



e3p

Phase II Geoenvironmental Site Assessment
Kenyon Lane, Failsworth

Reference: 16-717-R1-1
Date: September 2023



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Kenyon Lane
Moston
Manchester
M9 4PF

Prepared for:



Report Ref: 16-717-R1

Date Issued: 20 September 2023

Kenyon Lane, Failsworth

Phase II Geoenvironmental Site Assessment

September 2023

E3P

Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

+ 44 (0) 161 707 9612

<https://e3p.co.uk>

Registered in England

CRN: 08725262

QUALITY ASSURANCE

Report Reference	16-717-R1
-------------------------	------------------

REV REF:	DESCRIPTION	AUTHOR	CHECKED	AUTHORISED	DATE
R1-1	First Issue	EC	JS	BH	20/09/23

This report has been prepared for the sole benefit, use, and information for the client. The liability of E3P T/O Environmental Engineering Partnership Limited with respect to the information contained in the report will not extend to any third party. This report has been prepared by the qualified persons as listed below.

AUTHOR	QUALIFICATIONS	DATE
E. Canham	BSc, FGS	25 August 2023

REVIEWER	QUALIFICATIONS	DATE
J. Sheridan	MeSci, FGS	11 September 2023

SIGNATURE	QUALIFICATIONS	DATE
B. Hall	BSc (Hons) FGS MEnvSc PIEMA	20 September 2023

EXECUTIVE SUMMARY

Site Address	Land to the south of Kenyon Lane, Manchester, M40 5FH	
Grid Reference	E 387656, N 401212.	
Site Area	Approximately 0.38 Ha.	
Proposed Development	Jigsaw Homes propose to construct a low-rise residential development with associated adopted estate roads, gardens and infrastructure at land to the south of Kenyon Lane, Manchester.	
Current Site Use	<p>The site is irregular in shape and is located to the south west of Kenyon Lane and is predominantly occupied by grass surface cover with an area of mature trees present in the central sector of the site and a footpath that runs along the western boundary.</p> <p>The site slopes downwards towards Kenyon Lane to the north east. An electric junction box and three manhole covers are present to the east of the site.</p>	
Site History	<p>Earliest mapping (1848) shows the site was undeveloped until 1908 when two rows of terraced residential dwellings, one aligned along the northern boundary the other to the southwest site were constructed. From 1923 two additional buildings appear on site, one of which is demolished by 1932 and the other extended by 1952. Another two are shown by 1988 and by 1978 all buildings are absent from historical mapping.</p> <p>The Moston Brook flows roughly east to west, from 15 m south of the site and later, partially infilled to the south. Areas of cut and/or fill occupy most of the land to the south and northeast of the site from 1908 to 1978, with historical landfills noted in the area.</p>	
Environmental Setting	Drift Geology	Glacial Till – CLAY
	Bedrock Geology	Collyhurst Sandstone Formation – SANDSTONE.
	Faults	Nearest fault is located 136 m north east.
	Hydrogeology	<p>Secondary undifferentiated drift aquifer overlying Principal bedrock Aquifer.</p> <p>However, the site is not located within a Source Protection Zone and there are no recorded potable groundwater abstraction points within 500 m.</p>
	Hydrology	The nearest surface water course is recorded to be the Moston Brook located c. 15 m south of the site. However, at its closest point to the site, this feature is recorded to be infilled. Flood mapping indicates the surface water course to open up c. 250 m south east of the site.
	Flood Risk	The site is not located in an area affected by river flooding (Flood Risk Zone 1).
Previous Reports	<p>The following previous reports have been completed for the site:</p> <p>Curtins completed a Phase 1 Preliminary Risk Assessment for the site, prepared for Jigsaw Homes Group Ltd (Report Ref: 077873-CUR-00-XX-RP-GE-019, dated May 2021) and a summary of the pertinent information from this report is provided in Section 1.7.</p>	



Utility Locations	<p>A full ground penetrating radar (GPR) survey has not been undertaken for the site; however, a full review of the available service plans has identified the following services:</p> <ul style="list-style-type: none"> ✿ A low pressure gas main and water distribution main enter the site in the northeastern corner and run northwest (following same route). ✿ Low voltage electric cables enter the site in the east and run north and south towards a junction box. A further low voltage cable enters the site in the southwest and runs northeast. ✿ Foul and combined sewers (150 mm and 825 mm diameter) enter the site in the northeast and run along the north eastern boundary. Other surface water (225 mm) and combined (225 mm) sewers run north east through the site to join sewers in the main road.
Landfill Sites and Ground Gases	<p>There is an area of historical landfill which encroaches into the site from the south. The type of waste included inert and industrial waste. Input dates between May 1980 and December 1981.</p>
Radon	<p>The site is situated within an area of maximum radon potential of 1–3%.</p>
Coal Mining/Land Stability	<p>The site is located within a coal mining risk assessment, however, is not located within a Coal Authority deemed High-Risk Development Area. Additionally, there are no mine entries within 1km of the site, or probable/recorded workings in the site boundary or immediate surrounding area. The risk to of shallow coal mining is considered to be Low.</p>
Hazardous Installations	<p>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.</p>
Initial Conceptual Site Model	<p>The previous Curtins Phase I (Report Ref: 077873-CUR-00-XX-RP-GE-019, dated May 2021) concluded the following: The risk from Made Ground posed to the site's end-users and groundwater is considered to be Moderate/Low due to the anticipated lack of contamination in potential Made Ground soils on site. The risk posed to groundwater and surface water receptors is considered to be Low and Very Low taking into account the lack of historical industrial land use on site. The risk posed to site end-users from ground generating gases arising from organic/putrescible soils on or near the site is considered to be Moderate.</p>

GROUND INVESTIGATION

Ground Investigation Works	<p>E3P has completed an intrusive ground investigation comprising:</p> <ul style="list-style-type: none"> ✿ 11No. x mechanically excavated trial pits ✿ 6No. x window sample boreholes with environmental monitoring installations; and, ✿ 2No. x cable percussive boreholes.
Ground Conditions	<p>MADE GROUND – 0.00 m bgl to 7.10 m bgl</p> <p>A reworked topsoil of a brown slightly gravelly clayey medium to coarse sand with frequent roots and gravel of brick and mudstone was encountered within each exploratory hole location to 0.20-0.40 m bgl.</p>



In the northern sector, Made Ground generally comprised a reworked clay overlying brick fill, indicative of relict foundations/demolition materials to a maximum proven depth of 1.80 m.

