent stratum for the residential blocks.

It is assumed that site levels will remain close to present for the proposed residential development, however, a programme of cut and fill works may be required to remove the buried obstructions;

The final foundation solution will be dependent on the structural loadings and elevation and should be designed by a suitably qualified structural engineer;

It is considered the Made Ground and underlying soils may provide a sub-grade formation to support proposed roads and infrastructure with a likely CBR of >5%.

The site is not located in an area of historic mine workings or ground instability and the risk of future subsidence is considered to be very low; and

The presence of shallow groundwater and deep Made Ground deposits would likely preclude the use of soakaway drainage systems in this instance.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



Oldham Road, Manchester

Phase II Geoenvironmental Site Assessment

February 2021

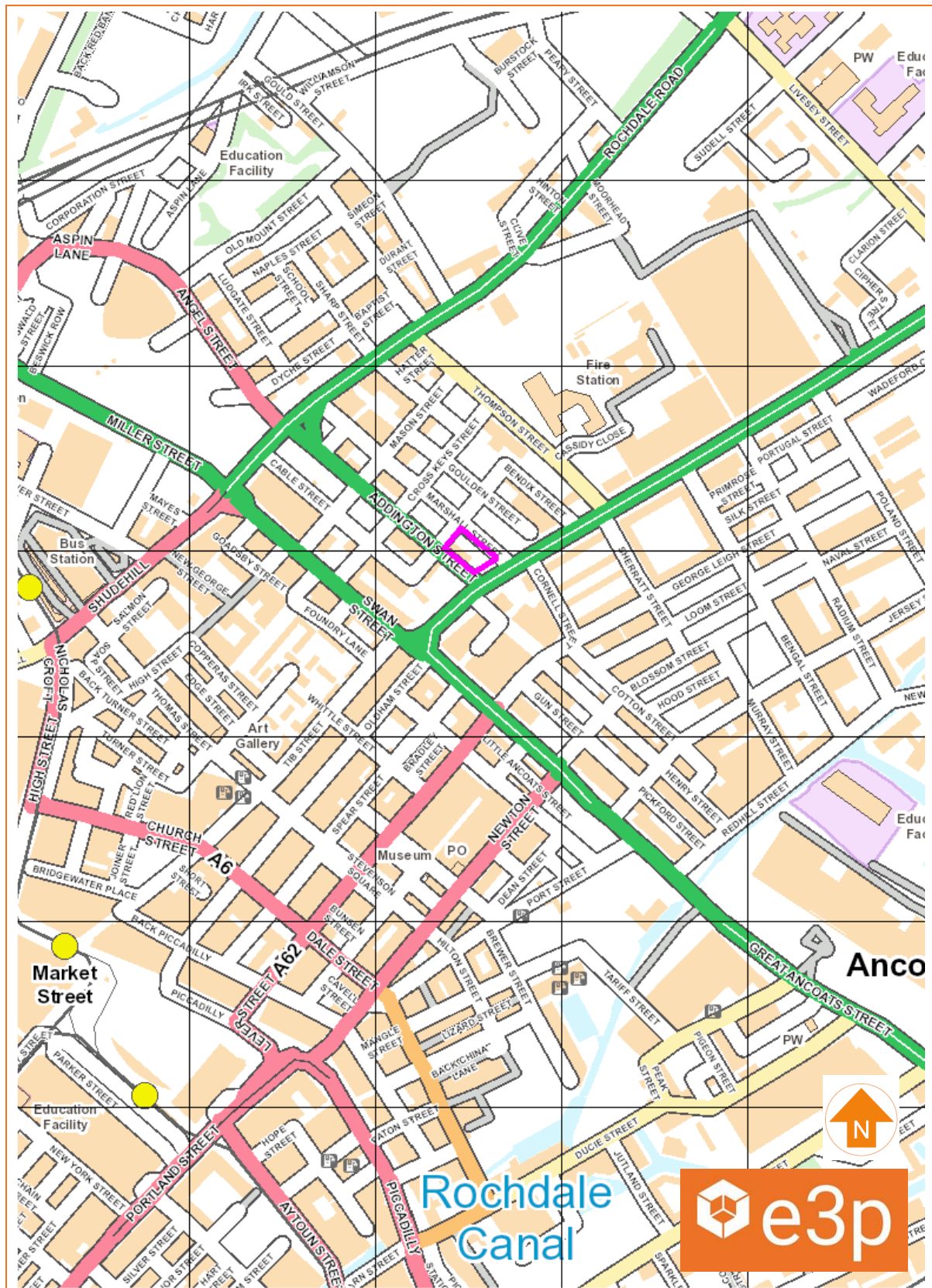
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection

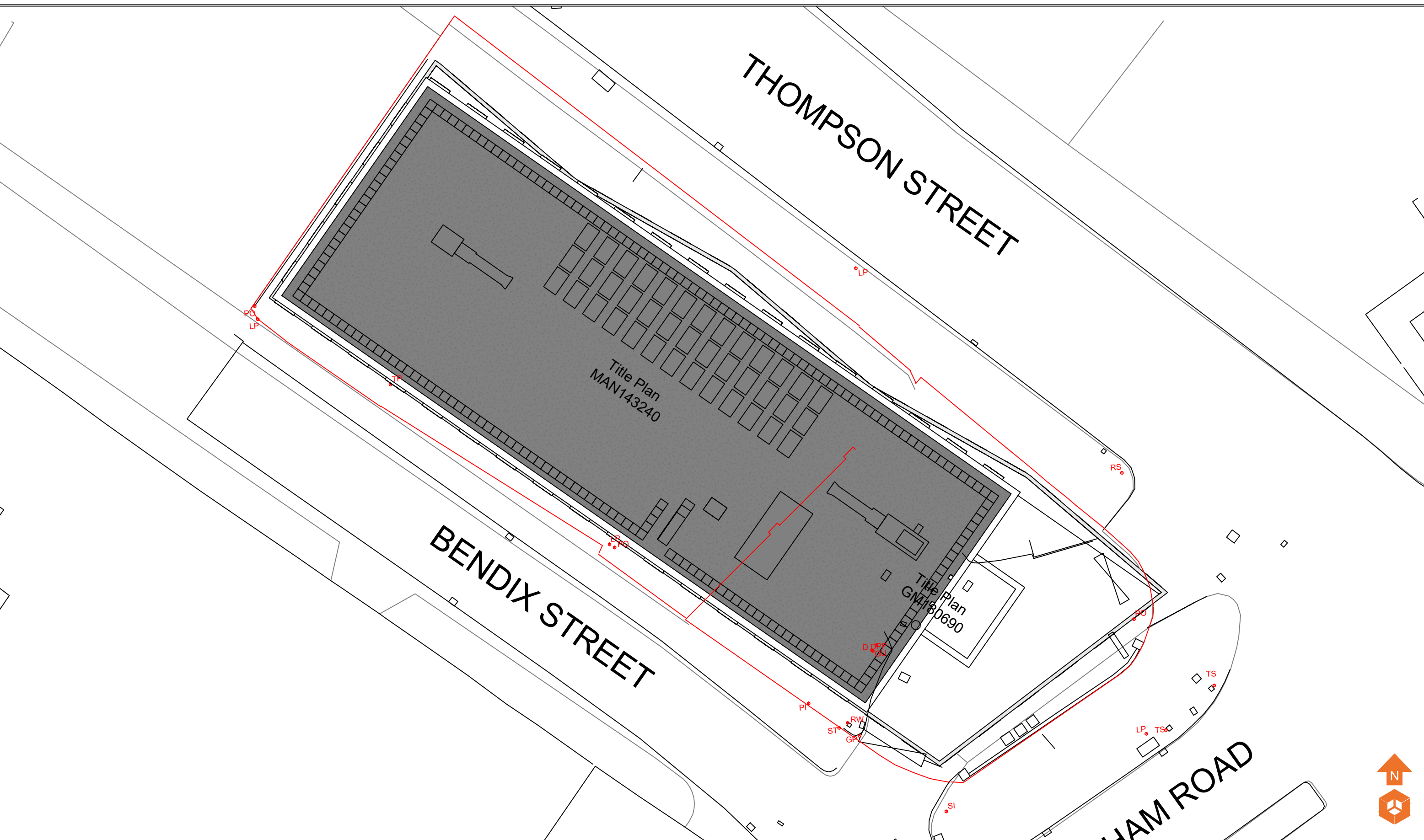


APPENDIX III

DRAWINGS

DRAWING 12-730-001 – SITE LOCATION PLAN





	Notes:					Client: Mulbury	Job No: 12-730	Date: 08.12.2020	 Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
							Drawing No: 002	Scale: NTS		
						Job Title: Oldham Road	Drawing Title: Proposed Development Plan			The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.
	P1	REVA	08.12.2020	HM	AS					
	Phase	Issue	Date	Drawn	Checked					



Location Symbols Former Buildings (Pre 1892 - Pre 1922) Former Boundary (Pre 1892 - Pre 1958) Former Buildings (Pre 1892 - Pre 1958) Former Buildings (Pre 1958 - Pre 1993) Buildings (Pre 1993 - Present)

Notes:

Client:

Job No:

12-730

Date:

08.12.2020

Mulbury

Drawing No:

003

Scale:

NTS

Oldham Road

Job Title:

