



e3p

Phase II Geoenvironmental Site Assessment
Sulby Street, Manchester

Reference: 15-395-R2-1
Date: February 2023



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Land off Sulby Street
Manchester
M40 5HY

Prepared for:
Challenger Homes (Moston) Limited

Report Ref: 15-395-R2-1
Date Issued: February 2023

Sulby Street

Phase II Geoenvironmental Site Assessment

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EXECUTIVE SUMMARY

Site Address	Land off Sulby Street, Manchester, M40 5HY	
Grid Reference	E387410 N401566	
Site Area	0.3 Ha.	
Proposed Development	Challenger Homes intends to construct eight townhouses and twelve apartments with associated adopted estate roads, landscaping/private gardens, and utility infrastructure.	
Current Site Use	The subject site is a rectangular shaped parcel of land located to the south of Moston and is currently unoccupied. In the north of the site is the unoccupied St Luke's Social Club (a one story brick building, with a mixture of a tiled and flat roof). The site is uniform in topography across the site. Several mature trees were noted in the south east of the site. The south of the site contained a mixture of soft cover (grass) and scrub. A formal drainage survey has not been completed; however, during the site walkover several manholes were noted around the perimeter of Luke's Social Club. An overhead cable is present transecting the site from the north east to the southwest.	
Site History	The site comprised agricultural fields until 1908, with a pond located on the western boundary from 1893. From 1908, several structures are recorded in the southeast of the site and an embankment in the centre of the site. The pond is no longer marked from 1922. From 1931, the site was recorded as Tennis Grounds in the south and a Hall structure in the north. The Tennis Grounds were no longer recorded from 1950. From 1987, the Hall was recorded as St Luke's Men's Club. There appears to have been no further changes to the subject site, to the present day.	
Environmental Setting	Drift Geology	Glacial Till.
	Bedrock Geology	Pennine Middle Coal Measures – MUDSTONE, SILTSTONE AND SANDSTONE.
	Faults	A normal fault trending north to south and dipping east is present in the southeast corner of the site.
	Hydrogeology	Secondary A bedrock aquifer with a secondary undifferentiated superficial aquifer recorded. One groundwater abstraction licence is recorded 1930 m south-west for general use.
	Hydrology	There are no surface watercourses within an influencing distance of the site. Due to the local topography, any shallow groundwater if present will likely flow in a southerly direction towards the Rochdale Canal.
	Flood Risk	Unaffected by flooding from rivers.



Natural Landform and Geomorphology	It would appear that the current site level plateau will have been formed by the placement and upfilling of material prior to the construction of the historical development in the north of the site. It is possible that the historical level raising has resulted in greater thicknesses of Made Ground overlying the natural glacial till and alluvial soils associated with the infilled pond along the western boundary of the site.
Previous Reports	The following previous reports have been completed for the site:  E3P – Phase I Geoenvironmental Site Assessment – Prepared for Challenger Homes. Report Ref: 15-395-R1-1. Dated February 2022. ▪ <i>The site was described as a rectangular-shaped parcel of land located to the south of Moston and is currently unoccupied. In the north of the site is the unoccupied St Luke’s Social Club (a one-story brick building, with a mixture of a tiled and flat roof).</i> ▪ <i>The site has undergone some historic development and ground working and an infilled pond is present on the western boundary.</i> ▪ <i>No current landfill sites are located within 250 m of the site.</i> ▪ <i>A historic landfill site is located 169 m northeast of the site.</i> ▪ <i>The Made Ground associated with the historic development and any organic deposits represent a potential source of hazardous ground gases such as methane and carbon dioxide.</i> ▪ <i>The site is located in a coal mining reporting area but not within a development high-risk area. The site is located in an area at low risk from coal mining and is not located within an area at risk from ground instability arising from historic coal mining activities.</i> ▪ <i>The bedrock is classified as a Secondary A Aquifer, with the superficial classified as a Secondary Undifferentiated Aquifer.</i> ▪ <i>There are no surface water features within 250 m of the subject site.</i> ▪ <i>The closest residential properties are located adjacent to the eastern boundary of the site. The site is located within a nitrate vulnerable zone and a SSSI impact risk zone.</i>
Utility Locations	A formal drainage survey has not been completed; however E3P have reviewed the service records for the site and have noted the following services:  Over head BT in the centre of the site leading from Sulby Street to St Dunstan’s RC Primary School.  Water main leading from the centre of the site to Sulby Street  Several LV electrical mains leading from the southern corner of the disused club house to Sulby Street.



Landfill Sites and Ground Gases	There are no current landfill sites within an influencing distance of the site. However, several waste exceptions have been identified, 144 m southwest of the site has a using waste exception. 193 m west of the site six waste exceptions for storing and treating waste. Due to the presence of low-permeability drift deposits and the distance of the landfill from the subject site, it is considered that these will pose a lower degree of risk associated with hazardous ground gases to the proposed development.
Radon	Less than 1% of houses above the 'Action Level' – no special precautions required.
Coal Mining/Land Stability	The site is located in a coal mining reporting area but not within a development high-risk area. The site is located in an area at low risk from coal mining and is not located within an area at risk from ground instability arising from historic coal mining activities
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.
Initial Conceptual Site Model	Contaminant Sources ✿ Made Ground (historical buildings/infilled ponds) – Polyaromatic hydrocarbons (PAH), heavy metals, hydrocarbon compounds (TPHs), asbestos-containing materials (ACMs), and ground gases. ✿ Historical car park use (spillages of fuel etc.) – PAHs, TPHs, Metals ✿ The current building in the centre of the site –ACMs. Pathways ✿ Direct contact and ingestion. ✿ Volatilisation/indoor explosion. ✿ Vapour inhalation. ✿ Dust inhalation. Receptors ✿ Future site users (proposed residential end-users and construction workers). ✿ Buildings (proposed residential units). ✿ Underlying aquifer (Secondary A bedrock aquifer).



GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: ✿ 6 x window sample boreholes, ✿ Construction of environmental monitoring installations.
Ground Conditions	Made Ground – 0.0mbgl to 2.5mbgl Made Ground deposits were encountered within all exploratory hole locations from ground level to a proven depth of 2.50m bgl (WS101), although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl. Made Ground deposits comprise a reworked topsoil of dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick and ash. The locations of soft standing (WS103, WS04 and WS106) in the eastern sector locations are situated within hardstanding (WS101, WS102 and WS105) underlying layers of asphalt ranging from 0.07m – 0.09m in thickness. Made Ground comprises brown to black very gravelly sand with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick and ash. Cobbles are angular bricks. DRIFT – 0.28mbgl to 5.45mbgl Drift deposits were encountered within all exploratory locations The drift deposits are varied, generally comprising a soft to very stiff, low to high strength, brown CLAY. SOLID – The solid bedrock geology was not encountered within any exploratory holes. GROUNDWATER – Perched Groundwater was encountered between 2.5 m bgl in WS102 and 2.6 m bgl in WS106.

CONTAMINATED LAND ASSESSMENT

Human Health	All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate, vapour inhalation and consumption of homegrown vegetables. Heavy metals, non-volatile PAHs have been identified within the Made Ground deposits across the site, likely related to former deposition and levelling of the site. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils. High levels of lead have been noted to be exceeding within WS102 at 0.50m (Made Ground). It is recommended that the area undergoes a hotspot removal, where the materials can be excavated and placed within an area of low sensitivity where they will post no further risk to the future end user. Asbestos in the form of chrysotile has been identified within Made Ground deposits. Out of 7 samples tested, one sample had a positive identification for asbestos where quantification has confirmed at <0.001%. As only trace fibres have been identified the installation of a 600 mm cover system with break the pollutant pathway.
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Human Health (Continued)	Evidence of potential asbestos sheeting has been noted within the roofing of the club house in the north-eastern sector of the site. Given the age of the buildings, it is likely ACM is present within the building fabric. Visible pieces of asbestos will require specialist removal and disposal to a licenced waste facility in accordance CAR (2012) and waste management legislation. Chemical analysis of the natural CLAY drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this prior to reuse. Similarly, topsoil was limited but identified the site was identified to be chemically suitable for reuse currently. SVOCs (2-Methylnaphthalene and Dibenzofuran) concentrations above the LOD have been, have been identified within the analysis of Made Ground deposits within WS101 and WS105. These elevated concentrations present potential volatilisation to indoor air risk. A desk-based risk assessment has been undertaken and there is seen to be a low vapour risk and following the installation of a clean cover system and hardstanding across the site the pollutant pathway will be broken.
Controlled Waters	The site poses a low risk to controlled waters with no exceedances of the Tier 1 GWS values being identified in both leachate and groundwater samples recovered from across the site. As the site is currently made up of both soft landscaping and hardstanding, rainfall is not being intercepted and subsequently infiltrates freely into the underlying soil. The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and therefore the leaching potential of the soils. Given the absence of mobile contamination or elevated concentrations of contaminants based on the soil analysis, the site is considered to pose a low risk to controlled waters.
Ground Gas	Preliminary ground gas monitoring has characterised the site as CS1/green with no elevated methane and carbon dioxide readings or any increased flow rates being noted. Full ground gas protection measures are to be confirmed following completion of the monitoring regime. It may be prudent to allow for CS2 protection measures at this time. The final ground gas classification will be confirmed upon the completion of the ground gas monitoring programme (and post demolition investigation).
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.



GEOTECHNICAL ASSESSMENT

Underground Obstructions	Concrete and brick obstructions have been encountered within the Made Ground and are anticipated beneath the current buildings on site. During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.
Allowable Bearing Pressure	The underlying natural clay drift deposits have been assessed as being firm to very stiff, high-strength with a net ABP in the order of 62 kN/m² at circa 1 m bgl increasing to 100–150 kN/m² at circa 2 m bgl. Triaxial shear strength testing has also been completed on underlying natural clays and all were found to range from 16.66kN/m² to 24.72kN/m².
Foundation Options	The Made Ground is not considered a suitable founding stratum due to the unquantifiable potential for long-term and differential settlement. Deeper Made Ground (>2.00 m bgl) has been recorded locally, however, Made Ground deposits are typically recorded to a depth of under 1.00 m bgl. 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 clay. At this time it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience with similar sites, we would anticipate that the final foundation solution would be a combination of the following: ✿ Shallow strip foundations bearing on stiff clay; and ✿ Piled foundations in areas of deep Made Ground, low-strength clays (WS104) and/or potential tree influence. ✿ Vibro stone columns (VSC) to support a double reinforced shallow strip foundation The final foundation solution will be dependent on the structural loadings, and elevation and should be designed by a suitably qualified structural engineer.
Building Floor Slabs	Ground-bearing floor slabs are unlikely to be viable given the anticipated depths or reworked Made Ground > 600 mm and shallow cohesive soils.
Heave Precautions	Given that the underlying clay is of low to medium volume change potential, heave precautions may be required to the internal face of a foundation less than 1.5 m in depth. Heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) and pile ground beams are required within the modelled influencing distance of trees.
Soakaway Drainage	The Made Ground soils are impacted by low-level heavy metal and no-volatile PAHs which would preclude the use of infiltration drainage systems. Furthermore, the site is predominantly underlain by circa 1.00–2.50 m of likely low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will be limited, it is not recommended that soakaways are utilised for the disposal of surface water runoff.
Sulphate Assessment	The concrete classification will be DS1 AC1s.



CBR Design %	The underlying predominantly granular Made Ground deposits could likely be re-engineered to achieve a CBR of 5% under favourable climatic conditions Where any compressible ground is present beneath proposed roads, adopted drainage infrastructure and hard standing (car park) consideration must be given to the potential for consolidation which will induce unacceptable degrees of total and differential settlement at the surface.
Cut/Fill	The development levels for the proposed residential units are likely to remain close to the present and therefore a significant cut-and-fill is not anticipated.
Civil Engineering Excavations	The intrusive ground investigation has identified the presence of relict substructures which may impede excavations for service corridors and foundations.
Waste Characterisation	Any material that is to be disposed of 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 beneath current buildings following demolition.
- ✳ Plot-specific foundation schedule (upon receipt of the final development levels).
- ✳ Arboricultural survey.
- ✳ Geotechnical earthworks strategy (infrastructure).
- ✳ Remediation and enabling works strategy.
- ✳ Construction phase Surface Water Management Plan.



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DRAWING LIST

15-395 - 001 - Site Location Plan
15-395 - 002 - Proposed Development Plan
15-395 - 003 - Site Features Plan
15-395 - 004 - Historical Features Plan
15-395 - 005 - Exploratory Hole Location Plan
15-395 - 006 - Depth of Made Ground Plan
15-395 - 010 - Conceptual Site Model



1. INTRODUCTION

1.1. BACKGROUND

E3P has been by Challenger Homes (the client) to undertake a detailed Phase I and II Geoenvironmental Site Assessment at land to the east of Sulby Street, M40 5HY.

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 low-rise residential development.

1.2. PROPOSED DEVELOPMENT

Challenger Homes intends to construct eight townhouses and twelve apartments with associated adopted estate roads, landscaping/private gardens, and utility infrastructure. E3P notes the sensitivity and confidentiality of the proposals. Drawing 15-395-002 (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

- ✿ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document *Land Contamination: Risk Management (LCRM) (2019)*.
- ✿ Undertake a preliminary stage of sampling and analysis to provide an overview of the 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 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. SCOPE OF WORKS

The scope of work includes the following elements:

- ✿ Detailed review of historic information;
- ✿ Design of suitable intrusive ground investigation;
- ✿ 6 No. Window sample probeholes with, and construction of, environmental monitoring installations;
- ✿ 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.

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.



1.6. 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. PREVIOUS REPORTS

E3P has completed a previous Phase I report for the subject site. The pertinent points of the reports are provided below

 E3P – Phase I Geoenvironmental Site Assessment – Prepared for Challenger Homes. Report Ref: 15-395-R1-1. Dated February 2022.

- *The site was described as a rectangular-shaped parcel of land located to the south of Moston and is currently unoccupied. In the north of the site is the unoccupied St Luke's Social Club (a one-story brick building, with a mixture of a tiled and flat roof).*
- *The site has undergone some historic development and ground working and an infilled pond is present on the western boundary.*
- *No current landfill sites are located within 250 m of the site.*
- *A historic landfill site is located 169 m northeast of the site.*
- *The Made Ground associated with the historic development and any organic deposits represent a potential source of hazardous ground gases such as methane and carbon dioxide.*
- *The site is located in a coal mining reporting area but not within a development high-risk area. The site is located in an area at low risk from coal mining and is not located within an area at risk from ground instability arising from historic coal mining activities.*
- *The bedrock is classified as a Secondary A Aquifer, with the superficial classified as a Secondary Undifferentiated Aquifer.*
- *There are no surface water features within 250 m of the subject site.*
- *The closest residential properties are located adjacent to the eastern boundary of the site. The site is located within a nitrate vulnerable zone and a SSSI impact risk zone.*

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 identified within the previous site investigations. 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 on 6th December 2022. The works are summarised in Table 2.1.



2.3. LIMITATIONS OF THE INVESTIGATION

St Lukes Social Club house is present in the north-eastern sector of the site. Investigation onsite has therefore been limited to external areas of the site and no internal works have been completed. Following the demolition of the club further investigation will be required within the buildings footprint.

2.4. SCOPE OF INVESTIGATION

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	5.45	0.50 – 2.50
	WS102		5.45	1.00 – 5.00
	WS103		5.45	0.50 – 1.00
	WS105		5.45	N/A
	WS106		5.45	N/A
Above-Ground historic pond – North-western boundary	WS104		5.45	1.00–4.00

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

The sampling locations are illustrated in Drawing 15-395-005 (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 were recovered for chemical analysis.

2.5. 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 probe hole logs in Appendix IV and presented in Table 3.4 and discussed in Section 5.



2.6. 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).
- ✦ Asbestos identification and quantification.
- ✦ Speciated and 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:

- ✦ Moisture Content:
- ✦ Atterberg limits determinations;
- ✦ One-dimensional consolidation tests; and
- ✦ Single-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	SOFT SAND CLAY	FIRM TO STIFF SANDY CLAY	FIRM TO VERY STIFF CLAY
WS101	0.00–2.50	–	–	2.50 – 5.45
WS102	0.00–0.95	–	–	0.95 – 5.45
WS103	0.00–1.00	–	–	1.00–5.45
WS104	0.00–0.70	2.00–3.00	0.70–2.00 3.00–5.45	–
WS105	0.00–0.50	–	–	0.50- 5.45
WS106	0.00–0.28	–	–	0.28–5.45

3.2. MADE GROUND

Made Ground deposits were encountered within all exploratory hole locations from ground level to a proven depth of 2.50m bgl (WS101), although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl.

Asphalt hand standing in the east of the site between 0.07 to 0.09 m bgl has been encountered within WS101, WS102 and WS105. Below this brown to black very gravelly sand with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick and ash. Cobbles are angular bricks. Reworked slightly sandy, gravelly clay is present within WS101 between 0.09-1.50 m bgl.

Across the remainder of the site, no hard standing is present, and the Made Ground deposits comprise a reworked topsoil of dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick and ash.

A Depth of Made Ground Plan is presented as Drawing 15-395-006 in Appendix III.

3.3. DRIFT DEPOSITS

Drift deposits were encountered within all exploratory locations between 0.28 m bgl (WS106) to a maximum proven depth of 5.45 m bgl. The drift deposits across the site comprise of firm to very stiff brown CLAY.

Firm to stiff brown slightly sandy CLAY was encountered in WS104 between 0.70 m bgl and 5.45 m bgl. Soft deposits have been identified within this deposit between 2.00 m and 3.00 m bgl.

3.4. SOLID GEOLOGY

The solid bedrock geology was not encountered within any exploratory holes.



3.5. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages is shown on the exploratory hole records in Appendix IV and is summarised in Table 3.2.

TABLE 3.2 SUMMARY GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS102	2.60	Slow ingress
WS106	2.50	Slow ingress

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation and these are summarised in Table 3.3.