In the southern sector (former landfill) Made Ground deposits were generally deeper than the north and comprised greyish brown clayey gravelly medium to coarse sand and gravelly clay, with frequent concrete and brick cobbles and boulders and inclusions of intact bricks, plastic, metal, wood, concrete and cloth.

The base of Made Ground was unproven in the southern sector in the majority of locations, except WS103 and CP102, where the Made Ground was proven at 2.00 m and 7.10 m bgl, respectively.

A hydrocarbon odour was noted within the Made Ground at four locations in the southern sector, WS105, TP102, TP104 and CP102;. A concrete slab obstruction was also encountered at 1.10 m bgl in TP102 (likely to be a large boulder rather than in-situ slab).

DRIFT – 1.00 m bgl to >12.35 m bgl

Drift deposits were encountered within nine out of the nineteen exploratory hole locations across the site, to a maximum depth of 12.35 m bgl (base not proven).

The shallow (<5.00 m bgl) soils generally comprised an orange/brown medium to coarse SAND overlying a greyish brown SILT.

A stiff medium strength CLAY was encountered in WS103 and WS104 to >5.45 m bgl with

Cable percussive boreholes encountered deeper soil horizons comprising a sandy SILT with CLAY bands to 6.00 m bgl in CP101 and a silty SAND within CP102 to 10.90 m bgl. A brown boulder CLAY was encountered underlying the silt and sand in both locations. CP101 refused in the CLAY, likely on a boulder at 8.41 m bgl, whereas CP102 refused within a brown sandy GRAVEL at 12.35 m bgl, that was encountered underlying the boulder CLAY.

SOLID

The solid bedrock geology was not encountered during the site investigation and BGS borehole records within 100 m of the site also did not encounter bedrock within boreholes advanced to 7.62 m bgl.

GROUNDWATER

Groundwater was not encountered during the fieldwork, however, during subsequent monitoring visits, groundwater was recorded between 2.54 m and 3.90 m bgl within WS105 and WS106.

Shallower water levels were recorded between 1.20 m and 1.50 m bgl within WS104, however this is likely perched and a result of heavy rainfall events, as the monitoring installation was installed at a shallow depth within Made Ground.



CONTAMINATED LAND ASSESSMENT

<p>Human Health</p>	<p>A Tier 2 human health risk assessment identified exceedances of residential end use with plant uptake GAC values for the following contaminants in samples taken from the southern sector of the site (associated with area of former landfill):</p> <ul style="list-style-type: none"> ☛ Lead, arsenic and mercury [potentially volatile] ☛ Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene ☛ TPH Aromatic C12-C16 ☛ Chrysotile and Amosite asbestos fibres at 0.003% wt/wt and Chrysotile at 0.002% wt/wt <p>Elevated total mercury encountered in the Made Ground in TP101 presents a potential volatilisation to indoor air risk (speciation required to confirm). Material deemed to have a potential vapour risk may require hotspot removal, resulting in the requirement to backfill the resulting void.</p> <p>Asbestos was detected within two samples of Made Ground. Remediation may include delineation as a hotspot and removal from site or placement at a depth of >1.00 m below finished level in residential plots, gardens or POS</p> <p>Risks associated with heavy metals, PAH compounds and heavy end TPH can be mitigated through installation of a clean cover system in gardens and soft landscaped areas. These have been encountered in samples taken from the southern sector of the site (associated with area of former landfill), however, given the sitewide spread of Made Ground, it would be considered prudent to apply a cover system to all plots where Made Ground remains at proposed development level.</p> <p>Chemical analysis of natural subsoils has indicated 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.</p> <p>Two samples of the reworked topsoil (noted to contain brick and anthropogenic inclusions) were also submitted for chemical analysis (TP102 and WS106). Chemical analysis has indicated these soils to be acceptable for use as topsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Should material be found to be chemically suitable, inspection of the soil composition should be undertaken along with suitable screening of unsuitable anthropogenic inclusions.</p>
<p>Controlled Waters</p>	<p>The primary receptor has been identified as the underlying Principal Aquifer (bedrock). No exceedances of DWS values have been found in the two leachate samples analysed. It has not been possible to obtain groundwater samples for a full appraisal due to boreholes either being dry or containing insufficient volumes of water. The drift deposits across the site are variable. Given the presence of lower permeability fine grained soils which will reduce downward migration of contamination and the absence of any exceedances in the leachate, or shallow groundwater to mobilise soil contamination, the overall risk may be considered low. Given the absence of a groundwater abstraction point or surface watercourse within close proximity to the site, there is not considered to be a complete pollutant linkage.</p>



	<p>However, given the nature of the site and presence of deep Made Ground / landfill materials, it would be prudent to obtain water samples for assessment if resting water levels are found to rise over the monitoring period.</p>
Ground Gas	<p>The southern part of the site forms part of a larger historical landfill and deep Made Ground (up to 7.10 m bgl in CP102), with degradable inclusions of wood and timber have been encountered. Other degradable organic materials may be present at intervening locations and cannot be discounted. WS102, WS103, WS104 and WS106, predominantly in the south of the site and area of former landfill, have recorded carbon dioxide above 5% v/v threshold, however the GSV is noted to be within a CS1 classification due to the absence of flow.</p> <p>A precautionary allowance for CS2 gas protection measures is recommended at this stage. The final classification will be confirmed on completion of the full ground gas monitoring programme.</p>
Potable Water Infrastructure	<p>Barrier pipe likely to be required. 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.</p>