Drawing Title:

e3p

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

P1

REVC

08.12.2020

HM

AS

P1

REVB

03.12.2020

HM

AS

P1

REVA

18.07.2018

HM

MD

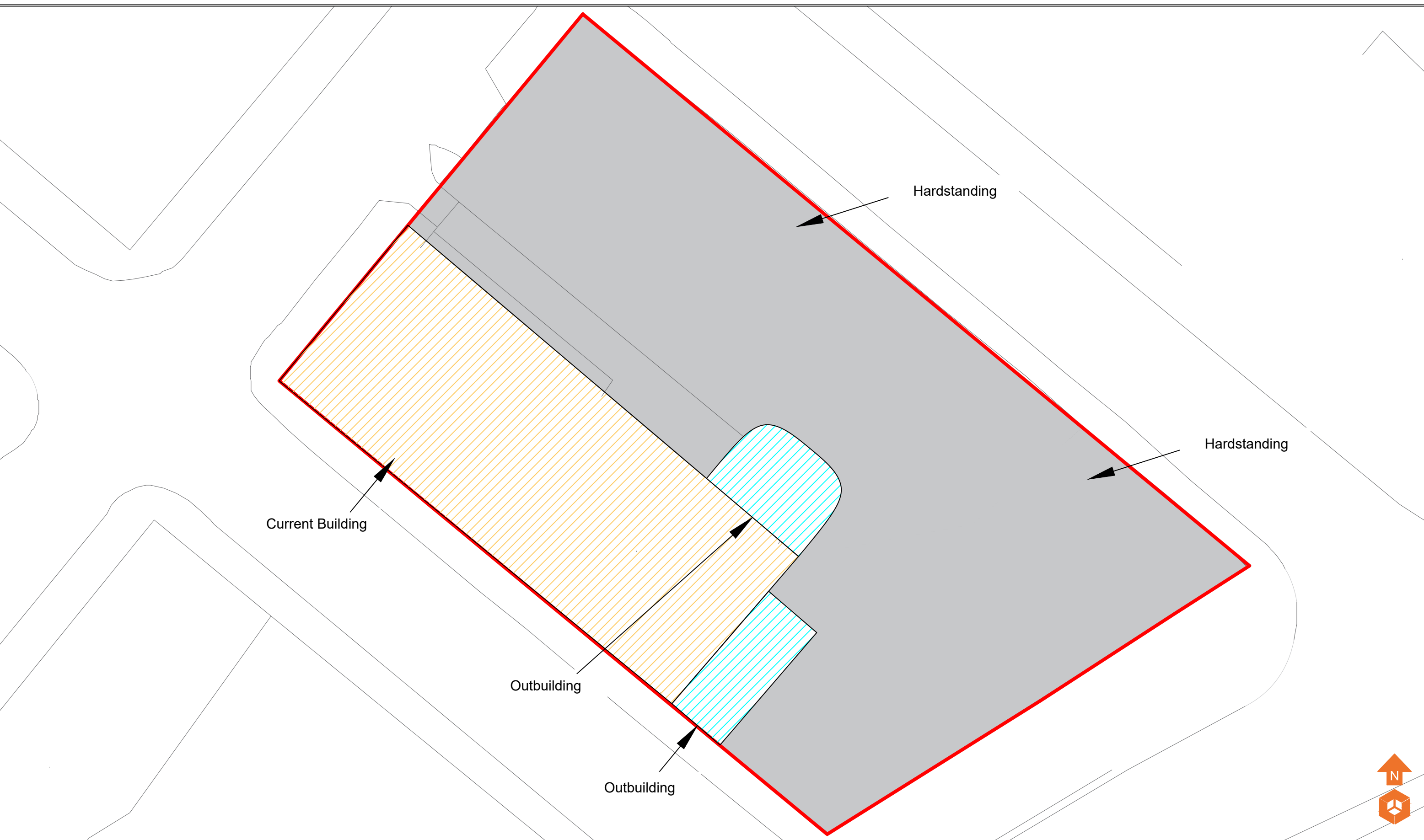
Phase

Issue

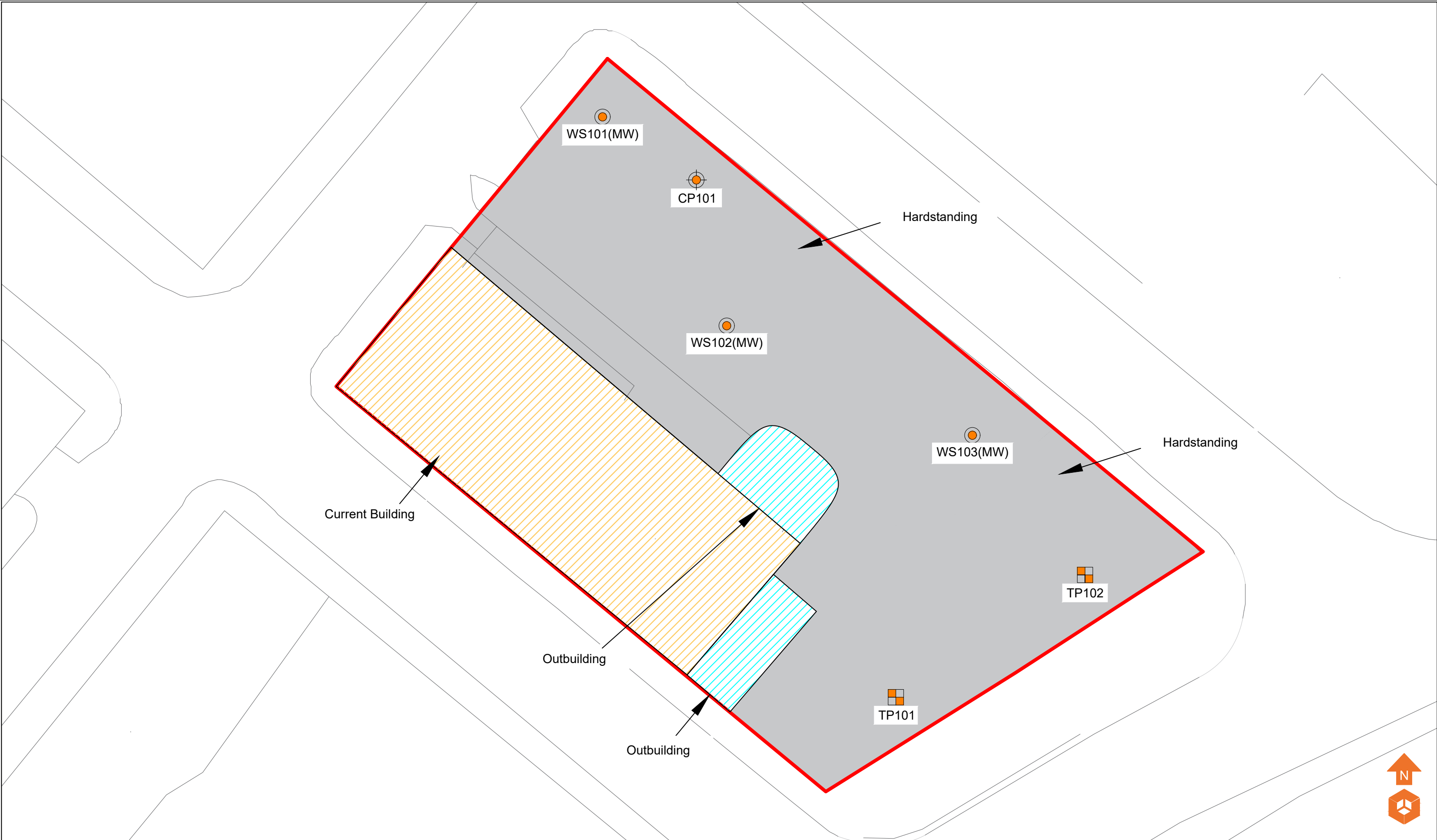
Date

Drawn

Checked



Location Symbols Outbuilding Current Building Hardstanding



Location Symbols

- Outbuilding
- Current Building
- Hardstanding
- Approximate Window Sample Probehole Location with Install
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location

Notes:

P1	REVC	08.12.2020	HM	AS
P1	REVC	03.12.2020	HM	AS
P1	REVB	15.09.2020	HM	AS
P1	REVA	17.08.2020	HM	AS
Phase	Issue	Date	Drawn	Checked

Notes:				
P1	REVC	08.12.2020	HM	AS
P1	REVC	03.12.2020	HM	AS
P1	REVB	15.09.2020	HM	AS
P1	REVA	17.08.2020	HM	AS
Phase	Issue	Date	Drawn	Checked

Client:

Mulbury

Job Title:

Oldham Road

Job No:

12-730

Drawing No:

005

Date:

08.12.2020

Scale:

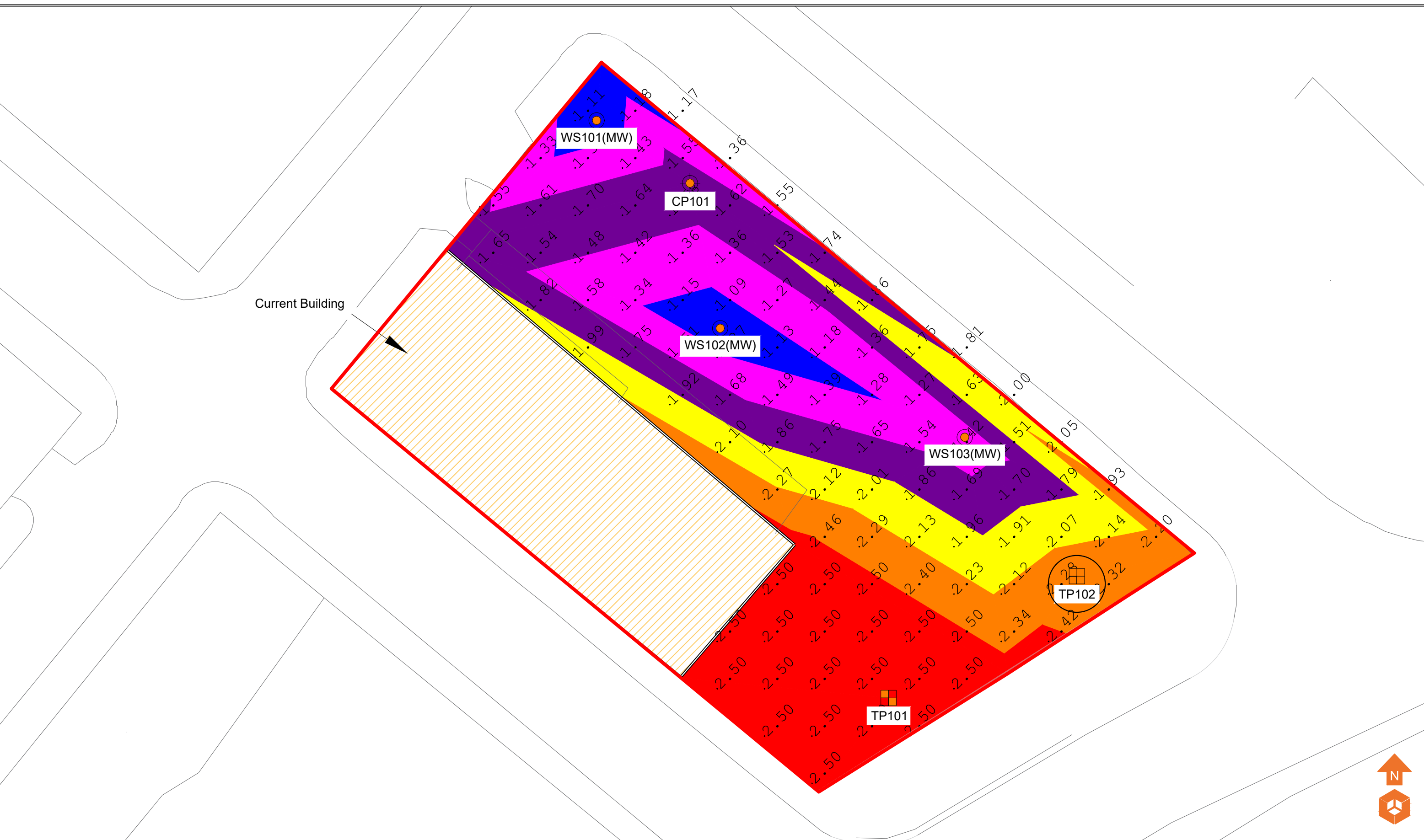
NTS

Drawing Title:

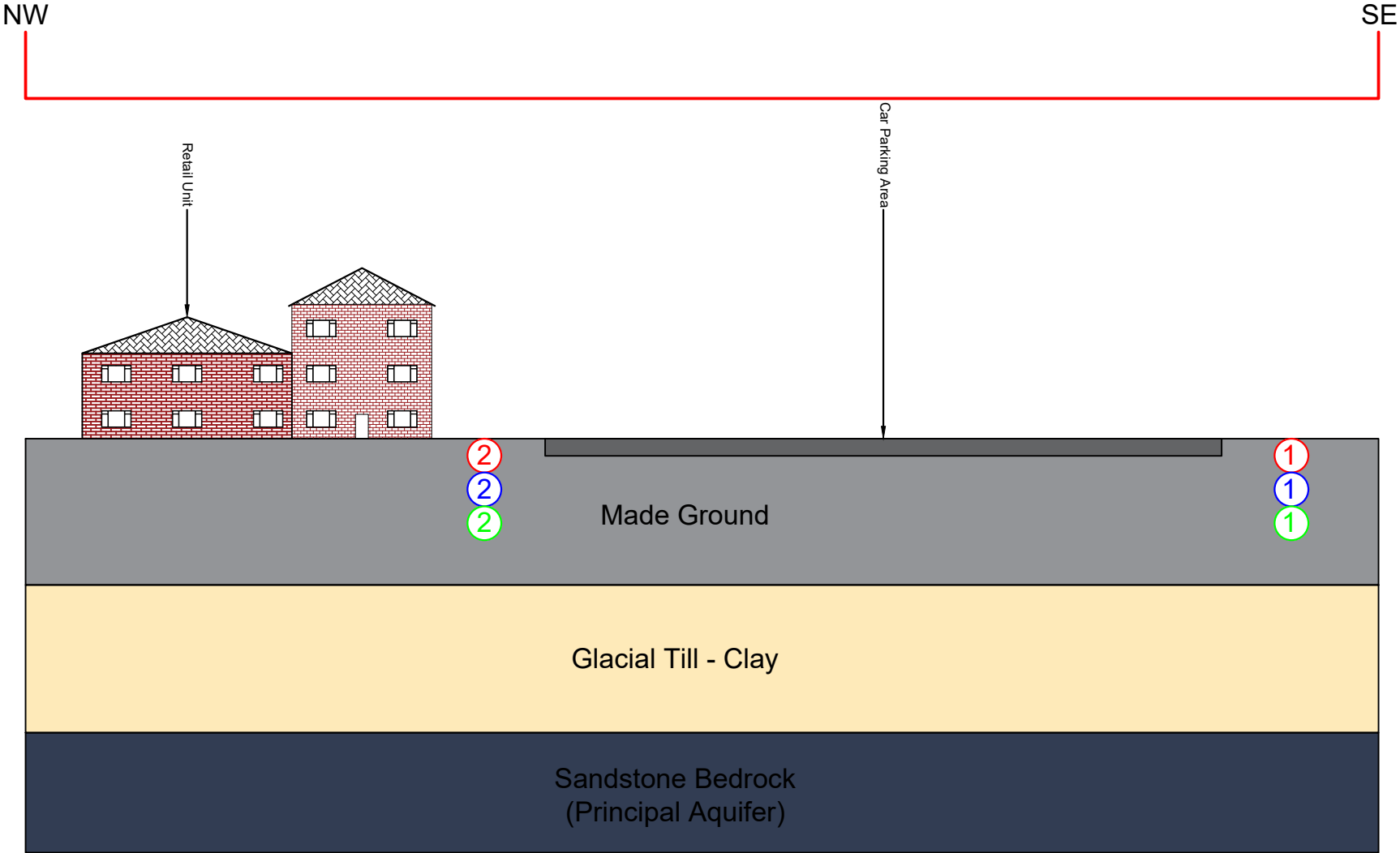
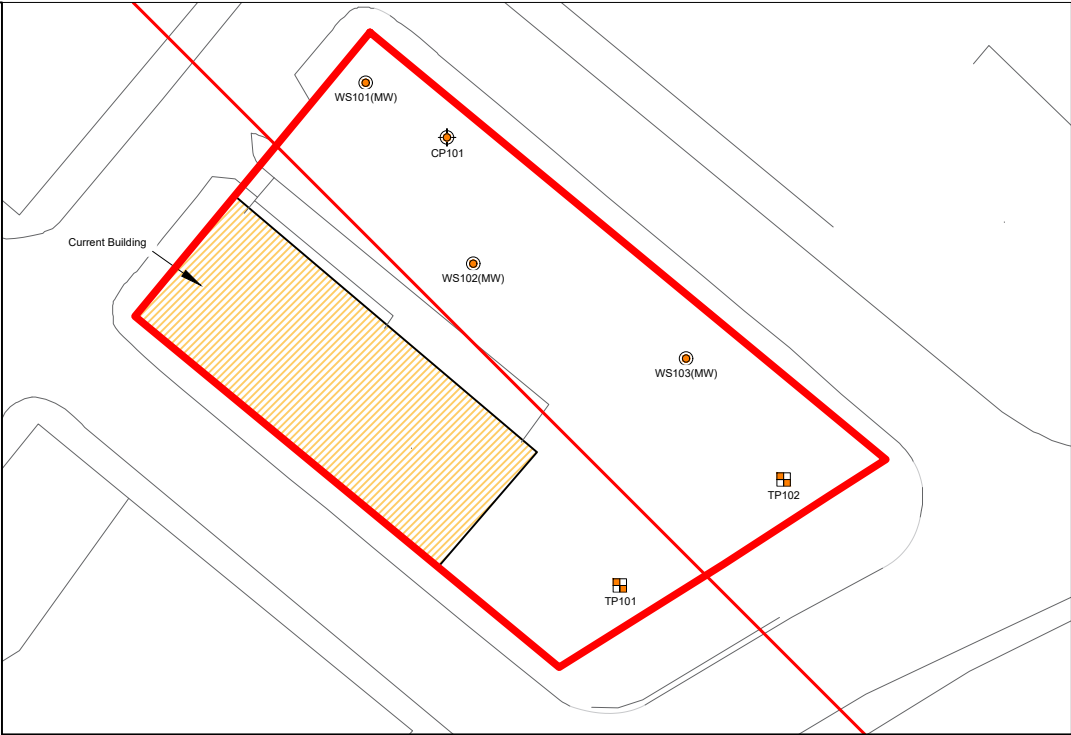
Exploratory Hole Location Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