TABLE 3.3 SUMMARY OF VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
WS101	1.50–2.50	Made Ground	Black gravels and ash
WS105	0.08–0.50	Made Ground	Black gravelly, clayey sands

3.7. SOIL CONSISTENCY

Undrained shear strength values were measured using laboratory undrained triaxial tests. Results of the tests are presented in Table 3.4, which indicates the clay soils vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

Results of the standard penetration tests, including undrained shear strengths derived from SPTs, are included in Table 3.5.

TABLE 3.4 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
WS102	2.50–3.00	Very soft brown slightly gravelly sandy silty CLAY	19	Very Soft
WS106	1.50–2.00	Stiff brown slightly gravelly sandy CLAY.	102	Stiff



TABLE 3.5 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS101	1	MADE GROUND: Slightly sandy gravelly clay.	7	7.06	N/A	Low strength	Firm	35.29	72.55
WS101	2	MADE GROUND: Sandy gravel	1	0.91	Very Loose	N/A	N/A	N/A	9.13
WS101	3	Very Stiff CLAY	18	15.65	N/A	High strength	Very Stiff	78.27	160.92
WS101	4	Stiff, CLAY	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS101	5	Very stiff, CLAY	30	24.89	N/A	High strength	Very Stiff	124.44	255.86
WS102	1	Stiff, CLAY	9	9.07	N/A	Medium strength	Stiff	45.37	93.27
WS102	2	Firm, CLAY	8	7.31	N/A	Low strength	Firm	36.54	75.13
WS102	3	Firm, CLAY	9	7.83	N/A	Low strength	Firm	39.13	80.46
WS102	4	Firm, CLAY	9	7.60	N/A	Low strength	Firm	38.02	78.17
WS102	5	Stiff, CLAY	14	11.61	N/A	Medium strength	Stiff	58.07	119.40
WS103	1	Stiff, CLAY	12	12.10	N/A	Medium strength	Stiff	60.49	124.37
WS103	2	Stiff, CLAY	14	12.79	N/A	Medium strength	Stiff	63.95	131.48



BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS103	3	Very stiff, CLAY	23	20.00	N/A	High strength	Very Stiff	100.01	205.62
WS103	4	Very stiff, CLAY	21	17.74	N/A	High strength	Very Stiff	88.71	182.39
WS103	5	Very stiff, CLAY	25	20.74	N/A	High strength	Very Stiff	103.70	213.21
WS104	1	Firm CLAY	6	6.05	N/A	Low strength	Firm	30.24	62.18
WS104	2	Soft CLAY	4	3.65	N/A	Very low strength	Soft	18.27	37.56
WS104	3	Stiff CLAY	17	14.78	N/A	Medium strength	Stiff	73.92	151.98
WS104	4	Stiff CLAY	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS104	5	Stiff CLAY	14	11.61	N/A	Medium strength	Stiff	58.07	119.40
WS105	1	Stiff CLAY	8	8.07	N/A	Medium strength	Stiff	40.33	82.91
WS105	2	Stiff CLAY	14	12.79	N/A	Medium strength	Stiff	63.95	131.48
WS105	3	Very stiff, CLAY	20	17.39	N/A	High strength	Very Stiff	86.97	178.80
WS105	4	Very stiff, CLAY	22	18.59	N/A	High strength	Very Stiff	92.93	191.07
WS105	5	Very stiff, CLAY	21	17.42	N/A	High strength	Very Stiff	87.11	179.10
WS106	1	Stiff CLAY	10	10.08	N/A	Medium strength	Stiff	50.41	103.64



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BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS106	2	Stiff CLAY	15	13.70	N/A	Medium strength	Stiff	68.52	140.87
WS106	3	Stiff CLAY	14	12.18	N/A	Medium strength	Stiff	60.88	125.16
WS106	4	Stiff CLAY	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS106	5	Stiff CLAY	18	14.93	N/A	Medium strength	Stiff	74.67	153.51

NOTES

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

The interpretation of in situ mass undrained shear strength (cu) data from SPT Blow Count (N) results and the influence of the Plasticity Index (PI) was reported in Standard Penetration Test in Insensitive Clays and Soft Rocks. Stroud (1974). The standard penetration test and the engineering properties of glacial materials subsequently. Stroud and Butler (1975) and (1989).

Allowable bearing pressure on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996.



3.8. CONSOLIDATION

One undisturbed sample of CLAY were submitted for oedometer analysis. The results are provided in Table 3.6.

TABLE 3.6 OEDOMETER CONSOLIDATION RESULT

LOCATION	DEPTH (m)	SAMPLE TYPE	MOISTURE CONTENT (%)	OEDOMETER CONSOLIDATION		
				PRESSURE RANGE (kPa)	M _v (m ² /MN)	C _v (m ² /year)
WS105	1.50	U100	21	0–35	0.404	0.759
				35 – 70	0.288	0.884
				70 – 140	0.202	0.876
				140 – 280	0.109	0.830
				280 – 35	0.060	1.573

The results have determined that the clay soil is of medium compressibility under loading of circa 100 kN/m². It should be noted that if this material is excavated for use in a cut/fill operation, then careful consideration should be taken in the stabilisation of this material.

Engineering of this type of material will need to be completed during dry weather periods only.

3.9. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.7, show the clay to be of predominantly low plasticity with discrete areas of moderate plasticity clay.

TABLE 3.7 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	1.00	27	19	37	18	99	17.82	Low
WS102	1.00	21	21	39	18	99	17.82	Low
WS103	2.00	18	19	36	17	98	16.66	Low
WS104	1.00	33	25	50	25	99	24.75	Medium
WS104	3.00	33	21	42	21	99	20.79	Medium

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



3.10. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.8), 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).

TABLE 3.8 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
WS101	0.50	0.069	8.1	DS-1, AC-1s
WS101	1.70	0.12	8.2	DS-1, AC-1s
WS102	0.50	0.13	10.7	DS-1, AC-1s
WS102	1.50	0.0075	7.6	DS-1, AC-1s
WS103	0.50	0.019	7.3	DS-1, AC-1s
WS103	1.20	0.014	7.3	DS-1, AC-1s
WS104	0.40	0.042	7.5	DS-1, AC-1s
WS104	1.50	0.019	7.2	DS-1, AC-1s
WS105	1.00	0.011	7.1	DS-1, AC-1s
WS106	0.20	0.016	7.4	DS-1, AC-1s
WS106	0.80	0.012	6.8	DS-1, AC-1s



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. DEVIATING SAMPLES

Deviating samples were to be avoided during the ground investigation by using best practice sampling procedures including the use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis undertaken.

No deviating samples were identified during the investigation or monitoring of the site.

4.2. 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).

Where Tier 1 screening values are not provided by LQM, other screening values have been used and these are referenced in Table 4.1.

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

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	12	51 48 42	WS104 - 0.40 m WS103 - 0.50 m WS106 - 0.20 m	1	Further Action
Cadmium	mg/kg	11	12	19	WS102 0.50 m	1	Further Action
Chromium (VI)	mg/kg	6.0	12	<1.8	N/A	1	No Further Action
Lead	mg/kg	200	12	840 250	WS102 - 0.50 m WS101 - 0.50 m	1	Further Action
Mercury	mg/kg	1.2	12	0.7	N/A	4	No Further Action
Nickel	mg/kg	130	12	41	N/A	1	No Further Action
Selenium	mg/kg	250	12	<1.0	N/A	1	No Further Action
Copper	mg/kg	2400	12	240	N/A	1	No Further Action
Zinc	mg/kg	3700	12	3200	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	12	16	N/A	1	No Further Action
Phenols – Total	mg/kg	120	12	<1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	7	Chrysotile	WS101 - 0.50 m	3	Further Action
Naphthalene	mg/kg	2.3	12	1.3	N/A	4	No Further Action
Acenaphthylene	mg/kg	170	12	0.05	N/A	2	No Further Action
Acenaphthene	mg/kg	210	12	0.35	N/A	1	No Further Action
Fluorene	mg/kg	170	12	0.24	N/A	1	No Further Action
Phenanthrene	mg/kg	95	12	3.6	N/A	2	No Further Action
Anthracene	mg/kg	2400	12	0.68	N/A	2	No Further Action
Fluoranthene	mg/kg	280	12	6.5	N/A	2	No Further Action
Pyrene	mg/kg	620	12	6.4	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	12	3.4	N/A	2	No Further Action
Chrysene	mg/kg	15	12	2.2	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	12	3.6 3.1 3	WS106 - 0.20 m WS104 - 0.40 m WS103 - 0.50 m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	12	1.4	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	12	2.8 2.6 2.3 2.2	WS106 - 0.20 m WS103 - 0.50 m WS104 - 0.40 m WS105 - 0.20 m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	12	0.44	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	12	0.48 0.37 0.33 0.33	WS106 - 0.20 m WS104 - 0.40 m WS103 - 0.50 m WS105 - 0.20 m	2	Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Benzo(ghi)Perylene	mg/kg	320	12	2.1	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	12	<1.0	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	12	<0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	12	<0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	12	<2.0	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	12	14	N/A	4	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	12	23	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	12	200	N/A	1	No Further Action

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.

* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 1 values for aromatic compound for the non-volatile fractions (C12-C35). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

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.
- ✳ Cadmium
- ✳ Benzo(b)Fluoranthene;.
- ✳ Benzo(a)pyrene
- ✳ Dibenz(a,h)anthracene
- ✳ Chrysotile.

The following SVOCs above the LOD have been identified:

- ✳ WS101 at 1.70m - 2-Methylnaphthalene (2.2 mg/kg) and Dibenzofuran (0.3 mg/kg)
- ✳ WS105 at 0.20m - 2-Methylnaphthalene (0.4 mg/kg)

Asbestos in the form of loose chrysotile fibres has been identified in the granular Made Ground in WS101.

No significant concentrations of VOCs were identified in the soils submitted for chemical analysis.



The laboratory analysis confirms the assessment within the initial conceptual site model that the main constituents of concern were likely to be asbestos, non-volatile PAHs, isolated SVOCs and heavy metals.

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);
 - Dermal contact and ingestion;
 - Consumption of homegrown vegetables; and
 - Fibre/dust inhalation.
- ✳ The exceedances for all determinands are generally associated with shallow Made Ground deposits (0.5 m).
- ✳ Elevated SVOCs above the LOD have been identified in deer Made Ground deposits associated with WS101 (1.70 m bgl).

HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate, vapour inhalation and consumption of homegrown vegetables. Heavy metals, non-volatile PAHs have been identified within the Made Ground deposits across the site, likely related to former deposition and levelling of the site. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils.

The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy; however, industry best practice (as outlined within BRE 465) will require the following minimum depths of certified clean cover:

- ✳ Private gardens where homegrown vegetables can be cultivated – **600 mm**;
- ✳ Landscaped areas within private dwellings – **300 mm**;
- ✳ Public open space – **300 mm**.

High levels of lead have been noted to be exceeding within WS102 at 0.50m (Made Ground). It is recommended that the area undergoes a hotspot removal, where the materials can be excavated and placed within an area of low sensitivity where they will pose no further risk to the future end user.

Asbestos in the form of chrysotile has been identified within Made Ground deposits. Out of 7 samples tested, one sample had a positive identification for asbestos where quantification has confirmed at <0.001%. As only trace fibres have been identified the installation of a 600 mm cover system with break the pollutant pathway.

Evidence of potential asbestos sheeting has been noted within the roofing of the club house in the north-eastern sector of the site. Given the age of the buildings, it is likely ACM is present within the building fabric. Visible pieces of asbestos will require specialist removal and disposal to a licenced waste facility in accordance CAR (2012) and waste management legislation.



Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1.

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 >1.00m 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 has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this prior to reuse.

Similarly, topsoil was limited but identified the site was identified to be chemically suitable for reuse currently.

4.2.1. SVOC ASSESSMENT

SVOCs, 2-Methylnaphthalene and Dibenzofuran have been identified within the analysis of Made Ground deposits within WS101 and 2-Methylnaphthalene in WS105. These elevated concentrations present a potential volatilisation to indoor air risk.

Information on the identified compounds is provided herein to help inform the assessment.



2-METHYLNAPHTHALENE

2-methylnaphthalene is a white crystalline solid compound. This determinant is classified as a non-threshold substance, therefore even the smallest amount of exposure is considered to pose a theoretical risk to the critical receptor within the context of the developed CSM.

This compound was detected at a concentration of 2.2 mg/kg in WS101 at 1.70m.

The vapour pressure of 2-methylnaphthalene is 0.055 mm Hg @ 25°C which is slightly lower than that of naphthalene ((0.085 mm Hg @ 25°C), it is therefore determined that the compound is less volatile than naphthalene. This data is obtained from Pub Chem.

The Tier 1 CIEH / LQM S4UL for naphthalene is 2.3 mg/kg for a residential development scenario, however, this assessment assumes dermal contact, inhalation of particulate and other direct exposure pathways. The developed CSM for the subject site will incorporate a clean cover system in all private gardens and landscaped areas to ensure no direct exposure pathways.

When considering that 2-Methylnaphthalene has a notably reduced vapour pressure to that of naphthalene, the absence of the compound in the vast majority of samples tested and in due consideration of the maximum concentration of the determinant being only 2.8 mg/kg, the potential for this compound to enter the vapour phase from the soil with temperatures ~10oC is low.

There is no justifiable or peer reviewed toxicological data for an inhalation pathway for 2-methylnaphthalene, therefore it is not possible to develop a robust site-specific risk assessment model given the absence of suitable input parameters.

In light of the above, we must consider the lines of evidence to hand and given that the compound is a non-threshold substance with no peer reviewed, robust or justifiable toxicological data the suggested method to ensure safe regeneration is the adoption of the As Low As Reasonably Possible (ALARP) approach.

In this instance, the methodology for the analytical technique is considered to be the lowest reasonably possible method of determining the presence of the non-threshold substance and mitigating risk to the lowest practicable level.

The US national library for medicine confirms:

If released to soil, 2-methylnaphthalene is expected to have slight to no mobility based upon log Koc values of 3.00-5.96. Volatilization from moist soil surfaces is expected based upon a Henry's Law constant of 5.18X10⁻⁴ atm-cu m/mole. However, adsorption to soil is expected to attenuate volatilization. 2-Methylnaphthalene is not expected to volatilize from dry soil surfaces based on its vapour pressure.

This compound has a very low to no actual volatility, there is no inhalation of dust (indoor or outdoor air) or inhalation of vapour (indoor or outdoor) exposure. The total inhalation background is 1.52%.

As discussed, herein it is highly unlikely that this compound can enter the vapour phase in the soil temperatures furthermore the presence of a passively ventilated sub-floor void with a reasonable volume change potential (24hr) will ensure that in the extremely unlikely event that this compound could volatilise and migrate, the standard mitigation measure would ensure there is absolutely no potential for ingress into the habitable space.

Therefore within the context of the developed site CSM and the lines of evidence approach, it can be determined that the residual compound in this instance is highly unlikely to pose any risk in terms of vapour migration and ingress to the dwelling.

DIBENZOFURAN

This is a white solid compound generally derived from coal tar. The US EPA have determined a threshold value of 7.8 mg/kg. As such the concentrations of 0.4 mg/kg identified within WS105 at 0.20m is not considered to be exceeding.



In addition to the above, the relatively low volatility of this compound within soils with a temperature of ~10°C all but inhibits any volatilisation potential.

The US national library for medicine confirms:

Volatilisation from moist soil surfaces is expected to be an important fate process based upon an estimated Henry's Law constant of 2.1×10^{-4} atm-cu m/mole. However, adsorption to soil is expected to attenuate volatilisation.

Dibenzofuran is not expected to volatilise from dry soil surfaces (SRC) based on its vapour pressure

Therefore, within the context of the developed site CSM and the lines of evidence approach, it can be determined that the residual compound in this instance is highly unlikely to pose any risk in terms of vapour migration and ingress to the dwelling. There is not considered to be a risk to the future end user



4.3. CONTROLLED WATERS RISK ASSESSMENT

E3P has undertaken a controlled waters risk assessment for the site based on the consideration of the conceptual site model and the sensitive receptors which are summarised in Table 4.2.

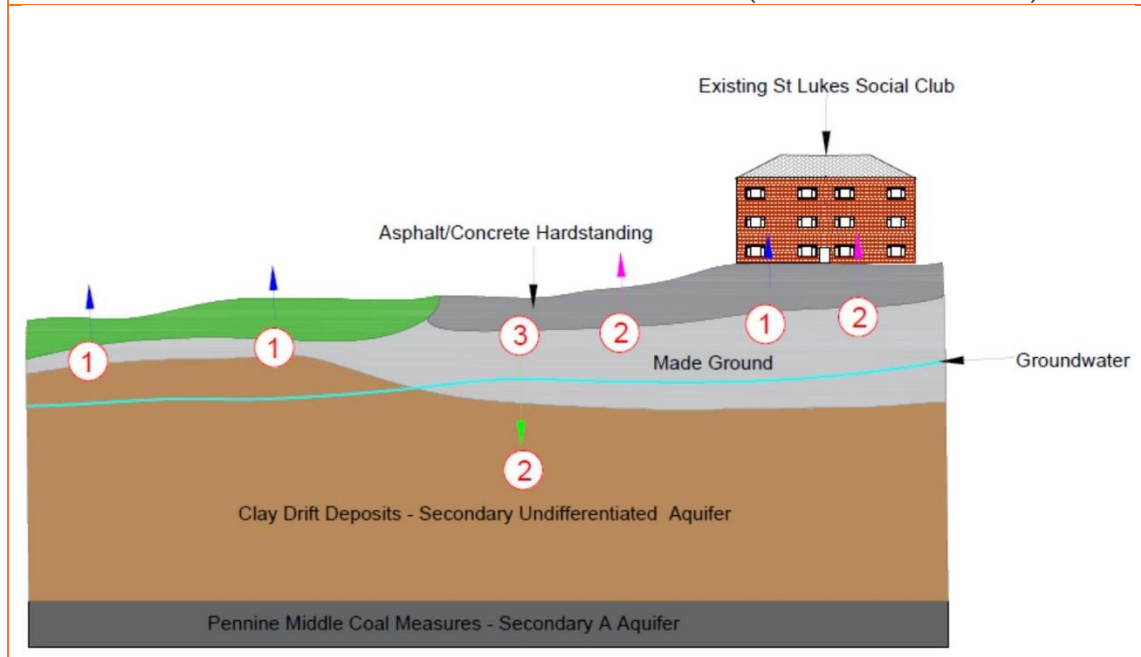
TABLE 4.2 CONTROLLED WATERS CONCEPTUAL MODEL AND SENSITIVITY PROFILE

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground The site has undergone limited historical development activities (construction and demolition of former buildings and possible cut/fill earthworks) and an infilled pond in the north of the site may have generated significant amounts of Made Ground that could contain contaminants such as inorganic heavy metals and polycyclic aromatic hydrocarbons (PAHs). The Made Ground has been identified across the majority of the site.		Medium
Pathway		
Vertical Migration The majority of the site is underlain by clay deposits beneath the Made Ground. The presence of this low permeability drift will inhibit vertical migration of any mobile contaminants towards the underlying Secondary A aquifer.		Low
Lateral migration Lateral migration of contaminants is considered low due to the presence of low permeability deposits across the site.		Low
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated	Medium
Aquifer Classification in Bedrock	Secondary A Aquifer	Medium
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected	Low
Distance to the Closest Groundwater Abstraction Point	None were identified within a 1 km radius.	Low
	The closest groundwater abstraction point is located 1.90 km southwest of the site	
Is the Site Located Within 50 m of a Surface Watercourse?	The site is not located within 50 m of a surface watercourse.	Low
The ICSM developed within the context of the site setting has a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants toward the underlying Secondary Undifferentiated (drift) and Secondary A (bedrock) aquifer.		