GEOTECHNICAL ASSESSMENT

Underground Obstructions	<p>Frequent concrete and brick obstructions have been identified, indicative of historical landfilling in the southern sector of the site and relict foundations in the northern sector. During a phase of cut-and-fill enabling works to create a developable platform, all obstructions (including redundant services) will require grubbing out to enable the construction of proposed plots.</p>
Allowable Bearing Pressure	<p>Shallow soils (beneath the Made Ground) are variable and comprise CLAY, SILT and SAND deposits.</p> <p>The suitable target founding stratum has been identified as the underlying firm to stiff CLAY (60-110 kN/m² at 2.00 m bgl). However, it should be noted that in a number of locations this stratum is underlain by soft/low strength SILT.</p> <p>Deeper CLAY strata beyond 6.00 m bgl is anticipated to offer an ABP in the region of >300 kN/m².</p>
Foundation Options	<p>Based on existing levels, the depth to suitable founding strata is generally greater than 2.50 m bgl due to the presence of deep Made Ground and unsuitable soft low strength SILT deposits underlying medium dense SAND deposits.</p> <p>However, prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels. Enabling works will also be required to locate/delineate the highwall of the landfill in the southern sector.</p>



	<p>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, given the ground conditions encountered and considering future potential cut/fill works to create a development platform, foundation options may include:</p> <ul style="list-style-type: none"> ✿ Piled foundations in areas of tree influence where cohesive soils are present and in area of former landfill in the southern sector where fill extends to depths >7.0 m bgl. ✿ Ground improvement using VSC in areas of deep Made Ground outside of tree influence or landfill area. ✿ Raft foundations for plots straddling the landfill highwall to mitigate risks of potential differential settlement. ✿ In the centre of the northern sector, it may be possible to utilise deep mass trench foundations, where firm CLAY is present at depths shallower than 2.50 m bffl, outside of tree influence.
Building Floor Slabs	Ground-bearing floor slabs are unlikely to be viable given the anticipated depths of reworked Made Ground > 600 mm and shallow cohesive soils.
Heave Precautions	The CLAY soils are of low volume change potential. Heave precautions will be required for foundations in clay within tree influence.
Soakaway Drainage	The presence of deep Made Ground will preclude the use of soakaway drainage.
Sulphate Assessment	Concrete classification will be DS1 AC1s.
CBR Design %	<p>Granular soils can be re-engineered to ensure 5% within the subgrade during favourable climatic conditions.</p> <p>Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.</p>
Cut/Fill	Development levels unknown at this time; however, significant cut-and-fill works will be required to prepare the development platform.
Civil Engineering Excavations	The E3P Intrusive Ground Investigation has not identified the presence of weathered/competent bedrock at a shallow depth of less than 2.00 m bgl.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: <i>Waste Classification – Guidance on the classification and assessment of waste</i> .

RECOMMENDATIONS

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



- ✿ Further investigation in centre of site following tree removal (if proposed).
- ✿ Completion of ground gas monitoring and ground water monitoring (subject to water levels).
- ✿ Location/delineation of landfill highwall in southern sector.
- ✿ Plot-specific foundation schedule (upon receipt of the final development levels).
- ✿ Arboricultural survey.
- ✿ Geotechnical earthworks strategy (infrastructure).
- ✿ Remediation and enabling works strategy.



Table of Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	10
1.1. Background	10
1.2. Proposed Development.....	10
1.3. Objectives	10
1.4. Scope of Works.....	10
1.5. Limitations	11
1.6. Confidentiality.....	11
1.7. Previous Reports	11
2. GROUND INVESTIGATION.....	14
2.1. General Overview	14
2.2. Limitations of the Investigation	14
2.3. Scope of Investigation.....	14
2.4. In-Situ Standard Penetration Testing (SPT).....	15
2.5. Laboratory Analysis.....	15
3. GROUND AND GROUNDWATER CONDITIONS	17
3.1. Summary of Ground Conditions	17
3.2. Made Ground	17
3.3. Drift Deposits	18
3.4. Solid Geology.....	18
3.5. Groundwater	18
3.6. Visual and Olfactory Evidence of Contamination	18
3.7. Soil Consistency	19
3.8. Side Stability and Ease of Excavation	19
3.9. Particle Size Distribution	24
3.10. Soil Density/Moisture Content Relationship	24
3.11. Soil Plasticity	24
3.12. pH and Sulphate	25
4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	26
4.1. Deviating Samples.....	26
4.2. Human Health Risk Assessment.....	26
4.2.1. Summary of Results.....	28
4.2.2. Discussion	29
4.3. Controlled Waters Risk Assessment.....	31
4.3.1. Summary of Results.....	36
4.3.2. discussion	36
4.4. Ground Gas Risk Assessment Methodology	36
4.5. Monitoring Methodology	37
4.6. Summary of Monitoring Results	40
4.6.1. Groundwater.....	40
4.6.2. Barometric pressure	40
4.6.3. Gas Flow.....	40
4.6.4. Gas Concentrations	40
4.7. CONCLUSION.....	40
4.8. Potable Water Supply	41
4.9. Conceptual Site Model	43
5. GEOTECHNICAL ASSESSMENT	47
5.1. Site Preparation	47
5.2. Foundation Assessment	47