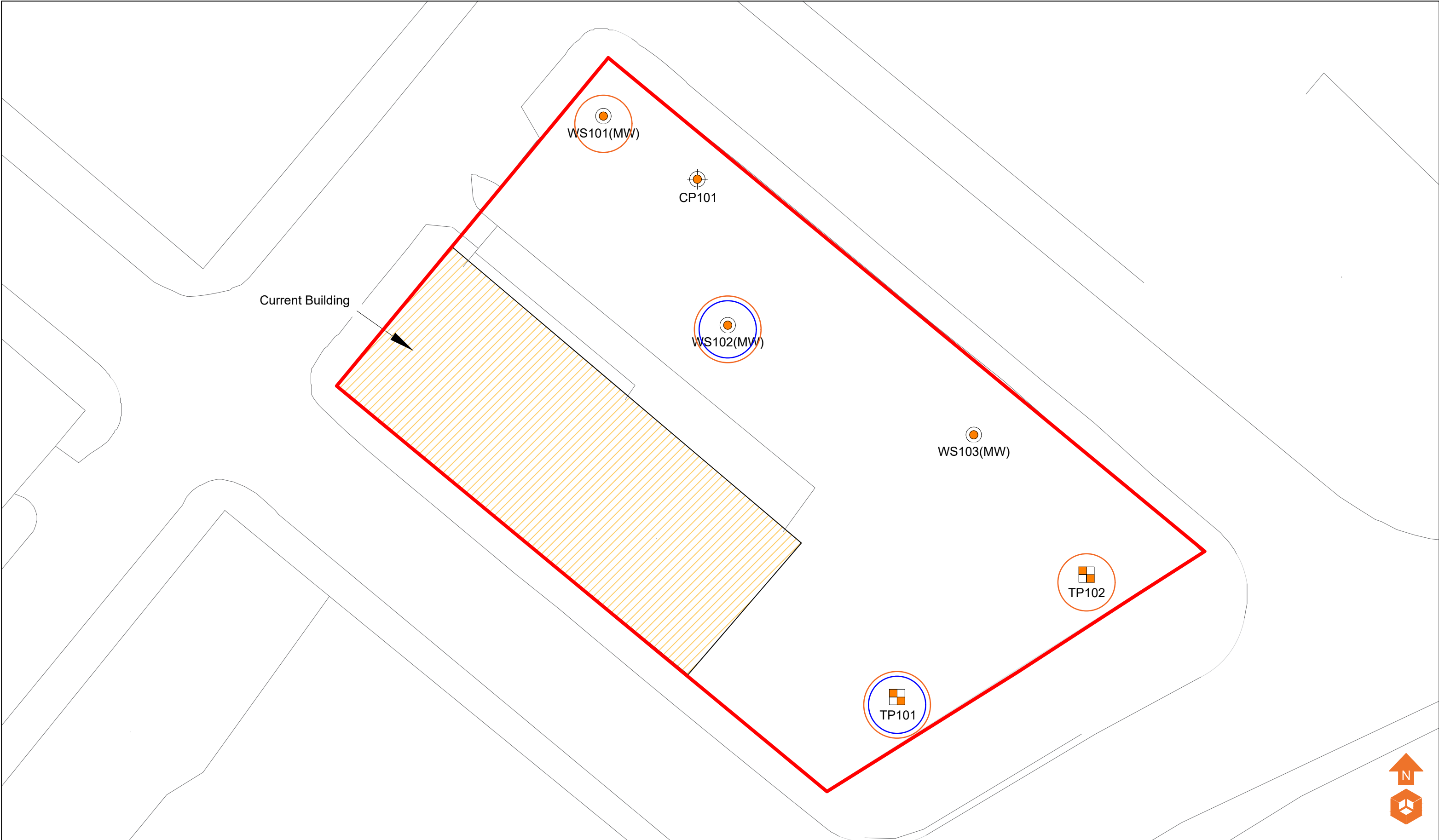
The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Location Symbols		Made Ground Depth (m)					Notes:					Client:		Job No:		Date:		 Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk			
Approximate Window Sample Probehole Location with Install		Depth of Made Ground 0.00 - 0.29m										Mulbury		12-730		08.12.2020					
Approximate Trial Pit Location		Depth of Made Ground 0.30 - 0.59m												Drawing No:		Scale:					
Approximate Cable Percussive Borehole Location		Depth of Made Ground 0.60 - 0.89m												006		NTS					
Current Building		Depth of Made Ground 0.90 - 1.19m																			
Full Extent of Made Ground Not Identified		Depth of Made Ground 1.20 - 1.49m																			
		Depth of Made Ground 1.50 - 1.79m																			
		Depth of Made Ground 1.80 - 2.09m																			
		Depth of Made Ground 2.10 - 2.39m																			
		Depth of Made Ground >2.40m																			
												Job Title:		Drawing Title:		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.					
												Oldham Road		Depth of Made Ground Plan							
												P1		REVA		08.12.2020		HM		AS	
												Phase		Issue		Date		Drawn		Checked	



Geology Key Made Ground Clay Sandstone Bedrock Car Parking Area	Sources ① Heavy Metals, Non Volatile PAH ② PH & Sulphate	Receptors ① Future Residential Site Users . Commercial Employees ② Foundations / Concrete	Pathways ① Dermal Contact / Ingestion ② Corrosion of Concrete	Notes:					Client:		Job No:	Date:	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk
				Mulbury					Mulbury		Drawing No:	Scale:	
											010	NTS	
P1 REVA 03.12.2020 HM AS PhaseIssueDateDrawnChecked					Job Title:		Drawing Title:		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.				
					Oldham Road		Conceptual Site Model						



Location Symbols

- Approximate Window Sample Probehole Location with Install
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location
- Current Building
- Heavy Metals
- Non Volatile PAH

Notes:

P1	REVA	08.12.2020	HM	AS
Phase	Issue	Date	Drawn	Checked

Client:

Mulbury

Oldham Road

Job No:	12-730	Date:	08.12.2020
Drawing No:	018	Scale:	NTS

Drawing Title:

Contamination Exceedance Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

APPENDIX IV

PHOTOGRAPHS

PLATE 1 TP101 EXCAVATION



PLATE 2 TP101 ARISINGS



PLATE 3 TP102 EXCAVATION



PLATE 4 TP102 ARISINGS



PLATE 7 RBH101 CORE (26.00-29.00M BGL)



PLATE 8 RBH101 CORE (29.00-32.00M BGL)



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Oldham Road	Project No. 12730	Co-ords: 384720.00 - 398797.00 Level:	Date 21/08/2020
Location: Manchester		Dimensions (m): 2.00 Depth 2.70	Scale 1:30
Client: Mulbury City			Logged M. Jackson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: : Reddish pebble concrete with rebar throughout.	
	0.80	HVP	61				MADE GROUND: Firm brown to black silty gravelly clay with frequent cobbles, timber and pipes. Gravel is coarse angular of sandstone and brick. Cobbles are sub-angular of brick and sandstone. (Reworked clay)	1
	1.20	HVP	80	1.20			MADE GROUND: Stiff brown to black silty gravelly clay with frequent cobbles, timber and pipes. Gravel is coarse angular of ash, sandstone and brick. Cobbles are sub-angular of brick and sandstone.	2
	1.80	ES						
	2.50	ES		2.50			Firm to stiff brown mottled grey slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of sandstone.	3
				2.70			End of Pit at 2.70m	4

Trial Pit Photographs



Trial Pit 101



Trial Pit 101 Spoil

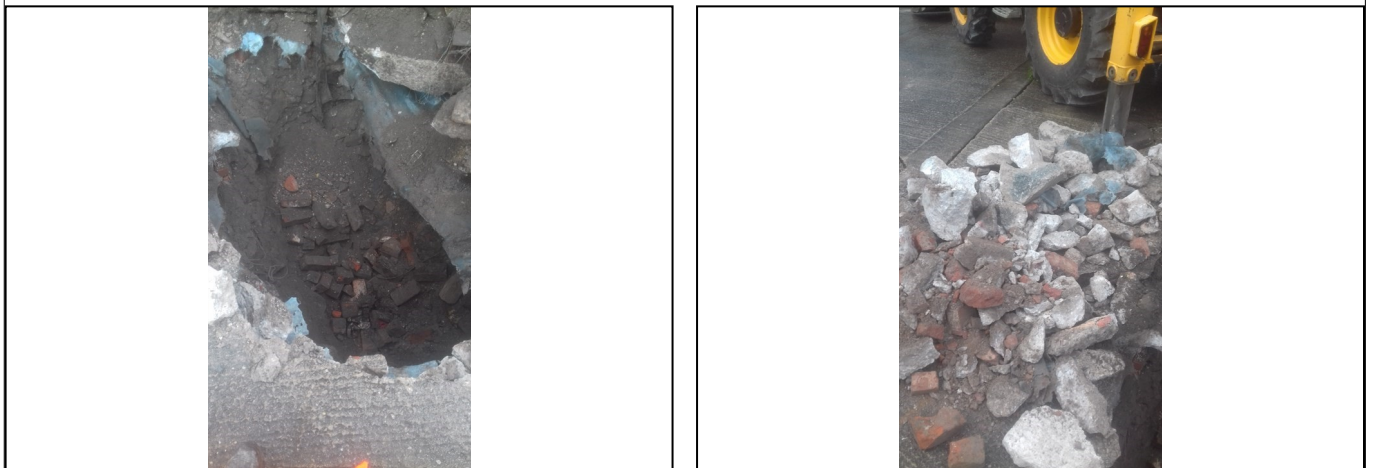
Remarks: 1.Complete. 2. Brick wall at southern end of trial pit.

Stability: Very unstable

Project Name: Oldham Road	Project No. 12730	Co-ords: 384709.00 - 398789.00 Level:	Date 21/08/2020
Location: Manchester	Dimensions (m): 2.00 		Scale 1:30
Client: Mulbury City	Depth 2.30		Logged M. Jackson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.35				0.35			MADE GROUND: Concrete hardstanding with blue plastic mebrane at base.	
	0.60 0.70	ES HVP	63				MADE GROUND: Firm brown to black silty gravelly clay with frequent cobbles, timber and pipes. Gravel is coarse angular of sandstone and brick. Cobbles are sub-angular of brick and sandstone. (Reworked clay)	1
	2.30 2.30	Bulk ES		2.30			End of Pit at 2.30m	2 3 4

Trial Pit Photographs



Trial Pit 102

Trial Pit 102 Spoil

Remarks: 1.Terminated due to collapse. 2.Historic structures present (Infilled cellar). 3. Perched water on plastic membrane at 0.35m bgl.