In addition to above, E3P has developed a diagrammatic conceptual model which considers the factors in Table 4.2. This is available as Drawing 15-395-010 and a snapshot is included in Figure 4.2.

FIGURE 4.2 **DIAGRAMMATIC CONCEPTUAL SITE MODEL (CONTROLLED WATERS)**



To ensure a robust appraisal of the identified risk to controlled waters, E3P has identified the sources of potential contamination that represent a risk to controlled waters from the initial CSM, we have then assessed the availability of ground investigation data in the form of analysis of the solid phase (soil) and dissolved phase within the perched groundwater or aquifer. The results of this assessment are presented in Table 4.3.

TABLE 4.3 **QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS**

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of VOCs above 1mg/kg or TPH C5 to C6 that might otherwise be indicative of VOC impact.	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	SVOC concentrations have been identified above 1 mg/kg in one isolated location within WS101 at 1.70m with a maximum concentration of 2.2 mg/kg.	Further discussion
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	All concentrations are below the laboratory LOD.	None
C12-C16 > 50 mg/kg	All concentrations are below the laboratory LOD.	None
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Total PAH > 10 mg/kg	No Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected throughout the site.	None
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	A single concentration of heavy metal (lead) above 500 mg/kg have been recorded in WS102 at 840 mg/kg.	Further discussion

The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground and natural deposits, along with groundwater samples to drinking water standards (DWS). These are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER AND LEACHATE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Arsenic	µg/l	50	10	2	1.58	N/A	2	1.5	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	2	0.05	N/A	2	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	2	<5.0	N/A	2	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	2	0.3	N/A	2	2.9	N/A	No Further Action
Copper	µg/l	1	2000	2	2.5	N/A	2	29	N/A	No Further Action
Total Cyanide	µg/l	1	50	2	1.1	N/A	2	1.6	N/A	No Further Action
Lead	µg/l	1.2	10	2	<2.0	N/A	2	2.7	N/A	No Further Action
Mercury	µg/l	–	1.0	2	<0.05	N/A	2	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	2	1	N/A	2	6.6	N/A	No Further Action
Selenium	µg/l	–	10	2	1.5	N/A	2	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	2	6.2	N/A	2	20	N/A	No Further Action
pH	6–9			2	7.2	N/A	2	8	N/A	No Further Action
Polycyclic Aromatic Hydrocarbons										
Naphthalene	µg/l	2	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Benzo(ghi)perylene	µg/l	1.7–4	10*	2	< 0.01	N/A	2	< 0.01	N/A	No Further Action
Aromatic Hydrocarbon 2										
TPH C5-C7 (benzene)	µg/l	10	1	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C8-C10 (xylene)	µg/l	30	300	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C10-C12 (naphthalene)	µg/l	2	90	2	< 10	N/A	2	< 10	N/A	No Further Action
TPH C12-C16	µg/l	–	90	2	< 10	N/A	2	< 10	N/A	No Further Action
TPH C16-C35	µg/l	–	90	2	< 10	N/A	2	< 10	N/A	No Further Action
Aliphatic Hydrocarbon										
TPH C5-C6	µg/l	–	1000 ⁵	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	2	< 1.0	N/A	2	< 10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	2	< 1.0	N/A	2	< 10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	2	< 1.0	N/A	2	< 10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	2	< 1.0	N/A	2	< 1.0	N/A	No Further Action
Volatile Organic Compounds										
Tetrachloroethylene	µg/l	0.4	10	2	< 1.0	N/A	2	N/A	N/A	No Further Action
Trichloroethylene	µg/l	10	10	2	< 1.0	N/A	2	N/A	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	2	< 1.0	N/A	2	N/A	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Trichloromethane	µg/l	2.5	–	2	< 1.0	N/A	2	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	200	2	< 1.0	N/A	2	N/A	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	3	2	< 1.0	N/A	2	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	–	0.3	2	< 1.0	N/A	2	N/A	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 Framework Directive \(Standards and Classification\) Directions \(England and Wales\) 2015 \(legislation.gov.uk\)](#)
2. [The Water Supply \(Water Quality\) Regulations 2018 \(legislation.gov.uk\)](#)
3. [Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum \(who.int\)](#)
4. [CL:AIRE publishes Petroleum Hydrocarbons in Groundwater guidance \(claire.co.uk\)](#)
5. A total TPH criteria of 1000 mg/kg will act as a surrogate criterion for remaining aliphatic and aromatic TPH fractions.



4.3.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

Within the 2 No. leachate and 2 No. groundwater samples (WS102 & WS104) analysed, no exceedance of the Tier 1 DWS values have been identified.

4.3.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

The site has remained largely undeveloped since the earliest available mapping.

As the site is currently made up of both soft landscaping and hardstanding, rainfall is not being intercepted and subsequently infiltrates freely into the underlying soil. The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and therefore the leaching potential of the soils.

However, given the absence of mobile contamination or elevated concentrations of contaminants based on the soil analysis, the site is considered to pose a low risk to controlled waters.



4.4. GROUND GAS RISK ASSESSMENT METHODOLOGY

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)
- ✿ BS8485:2015+A1:2019 – Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

BS8485 provides guidance on the level of gas protection requirements based on the characteristic situation (CS) and the proposed development based on building type.

Therefore, in accordance with BS8485, based on the measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) shall be derived for each monitoring point, from which the site characteristic hazardous gas flow rate (Q_{hgs}), and then the Characteristic Situation (CS) can be determined.

The following equation should be utilised:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where:

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

The subsequent derived gas screening value (GSV) should be the maximum Q_{hg} (flow rate x concentration as a percentage volume) for all the monitoring events.

A 'worst case check' may be carried out using the maximum recorded flow in any hole with the maximum concentration in any hole to present the plausible worst-case conditions. Adoption of the worst case Q_{hg} requires thorough justification and reference to the CSM.

The final derived GSV can then be used to characterise the site as summarised in Table 4.5.

TABLE 4.5 SITE CHARACTERISATION BY GSV (BS8485:2015)

CS	HAZARD POTENTIAL	GSV (l/hr) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS1	Very Low	< 0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	< 0.70	Typical measured flow rate <70 l/h (otherwise consider an increase to CS3)
CS3	Moderate	< 3.5	N/A
CS4	Moderate to High	< 15	N/A
CS5	High	< 70	N/A



CS	HAZARD POTENTIAL	GSV (l/hr) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS6	Very High	> 70	N/A

Notes

1. The CS is equivalent to the characteristic GSV in CIRIA C665.
2. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter should be considered.
3. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, multiplied by the concentration in the air stream of the particular gas being considered.
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

4.4.1. MONITORING METHODOLOGY

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

Gas measurements were recorded for a minimum of 500 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 4.6.

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485:2015. Based on the initial peak measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) have been derived for each monitoring point, from which an individual Characteristic Situation (CS) can ultimately be determined.



TABLE 4.6 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	Made Ground	06/01/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19	996	Rising	0.1	0.1	0.50 – 2.50	2.44	Dry
		12/01/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	19.2	984	Falling	0.1	0.1		2.44	2.4
WS102	Natural CLAY Drift	06/01/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	998	Rising	0.1	0.1	1.00-4.00	4.07	1.08
		12/01/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	19.2	985	Falling	0.1	0.1		4.06	1.01
WS103	Made Ground	06/01/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	997	Rising	0.1	0.1	0.50-1.00	0.99	0.93
		12/01/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	19.2	984	Falling	0.1	0.1		0.99	0.8
WS104	Natural CLAY Drift	06/01/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19.1	996	Rising	0.1	0.1	1.00 - 4.00	3.6	1.65
		12/01/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	19.2	982	Falling	0.1	0.1		3.57	0.47

Notes

CIRIA Characteristic Situation		Q _{hg}			
	CS1	<0.07	Typical Max CO2 <5 % Typical Max CH4 <1 %	Values in BOLD exceed CS1 Thresholds	
	CS2	<0.7	Flow rate not to exceed 70 l/hr otherwise consider increase to CS3	Values in BLUE denote water above level of response zone (flooded)	
	CS3	<3.5			
	CS4	<15	Quantitative Risk Assessment required to evaluate scope of protective measures		



4.4.2. SUMMARY OF MONITORING RESULTS

GROUNDWATER

The water level within the monitoring well installed in WS104 was recorded to be above the top of the response zone (flooded) during the first two monitoring visits, as summarised in Table 4.7, thus rendering some of the monitoring data unreliable. Therefore, each time a flooded well was encountered, the well was bailed and left to re-equilibrate. Wells were re-monitored after a period of 20–30 minutes.

Table 4.7 FLOODED MONITORING WELL DATA

Well	Visit 1 06/01/2023	Visit 2 12/01/2023
WS101	–	–
WS102	–	–
WS103	–	–
WS104	Y	Y

Within remaining monitoring wells, groundwater levels were observed to rise over the monitoring period, however, due to the predominantly low permeability cohesive drift stratum, it is likely that water levels are representative of surface water collecting within the standpipes and not a true representation of groundwater.

BAROMETRIC PRESSURE

Monitoring completed to date has been during periods of falling and rising atmospheric pressures.

To date, atmospheric pressure has been relatively low, generally between 982 mb and 998 mb.

It is therefore considered that the visits have been undertaken during representative atmospheric dynamic conditions, however further visits are to be completed which will capture higher atmospheric pressures.

GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.1 l/hr (limit of detection of the analyser).

GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 0.1% v/v (limit of detection of the analyser).

Carbon dioxide concentrations were recorded at concentrations ranging from 0.1% v/v to 0.3% v/v.



4.4.3. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is presented in Table 4.8. This indicates that based on the peak flow rates the majority of the monitoring visits classify as Characteristic Situation (CS)1 – Very Low Gas Risk.

TABLE 4.8 GAS RISK PROFILE AND LOCATION

WELL	DATE	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH ₄ (%V/V)	MAX CH ₄ Q _{hg} (l/hr)	MAX CO ₂ (%V/V)	MAX CO ₂ Q _{hg} (l/hr)	CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT
WS101	06/01/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	12/01/2023	2.4	0.1	0.1	0.0001	0.3	0.0003	CS1	Green
WS102	06/01/2023	1.08	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	12/01/2023	1.01	0.1	0.1	0.0001	0.3	0.0003	CS1	Green
WS103	06/01/2023	0.93	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	12/01/2023	0.8	0.1	0.1	0.0001	0.3	0.0003	CS1	Green
WS104	06/01/2023	Monitoring well flooded – not included within the assessment							
	12/01/2023	Monitoring well flooded – not included within the assessment							

E3P has assessed the previous variables and come to the following conclusions:

- ✳ Preliminary ground gas monitoring suggests that the site can be classified as CS1, and it is considered that gas protection measures will not be required. However, the final ground gas regime will be confirmed upon the completion of the ground gas monitoring.
- ✳ Made Ground has been encountered in localised areas at a maximum depth of 2.50m bgl but more generally was encountered at a depth less than 1.00m bgl.
- ✳ The site is predominantly CLAY at depths of 0.28m bgl to 5.45 m bgl.

4.4.4. NHBC

The NHBC Traffic Light guidance can still be used where the development proposals are based on the 'typical house' used in the modelling for the traffic light classification system.

A typical house is defined as a house (up to three storeys) with <100 m² footprint and a minimum 150 mm depth clear ventilated void achieving sub-slab ventilation of one complete air exchange per day.

NHBC expectations for verification to satisfy the Traffic Light gas regime classifications are as detailed in Table 4.9.

TABLE 4.9 TYPICAL NHBC EXPECTATION AND VERIFICATION REQUIREMENTS

GAS REGIME	MINIMUM GAS PROTECTION EXPECTATIONS	VERIFICATION OR INFORMATION REQUIREMENTS
Green	N/A – but need to comply with BR211 radon requirements, where applicable	
Amber 1	Ventilation – subfloor venting to achieve at least one air exchange per day (minimum 150 mm void height; 1500 mm ² /m air vent opening or	Construction drawings – showing the position of membrane; sealing details and ventilation points to be provided.



GAS REGIME	MINIMUM GAS PROTECTION EXPECTATIONS	VERIFICATION OR INFORMATION REQUIREMENTS
Amber 1	500 mm² /m² floor area spaced at not more than 2 m centres on at least two opposing sides). Membrane – must be suitable for the purpose. Membrane installation/design - to achieve complete integrity across the entire building footprint. Penetrations and joints sealed.	Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – photographic evidence of installed membrane may be requested.
Amber 2	Ventilation – subfloor venting to achieve at least one air exchange per day. Membrane – must be suitable for purpose (criterion detailed in BS8485 clause 7.2.4). Membrane installation and design to achieve complete integrity across entire building footprint. Penetrations and joints sealed. Installer – installers must be experienced and appropriately trained and/or qualified.	Construction drawings showing position of membrane, sealing details and ventilation points to be provided. Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – third-party verification report with supporting evidence to be included (i.e. photographic evidence and certificates of conformity, observations relating to sealing, location of ventilators and standards of installation). Integrity testing – may be requested; testing plan to be agreed in advance.
Red	Standard residential housing is not generally acceptable without further ground gas risk assessment and/or possible remedial mitigation measures to reduce or remove the source of the ground gases.	



4.5. 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 4.9 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	<LOD
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<LOD
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	<LOD
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<LOD
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	N/A
Ethers*	0.5	N/A
Nitrobenzene*	0.5	N/A
Ketones*	0.5	N/A
Aldehydes*	0.5	N/A
Amines	Fail	N/A
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	Yes – exceedances of SVOCs have been noted outside of pipeline depth.	
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 hydrocarbon impact has been identified at depth.	
Will soils impact with above determinands likely be utilised elsewhere on site?	Yes – the site is likely to undergo a full Made Ground depth turnover, with soils potentially re-used on site.	
Will soils be imported to the site as part of any future earth works	Currently unknown, however, soils may be required to be imported to the site to create the development platform. The importation of materials may affect the UKWIR Risk Assessment which should be updated after the importation of materials.	

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

Based on the assessment of current site conditions it is likely that PE pipe will be suitable for the proposed development.



4.6. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table.10 has been prepared for the site.

TABLE 4.10 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact.	Future site users.	Likely	Moderate	LOW
PL2		Dermal contact and ingestion.	Off-site receptors.			
Assessment: Elevated concentrations of heavy metals (Arsenic, Lead and Cadmium), non-volatile PAHs have been identified within Made Ground deposits between depths of 0.20 m bgl and 0.50m bgl. These elevated concentrations of contaminants of concern have a dermal contact and ingestion pathway to future site users and construction workers when coming into direct contact with impacted soils.						
Recommendation: Cover system to be installed within all private gardens and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW

Assessment:

Asbestos in the form of loose chrysotile fibres has been identified in the Made Ground in WS101 at 0.50 m bgl at a concentration of <0.001%.

Evidence of potential asbestos sheeting has been noted within the roofing of the club house in the north-eastern sector of the site. Given the age of the buildings, it is likely ACM is present within the building fabric.

Recommendation:

Impacted soils identified in WS101 should be placed in accordance with the asbestos conceptual site model with a suitable cover system placed in all garden and landscaped areas to prevent exposure to future site users. If asbestos is identified >0.001% a hotspot removal will be required with the soils being placed in accordance with the asbestos conceptual model.

A complete asbestos survey is recommended prior to the demolition of the existing club house structure in the north-eastern sector of the site.

Risks from ACM can be mitigated through the development of a detailed enabling works strategy following guidance and protocol specified within the Control of Asbestos Regulations (2012) and industry best practice as detailed in CIRIA733 (Asbestos in Soil and Made Ground: A guide to understanding risk). Construction works must be completed with appropriate PPE/RPE and the provision of adequate welfare facilities for site workers.

Further investigation within the former building footprint after demolition.