5.3.	Ground Floor Slabs	50
5.4.	Heave Precautions	50
5.5.	Highways Construction	51
5.6.	Drainage	51
5.7.	Concrete Durability	52
5.8.	Excavations	52
5.9.	Construction Activity and Inspection	53
5.10.	Geotechnical Risk Register	54
5.11.	Further Works	58
6.	CONCLUSIONS AND RECOMMENDATIONS.....	59
6.1.	Contaminated Land Assessment	59
6.2.	Geotechnical Assessment	61
APPENDIX I LIMITATIONS.....		62
APPENDIX II GLOSSARY		64
APPENDIX III DRAWINGS		67
APPENDIX IV PHOTOGRAPHS		69
APPENDIX V E3P EXPLORATORY HOLE LOGS		76
APPENDIX VI CHEMICAL TESTING RESULTS		77
APPENDIX VII ORIGIN OF TIER 2 GENERIC ASSESSMENT CRITERIA.....		78
APPENDIX VIII GEOTECHNICAL TESTING RESULTS.....		80

DRAWING LIST

16-717-001 - Site Location Plan
16-717-004 - Site Features Plan
16-717-003 - Historical Features Plan
16-717-005 - Exploratory Hole Location Plan
16-717-006 - Depth of Made Ground Plan
16-717-008 - Depth to Founding Strata Plan
16-717-010 - Conceptual Site Model
16-717-015 - Development Constraints Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Jigsaw Homes to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of land to the south of Kenyon Lane in Failsworth, Manchester.

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

Jigsaw Homes intend to construct a low-rise residential development with associated gardens, estate roads and infrastructure.

A proposed development layout has not been provided at the time of writing this report.

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)* (July 2023).
- ✦ Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- ✦ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✦ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✦ Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of work includes the following elements:

- ✦ Detailed review of historical information;
- ✦ Design of suitable intrusive ground investigation;
- ✦ 6 No. window sample probeholes with, and construction of, environmental monitoring installations;
- ✦ 2 No. deep cable percussive boreholes;



- ✦ 11 No. Mechanically excavated trial pits;
- ✦ 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.

1.7. PREVIOUS REPORTS

E3P have been provided the following reports for the site:

- ✦ **Curtins** - Phase 1 Preliminary Risk Assessment, Kenyon Lane (REF; 077873-CUR-00-XX-RP-GE-019-V01, dated 10 May 2021). Prepared for Jigsaw Homes Group Ltd

A summary of the pertinent information from this report is provided below:

Site Setting

- ✦ The site is located southwest of Kenyon Lane. The site is currently occupied by well-kept grass surface cover and trees along the site boundary running northeast to southwest. A public footpath extends along the western boundary.

Site History

- ✦ Earliest mapping (1848) shows that the site was undeveloped until 1908 when two rows of terraced residential dwellings, one aligned along the northern boundary the other to the southwest site were constructed. From 1923 two additional buildings appear on site, once of which is demolished by 1932 and the other extended by 1952. Another two appear by 1988 and in 1978 all buildings are absent from historical mapping.



- ✚ The Lancashire and Yorkshire Railway orientated northeast to southwest, 123m south of the site, later accompanied by the Newton Heath Station in 1893. This is expanded from 1908 and reduced in size again by 1978. The surrounding area is continuously developed through into the 1980's with various terraced housing and residential properties constructed in all directions from site. Other buildings like the Mill Dye Works are noted 217m east of site (demolished by 1923) and a school 243m southeast of the site.
- ✚ The Moston Brook flows roughly east to west, from 15m south of the site and later, partially infilled to the south. Areas of cut and/or fill occupy most of the land to the south and northeast of the site from 1908 to 1978, with historical landfills noted in the area.

Environmental Setting

- ✚ There is an area of historical landfill which encroaches into the site from the south. The type of waste included inert and industrial waste. Input dates between May 1980 and December 1981.
- ✚ BGS mapping indicates the site is underlain by Glacial Till superficial deposits and Collyhurst Sandstone Formation bedrock (principal aquifer). The site is not located within a source protection zone.
- ✚ BGS borehole records located within 100 m of the site record made ground underlain by clay and sand deposits, with bedrock deeper than 7.62 m bgl.
- ✚ The site is located within an area assessed as being within at moderate risk from UXO. A preliminary risk assessment was undertaken by Curtins as part of the Phase 1 report and summarised the following:

"A review of the available post-WWII historic mapping (Ref. 1) identified that the majority of terraced properties to the northeast of the site were demolished post-WWII. However, a review of available online bomb damage mapping for Manchester (Ref. 8) does not record any explosive bombs in the area. Considering the above, the risk of encountering potential UXO as part of future intrusive works is considered **Low** and no specialist information is required prior to any intrusive works."

Initial Conceptual Model

- ✚ The Curtins Phase I concluded the following: The risk from Made Ground posed to the site's end-users and groundwater is considered to be Moderate/Low due to the anticipated lack of contamination in potential Made Ground soils on site. The risk posed to groundwater and surface water receptors is considered to be Low and Very Low taking into account the lack of historical industrial land use on site. The risk posed to site end-users from ground generating gases arising from organic/putrescible soils on or near the site is considered to be Moderate.

Coal Mining Geology

- ✚ A review of the Coal Authority interactive mapping (Ref. 4) for the area indicates that the site is located within a Coal Mining Reporting Area, however, it is not located within a Development High-Risk Area.
- ✚ There are no recorded mine entries within 500 m of the site.



- ✚ There are no recorded coal workings and no probable coal workings within 850 m of the site.
- ✚ Consequently, the risk to development from historic coal mining is considered to be Low. No further actions are required to further assess the risk to development from historic coal mining.
- ✚ The closest recorded BGS mineral site is located 420 m northeast of the site, an opencast site known as Moston Hall Sand Pit which extracted sand from superficial soils (Till) and is recorded to have ceased works.



2. GROUND INVESTIGATION

2.1. 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 between 22nd June 2023 and 3rd July 2023. The works are summarised in Table 2.1.

2.2. LIMITATIONS OF THE INVESTIGATION

Several services (gas, electricity and drainage networks) are present within the site boundary, therefore safe easements were applied, and exploratory hole locations were not advanced within these areas.