Stability: Very unstable

Project Name: Oldham Road

Project No.
12730

Co-ords:

Hole Type
WS

Location: Manchester

Level:

Scale
1:50

Client: Mulbury City

Dates: 24/08/2020

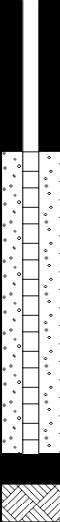
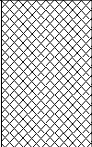
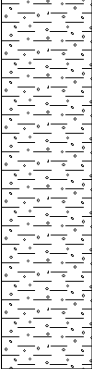
Logged By
E.Moss

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.20	SPT	N=7 (1,1/1,1,2,3)	1.00			MADE GROUND: Brown gravelly clay. Gravel is fine to coarse, sub-angular to sub-rounded of sandstone, mudstone, concrete and brick. (Reworked clay).	1
		2.00	SPT	N=20 (5,5/4,4,5,7)				Firm low strength brown slightly gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded of sandstone and mudstone. (Becoming very stiff high strength at 2.00m bgl) (Becoming very stiff very high strength at 2.50m bgl).	2
		2.50	SPT	50 (8,8/50 for 60mm)	2.94				
								End of Borehole at 2.94m	3
									4
									5
									6
									7
									8
									9
									10

Remarks

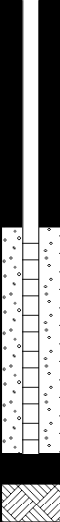
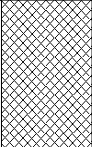
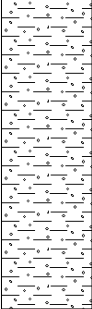
1.Terminated at 2.94 m bgl due to refusal on very stiff clay. 2.Monitoring well installed.

				Borehole Log				Borehole No. WS102 Sheet 1 of 1	
Project Name: Oldham Road				Project No. 12730		Co-ords:		Hole Type WS	
Location: Manchester				Level:		Scale 1:50			
Client: Mulbury City				Dates: 24/08/2020		Logged By E.Moss			

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00		 MADE GROUND: Brown sandy gravel. Gravel is fine to coarse, sub-angular to sub-rounded of ash, concrete, asphalt and brick.	1	
		1.20	SPT	N=5 (2,1/1,1,1,2)			 Firm low strength brown slightly gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded of sandstone, mudstone and mudstone. (becoming very stiff high strength at 2.00m bgl) (Becoming very stiff very high strength at circa 3.00m bgl).	2	
		2.00	SPT	N=20 (5,5/4,5,5,6)				3	
		3.00	SPT	N=50 (7,8/11,12,14,13)				4	
					3.45		End of Borehole at 3.45m	5	
								6	
								7	
								8	
								9	
								10	

Remarks 1.Terminated at 3.45m bgl due to refusal on very stiff clay. 2.Monitoring well installed.									
--	--	--	--	--	--	--	--	---	--

				Borehole Log				Borehole No. WS103 Sheet 1 of 1	
Project Name: Oldham Road				Project No. 12730		Co-ords:		Hole Type WS	
Location: Manchester				Level:		Scale 1:50			
Client: Mulbury City				Dates: 24/08/2020		Logged By E.Moss			

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									
	1.20	SPT	N=4 (1,1/1,1,1,1)	1.00 1.30			MADE GROUND: Brown sandy gravel. Gravel is fine to coarse, sub-angular to sub-rounded of ash, concrete, asphalt and brick.	1	
	2.00	SPT	N=13 (3,4/3,2,3,5)			MADE GROUND: Brown gravelly clay. Gravel is fine to coarse, sub-angular to sub-rounded of sandstone, mudstone, concrete and brick. (Reworked clay).			
	3.00	SPT	N=50 (6,7/10,13,14,13)			Soft very low strength brown slightly gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded of sandstone, mudstone and mudstone. (becoming stiff medium strength at 2.00m bgl and very stiff very high strength at 3.00m bgl)	2 3		
					3.45		End of Borehole at 3.45m	4 5 6 7 8 9 10	

Remarks
 1.Terminated at 3.45m bgl due to refusal on very stiff clay. 2.Monitoring well installed.



Borehole Log

Borehole No.

CP101

Sheet 1 of 4

Project Name: Oldham Road

Project No.
12730

Co-ords:

Hole Type
CP

Location: Manchester

Level:

Scale
1:50

Client: Mulbury City

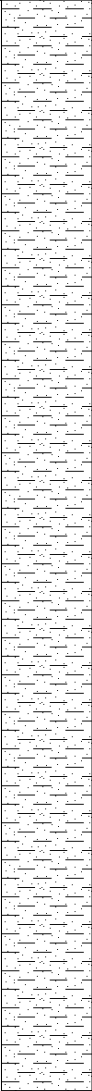
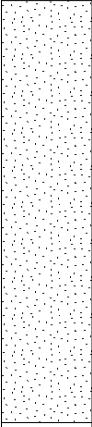
Dates: 13/10/2020

Logged By
M. Jackson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Asphalt. MADE GROUND: Stiff brown gravelly clay. Gravel is fine to coarse sub-angular to sub-rounded of sandstone, mudstone, concrete and brick (Reworked clay).	1
		1.20	SPT	N=9 (1,1/1,2,3,3)					
					1.70			Stiff brown silty CLAY.	2
		2.00	U	Ublow=27					
					3.00			Very stiff high strength brown sandy CLAY. (Very stiff very high strength at circa 15.50m bgl).	3
		3.00	SPT	N=23 (4,7/8,5,5,5)					
		4.00	SPT	N=24 (4,5/5,6,6,7)					4
		5.00	SPT	N=18 (2,3/4,4,5,5)					5
		6.50	SPT	N=27 (4,4/5,7,7,8)					6
		8.00	SPT	N=28 (4,5/6,6,8,8)					7
									8
									9
									10

Remarks
Complete.

				Borehole Log				Borehole No. CP101 Sheet 2 of 4	
Project Name: Oldham Road				Project No. 12730		Co-ords:		Hole Type CP	
Location: Manchester				Level:		Scale 1:50		Logged By M. Jackson	
Client: Mulbury City				Dates: 13/10/2020					

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00	SPT	N=33 (5,5/8,8,8,9)				Very stiff high strength brown sandy CLAY. (Very stiff very high strength at circa 15.50m bgl).	11
		12.50	SPT	N=32 (5,5/7,8,9,8)				12	
		14.00	SPT	N=38 (6,7/9,10,9,10)				13	
		15.50	SPT	50 (7,9/50 for 60mm)				14	
		17.00	SPT	50 (25 for 30mm/50 for 25mm)	17.21			15	
							SAND and GRAVEL.	16	
							17		
							18		
							19		
							20		

Remarks
 Complete.





Borehole Log

Borehole No.

CP101

Sheet 3 of 4

Project Name: Oldham Road

Project No.
12730

Co-ords:

Hole Type
CP

Location: Manchester

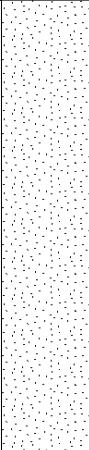
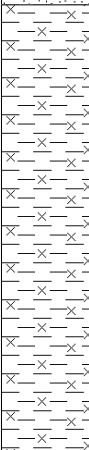
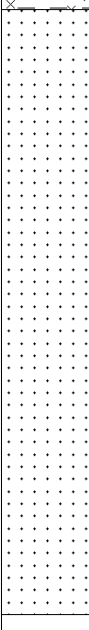
Level:

Scale
1:50

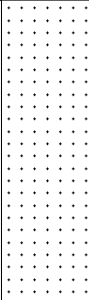
Client: Mulbury City

Dates: 13/10/2020

Logged By
M. Jackson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					23.00			SAND and GRAVEL.	21
								Brown silty CLAY.	23
					26.00			Red brown SANDSTONE.	26
									27
									28
									29
									30

Remarks
Complete.

					Borehole Log			Borehole No. CP101 Sheet 4 of 4	
Project Name: Oldham Road					Project No. 12730		Co-ords:		Hole Type CP
Location: Manchester					Level:		Scale 1:50		Logged By M. Jackson
Client: Mulbury City					Dates: 13/10/2020				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					32.00			Red brown SANDSTONE.	31
								End of Borehole at 32.00m	32
									33
									34
									35
									36
									37
									38
									39
									40
Remarks Complete.									

APPENDIX VI

CHEMICAL TESTING

RESULTS



4041



Environmental Science

Ella Mosse3p
Taylor Road
Urmston
Manchester
M41 7JQi2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS**t:** 01923 225404**f:** 01923 237404**e:** reception@i2analytical.com**e:** EMoss@e3p.co.uk

Analytical Report Number : 20-26984

Project / Site name:	Oldham Road	Samples received on:	25/08/2020
Your job number:	12-730	Samples instructed on/ Analysis started on:	27/08/2020
Your order number:	12-730-EM-D	Analysis completed by:	03/09/2020
Report Issue Number:	1	Report issued on:	03/09/2020
Samples Analysed:	1 leachate sample - 7 soil samples		

Signed:Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 20-26984
Project / Site name: Oldham Road



Your Order No: 12-730-EM-D

Lab Sample Number				1604881
Sample Reference				WS103
Sample Number				None Supplied
Depth (m)				0.80
Date Sampled				21/08/2020
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH	pH Units	N/A	ISO 17025	7.9
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	2

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0
----------------------------	------	---	-----------	-------

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
-------------------	------	-----	------	-------

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	5.7
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.3
Copper (dissolved)	µg/l	0.7	ISO 17025	9
Lead (dissolved)	µg/l	1	ISO 17025	6.8
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.5
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	11

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604881
Sample Reference				WS103
Sample Number				None Supplied
Depth (m)				0.80
Date Sampled				21/08/2020
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10
------------------	------	----	------	------

TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10

TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number	1604874	1604875	1604876	1604877
Sample Reference	TP101	TP102	TP102	WS103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.80	0.60	2.30	1.90
Date Sampled	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	25	17	14	13
Total mass of sample received	kg	0.001	NONE	0.5	0.5	0.5	0.5

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	-
------------------	------	-----	-----------	--------------	--------------	---	---

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	8.3	11	8.2
Total Cyanide	mg/kg	1	MCERTS	8	1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	28000	7500	7800	190
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	6900	3400	4400	76
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	3.5	1.7	2.2	0.038
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	3470	1710	2220	37.9
Sulphide	mg/kg	1	MCERTS	31	39	20	< 1.0
Total Sulphur	mg/kg	50	MCERTS	10000	2800	2800	140
Total Organic Carbon (TOC)	%	0.1	MCERTS	4.7	-	1.4	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	9.5	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-----	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.82	0.2	0.77	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	2.7	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.24	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.63	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	2.4	1.1	1	< 0.05
Anthracene	mg/kg	0.05	MCERTS	11	0.29	0.11	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	4.8	1.6	1.4	< 0.05
Pyrene	mg/kg	0.05	MCERTS	4.2	1.6	1.2	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	5.2	1	0.55	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.9	0.78	0.61	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	11	1.1	0.58	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.2	0.36	0.23	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.9	0.62	0.37	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3.8	0.4	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.4	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.6	0.52	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	62.4	9.54	6.88	< 0.80
-----------------------------	-------	-----	--------	------	------	------	--------



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604874	1604875	1604876	1604877
Sample Reference				TP101	TP102	TP102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.60	2.30	1.90
Date Sampled				21/08/2020	21/08/2020	21/08/2020	21/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	74	16	16	8.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.4	0.4	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	12	14	38
Copper (aqua regia extractable)	mg/kg	1	MCERTS	71	74	72	28
Lead (aqua regia extractable)	mg/kg	1	MCERTS	690	610	440	13
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	4.7	1.2	0.9	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	12	12	41
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	3.3	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	280	130	130	62

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	5.2	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	14	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	82	14	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	410	40	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	81	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	600	57	< 10	< 10

VOCs

Chloromethane	µg/kg	1	ISO 17025	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604874	1604875	1604876	1604877
Sample Reference				TP101	TP102	TP102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.60	2.30	1.90
Date Sampled				21/08/2020	21/08/2020	21/08/2020	21/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604874	1604875	1604876	1604877
Sample Reference				TP101	TP102	TP102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.60	2.30	1.90
Date Sampled				21/08/2020	21/08/2020	21/08/2020	21/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number	1604878	1604879	1604880
Sample Reference	WS102	WS102	WS101
Sample Number	None Supplied	None Supplied	None Supplied
Depth (m)	0.80	1.80	1.80
Date Sampled	21/08/2020	21/08/2020	21/08/2020
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	12	24
Total mass of sample received	kg	0.001	NONE	0.5	0.5	0.6

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-
------------------	------	-----	-----------	--------------	---	---

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.4	7.5
Total Cyanide	mg/kg	1	MCERTS	2	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1100	200	640
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	100	81	200
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.05	0.041	0.098
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	50.1	40.5	97.8
Sulphide	mg/kg	1	MCERTS	18	1.5	12
Total Sulphur	mg/kg	50	MCERTS	820	150	730
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	0.7	2.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	< 0.80	< 0.80
-----------------------------	-------	-----	--------	---	--------	--------

Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number	1604878	1604879	1604880
Sample Reference	WS102	WS102	WS101
Sample Number	None Supplied	None Supplied	None Supplied
Depth (m)	0.80	1.80	1.80
Date Sampled	21/08/2020	21/08/2020	21/08/2020
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	32	6.6	21
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	35	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	140	25	81
Lead (aqua regia extractable)	mg/kg	1	MCERTS	530	12	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.2	< 0.3	1.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	41	38	33
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.7	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	190	60	79

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	4.8	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	18	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	87	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	310	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	140	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	570	< 10	< 10

VOCs

Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-
Benzene	µg/kg	1	MCERTS	< 1.0	-	-
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604878	1604879	1604880
Sample Reference				WS102	WS102	WS101
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.80	1.80
Date Sampled				21/08/2020	21/08/2020	21/08/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-
Styrene	µg/kg	1	MCERTS	< 1.0	-	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	< 0.1	-	-
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	-
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-
Naphthalene	mg/kg	0.05	MCERTS	0.8	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	-



Analytical Report Number: 20-26984

Project / Site name: Oldham Road

Your Order No: 12-730-EM-D

Lab Sample Number				1604878	1604879	1604880
Sample Reference				WS102	WS102	WS101
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.80	1.80
Date Sampled				21/08/2020	21/08/2020	21/08/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	1	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.44	-	-
Acenaphthene	mg/kg	0.05	MCERTS	0.95	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	0.7	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	-	-
Fluorene	mg/kg	0.05	MCERTS	1.5	-	-
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-
Phenanthrene	mg/kg	0.05	MCERTS	10	-	-
Anthracene	mg/kg	0.05	MCERTS	2.5	-	-
Carbazole	mg/kg	0.3	MCERTS	0.4	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-
Anthraquinone	mg/kg	0.3	MCERTS	0.6	-	-
Fluoranthene	mg/kg	0.05	MCERTS	11	-	-
Pyrene	mg/kg	0.05	MCERTS	11	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	7.3	-	-
Chrysene	mg/kg	0.05	MCERTS	4.8	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	5.7	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.5	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5.1	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.62	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.6	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 20-26984
Project / Site name: Oldham Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1604874	TP101	None Supplied	1.8	Brown clay and loam with gravel.
1604875	TP102	None Supplied	0.6	Brown loam and sand with gravel.
1604876	TP102	None Supplied	2.3	Brown loam and sand with gravel.
1604877	WS103	None Supplied	1.9	Brown clay with gravel.
1604878	WS102	None Supplied	0.8	Brown loam and clay with gravel.
1604879	WS102	None Supplied	1.8	Brown clay.
1604880	WS101	None Supplied	1.8	Brown clay and loam.



Analytical Report Number : 20-26984

Project / Site name: Oldham Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In house method.	L005-PL	W	ISO 17025
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS



Analytical Report Number : 20-26984
Project / Site name: Oldham Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene (iii)	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C ₅ -C ₆ (aliphatic)	
TPH C ₆ -C ₈ (aliphatic)	
TPH C ₈ -C ₁₀ (aliphatic)	
TPH C ₁₀ -C ₁₂ (aliphatic)	
TPH C ₁₂ -C ₁₆ (aromatic)	
TPH C ₁₆ -C ₂₁ (aromatic)	
TPH C ₂₁ -C ₃₅ (aromatic)	



APPENDIX VIII GEOTECHNICAL TESTING RESULTS



LABORATORY REPORT



4043

Contract Number: PSL20/4603

Report Date: 29 September 2020
Client's Reference: 12-730
Client Name: E3P
Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

For the attention of: Ella Moss

Contract Title: Oldham Road
Date Received: 3/9/2020
Date Commenced: 3/9/2020
Date Completed: 29/9/2020

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

S Royle
(Laboratory Manager)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Oldham Road

Contract No:**PSL20/4603****Client Ref:**

12-730

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL

Professional Soils Laboratory

Oldham Road

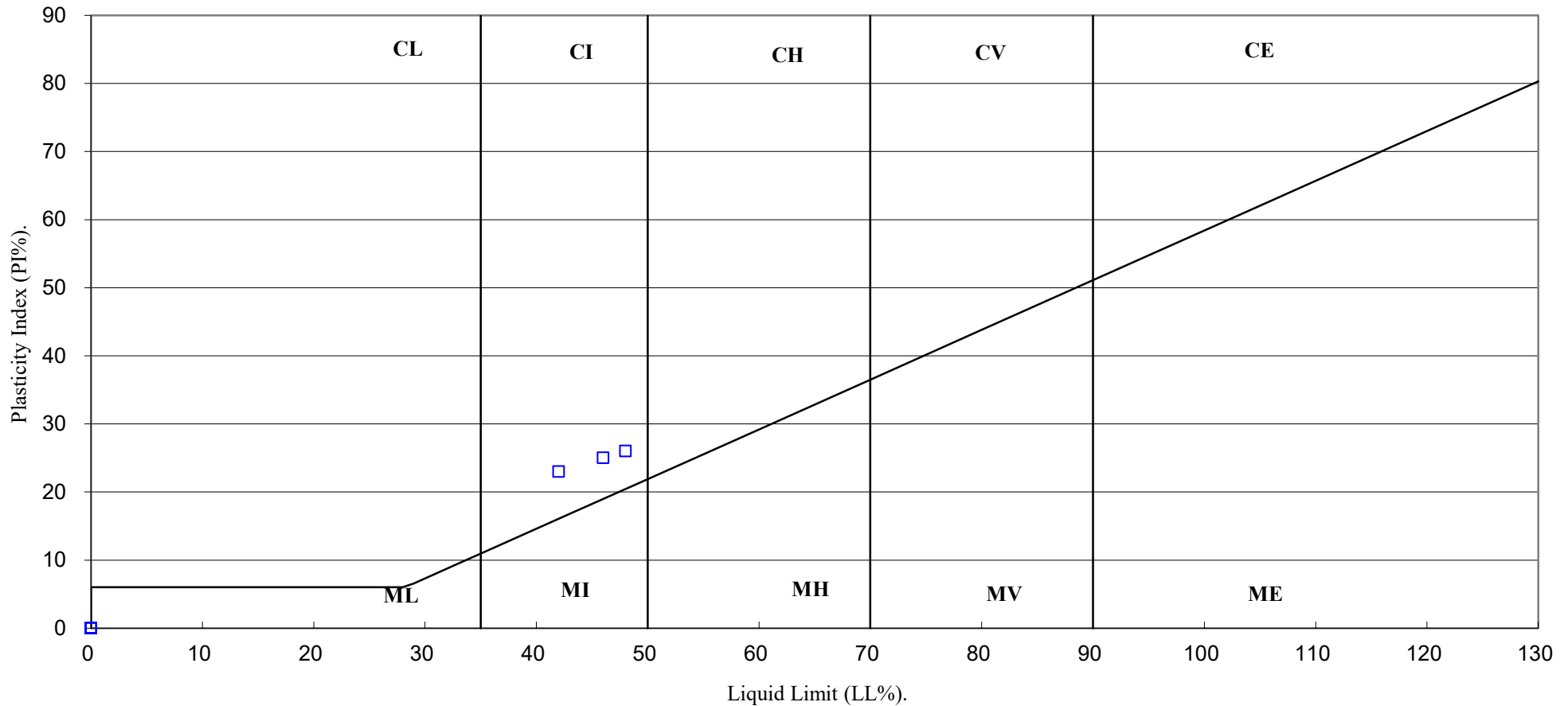
Contract No:

PSL20/4603

Client Ref:

12-730

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Oldham Road

Contract No:

PSL20/4603

Client Ref:

12-730

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: WS101

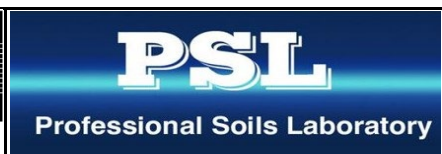
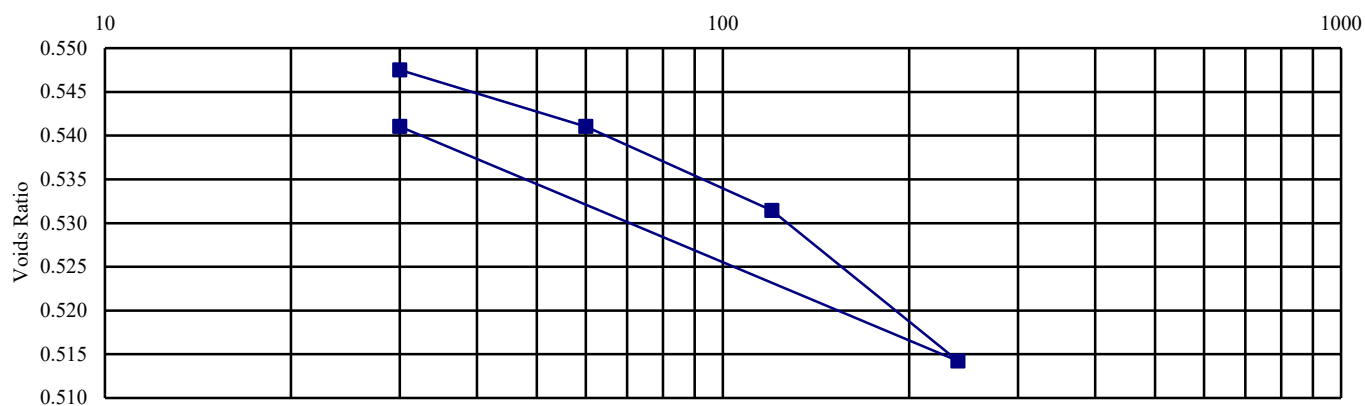
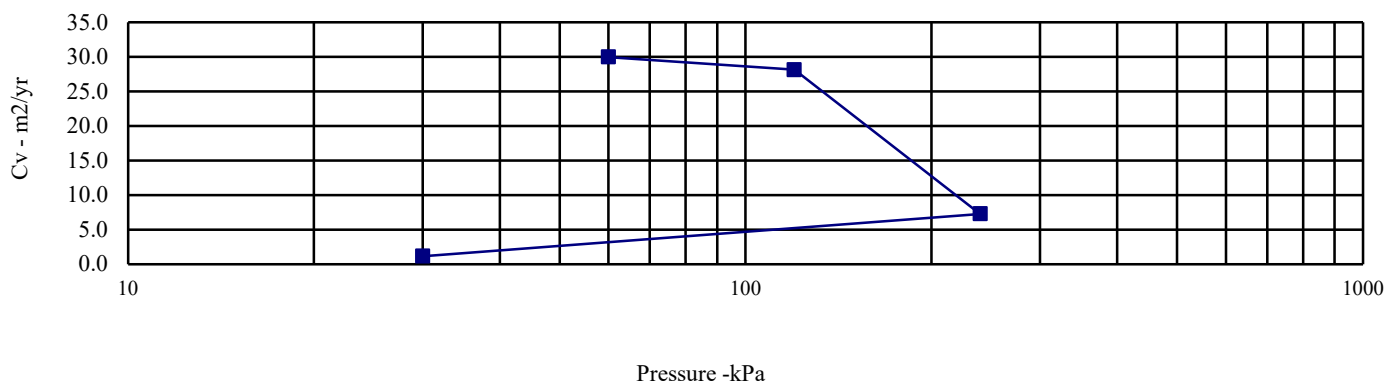
Top Depth (m): 1.50

Sample Number:

Base Depth (m) : 2.00

Sample Type: Liner

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	21	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.07	0	30	Swelling	Swelling	Method used to	
Dry Density (Mg/m3):	1.71	30	60	0.139	29.972	determine CV:	T90
Voids Ratio:	0.552	60	120	0.104	28.127	Nominal temperature	
Degree of saturation:	101.8	120	240	0.094	7.276	during test ' C:	20
Height (mm):	20.376	240	30	0.084	1.152	Remarks:	
Diameter (mm)	75.023					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Oldhma Road

Contract No:
PSL20/4603
Client Ref:
12-730

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: WS101

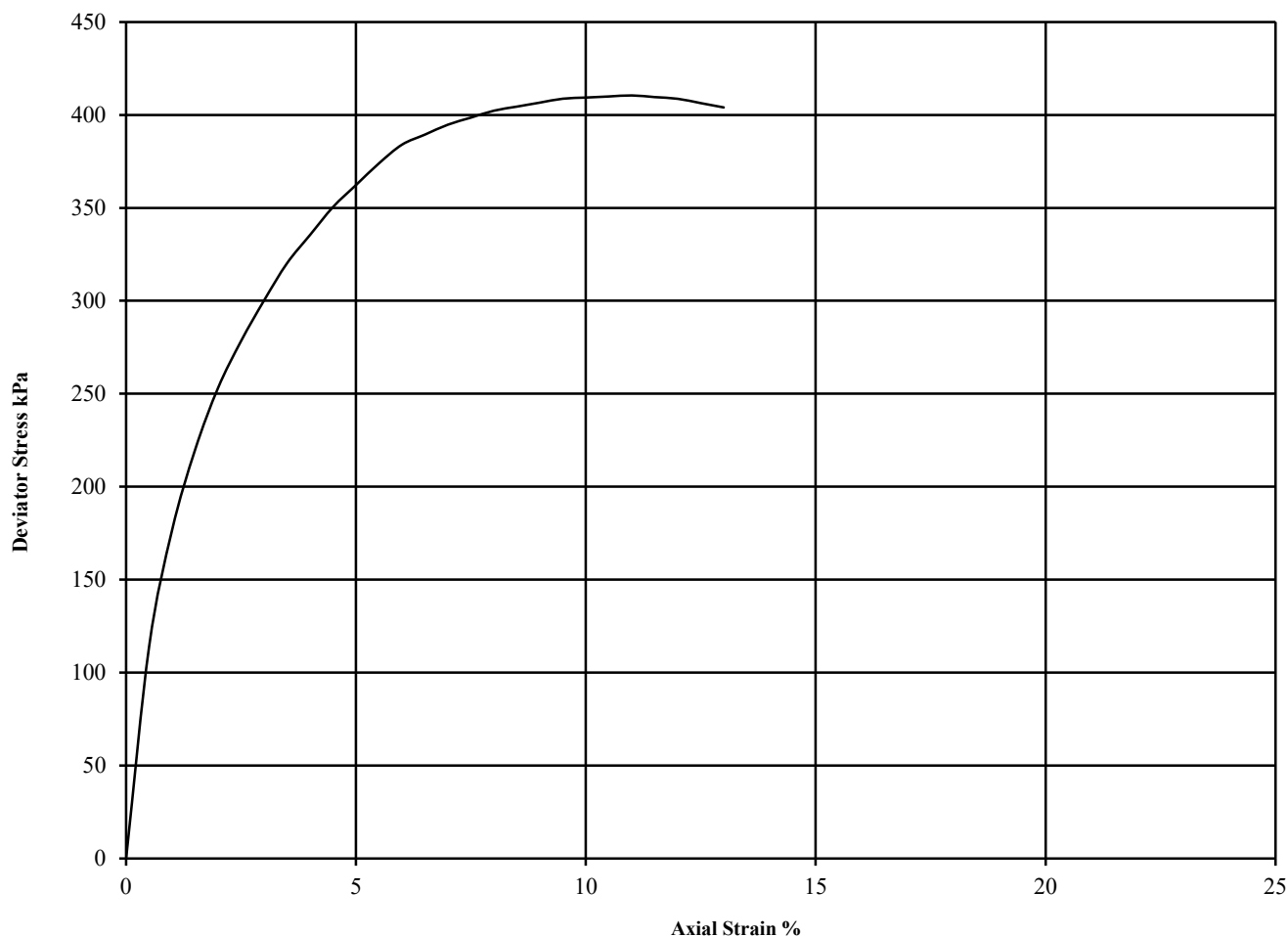
Top Depth (m): 1.50

Sample Number:

Base Depth (m): 2.00

Sample Type

Liner



Diameter (mm):		85		Height (mm):		170	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure		Undisturbed Sample
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$				Sample taken from top of tube
										Rate of strain = 2 %/min
										Latex Membrane used 0.2 mm thick,
										Correction applied 0.42
1	19	2.12	1.78	30	410	205	11.0	Plastic		See summary of soil descriptions



4043

PSL
Professional Soils Laboratory

Oldham Road

Contract No:

PSL20/4603

Client Ref:

12-730



LABORATORY REPORT



4043

Contract Number: PSL20/5625

Report Date: 03 November 2020
Client's Reference: 12730
Client Name: E3P
Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

For the attention of: Ella Moss

Contract Title: Oldham Road
Date Received: 15/10/2020
Date Commenced: 15/10/2020
Date Completed: 3/11/2020

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

H Daniels
(Senior Technician)

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

S Eyre
(Senior Technician)

L Knight
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Oldham Road

Contract No:**PSL20/5625****Client Ref:**

12730-MJ-G

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL
Professional Soils Laboratory

Oldham Road

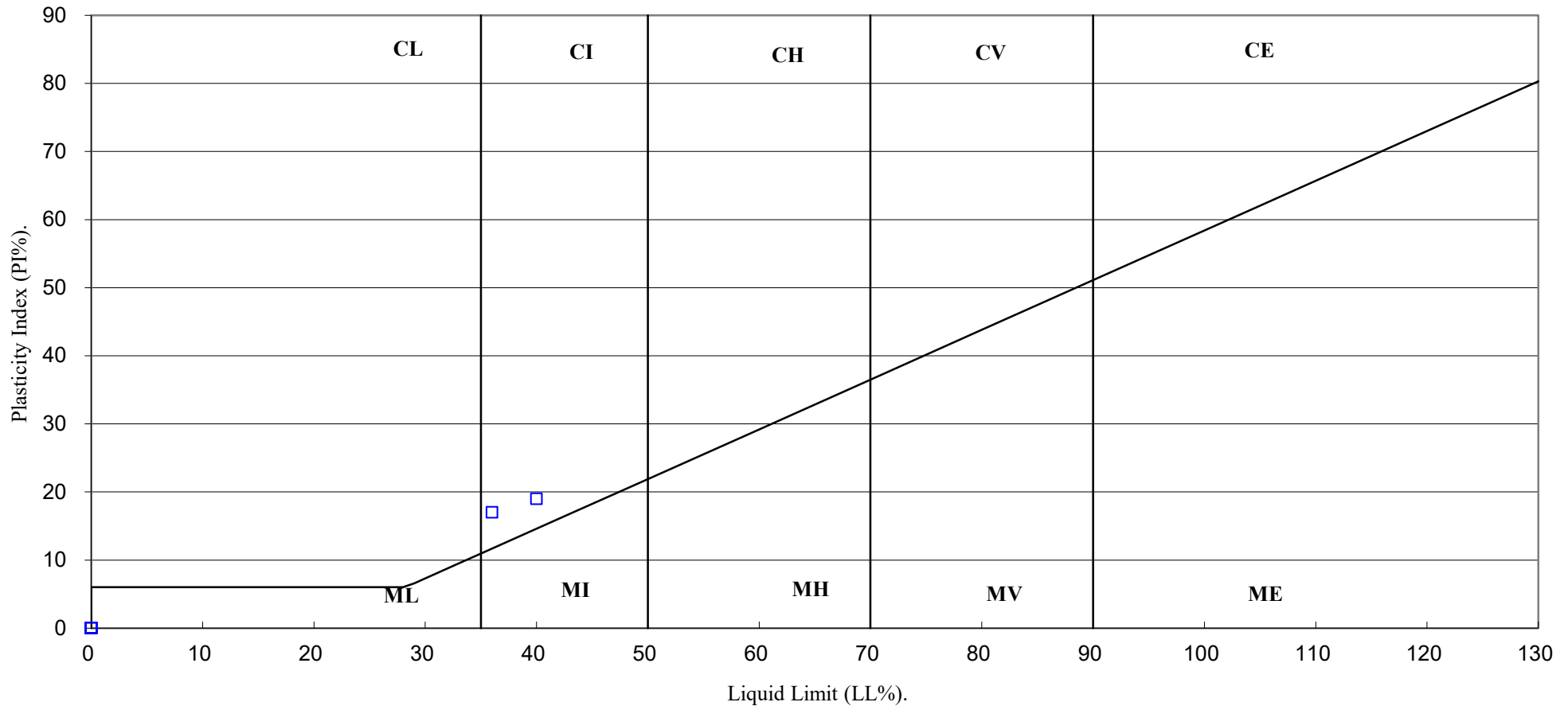
Contract No:

PSL20/5625

Client Ref:

12730-MJ-G

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Oldham Road

Contract No:

PSL20/5625

Client Ref:

12730-MJ-G

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

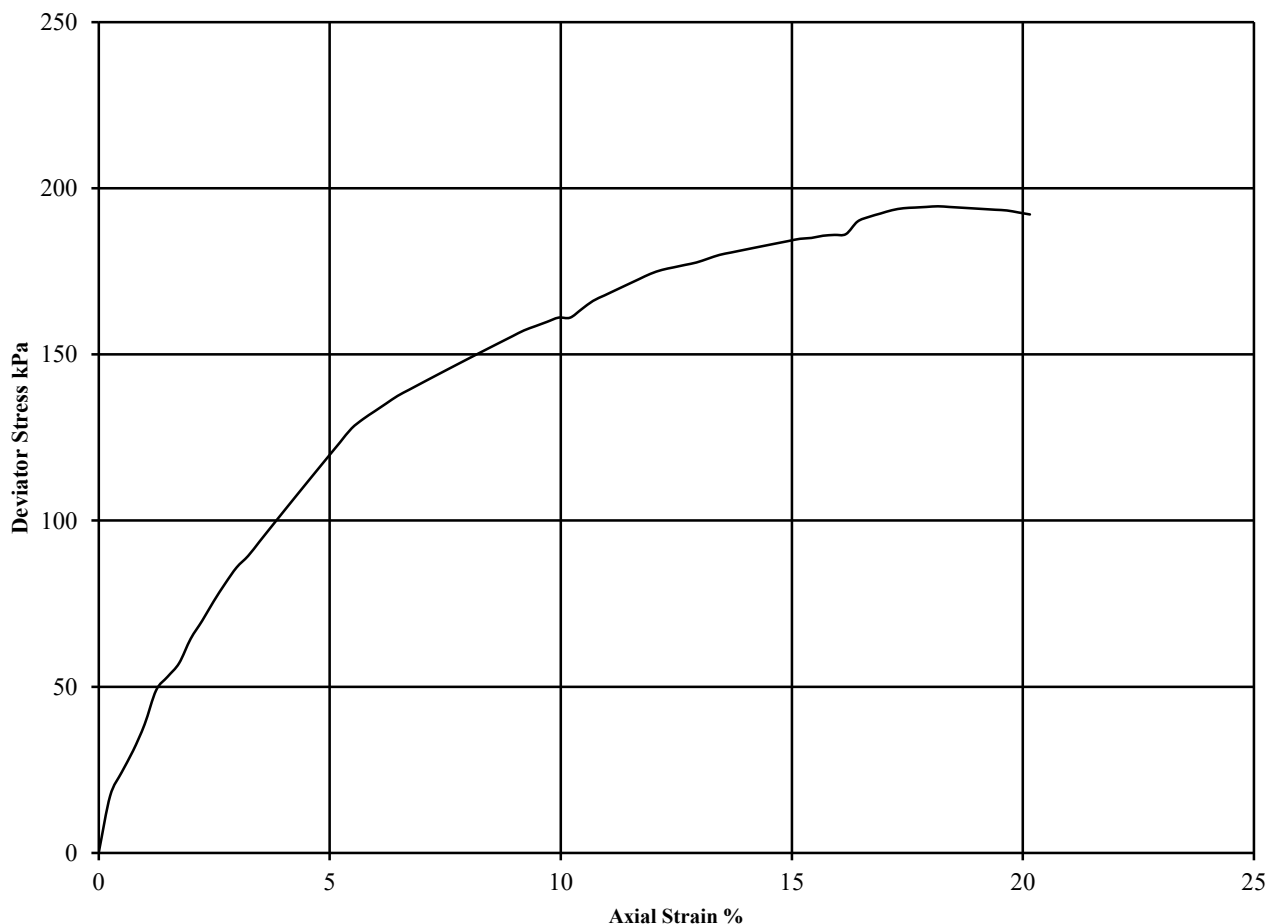
Hole Number: CP101

Top Depth (m): 9.50

Sample Number:

Base Depth (m): 9.95

Sample Type U100



Diameter (mm):		103	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa) 0.35 0.34 0.33 See summary of soil descriptions
	1	18	2.17	97.5	161	81	10.0		
				105	186	93	16.2		
				210	195	97	18.2	Plastic	



PSL
Professional Soils Laboratory

Oldham Road

Contract No:

PSL20/5625

Client Ref:

12730-MJ-G



LABORATORY REPORT



4043

Contract Number: PSL21/0252

Report Date: 02 February 2021

Client's Reference: 12-730

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Alex Smith

Contract Title: Oldham Road, Manchester

Date Received: 6/1/2021

Date Commenced: 6/1/2021

Date Completed: 2/2/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Senior Technician)


S Eyre
(Senior Technician)

H Daniels
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

[illegible]

Oldham Road, Manchester

Contract No:

PSL21/0252

Client Ref:

12-730

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

[illegible]

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular



Oldham Road, Manchester

Contract No:

PSL21/0252

Client Ref:

12-730

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

[illegible]

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Oldham Road, Manchester

Contract No:

PSL21/0252

Client Ref:

12-730