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons and solvents (Made Ground))	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Low likelihood	Low	LOW
Assessment: Limited elevated SVOCs concentration above the LOC have been identified in WS101 and WS105, however following a desk-based risk assessment there is seen to be a low vapour risk. Throughout the remainder of the site no exceedances recorded within soil and water samples tested. Recommendation: Further investigation within former building footprint after demolition						
PL5	Methane, carbon dioxide (Made Ground – infilled field boundaries and infilled pond)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Low	LOW
Assessment: Preliminary ground gas monitoring has characterised the site as CS1/green with no elevated methane and carbon dioxide readings or any increased flow rates being noted. Recommendation: Full ground gas protection measures to be confirmed following completion of monitoring regime. It may be prudent to allow for CS2 protection measures at this time. The final ground gas classification will be confirmed upon the completion of the ground gas monitoring programme (and post demolition investigation).						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL6	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Secondary Undifferentiated and Secondary A aquifer).	Low likelihood	Low	LOW
Assessment: Leachate and groundwater analysis has not identified a source of mobile contamination.						
Recommendation: As the site is currently made up of both soft landscaping and hardstanding, rainfall is not being intercepted and subsequently infiltrates freely into the underlying soil. The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and therefore the leaching potential of the soils.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Unlikely	Low	LOW
Assessment: The soils at the site meet class DS-1, and AC-1s.						
Recommendation: Concrete should be designed in accordance with the chemical testing results.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Unlikely	Low	LOW

Assessment:

No elevated concentrations of TPHs have been identified at the proposed pipeline depth (0.75 m – 1.35 m).

Recommendation:

Based on the assessment of current site conditions it is likely that PE pipe will be suitable for the proposed development.

PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
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Assessment:

Limited 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 any 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

Challenger Homes intends to construct eight townhouses and twelve apartments with associated adopted estate roads, landscaping/private gardens, and utility infrastructure.

5.2. 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 hardstanding.
-  Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
-  Buried structures and old foundations have been encountered on site. These should be excavated from below the proposed development footprint with the resulting void backfilled.

5.3. 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 ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
MADE GROUND Gravelly Sand	2.00	Very Loose	9.13
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Soft CLAY (WS104)	2.00 – 3.00	18.27	37.56
Firm CLAY	1.00 – 4.00	30.24 – 39.13	62.18 – 80.46
Stiff CLAY	1.00 – 5.45	40.33 - 71.81	82.91 – 147.65
Very Stiff CLAY	3.00 – 5.45	86.97- 124.44	178.80 – 255.86

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 firm to very stiff glacial clays.

Prior to the detailed design of suitable foundation solutions, a programme of remediation and enabling works will be required to demolish the current on-site buildings and remove all extensive buried obstructions to provide a suitable development platform. All underground obstructions will require grubbing out in their entirety and cut/fill the site to allow the formation of a suitable platform for residential development. Voids will require backfilling and engineering of materials to a suitable geotechnical specification.

Therefore, upon completion of these enabling works, and due to the depths of Made Ground encountered on site, it is likely the most cost-effective option for the site would be an engineered solution comprising the re-engineering of the newly placed and in-situ Made Ground using vibro stone columns (VSC) to support a double reinforced shallow strip foundation. Piled foundation could also be utilised within areas of deep made ground.

Within the historical deposited materials areas, should pockets of Made Ground which are found to contain any putrescible content be encountered, these materials have the potential to degrade and induce consolidation and potential subsidence at the surface and as such will be unsuitable for retention and reuse within the context of residential development and will therefore require removal as it is not possible to model or predict the potential for future consolidation, therefore such material cannot remain beneath areas of adopted highway, drives, garden or service infrastructure.

To determine if VSC is viable at the subject site, E3P has completed a Ground Improvement Design Risk Matrix that is summarised in Table 5.2.



TABLE 5.2 GROUND IMPROVEMENT DESIGN RISK MATRIX

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m ²	None identified	PASS
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200 mm, either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column	None identified	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground beneath the site will require processing to render the site suitable for VSC. The existing building's substructure will also require excavation and processing into a graded aggregate suitable for Vibro treatment.	PASS – on completion of enabling works
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified.	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	None identified organic deposits may be present within the infilled pond.	PASS – on completion of enabling works
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None identified.	PASS
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS
Cohesive soils with trees in influencing distance	None identified.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS

It is likely that proposed plots across much of the site would be constructed using strip or trench-fill foundations bearing on the underlying stiff to very stiff high-strength natural clays.

The exception to this would be in the vicinity of WS101, where Made Ground >2.00 m bgl has been identified, underlain by silty clays. Dependent on development levels, plots in this area may require an engineered foundation with VSC to create a development platform to support reinforced strip foundations.



Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

It is recommended that at the working drawing stage, a foundation schedule is prepared for the development, taking account of the physical change of natural clay soils and the current/proposed locations of trees.

At this time it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience of similar sites, we would anticipate that the final foundation solution would be a combination of the following:

- ✳ Shallow strip foundations bearing on firm to very stiff gravelly CLAY at circa 1 m bgl; and
- ✳ VSC to support reinforced strip foundations in areas of deep Made Ground and/or potential tree influence.
- ✳ Piled foundations in areas of deep Made Ground, low-strength clays (WS104) and/or potential tree influence.

TABLE 5.3 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	>2.50	N/A	Stiff CLAY	N	Engineered	DS-1 AC-1s
WS102	1.40	2.60	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS103	1.45	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS104	1.15	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS105	0.95	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS106	0.73	2.50	Stiff CLAY	Y	Shallow Strip	DS-1 AC-1s

It is recommended that, at working drawing stage, a foundation schedule is prepared for the development taking account of the physical change of natural clay soils and the current/proposed locations of trees.

5.4. GROUND FLOOR SLABS

Current building control regulations require that where infilled ground is present to depths in excess of 600 mm, or where the substratum is variable in terms of the structure and settlement potential, or where clay soils are present within the influence of existing or proposed trees, a suspended floor slab is required.

In this instance, it is considered that for the majority of substructures, the underlying stratum would have in excess of 600 mm of infill and, as such, a suspended floor slab will be required.

Where a cast in-situ suspended slab is utilised with no subfloor void, appropriate compressible material (heave precautions) will be required in the construction of the substructure.



5.5. 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 low to medium plasticity, heave precautions are required to the internal face of the external load-bearing walls (outside or within tree influence).

If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams.

If the ground floor slab is to be constructed with a beam and block floor, a minimum subfloor void of 200 mm is required within any structures located in the zone of conjectured tree influence.

If the ground floor slab is constructed with a cast in-situ suspended floor slab, then heave precautions that can tolerate 50 mm of clay swelling are required within any part of the floor slab to be located within the zone of influence of a tree.

A summary of heave precautions is presented in Table 5.4.

TABLE 5.4 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		



5.6. 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 5% if works are completed in favourable climatic conditions.

5.7. DRAINAGE

The presence of varying depths of Made Ground across some areas of the site may result in settlement. 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 circa 1.00–2.50 m of likely low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will be limited, it is not recommended that soakaways are utilised for the disposal of surface water runoff.

If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.

5.8. 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).

5.9. EXCAVATIONS

Trial pits were generally stable in both granular Made Ground and natural strata; as such, it is considered that near-surface excavations will be feasible. In areas where Made Ground exceeded 2 m, excavations were generally less stable.

Site observations indicated that excavations should be feasible in the near surface with normal plant; however, obstructions were identified in the near surface, including former foundations and former floor slabs. It is anticipated that any obstructions will be grubbed out during the reduced-level dig for the substructure works.

However, 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 then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures 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	No	Mine water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	Shallow bedrock has not been encountered within the ground investigation.

5.10. 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 sub-formations 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).



5.11. GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils	Onsite	TBC	Made Ground will require processing to remove any deleterious materials considered to be unsuitable for re-use as part of the proposed development. Chemical analysis has identified a number of exceedances across the site which mitigation via cover system. Consideration as to whether the materials can remain on site in an area of low sensitivity or will require removal from the site.
Bedrock	N/A	N/A	Shallow bedrock had not been encountered during the site investigation.
Obstructions	Onsite	60 %	Site has been subject to historical development, with above-ground structures remaining across the site, and potential for further subsurface obstructions from relict foundations to be present. These will require removal in their entirety in order to provide a development platform.
Artificially levelled and filled platforms	Onsite	100 %	The site is considered to have undergone phases of cut/fill works previously in order to create the current platform; additionally Made Ground materials to significant depths have been noted to be present across the site which is indicative of former infilling works within the infilled pond area.
Retaining walls	N/A	N/A	No retaining walls identified.
Trench collapse	All	TBC	Made Ground present beneath the site is likely to be loosely compacted and possibly prone to collapse. It is anticipated that trench collapse is likely therefore mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.



POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Mature trees	Site boundary	N/A	Occasional mature and semi-mature trees are present along the site boundary. If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams.
Volume change potential clay	Onsite	50 %	As the clay is deemed to be low to medium plasticity, heave precautions are required to the internal face of the external load-bearing walls (outside or within tree influence).
Peat	N/A	N/A	Not encountered, there is a possibility peat soils may be present within the infilled pond area. Current development plans indicate no dwellings will be located over the infilled area. Consideration should be given to hardstanding areas over deep made ground.
Running sands	N/A	N/A	Data searches indicate very low to low risk.
Ground dissolution	N/A	N/A	Data searches indicate no hazard to very low risk.
Concrete design	Onsite	100 %	The soils generally meet class DS-1, AC-1s.
Low-permeability ground	Onsite	100 %	Soakaways unlikely to be effective in areas where low permeability cohesive deposits are present or where areas of potentially contaminated soil and groundwater are present.
Abnormal foundation solutions	All	100 %	Ground investigation has indicated that a combination of shallow strip and engineered foundation solutions are likely on site.
Surface water features	N/A	N/A	None identified.



5.12. 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 beneath current buildings following demolition.
-  Delineation of elevated Lead within WS102 at 0.50 m bgl.
-  Plot-specific foundation schedule (upon receipt of the final development levels).
-  Arboricultural survey.
-  CL:AIRE DoW CoP Materials management plan.
-  Geotechnical earthworks strategy (infrastructure).
-  Remediation and enabling works strategy.
-  Construction Phase Surface Water Management Plan.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

Human Health	All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate, vapour inhalation and consumption of homegrown vegetables. Heavy metals, non-volatile PAHs have been identified within the Made Ground deposits across the site, likely related to former deposition and levelling of the site. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils. High levels of lead have been noted to be exceeding within WS102 at 0.50m (Made Ground). It is recommended that the area undergoes a hotspot removal, where the materials can be excavated and placed within an area of low sensitivity where they will post no further risk to the future end user. Asbestos in the form of chrysotile has been identified within Made Ground deposits. Out of 7 samples tested, one sample had a positive identification for asbestos where quantification has confirmed at <0.001%. As only trace fibres have been identified the installation of a 600 mm cover system with break the pollutant pathway. Evidence of potential asbestos sheeting has been noted within the roofing of the club house in the north-eastern sector of the site. Given the age of the buildings, it is likely ACM is present within the building fabric. Visible pieces of asbestos will require specialist removal and disposal to a licenced waste facility in accordance CAR (2012) and waste management legislation. Chemical analysis of the natural CLAY drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this prior to reuse. Similarly, topsoil was limited but identified the site was identified to be chemically suitable for reuse currently SVOCs (2-Methylnaphthalene and Dibenzofuran) concentrations above the LOD have been, have been identified within the analysis of Made Ground deposits within WS101 and WS105. These elevated concentrations present potential volatilisation to indoor air risk. A desk-based risk assessment has been undertaken and there is seen to be a low vapour risk and following the installation of a clean cover system and hardstanding across the site the pollutant pathway will be broken.
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Controlled Waters	The site pose a low risk to controlled waters with no exceedances of the Tier 1 GWS values being identified in both leachate and groundwater samples recovered from across the site. As the site is currently made up of both soft landscaping and hardstanding, rainfall is not being intercepted and subsequently infiltrates freely into the underlying soil. The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and therefore the leaching potential of the soils. However, given the absence of mobile contamination or elevated concentrations of contaminants based on the soil analysis, the site is considered to pose a very low risk to controlled waters.
Ground Gas	Preliminary ground gas monitoring has characterised the site as CS1/green with no elevated methane and carbon dioxide readings or any increased flow rates being noted. Full ground gas protection measures to be confirmed following completion of monitoring regime. It may be prudent to allow for CS2 protection measures at this time. The final ground gas classification will be confirmed upon the completion of the ground gas monitoring programme (and post demolition investigation).
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.

6.2. COAL MINING

Coal Mining	The site is located in a coal mining reporting area but not within a development high-risk area. The site is located in an area at low risk from coal mining and is not located within an area at risk from ground instability arising from historic coal mining activities
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6.3. GEOTECHNICAL ASSESSMENT

During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.

The Made Ground is not considered a suitable founding stratum due to the unquantifiable potential for long-term and differential settlement. Deeper Made Ground (>2.00m bgl) has been recorded locally, however, Made Ground deposits are typically recorded to a depth of < 1.00m bgl.

The underlying natural clay drift deposits have been assessed as being firm to very stiff, high-strength with a net ABP in the order of 62 kN/m² at circa 1 m bgl increasing to 100–150 kN/m² at circa 2 m bgl. Triaxial shear strength testing has also been completed on underlying natural clays and all were found to range from 16.66kN/m² to 24.72kN/m².

This time it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience with similar sites, we would anticipate that the final foundation solution would be a combination of the following:

-  Shallow strip foundations bearing on stiff clay.
-  VSC to support reinforced strip foundations in areas of deep Made Ground and/or potential tree influence.
-  Driven pile foundation in areas of variable ground, deep Made Ground and/or potential tree influence.

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

Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

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 low.

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



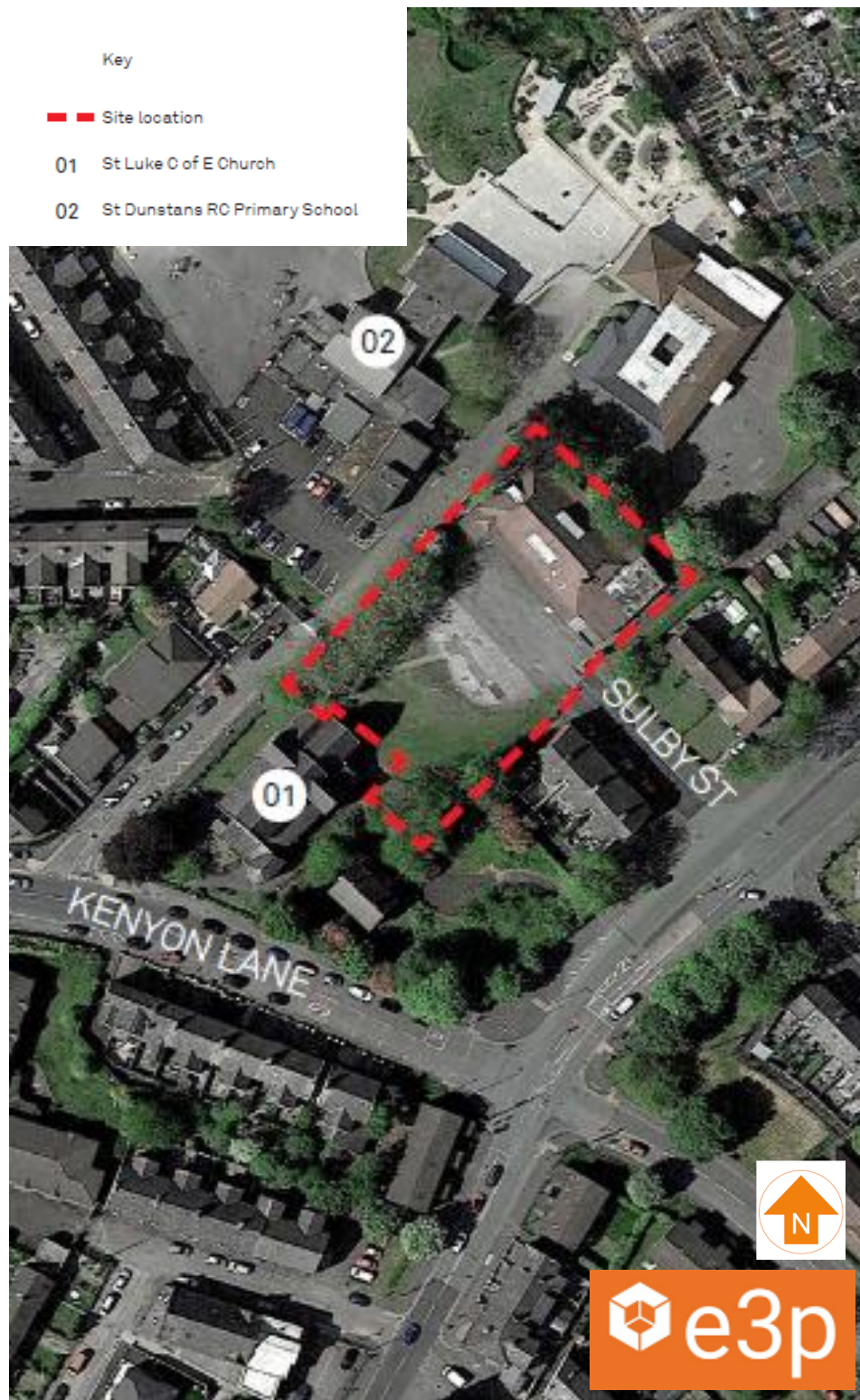
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance 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