An area of woodland is also present in the centre of the site, occupying approximately 35-40% of the total site area and dividing the site into two; the northern sector and southern sector and. Exploratory hole locations could only be advanced within the woodland and so investigation was limited to the north and south.

2.3. 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)
Northern Sector				
Former Terraced Housing in North of Site	TP106	Mechanically Excavated Trial Pit	3.50	N/A
	TP107		3.00	
	TP108		2.80	
	TP111		1.60	
	WS105	Window Sample Probehole	5.45	2.50–4.50
	WS106		5.45	2.00–4.00
Deeper Ground Conditions and Former Terraced Housing in North of Site	CP101	Cable Percussive Borehole	8.41	N/A
General Ground Conditions in North of Site	TP109	Mechanically Excavated Trial Pit	1.20	
	TP110		3.00	
	WS104	Window Sample Probehole	5.45	0.50–2.00



POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
Southern Sector				
Former Landfill in South of Site	WS102	Window Sample Probehole	2.26	1.00–2.00
	WS103	Window Sample Probehole	5.45	2.00–5.00
	TP102	Mechanically Excavated Trial Pit	1.20	N/A
	TP103		2.50	
	TP104		2.90	
	TP105		4.00	
Deeper Ground Conditions and Former Landfill in South of Site	CP102	Cable Percussive Borehole	12.35	N/A
General Ground Conditions in South West of Site	WS101	Window Sample Probehole	5.45	1.00–4.00
	TP101	Mechanically Excavated Trial Pit	3.60	N/A

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

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

Cable percussive boreholes were advanced to undertake in-situ detailed geotechnical testing and to investigate the deeper soil horizons.

The sampling locations are illustrated in Drawing 16-717-005 (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.

2.4. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in Appendix V and presented in Table 3.3 and discussed in Section 6.

2.5. 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:

- ✦ Liquid and plastic limit (Atterberg);
- ✦ Natural moisture content;
- ✦ Particle Size Distribution;
- ✦ 2.5 kg compaction (OMC/MDD ratio).

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 3.



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 / TOPSOIL	MADE GROUND	CLAY	SAND	SILT	GRAVEL	NO RECOVERY
TP101	0.00–0.30	0.30–3.60*	–	–	–	–	–
TP102	0.00–0.30	0.30–1.20*	–	–	–	–	–
TP103	0.00–0.25	0.25–2.50*	–	–	–	–	–
TP104	0.00–0.25	0.25–2.90*	–	–	–	–	–
TP105	0.00–0.30	0.30–4.00*	–	–	–	–	–
TP106	0.00–0.40	0.40–1.20	–	1.20–3.00	3.00–3.50	–	–
TP107	0.00–0.25	0.25–1.00	1.00–1.40	1.40–2.70	2.70–3.00	–	–
TP108	0.00–0.25	0.25–1.80	–	1.80–2.40	2.40–2.80	–	–
TP109	0.00–0.30	0.30–1.20*	–	–	–	–	–
TP110	0.00–0.30	0.30–2.10	2.10–2.70	2.70–2.80	2.80–3.00	–	–
TP111	0.00–0.35	0.35–1.60*	–	–	–	–	–
WS101	0.00–0.30	0.30–5.45*	–	–	–	–	–
WS102	0.00–0.25	0.25–2.26*	–	–	–	–	–
WS103	0.00–0.30	0.30–2.00	3.00–5.45	–	–		2.00–3.00
WS104	0.00–0.20	0.20–1.50	4.80–5.45	1.50–1.60 2.70–2.80	1.60–2.70 2.80–4.80	–	–
WS105	0.00–0.35	0.35–1.20	–	1.20–2.50	2.50–5.45	–	–
WS106	0.00–0.25	0.25–1.80	1.80–3.00	–	3.00–5.45	–	–
CP101	0.00–0.20	0.20–1.30	6.00–8.41	–	1.30–6.00	–	–
CP102	0.00–0.20	0.20–7.10	10.90–11.60	7.10–10.90	–	11.60–12.35	–

*Base of Made Ground unproven

3.2. MADE GROUND

Made Ground was encountered across the entirety of the site from ground level to a maximum proven depth of 7.10 m bgl (CP102).

A reworked topsoil of a brown slightly gravelly clayey medium to coarse sand with frequent roots and gravel of brick and mudstone was encountered within each exploratory hole location to 0.20–0.40 m bgl.



In the northern sector, Made Ground generally comprised a reworked clay overlying brick fill, indicative of relict foundations/demolition materials from the former terraced residential properties to a maximum proven depth of 1.80 m. The base of Made Ground was unproven in TP109 due to encountering a concrete slab. TP111 was also terminated due to the presence of a potential drain/service encountered at 1.20 m bgl.

In the southern sector (former landfill) Made Ground deposits were generally deeper than the north and comprised greyish brown clayey gravelly medium to coarse sand and gravelly clay, with frequent concrete and brick cobbles and boulders and inclusions of intact bricks, plastic, metal, wood, concrete and cloth.

Within TP101 and WS101 located to the very south west of the site, the Made Ground deposits differed and comprised a slightly gravelly clayey sand with pockets of clay and gravel of brick and clinker to 3.40 m bgl, with a gravelly reworked ashy clay underlying the sand with inclusions of wood and organic matter in TP101 and a grey sandy gravel of clinker and concrete within WS101.

The base of Made Ground was unproven in the southern sector in the majority of locations, except WS103 and CP102, where the Made Ground was proven at 2.00 m and 7.10 m bgl, respectively.

A hydrocarbon odour was noted within the Made Ground at four locations in the southern sector, WS105, TP102, TP104 and CP102;. A concrete slab obstruction was also encountered at 1.10 m bgl in TP102 (likely to be a large boulder rather than in-situ slab).

A Depth of Made Ground Plan is presented as Drawing 16-717-006 in Appendix III.

3.3. DRIFT DEPOSITS

Drift deposits were encountered within nine out of the 19No. exploratory hole locations across the site, to a maximum depth of 12.35 m bgl (base not proven).

The shallow (<5.00 m bgl) soils generally comprised an orange/brown medium to coarse SAND overlying a greyish brown SILT.

A stiff medium strength CLAY was encountered in WS103 and WS104 to >5.45 m bgl.

Cable percussive boreholes encountered deeper soil horizons comprising a sandy SILT with CLAY bands to 6.00 m bgl in CP101 and a silty SAND within CP102 to 10.90 m bgl. A brown boulder CLAY was encountered underlying the silt and sand in both locations. CP101 refused in the CLAY, likely on a boulder at 8.41 m bgl, whereas CP102 refused within a brown sandy GRAVEL at 12.35 m bgl, that was encountered underlying the boulder CLAY.

3.4. SOLID GEOLOGY

The solid bedrock geology was not encountered during the site investigation and BGS borehole records within 100 m of the site also did not encounter bedrock within boreholes advanced to 7.62 m bgl.

3.5. GROUNDWATER

Groundwater was not encountered during the site investigation.

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation as summarised in Table 3.2.



TABLE 3.2 SUMMARY VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
WS105	0.70–1.00	Made Ground	Slight hydrocarbon odour and black band
TP102	0.70	Made Ground	Strong hydrocarbon odour
TP104	0.50–2.90	Made Ground	Slight hydrocarbon odour
WS101	1.00–4.95	Made Ground	Clinker
WS103	0.30–2.00	Made Ground	Clinker

3.7. SOIL CONSISTENCY

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

3.8. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation.

The presence of brick and concrete cobbles within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground and in some places, Made Ground could not be fully penetrated. The natural strata was excavated with relative ease.



TABLE 3.3 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" 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: Black gravelly fine to medium sand.	6	6.05	Loose	N/A	N/A	N/A	60.49
WS101	2	MADE GROUND: Black gravelly fine to medium sand.	5	4.57	Loose	N/A	N/A	N/A	45.68
WS101	3	MADE GROUND: Grey sandy clayey gravel.	4	3.48	Very Loose	N/A	N/A	N/A	34.79
WS101	4	MADE GROUND: Grey sandy clayey gravel.	3	2.53	Very Loose	N/A	N/A	N/A	25.35
WS101	5	MADE GROUND: Orangish brown sandy clay.	4	3.32	N/A	Very low strength	Soft	16.59	34.11
WS102	1	MADE GROUND: Greyish brown slightly silty gravelly reworked clay with frequent cobbles.	15	15.12	N/A	High strength	Very Stiff	75.61	155.46



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)*
WS102	2	MADE GROUND: Greyish brown slightly silty gravelly reworked clay with frequent cobbles.	50	45.68	N/A	Very high strength	Very Stiff	228.38	469.56
WS103	1	MADE GROUND: Greyish brown sandy gravelly reworked clay.	10	10.08	N/A	Medium strength	Stiff	50.41	103.64
WS103	2	No recovery.	2	1.83	N/A	Extremely low strength	Very Soft	9.14	18.78
WS103	3	Greyish brown silty CLAY.	12	10.44	N/A	Medium strength	Stiff	52.18	107.28
WS103	4	Greyish brown silty CLAY.	12	10.14	N/A	Medium strength	Stiff	50.69	104.22
WS103	5	Greyish brown silty CLAY.	13	10.79	N/A	Medium strength	Stiff	53.93	110.87
WS104	1	MADE GROUND: Black slightly gravelly sandy clay.	40	40.33	N/A	Very high strength	Very Stiff	201.63	414.55



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)*
WS104	2	Brown sandy SILT.	11	10.05	N/A	Medium strength	Stiff	50.24	103.30
WS104	3	Greyish brown SILT.	5	4.35	N/A	Low strength	Firm	21.74	44.70
WS104	4	Greyish brown SILT.	11	9.29	N/A	Medium strength	Stiff	46.47	95.54
WS104	5	Greyish brown CLAY.	13	10.79	N/A	Medium strength	Stiff	53.93	110.87
WS105	1	MADE GROUND: Greyish brown reworked clay.	6	6.05	N/A	Low strength	Firm	30.24	62.18
WS105	2	Greyish brown silty fine to medium SAND.	6	5.48	Loose	N/A	N/A	N/A	54.81
WS105	3	Greyish brown sandy SILT.	9	7.83	N/A	Low strength	Firm	39.13	80.46
WS105	4	Greyish brown sandy SILT.	12	10.14	N/A	Medium strength	Stiff	50.69	104.22
WS105	5	Greyish brown sandy SILT.	13	10.79	N/A	Medium strength	Stiff	53.93	110.87



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	1	MADE GROUND: Greyish brown slightly sandy gravelly reworked clay.	9	9.07	N/A	Medium strength	Stiff	45.37	93.27
WS106	2	Orangish brown sandy CLAY.	7	6.39	N/A	Low strength	Firm	31.97	65.74
WS106	3	Orangish brown sandy SILT.	9	7.83	N/A	Low strength	Firm	39.13	80.46
WS106	4	Greyish brown SILT.	11	9.29	N/A	Medium strength	Stiff	46.47	95.54
WS106	5	Greyish brown SILT.	12	9.96	N/A	Medium strength	Stiff	49.78	102.34

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.



3.9. PARTICLE SIZE DISTRIBUTION

Particle Size Distribution Tests have been undertaken on selected samples of granular material via wet sieve to obtain information on the soil fractions.

The results of the tests are summarised in Table 3.4. The full results can be found in Appendix VIII.

TABLE 3.4 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP105	1.50 (Natural)	0	47	17	30
TP106	2.00 (Natural)	0	1	53	46

3.10. SOIL DENSITY/MOISTURE CONTENT RELATIONSHIP

Maximum dry density / optimum moisture content relationship analysis has been conducted on soils using via utilising compaction tests utilising a 2.5 kg rammer.