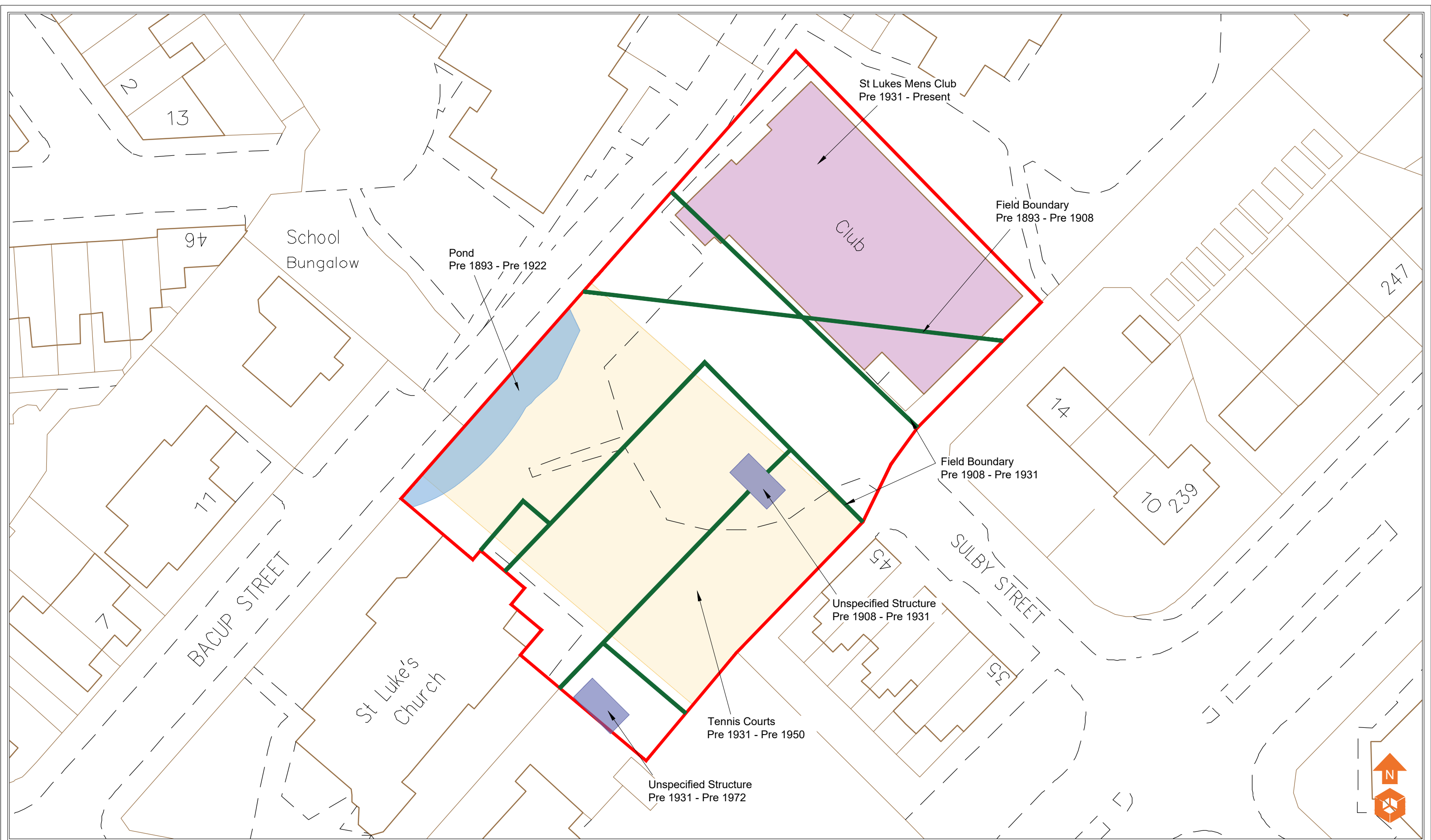
DRAWINGS

DRAWING 15-395-001 – SITE LOCATION PLAN

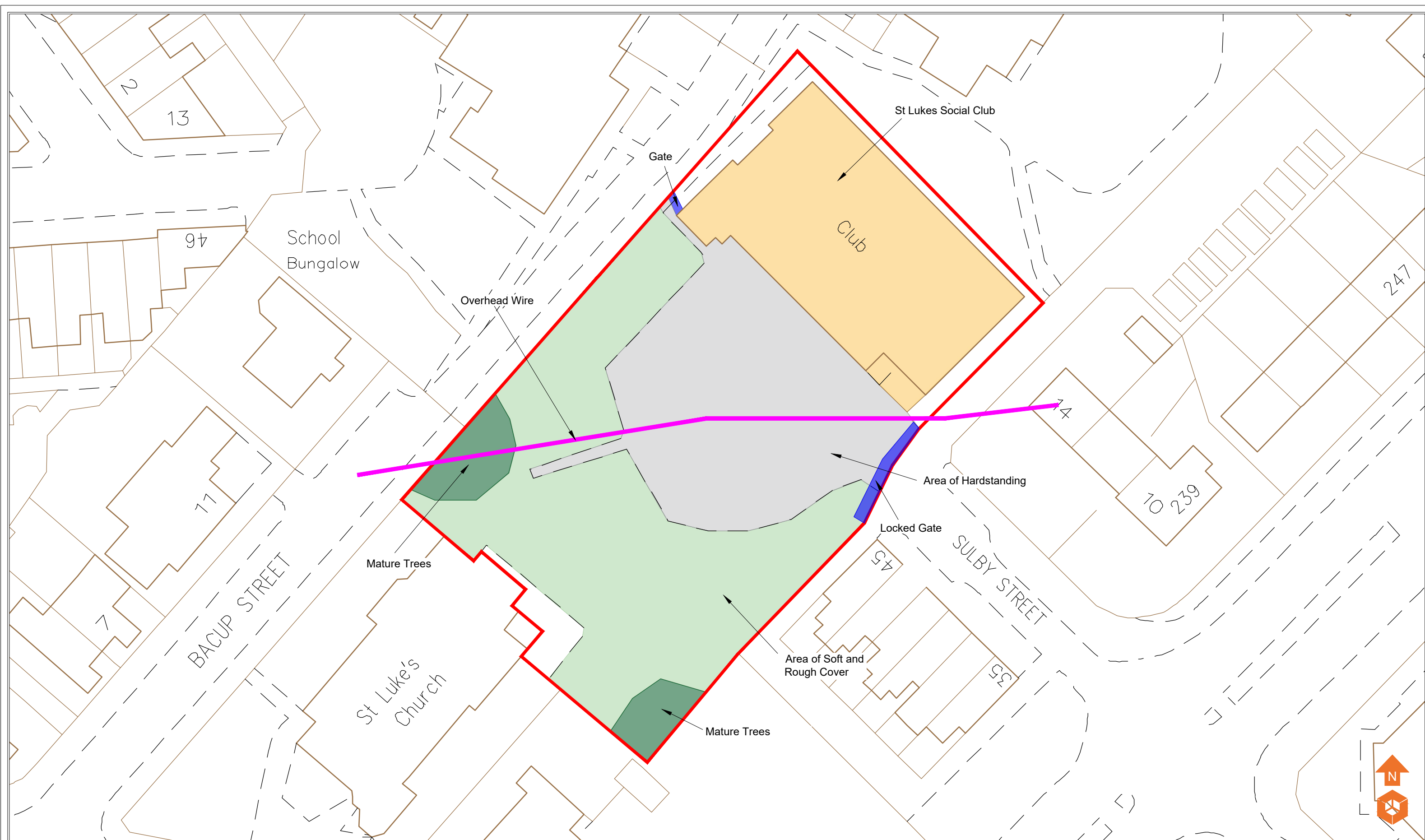




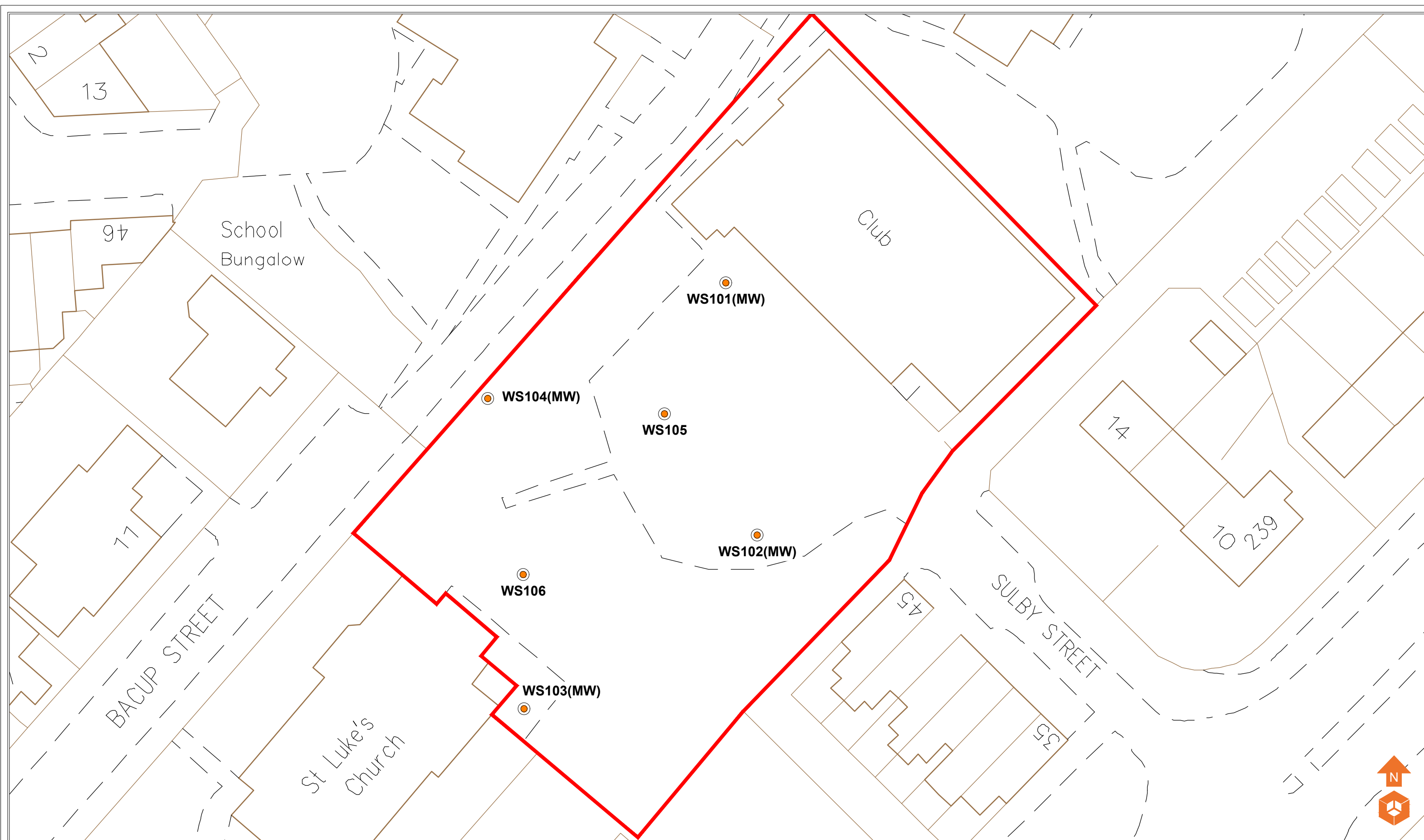
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							Drawing No: 002	Scale: NTS @ A3		
						Job Title: Sulby Street, Moston	Drawing Title: Proposed Development Plan			The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing 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.
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	Phase	Issue	Date	Drawn	Checked					



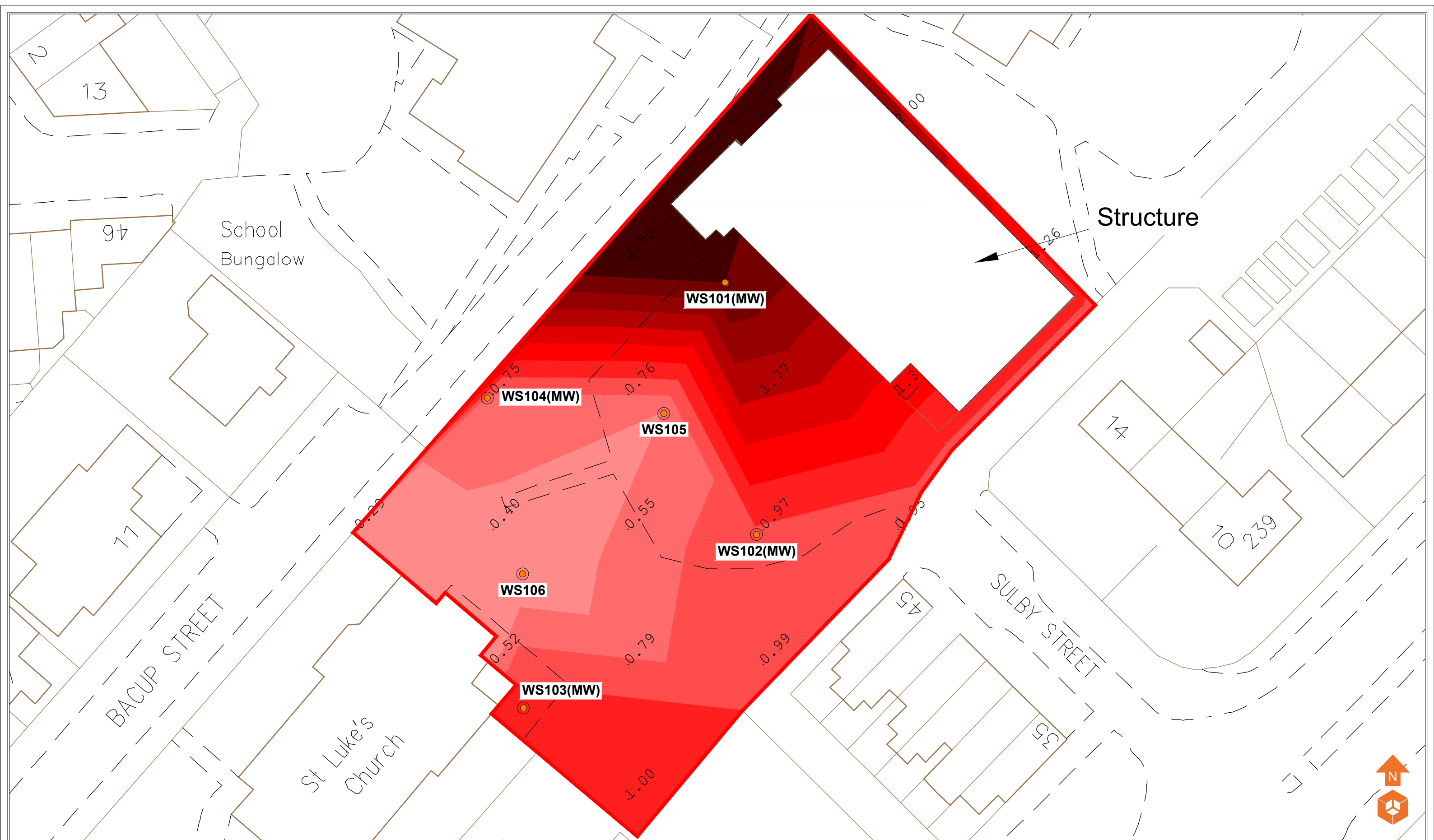
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P1	REVA	20.01.2022	CB	BH																					
Phase	Issue	Date	Drawn	Checked																					



Site Features St Lukes Social Club Overhead Wire Area of Hardstanding Area of Soft and Rough Cover Mature Trees Gate



Location Symbols Approximate Window Sample Probehole Location Approximate Window Sample Probehole Location with Install	Notes:					Client: Challenger Homes	Job No: 15-395	Date: 06.01.2023	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									
							Drawing No: 005	Scale: NTS @ A3										
	<table><tr><td>P1</td><td>REVA</td><td>06.01.2023</td><td>OW</td><td>NG</td></tr><tr><td>Phase</td><td>Issue</td><td>Date</td><td>Drawn</td><td>Checked</td></tr></table>					P1	REVA	06.01.2023		OW	NG	Phase	Issue	Date	Drawn	Checked	Job Title: Sulby Street, Moston	Drawing Title: Exploratory Hole Location Plan
P1	REVA	06.01.2023	OW	NG														
Phase	Issue	Date	Drawn	Checked														



Location Symbols

- Approximate Window Sample Probehole Location
- Approximate Window Sample Probehole Location with Install

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.24m
- Depth of Made Ground 0.25 - 0.49m
- Depth of Made Ground 0.50 - 0.74m
- Depth of Made Ground 0.75 - 0.99m
- Depth of Made Ground 1.00 - 1.24m
- Depth of Made Ground 1.25 - 1.49m
- Depth of Made Ground 1.50 - 1.74m
- Depth of Made Ground 1.75 - 1.99m
- Depth of Made Ground >2.00m

Notes:

P1	REVA	19.01.2023	OW	NG
Phase	Issue	Date	Drawn	Checked

Client:

Challenger Homes

Job Title:

Sulby Street, Moston

Job No:

15-395

Drawing No:

006

Date:

19.01.2023

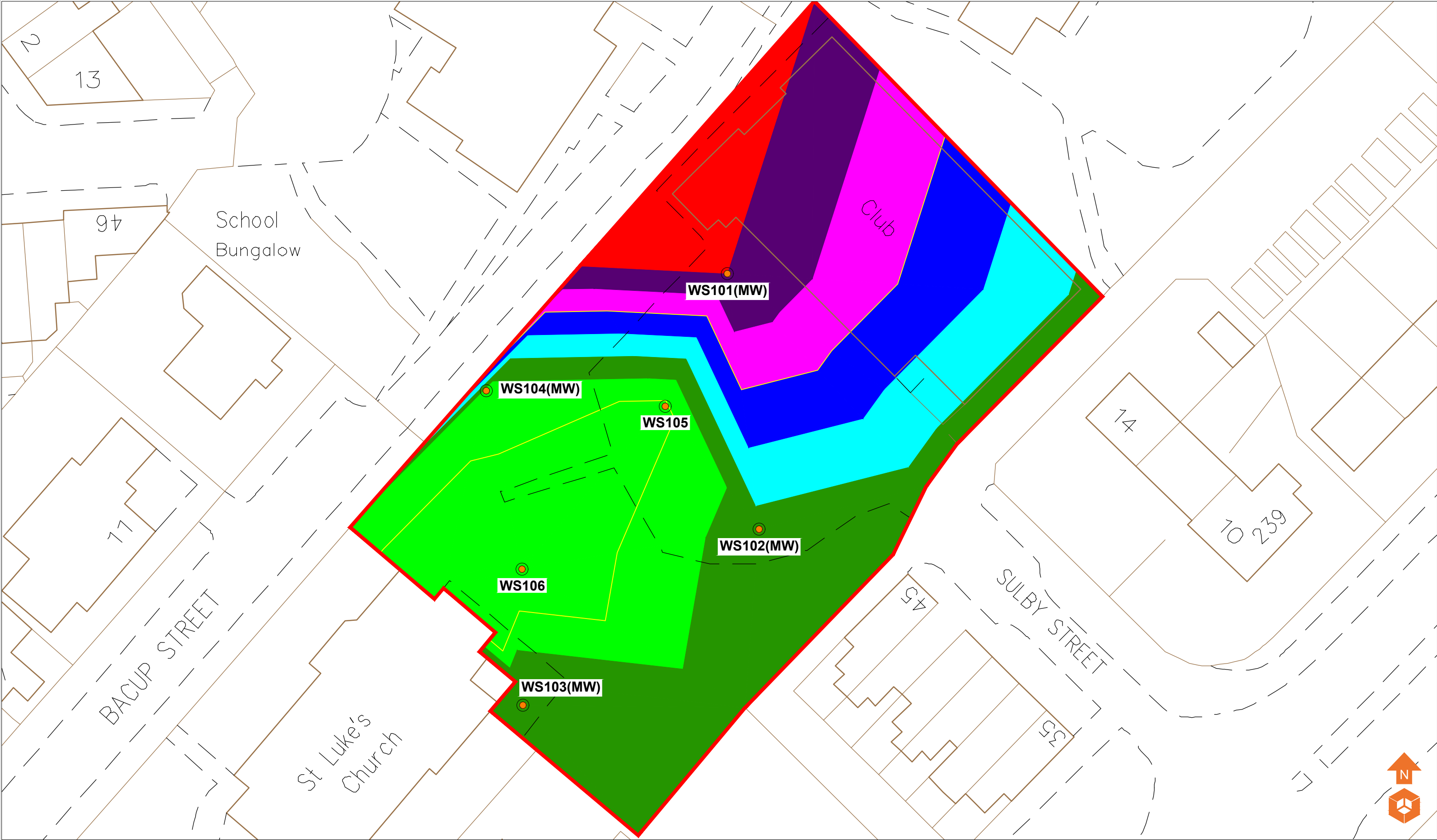
Scale:

NTS @ A3

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.