The results of the tests are summarised in Table 3.5. The full test results can be found in Appendix VIII.

TABLE 3.5 SUMMARY DRY DENSITY AND MOISTURE CONTENT

LOCATION	LABORATORY DESCRIPTION	TOP DEPTH (m)	METHOD OF COMPACTION	INITIAL MOISTURE CONTENT (%)	OPTIMUM MOISTURE CONTENT (%)	MATERIAL RETAINED ON 37.5 mm SIEVE (%)	MAX DRY DENSITY (mg/m ³)	MATERIAL RETAINED ON 20.0 mm TEST SIEVE (%)
TP105	Brown clay bound silty SAND and GRAVEL	1.50	2.5 kg	10.3	14	26	1.86	33

The compaction tests have indicated that the granular soils from TP105 to be dry of the optimum.

3.11. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.6, show the clay to be of low volume change potential.

TABLE 3.6 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
WS103	2.00	17.9	14	38	24	79	18.96	Low



LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS103	3.00	18.8	16	40	24	68	16.38	Low
WS106	2.00	19.1	14	39	25	78	19.50	Low

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

3.12. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content are summarised in Table 3.7. Full results are included in Appendix VI.

Results show 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 3.7 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	1.20	0.14	5.5	DS-1, AC-1s
TP102	0.20	0.047	7.6	DS-1, AC-1s
TP102	0.80	0.37	8.9	DS-1, AC-1s
TP104	0.80	0.25	8.3	DS-1, AC-1s
TP105	1.00	0.061	8.5	DS-1, AC-1s
TP108	1.00	0.011	8.3	DS-1, AC-1s
WS106	0.20	0.096	8.4	DS-1, AC-1s



4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 2 quantitative 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 avoided during the ground investigation by using best practice sampling procedures including use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis undertaken. No deviations were noted in the soil samples.

4.2. HUMAN HEALTH RISK ASSESSMENT

At Tier 2 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

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



TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A RESIDENTIAL END USE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	9	130 70	TP101 1.20 m TP104 0.80 m	1	Further Action
Cadmium	mg/kg	11	9	0.8	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	9	<1.8	N/A	1	No Further Action
Lead	mg/kg	200	9	560 260 320	TP101 1.20 m TP104 0.80 m TP105 1.00 m	1	Further Action
Mercury	mg/kg	1.2	9	3.3	TP101 1.20 m	4	Further Action
Nickel	mg/kg	130	9	24	N/A	1	No Further Action
Selenium	mg/kg	250	9	25	N/A	1	No Further Action
Copper	mg/kg	2400	9	130	N/A	1	No Further Action
Zinc	mg/kg	3700	9	580	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	9	1.7	N/A	1	No Further Action
Phenols – Total	mg/kg	120	7	<1	N/A	1	No Further Action
Asbestos	Fibres	NFD	7	0.003% wt/wt (Chrysotile & Amosite) 0.002% wt/wt (Chrysotile)	TP102 0.80 m TP105 1.00 m	3	Further Action
Naphthalene	mg/kg	2.3	9	0.77	N/A	4	No Further Action
Acenaphthylene	mg/kg	170	9	0.25	N/A	2	No Further Action
Acenaphthene	mg/kg	210	9	1.8	N/A	1	No Further Action
Fluorene	mg/kg	170	9	1.4	N/A	1	No Further Action
Phenanthrene	mg/kg	95	9	12	N/A	2	No Further Action
Anthracene	mg/kg	2400	9	2.9	N/A	2	No Further Action
Fluoranthene	mg/kg	280	9	16	N/A	2	No Further Action
Pyrene	mg/kg	620	9	15	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	9	6.9	N/A	2	No Further Action
Chrysene	mg/kg	15	9	6.3	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	9	4.8 5.5 8.0 2.8	TP102 0.20 m TP102 0.80 m TP104 0.80 m TP105 1.00 m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	9	2.4	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	9	4.2 4.7 5.9	TP102 0.20 m TP102 0.80 m TP104 0.80 m	2	Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
				2.4	TP105 1.00 m		
Indeno(123-cd)Pyrene	mg/kg	27	9	3.3	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	9	0.67 0.62 0.60 0.34	TP102 0.20 m TP102 0.80 m TP104 0.80 m TP105 1.00 m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	9	3.6	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	20	1	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	20	0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	20	0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	20	7.8	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	20	150	TP102 0.80 m	4	Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	20	210	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	20	130	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.

4.2.1. SUMMARY OF RESULTS

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

Results have been compared to residential end use with plant uptake GAC values (S4UL and C4SL) with 1% soil organic matter in the first instance.

This comparison indicates that the data exceeds the GAC values for the following:

- ☛ Heavy metals (lead, arsenic and mercury [potentially volatile])
- ☛ PAHs (Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene)



☼ TPH (TPH Aromatic C12-C16)

☼ Asbestos (Chrysotile and Amosite fibres at 0.003% wt/wt and Chrysotile at 0.002% wt/wt)

VOC analysis was also undertaken on one sample of Made Ground from TP102 in which the strongest hydrocarbon odour was observed. SVOC and VOC concentrations were reported to be below the laboratory limit of detection (LOD).

It should be noted that the exceedances were identified in samples taken from the southern sector of the site (associated with area of former landfill).

4.2.2. DISCUSSION

MERCURY

The elevated total mercury encountered in the Made Ground in TP101 presents a potential volatilisation to indoor air risk. It should be noted that only the elemental proportion of the total mercury is potentially volatile, and speciation of this mercury may conclude the elemental proportion to be lower than the GAC value of 1.2 mg/kg. However, speciation was outside of the scope of this investigation.