Location Symbols

- Approximate Window Sample Probehole Location
- Approximate Window Sample Probehole Location with Install

Shallow Spread Footings

- Depth to Founding Strata 0.00 - 1.24m
- Depth to Founding Strata 1.25 - 1.49m

Mass Trench Fill Footings

- Depth to Founding Strata 1.50 - 1.74m
- Depth to Founding Strata 1.75 - 1.99m
- Depth to Founding Strata 2.00 - 2.24m

Engineered Footings

- Depth to Founding Strata 2.25 - 2.49m
- Depth to Founding Strata >2.50m

Notes:

P1	REVA	23.01.2023	EB	MJ
Phase	Issue	Date	Drawn	Checked

Client:

Challenger Homes

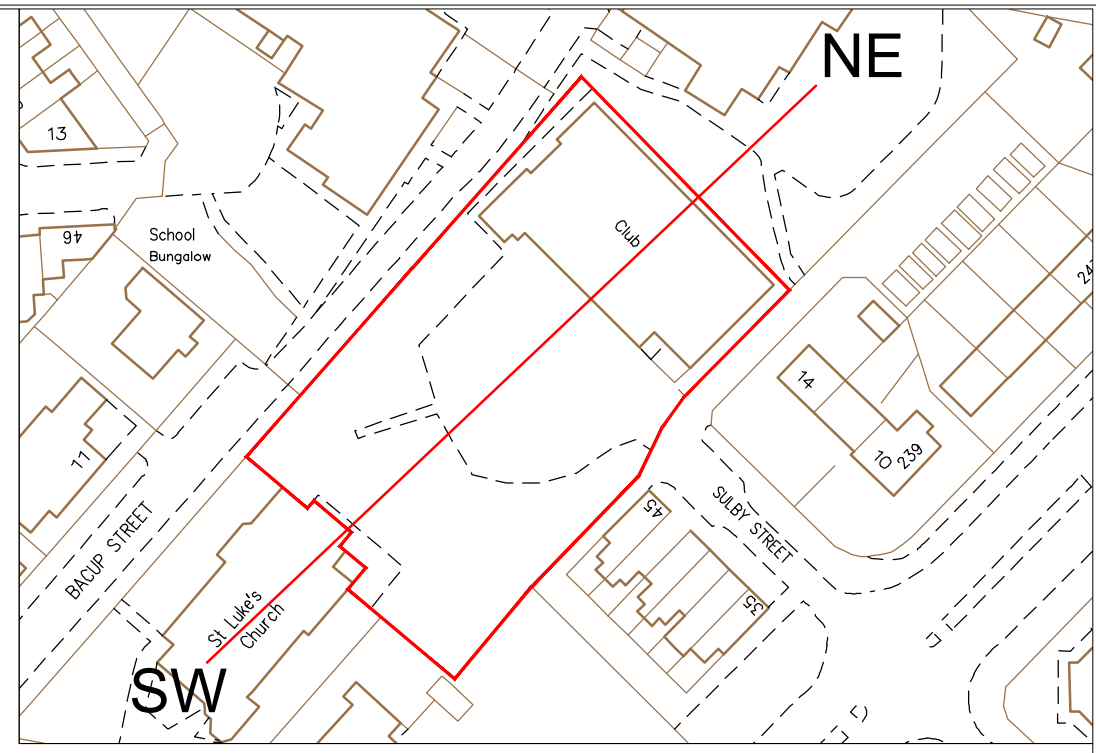
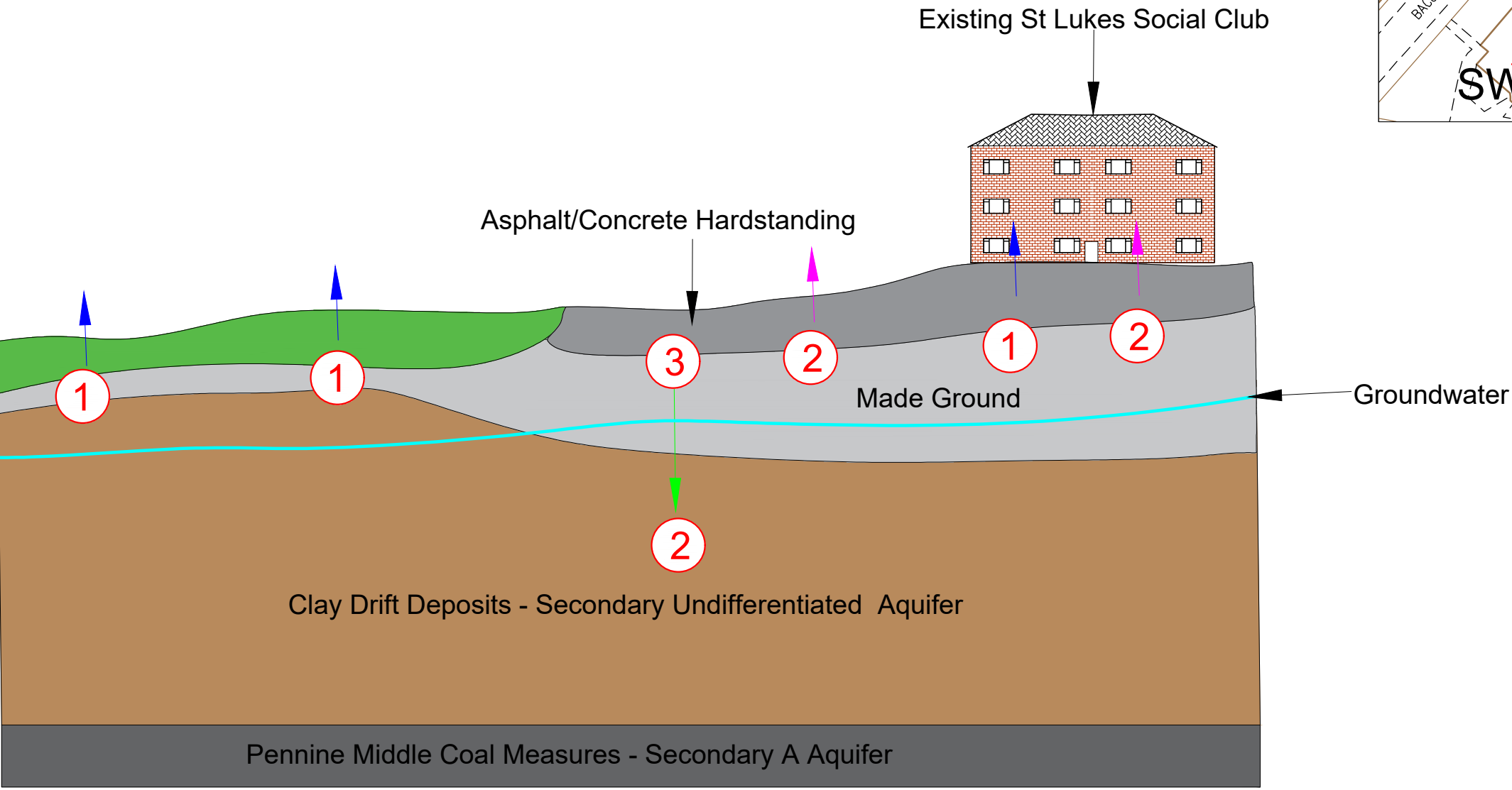
Job Title:

Sulby Street, Moston

Job No:	15-395	Date:	23.01.2023
Drawing No:	008	Scale:	NTS @ A3
Drawing Title:		Depth to Founding Strata Plan	

Environmental Engineering Partnership Ltd
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Urmston, Manchester, M41 7JQ
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Website: www.e3p.co.uk

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Geology Key Asphalt/Concrete Hardstanding Made Ground Clay Pennine Middle Coal Measures Groundwater	Sources ① Heavy Metals and Non-Volatile PAHs ② Asbestos ③ SVOCs	Receptors ① Future End Users ② Secondary A Aquifer ③ Buildings ④ Tainted Water Supply ③ Landscaping and Trees ④ Construction Workers	Pathways Dermal Contact Inhalation/Ingestion Leaching of Contaminants	Notes:	Client: Challenger Homes	Job No: 15-395	Date: 05.01.2023	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JG Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk
					Job Title: Sulby Street, Moston	Drawing No: 010	Scale: 1:1000 @ A3	
	P1 Phase	REVA Issue	05.01.2023 Date	OW Drawn	NG Checked	Drawing Title: Conceptual Site Model		

APPENDIX IV PHOTOGRAPHS

PLATE 1 ENTRANCE TO SITE – SOUTH EASTERN BOUNDARY

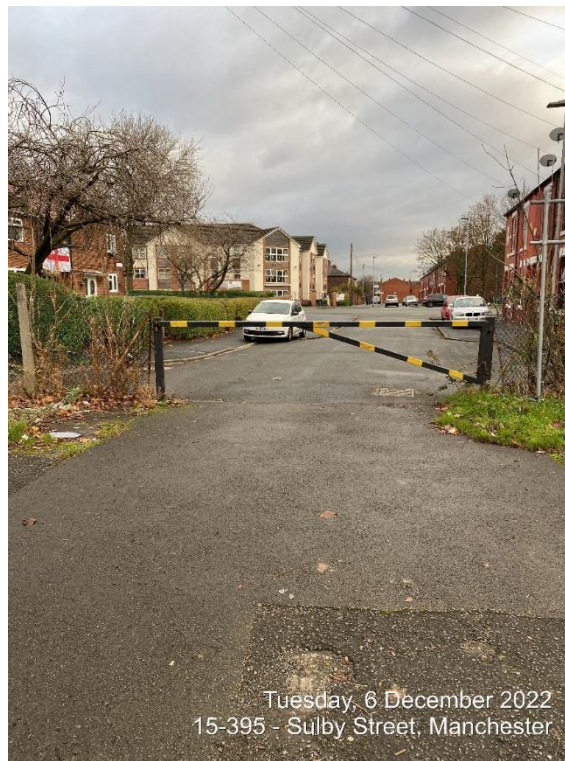


PLATE 2 VIEW OF EXSITING BUILDING FACING NORTH EAST



PLATE 3 VIEW OF SITE FACING NORTH WEST



PLATE 4 VIEW OF SITE FACING SOUTH



PLATE 5 SAMPLE RECOVERY – WS102 (EASTERN SECTOR OF SITE)



PLATE 6 SAMPLE RECOVERY – WS103 (SOUTHER SECTOR OF SITE)



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387411.70 - 401576.83

Hole Type
WS

Location: Moston

Level: 87.41

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 - 06/12/2022

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.09			0.09	87.32		MADE GROUND: Asphalt.	
		0.50	ES					MADE GROUND: Brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick and ash.	1
		1.00	D	N=7 (1,1/1,2,2,2)					
		1.00							
		1.50	ES		1.50	85.90		MADE GROUND: Black sandy gravel is angular to subrounded of brick, clinker and ash.	2
		1.70							
		2.00		N=1 (1,1/1,0,0,0)					
		2.50			2.50	84.90		Very stiff high strength brown CLAY. Circa 4.00m bgl becomes stiff medium strength. Circa 5.00m bgl becomes very stiff high strength.	3
		3.00	D	N=18 (3,3/4,4,5,5)					
		3.00							
		4.00		N=17 (3,3/4,3,4,6)					4
		5.00	D	N=30 (3,4/4,6,10,10)					5
		5.00							
		5.45			5.45	81.96		End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Completed. 2. Monitoring well installed response zone between 0.50m and 2.50m bgl.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387416.90 - 401555.95

Hole Type
WS

Location: Moston

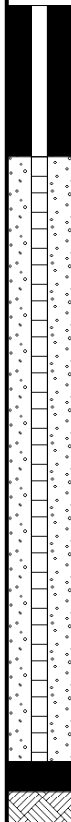
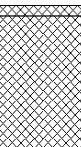
Level: 87.66

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 - 06/12/2022

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.07			0.07	87.59		MADE GROUND: Asphalt.	
		0.50	ES					MADE GROUND: Brown to black very gravelly sand with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick and ash. Cobbles are angular of brick.	
		1.00	D	N=9 (5,3/2,2,3,2)	0.95	86.71		Stiff medium strength brown CLAY. Circa 2.00m bgl becomes firm low strength. Circa 5.00m bgl becomes stiff medium strength.	1
		1.00							
		1.50	ES						
		2.00	D	N=8 (1,1/1,3,2,2)					2
		2.00							
		2.50	U						
		3.00	D	N=9 (1,2/2,2,2,3)					3
		3.00							
		4.00	D	N=9 (1,1/1,2,3,3)					4
		4.00							
		5.00	D	N=14 (2,3/3,3,4,4)					5
		5.00							
					5.45	82.21		End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Completed. 2. Monitoring well installed response zone between 1.00m and 5.00m bgl. 3. Water strike encountered at 2.60m bgl.



Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387393.81 - 401535.93

Hole Type
WS

Location: Moston

Level: 87.65

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 - 06/12/2022

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.08			0.08	87.57		MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick and ash.	
		0.50	ES					MADE GROUND: Black very gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of clinker and ash.	
		1.00	D	N=12 (1,2/2,3,3,4)	1.00	86.65		Stiff medium strength brown CLAY. Circa 3.00m bgl becomes very stiff high strength.	1
		1.00	ES						
		1.20							
		2.00	D	N=14 (2,3/3,4,3,4)					2
		2.00							
		2.50	U						
		3.00	D	N=23 (3,4/5,6,6,6)					3
		3.00							
		4.00	D	N=21 (2,3/3,6,6,6)					4
		4.00							
		5.00	D	N=25 (2,2/4,5,7,9)					5
		5.00							
		5.45			5.45	82.20		End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Completed. 2. Monitoring well installed response zone between 0.50m and 1.00m bgl.



Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387390.35 - 401566.55

Hole Type
WS

Location: Moston

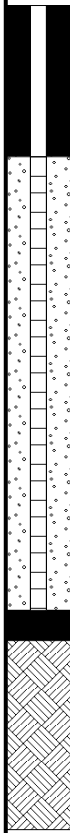
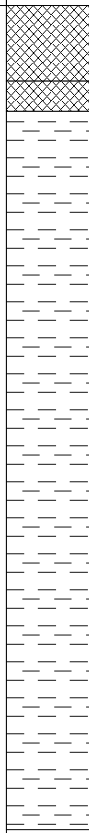
Level: 87.47

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 - 06/12/2022

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.50 0.70	86.97 86.77			
		1.00 1.00	D	N=6 (1,2/1,1,2,2)					1
		1.50	ES						
		2.00		N=4 (1,1/1,1,1,1)					2
		3.00 3.00	D	N=17 (3,4/3,4,5,5)					3
		4.00 4.00	D	N=17 (3,4/3,4,5,5)					4
		5.00		N=14 (1,2/3,3,3,5)					5
					5.45	82.02		End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Completed. 2. Monitoring well installed response zone between 1.00m and 4.00m bgl.



Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387404.95 - 401565.71

Hole Type
WS

Location: Moston

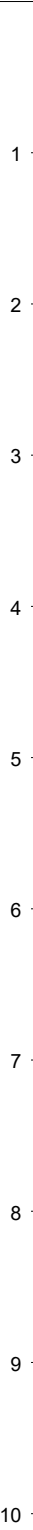
Level: 87.55

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 - 06/12/2022

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES	N=8 (1,1/1,2,2,3)	0.08	87.47		MADE GROUND: Asphalt.	
					0.50	87.05		MADE GROUND: Black gravelly clayey sand. Gravel is fine to coarse angular to subrounded of brick and concrete.	
		1.00	D					Stiff medium strength brown CLAY. Circa 3.00m bgl becomes very stiff high strength.	
		1.00	ES						
		1.00							
		1.50	U						
		2.00	D	N=14 (2,3/3,3,4,4)					
		2.00							
		3.00	D	N=20 (3,3/3,5,6,6)					
		3.00							
		4.00	D	N=22 (4,3/4,6,6,6)					
		4.00							
		5.00	D	N=21 (4,4/4,5,6,6)					
		5.00							
					5.45	82.10		End of borehole at 5.45 m	

Remarks

1. Completed.



Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Sulby Street

Project No.
15395

Co-ords: 387391.17 - 401551.22

Hole Type
WS

Location: Moston

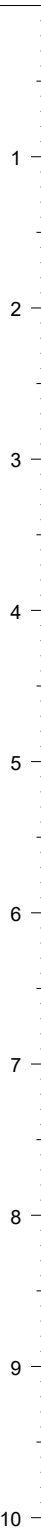
Level: 87.59

Scale
1:50

Client: Challenger Group

Dates: 06/12/2022 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.28	87.31		MADE GROUND: Black very gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick, clinker and ash. Stiff medium strength brown CLAY.	
		0.80	ES						
		1.00	D						
		1.00		N=10 (1,2/2,2,3,3)					
		1.50	U						
		2.00	D						
		2.00		N=15 (2,3/3,4,4,4)					
		3.00	D						
		3.00		N=14 (2,3/3,3,3,5)					
		4.00	D						
		4.00		N=17 (2,3/3,4,4,6)					
		5.00	D						
		5.00		N=18 (2,3/4,4,5,5)					
					5.45	82.14		End of borehole at 5.45 m	

Remarks

1. Completed. 2. Water strike encountered at 2.50m bgl.

APPENDIX VI

CHEMICAL TESTING

RESULTS

Nick Gregory
e3p
Taylor Road
Urmston
Manchester
M41 7JQ

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: ngregory@e3p.co.uk

Analytical Report Number : 22-12001

Project / Site name:	15 395 Sulby Street Moston	Samples received on:	07/12/2022
Your job number:	15 395	Samples instructed on/ Analysis started on:	07/12/2022
Your order number:	003654	Analysis completed by:	16/12/2022
Report Issue Number:	1	Report issued on:	16/12/2022
Samples Analysed:	2 leachate samples - 12 soil samples		


Signed:
Adam Fenwick
Technical Reviewer
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: 22-12001
Project / Site name: 15 395 Sulby Street Moston
Your Order No: 003654

Lab Sample Number	2525288	2525289	2525290	2525291	2525292
Sample Reference	WS101	WS101	WS102	WS102	WS103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	1.70	0.50	1.50	0.50
Date Sampled	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken	None Supplied	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
Moisture Content	%	0.01	NONE	17	25
Total mass of sample received	kg	0.001	NONE	0.4	1.1

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	SCA	SCA	SCA	N/A	SCA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	8.2	10.7	7.6	7.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	16	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	880	980	2000	110	600
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.069	0.12	0.13	0.0075	0.019
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	140	250	260	15	37
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	68.7	124	128	7.5	18.5
Sulphide	mg/kg	1	MCERTS	85	38	36	1.7	5.6
Total Sulphur	mg/kg	50	MCERTS	820	2000	2100	63	870
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.5	2	1.1	0.6	6.7

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.11	-	0.22	< 0.05	0.62
Acenaphthylene	mg/kg	0.05	MCERTS	0.05	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.13	-	0.05	< 0.05	0.23*
Fluorene	mg/kg	0.05	MCERTS	0.14	-	< 0.05	< 0.05	0.2
Phenanthrene	mg/kg	0.05	MCERTS	1	-	0.62	0.05*	*
Anthracene	mg/kg	0.05	MCERTS	0.23	-	0.09	< 0.05*	0.63*
Fluoranthene	mg/kg	0.05	MCERTS	1.7	-	0.9	0.06*	3.7*
Pyrene	mg/kg	0.05	MCERTS	1.7	-	0.94	0.06	3.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.8	-	0.52*	0.05*	2.2*
Chrysene	mg/kg	0.05	MCERTS	0.88	-	0.52*	< 0.05	2.2*
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1	-	0.58*	< 0.05*	3*
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.26*	-	0.21*	< 0.05*	0.89*
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.72	-	0.38*	< 0.05*	2.6*
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.44	-	0.24*	< 0.05*	1.6*
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.12	-	0.07*	< 0.05*	0.33*
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.44*	-	0.32	< 0.05*	2.1*

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	9.68*	-	5.66*	< 0.80*	26.8*
-----------------------------	-------	-----	-----------	-------	---	-------	---------	-------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	22	17	14	8.9	48
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	19	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	21	14	28	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	240	61	49	55	93

Analytical Report Number: 22-12001
 Project / Site name: 15 395 Sulby Street Moston
 Your Order No: 003654

Lab Sample Number				2525288	2525289	2525290	2525291	2525292
Sample Reference				WS101	WS101	WS102	WS102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.70	0.50	1.50	0.50
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Lead (aqua regia extractable)	mg/kg	1	MCERTS	250	52	840	14	110
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.7	< 0.3	< 0.3	< 0.3	0.8
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	35	41	17	30	45
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	750	92	3200	54	150

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0	< 2.0*	< 2.0	< 2.0*	< 2.0*
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0	11*	< 4.0	< 4.0*	14*
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	3.9	20*	3.8	< 1.0*	18*
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	4.9	150*	3.1	< 1.0*	36*
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	67	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	< 10	250	< 10	< 10	67

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Chloroethane	µg/kg	5	NONE	-	< 5.0	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	< 5.0	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	< 5.0	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	< 5.0	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	-
Benzene	µg/kg	5	MCERTS	-	< 5.0	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	< 5.0	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Toluene	µg/kg	5	MCERTS	-	< 5.0	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	< 5.0	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	-
Styrene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-

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 Project / Site name: 15 395 Sulby Street Moston
 Your Order No: 003654

Lab Sample Number				2525288	2525289	2525290	2525291	2525292
Sample Reference				WS101	WS101	WS102	WS102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.70	0.50	1.50	0.50
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Tribromomethane	µg/kg	5	NONE	-	< 5.0	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Butylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	< 5.0	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	< 0.1	-	-	-
Phenol	mg/kg	0.2	MCERTS	-	< 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	ISO 17025	-	< 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	NONE	-	< 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	-	1.3	-	-	-
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	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	< 0.1	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	< 0.2	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	2.2	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	< 0.1	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	< 0.1	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	< 0.1	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	0.15	-	-	-

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Lab Sample Number				2525288	2525289	2525290	2525291	2525292
Sample Reference				WS101	WS101	WS102	WS102	WS103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.70	0.50	1.50	0.50
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	0.3	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	< 0.3	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	< 0.2	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	0.18*	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	< 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	-	1.1*	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	0.31*	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	< 0.3	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	1.7*	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	1.5*	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.78	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	0.83*	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	0.77*	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	0.25	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.48	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.35	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.4	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected
 *Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted and the failure justified as having no significant impact on sample data reported.

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 Project / Site name: 15 395 Sulby Street Moston
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Lab Sample Number	2525293	2525294	2525295	2525296	2525297
Sample Reference	WS103	WS104	WS104	WS105	WS105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.20	0.40	1.50	0.20	1.00
Date Sampled	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken	None Supplied	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
Moisture Content	%	0.01	NONE	18	18
Total mass of sample received	kg	0.001	NONE	0.4	0.4

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	SCA	N/A	SCA	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.3	7.5	7.2	-	7.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	160	3800	420	-	200
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.014	0.042	0.019	-	0.011
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	27	85	37	-	22
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	13.5	42.4	18.7	-	11.1
Sulphide	mg/kg	1	MCERTS	< 1.0	2.2	1.3	-	4.1
Total Sulphur	mg/kg	50	MCERTS	140	2000	390	-	180
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1	4.5	3.3	-	0.9

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.23	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.07	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.13	0.13	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.07*	0.11*	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.07*	1.3*	1*	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05*	0.35*	0.28*	-	< 0.05*
Fluoranthene	mg/kg	0.05	MCERTS	0.13*	5*	2*	-	0.05*
Pyrene	mg/kg	0.05	MCERTS	0.14	4.8*	1.8*	-	0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.07*	2.1	1	-	< 0.05*
Chrysene	mg/kg	0.05	MCERTS	0.09*	2.8*	0.87*	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.12*	3.1*	1.3*	-	< 0.05*
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05*	1.6	0.5	-	< 0.05*
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.07*	2.3	0.97	-	< 0.05*
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05*	1.7	0.7	-	< 0.05*
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05*	0.37	0.18	-	< 0.05*
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05*	1.9	0.83	-	< 0.05*

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80*	27.7*	11.7*	-	< 0.80*
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	51	11	-	8.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	-	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	34	35	20	-	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	31	110	32	-	22

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Lab Sample Number				2525293	2525294	2525295	2525296	2525297
Sample Reference				WS103	WS104	WS104	WS105	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.40	1.50	0.20	1.00
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Lead (aqua regia extractable)	mg/kg	1	MCERTS	20	180	81	-	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	38	17	-	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	50	120	47	-	40

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0*	< 2.0*	< 2.0*	< 2.0	< 2.0*
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	7.3*	< 4.0*	< 4.0*	4.5	< 4.0*
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	6.6*	18*	7.9*	23	< 1.0*
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	< 1.0*	150*	200*	120	< 1.0*
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	73	120	45	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	14	240	330	190	< 10

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Chloroethane	µg/kg	5	NONE	-	-	-	< 5.0	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	< 5.0	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	< 5.0	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trichloromethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	< 5.0	-
Benzene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Toluene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
Styrene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-

Analytical Report Number: 22-12001
 Project / Site name: 15 395 Sulby Street Moston
 Your Order No: 003654

Lab Sample Number				2525293	2525294	2525295	2525296	2525297
Sample Reference				WS103	WS104	WS104	WS105	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.40	1.50	0.20	1.00
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Tribromomethane	µg/kg	5	NONE	-	-	-	< 5.0	-
o-Xylene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Bromobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Butylbenzene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Phenol	mg/kg	0.2	MCERTS	-	-	-	< 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	ISO 17025	-	-	-	< 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	NONE	-	-	-	< 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	-	-	-	0.28	-
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	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	0.4	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	0.05*	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	0.25*	-

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Project / Site name: 15 395 Sulby Street Moston

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Lab Sample Number				2525293	2525294	2525295	2525296	2525297
Sample Reference				WS103	WS104	WS104	WS105	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.40	1.50	0.20	1.00
Date Sampled				06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	0.2*	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	< 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	-	-	-	2.6*	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	0.6*	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	5.2*	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	5.2*	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	2.3*	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	2.6*	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	2.4*	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	1.4	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	2.2*	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	1.3*	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	0.33*	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	1.7	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

*Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted and the failure justified as having no significant impact on sample data reported.

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 Project / Site name: 15 395 Sulby Street Moston
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Lab Sample Number	2525298			2525299
Sample Reference	WS106			WS106
Sample Number	None Supplied			None Supplied
Depth (m)	0.20			0.80
Date Sampled	06/12/2022			06/12/2022
Time Taken	None Supplied			None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	20
Total mass of sample received	kg	0.001	NONE	1.2

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-
Asbestos Analyst ID	N/A	N/A	N/A	SCA	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	6.8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	590	120
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.016	0.012
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	31	24
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	15.7	11.8
Sulphide	mg/kg	1	MCERTS	11	< 1.0
Total Sulphur	mg/kg	50	MCERTS	680	85
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.6	0.6

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	0.21	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.07	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.35*	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.24	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	3.6*	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.68*	< 0.05*
Fluoranthene	mg/kg	0.05	MCERTS	6.5*	< 0.05*
Pyrene	mg/kg	0.05	MCERTS	6.4	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.4*	< 0.05*
Chrysene	mg/kg	0.05	MCERTS	3.2*	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.6*	< 0.05*
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.1*	< 0.05*
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.8*	< 0.05*
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.6*	< 0.05*
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.48*	< 0.05*
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.9*	< 0.05*

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	36.1*	< 0.80*
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	42	7.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	35
Copper (aqua regia extractable)	mg/kg	1	MCERTS	100	29

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Lab Sample Number				2525298	2525299
Sample Reference				WS106	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.20	0.80
Date Sampled				06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	140	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	40	25
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	220	41

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0*	< 2.0*
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	7*	< 4.0*
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	23*	< 1.0*
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	43*	< 1.0*
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	73	< 10

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-
Chloroethane	µg/kg	5	NONE	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-
Benzene	µg/kg	5	MCERTS	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-
Toluene	µg/kg	5	MCERTS	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-
Styrene	µg/kg	5	ISO 17025	-	-

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 Project / Site name: 15 395 Sulby Street Moston
 Your Order No: 003654

Lab Sample Number				2525298	2525299
Sample Reference				WS106	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.20	0.80
Date Sampled				06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Tribromomethane	µg/kg	5	NONE	-	-
o-Xylene	µg/kg	5	MCERTS	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-
Butylbenzene	µg/kg	5	NONE	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-
Phenol	mg/kg	0.2	MCERTS	-	-
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	ISO 17025	-	-
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	NONE	-	-
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	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-
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	NONE	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-

Analytical Report Number: 22-12001
 Project / Site name: 15 395 Sulby Street Moston
 Your Order No: 003654

Lab Sample Number				2525298	2525299
Sample Reference				WS106	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.20	0.80
Date Sampled				06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-
Azobenzene	mg/kg	0.3	NONE	-	-
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	NONE	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-
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 ND = Not detected
 *Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted and the failure justified as having no significant impact on sample data reported.



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Analytical Report Number: 22-12001

Project / Site name: 15 395 Sulby Street Moston

Your Order No: 003654

Lab Sample Number				2525300	2525301
Sample Reference				WS101	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				1.70	0.40
Date Sampled				06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	8	8
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	1.6	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	1.2	1.6
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Speciated PAHs

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

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	1.5	< 1.0
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.4	2.9
Copper (dissolved)	µg/l	0.7	ISO 17025	29	23
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	2.7
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	6.6	3.2
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	13	20

Monoaromatics & Oxygenates

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

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	NONE	< 10	< 10
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4041



Analytical Report Number: 22-12001

Project / Site name: 15 395 Sulby Street Moston

Your Order No: 003654

Lab Sample Number				2525300	2525301
Sample Reference				WS101	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				1.70	0.40
Date Sampled				06/12/2022	06/12/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		
TPH-CWG - Aliphatic >C5 - C6 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH, 1D, AL, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 _{EH, 1D, AL, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 _{EH, 1D, AL, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 _{EH, 1D, AL, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH, 1D, AL, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) _{HS+EH, 1D, AR, MS}	µg/l	10	NONE	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number: 22-12001
Project / Site name: 15 395 Sulby Street Moston
Your Order No: 003654

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2525288	WS101	0.50	131	Loose Fibres	Chrysotile	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 22-12001

Project / Site name: 15 395 Sulby Street Moston

* 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 *
2525288	WS101	None Supplied	0.5	Brown clay and loam with gravel.
2525289	WS101	None Supplied	1.7	3.10.20.0
2525290	WS102	None Supplied	0.5	Brown sand with gravel.
2525291	WS102	None Supplied	1.5	Brown clay and sand with gravel.
2525292	WS103	None Supplied	0.5	3.10.20.0
2525293	WS103	None Supplied	1.2	Brown clay and loam with gravel and vegetation.
2525294	WS104	None Supplied	0.4	Brown loam and clay with gravel and vegetation.
2525295	WS104	None Supplied	1.5	Brown clay and loam with rubble and gravel.
2525296	WS105	None Supplied	0.2	3.10.20.0
2525297	WS105	None Supplied	1	Brown clay.
2525298	WS106	None Supplied	0.2	Brown loam with gravel and clinker
2525299	WS106	None Supplied	0.8	Brown clay and sand.

Analytical Report Number : 22-12001

Project / Site name: 15 395 Sulby Street Moston

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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
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
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 dispersion 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 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
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	ISO 17025
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 (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	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
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
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 : 22-12001
Project / Site name: 15 395 Sulby Street Moston

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

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	ISO 17025
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
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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 (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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 arithmetically using the moisture content which is carried out at a maximum of 30°C. Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
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Analytical Report Number : 22-12001

Project / Site name: 15 395 Sulby Street Moston

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
HS	Headspace Analysis				
MS	Mass spectrometry				
FID	Flame Ionisation Detector				
GC	Gas Chromatography				
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))				
CU	Clean-up - e.g. by Florisil®, silica gel				
1D	GC - Single coil/column gas chromatography				
2D	GC-GC - Double coil/column gas chromatography				
Total	Aliphatics & Aromatics				
AL	Aliphatics				
AR	Aromatics				
#1	EH_2D_Total but with humics mathematically subtracted				
#2	EH_2D_Total but with fatty acids mathematically subtracted				
_	Operator - understore to separate acronyms (exception for +)				
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total				



4041



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Analytical Report Number : 23-10620

Project / Site name:	Sulby Street	Samples received on:	06/01/2023
Your job number:	15-395	Samples instructed on/ Analysis started on:	06/01/2023
Your order number:	003819	Analysis completed by:	13/01/2023
Report Issue Number:	1	Report issued on:	13/01/2023
Samples Analysed:	2 water samples		


Signed:

Anna Goc
Junior Reporting Specialist
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

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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.



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Analytical Report Number: 23-10620

Project / Site name: Sulby Street

Your Order No: 003819

Lab Sample Number				2547493	2547494
Sample Reference				WS102	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				06/01/2023	06/01/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.2	7.2
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	1.1	< 1.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	3.03	2.91

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	1.3	1.3
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	58	63
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0

Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.58	0.65
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.05	0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.2	0.3
Copper (dissolved)	µg/l	0.5	ISO 17025	1.7	2.5
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	130	16
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	1	0.6
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.5	1.3
Zinc (dissolved)	µg/l	0.5	ISO 17025	6.2	2.4

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	ISO 17025	< 10	< 10
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TPH-CWG - Aliphatic >C5 - C6 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10

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



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Analytical Report Number: 23-10620

Project / Site name: Sulby Street

Your Order No: 003819

Lab Sample Number				2547493	2547494
Sample Reference				WS102	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				06/01/2023	06/01/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0



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Analytical Report Number: 23-10620

Project / Site name: Sulby Street

Your Order No: 003819

Lab Sample Number				2547493	2547494
Sample Reference				WS102	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				06/01/2023	06/01/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01



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Analytical Report Number: 23-10620

Project / Site name: Sulby Street

Your Order No: 003819

Lab Sample Number				2547493	2547494
Sample Reference				WS102	WS104
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				06/01/2023	06/01/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
3&4-Methylphenol	µg/l	0.1	NONE	< 0.10	< 0.10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-10620

Project / Site name: Sulby Street

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 *for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Monohydric phenols in water - LOW LEVEL 1 ug/l	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Low level total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	ISO 17025

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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 30oC Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector



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Analytical Report Number : 23-10620

Project / Site name: Sulby Street

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
GC	Gas Chromatography				
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))				
CU	Clean-up - e.g. by Florisil®, silica gel				
1D	GC - Single coil/column gas chromatography				
2D	GC-GC - Double coil/column gas chromatography				
Total	Aliphatics & Aromatics				
AL	Aliphatics				
AR	Aromatics				
#1	EH_2D_Total but with humics mathematically subtracted				
#2	EH_2D_Total but with fatty acids mathematically subtracted				
-	Operator - understore to separate acronyms (exception for +)				
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total				

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 C₅-C₆ (aliphatic)	
TPH C₆-C₈ (aliphatic)	
TPH C₈-C₁₀ (aliphatic)	
TPH C₁₀-C₁₂ (aliphatic)	
TPH C₁₂-C₁₆ (aromatic)	
TPH C₁₆-C₂₁ (aromatic)	
TPH C₂₁-C₃₅ (aromatic)	



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



4043

Contract Number: PSL22/7940

Report Date: 10 January 2023

Client's Reference: 15-395

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Nick Gregory

Contract Title: Sulby Street, Moston

Date Received: 14/12/2022

Date Commenced: 14/12/2022

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
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

M Fennell
(Senior Technician)

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

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Sulby Street, Moston

Contract No:

PSL22/7940

Client Ref:

15-395

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

Sulby Street, Moston

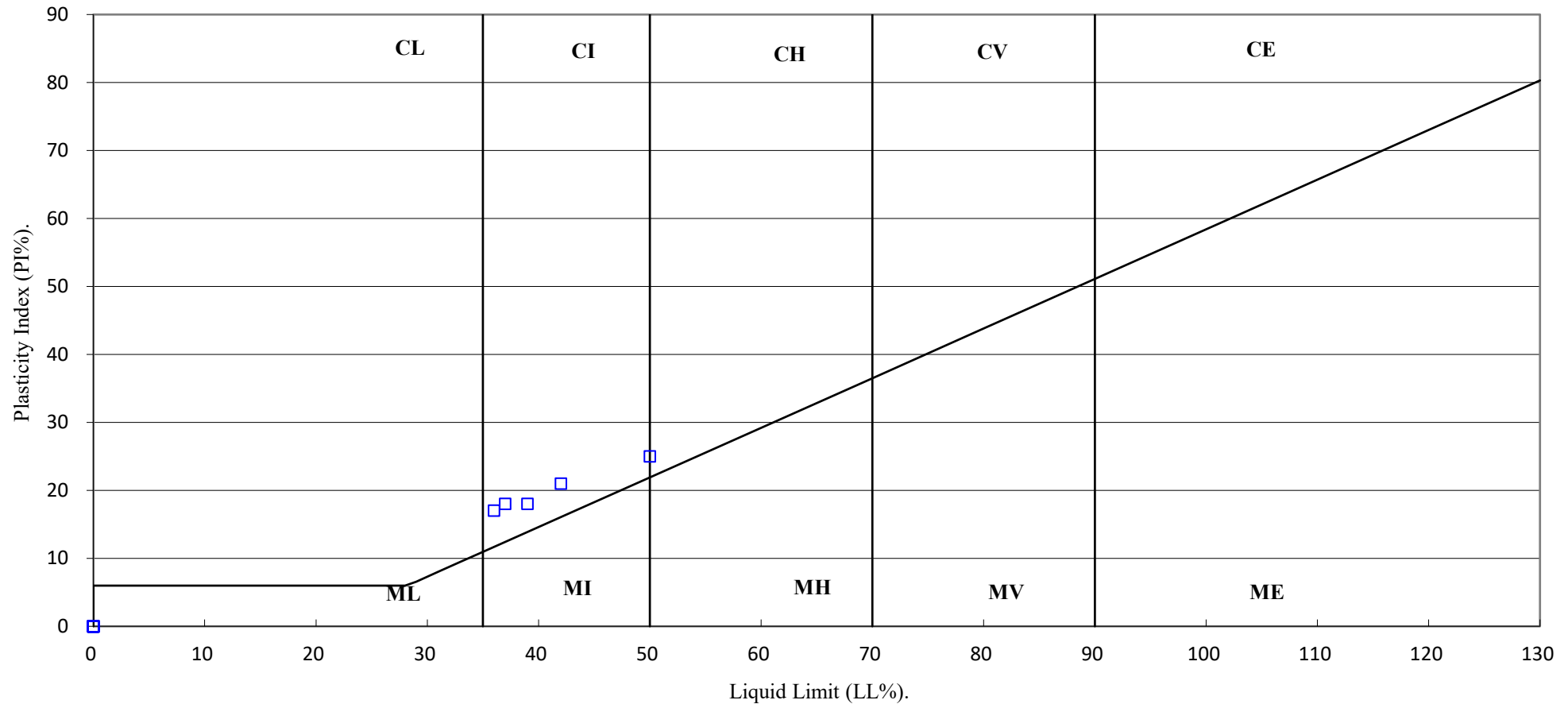
Contract No:

PSL22/7940

Client Ref:

15-395

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Sulby Street, Moston

Contract No:

PSL22/7940

Client Ref:

15-395

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

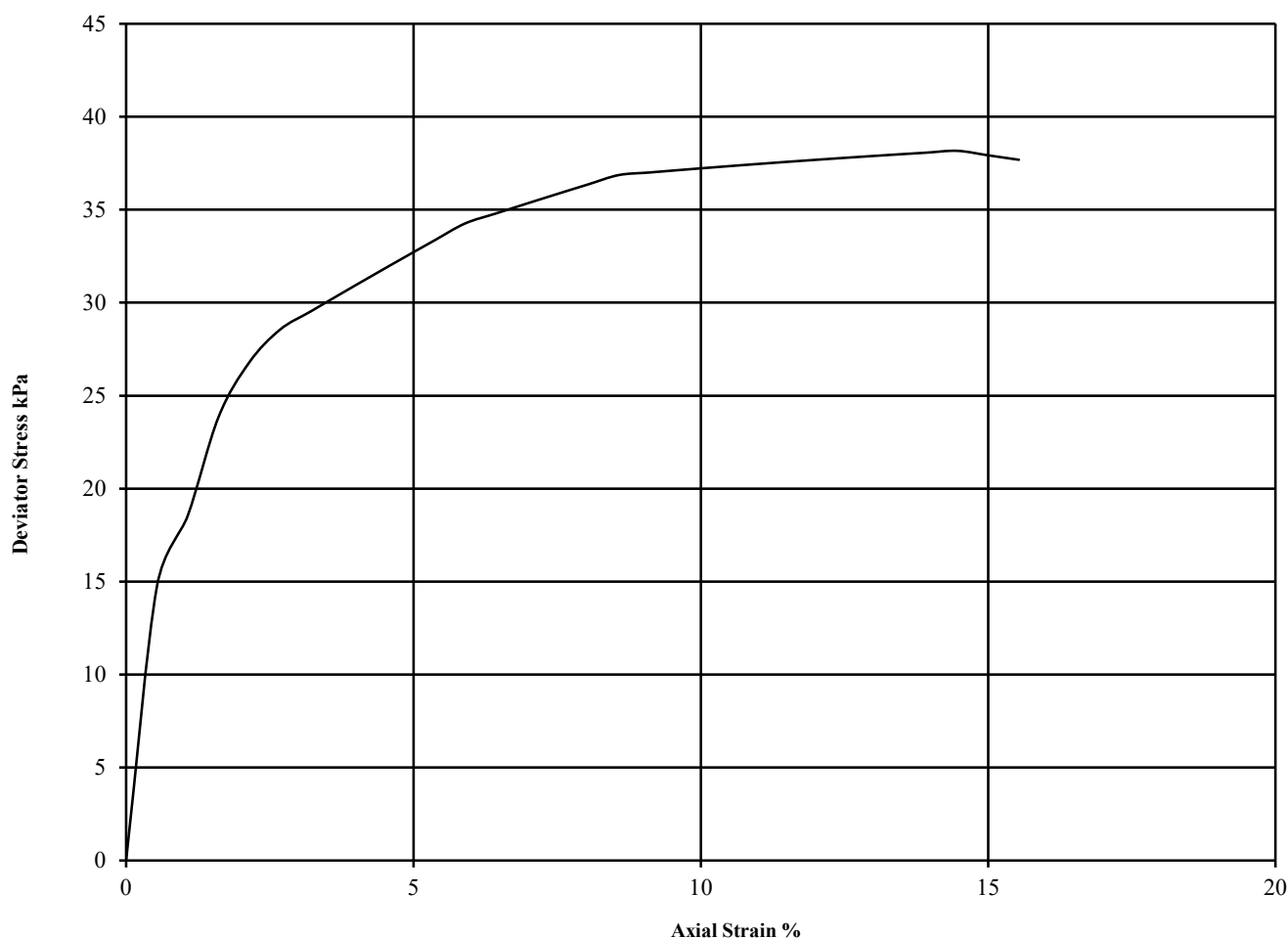
Hole Number: WS102

Top Depth (m): 2.50

Sample Number:

Base Depth (m): 3.00

Sample Type U



Diameter (mm):		75	Height (mm):		140	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	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, Correction applied 0.46 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	24	1.94	1.57	55	38	19	14.5	Plastic	



4043

PSL
Professional Soils Laboratory

Sulby Street, Moston

Contract No:

PSL22/7940

Client Ref:

15-395

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

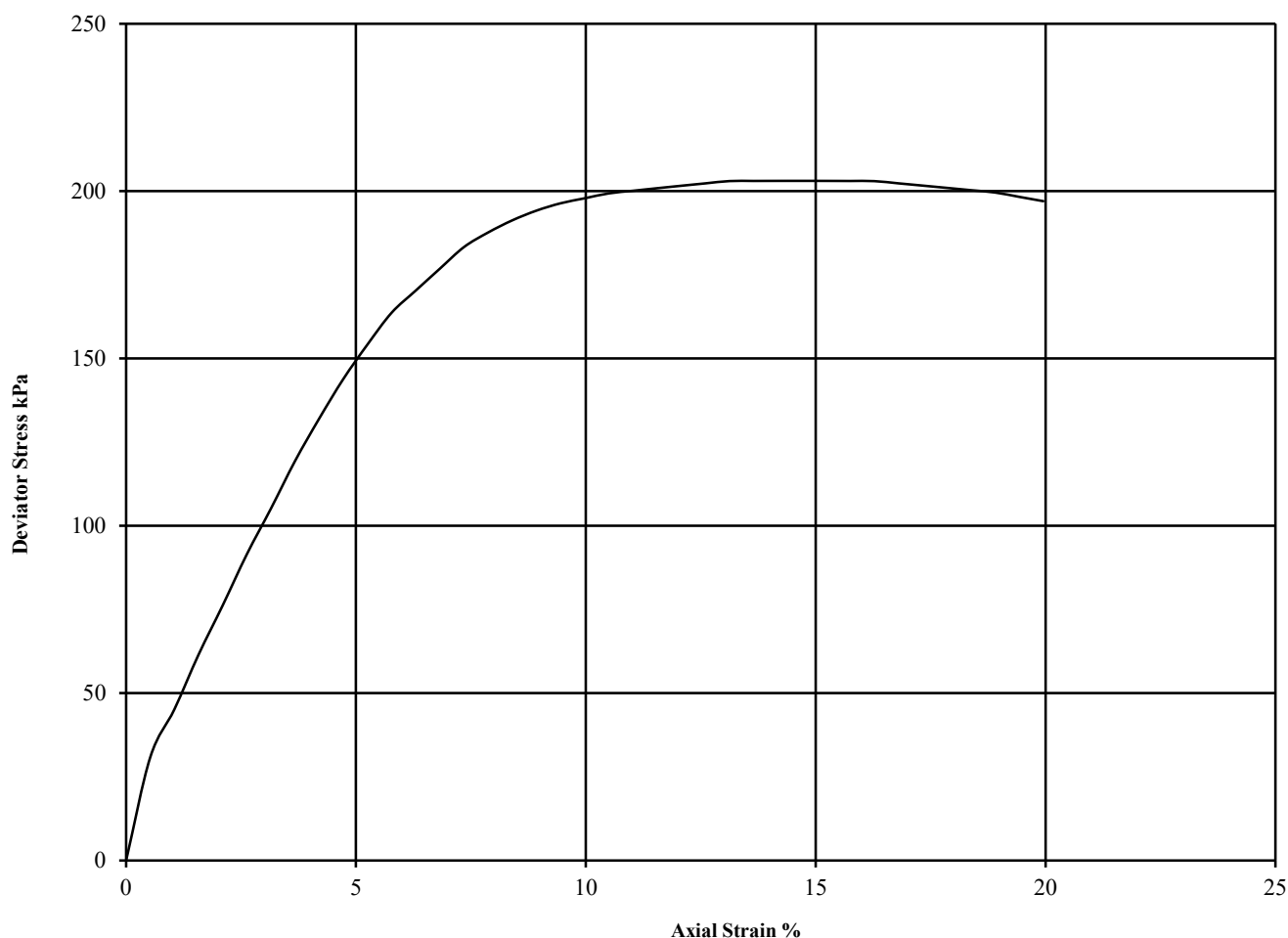
Hole Number: WS106

Top Depth (m): 1.50

Sample Number:

Base Depth (m): 2.00

Sample Type U



Diameter (mm):		84		Height (mm):		160	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	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, Correction applied 0.41 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$				
1	19	1.96	1.64	35	203	102	14.7	Plastic		



PSL
Professional Soils Laboratory

Sulby Street, Moston

Contract No:

PSL22/7940

Client Ref:

15-395

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: WS105

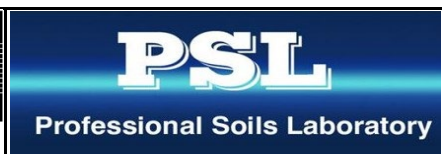
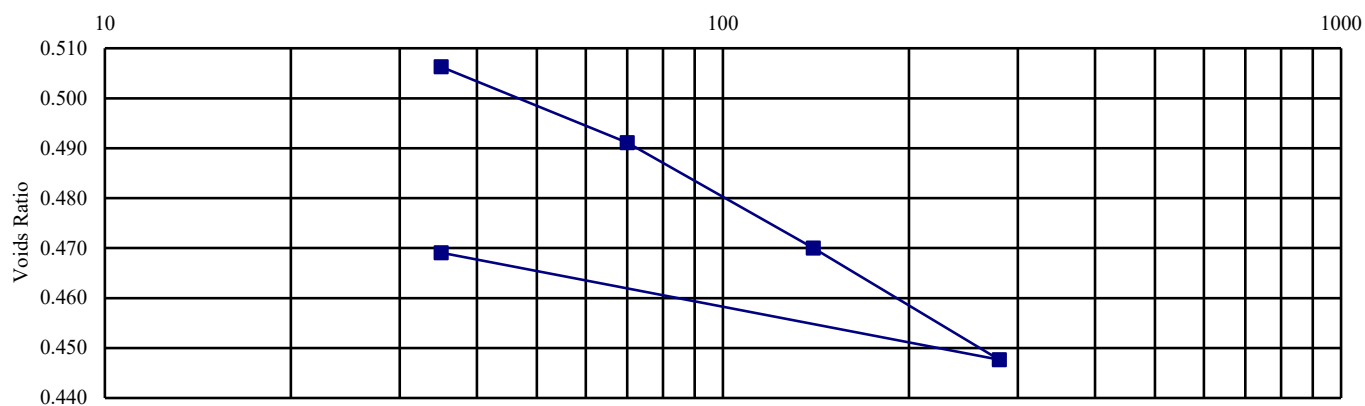
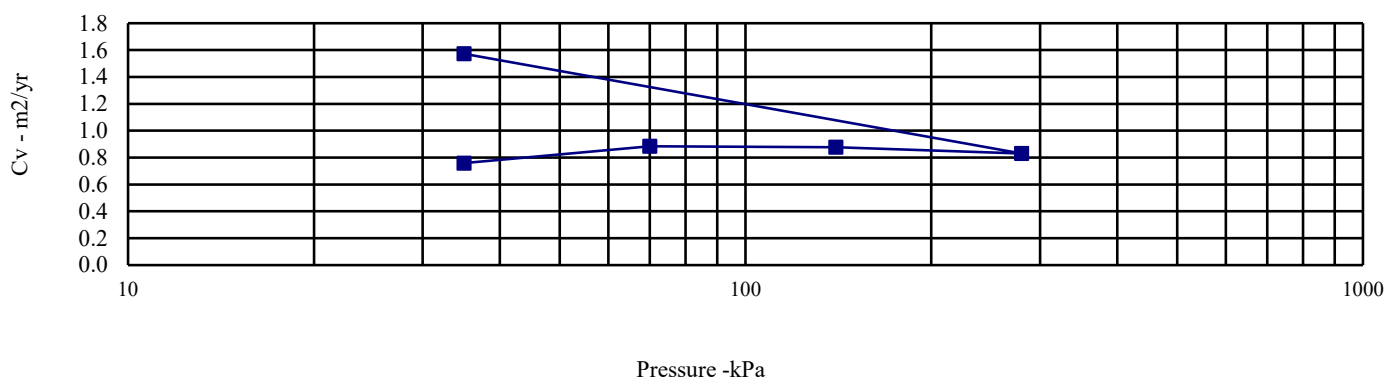
Top Depth (m): 1.50

Sample Number:

Base Depth (m) : 2.00

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	21	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.09	0	35	0.404	0.759	Method used to	
Dry Density (Mg/m3):	1.73	35	70	0.288	0.884	determine CV:	T90
Voids Ratio:	0.528	70	140	0.202	0.876	Nominal temperature	
Degree of saturation:	103.4	140	280	0.109	0.830	during test ' C:	20
Height (mm):	20.018	280	35	0.060	1.573	Remarks:	
Diameter (mm)	75.028					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Sulby Street, Moston

Contract No:

PSL22/7940

Client Ref:

15-395