Alternatively, given the elevated concentration of total mercury has only been identified within one isolated area of the site (TP101 at 1.20 m bgl), it is therefore considered to be a localised hotspot. Therefore, during a process of cut-and-fill enabling works, hotspot removal may be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.

ASBESTOS

Asbestos was detected within two of the seven samples of Made Ground submitted for chemical analysis. Quantification confirmed the following concentrations:

☼ TP102 at 0.80 m bgl: 0.003% wt/wt (Chrysotile& Amosite)

☼ TP105 1.00 m bgl: 0.002% wt/wt (Chrysotile)

Impacted soil should be managed according to the asbestos risk mitigation conceptual site model (Figure 4.1). This may include delineation as a hotspot and removal from site or placement at a depth of >1.00 m below finished level in residential plots, gardens or POS.



FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Notes

ND None Detect

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

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

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

HEAVY METALS, PAH COMPOUNDS AND HEAVY END TPH

The identified elevated concentrations of heavy metals, PAH compounds and heavy end TPH have primary exposure pathways related to dermal contact and ingestion, soil ingestion and consumption of homegrown produce.

These exceedances can be mitigated by the installation of a chemically suitable cover system within all proposed private garden areas, landscaping and public open space.

The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy.

Although the identified contamination exceedances were only identified in samples taken from the southern sector of the site (associated with area of former landfill), given the sitewide spread of Made Ground, it would be considered prudent to apply the cover system to all plots where Made Ground remains at proposed development level.



Two samples of natural deeper drift deposits were submitted for chemical analysis (TP108 and TP110). Chemical analysis has indicated 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.

Two samples of the reworked topsoil (noted to contain brick and anthropogenic inclusions) were also submitted for chemical analysis (TP102 and WS106). Chemical analysis has indicated these soils to be acceptable for use as topsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Should material be found to be chemically suitable, inspection of the soil composition should be undertaken along with suitable screening of unsuitable anthropogenic inclusions.

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 / Former Landfill Elevated concentrations of heavy metals, PAH and heavy end TPH fractions have been found in the former landfill area in the south of the site, which may leach to underlying shallow groundwater and migrate towards nearby watercourses and waterbodies.		High
Pathway		
Vertical Migration Ground conditions comprise predominantly silt and sand with deeper clay layers to depths in excess of 8.00 m. The presence of fine grained lower permeability soils will reduce the potential for downward migration of leachable contaminants.		Medium
Lateral migration Lateral migration of contaminants is considered possible via granular layers of Made Ground and natural strata.		Low
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary undifferentiated aquifer	Low
Aquifer Classification in Bedrock	Principal aquifer	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected	Low
Distance to the Closest Groundwater Abstraction Point	None identified within a 500 m radius.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	The nearest surface water course is recorded to be the Moston Brook located c. 15 m south of the site. However, at its closest point to the site, this feature is recorded to be infilled. Flood mapping indicates the surface water course to open up c. 250 m south east of the site.	Low
The ICSM developed within the context of the site setting has viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer.		



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 analysis recorded concentrations of speciated PAH above 2 mg/kg within TP102 at 0.80 m bgl. SVOCs have not been found above the LOD.	None
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	All concentrations of C10-C12 have been recorded below 10 mg/kg.	None
C12-C16 > 50 mg/kg	Concentrations of C12-C16 have been recorded above 50 mg/kg within TP102 at 0.80 m bgl with a concentration 150 mg/kg.	Further discussion
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	Concentrations of Naphthalene above 2 mg/kg have not been recorded on site.	None
Total PAH > 10 mg/kg	Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected in four locations, with a maximum concentration recorded in TP104 at 87 mg/kg.	Further discussion
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	Concentrations of heavy metals above 500 mg/kg have been recorded in TP101 and TP105.	Further discussion

It should be noted that it has not been possible to obtain groundwater samples due to boreholes either being dry or containing insufficient volumes of water.

The Tier II assessment has therefore included a comparison of leachate analysis from samples of the Made Ground to drinking water standards (DWS) due to the presence of a Principal bedrock Aquifer underlying the site. Results are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER AND LEACHATE ANALYSIS WITH TIER 2 SCREENING LEVELS

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Arsenic	µg/l	50	10	2	2.1	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	2	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	2	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	2	3.3	N/A	No Further Action
Copper	µg/l	1	2000	2	7.3	N/A	No Further Action
Total Cyanide	µg/l	1	50	2	6.4	N/A	No Further Action
Lead	µg/l	1.2	10	2	6.3	N/A	No Further Action
Mercury	µg/l	–	1.0	2	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	2	1.1	N/A	No Further Action
Selenium	µg/l	–	10	2	5.4	N/A	No Further Action
Zinc	µg/l	10.9	–	2	7.7	N/A	No Further Action
pH	6–9			2	8.4	N/A	No Further Action
Polycyclic Aromatic Hydrocarbons							
Naphthalene	µg/l	2	10*	2	0.51	N/A	No Further Action
Anthracene	µg/l	0.1	10*	2	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	2	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	2	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	2	<0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	2	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	2	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	2	<0.01	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1, 2}	DWS _{3,4}	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Aromatic Hydrocarbon							
TPH C5-C7 (benzene)	µg/l	10	1	2	<1.0	N/A	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	2	<1.0	N/A	No Further Action
TPH C8-C10 (xylene)	µg/l	30	300	2	<1.0	N/A	No Further Action
TPH C10-C12 (naphthalene)	µg/l	2	90	2	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	90	2	<10	N/A	No Further Action
TPH C16-C35	µg/l	–	90	2	<10	N/A	No Further Action
Aliphatic Hydrocarbon							
TPH C5-C6	µg/l	–	1000 ⁵	2	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	2	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	2	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	2	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	2	<10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	2	<10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	2	<10	N/A	No Further Action
Volatile Organic Compounds							
Tetrachloroethylene	µg/l	0.4	10	3	N/A	N/A	No Further Action
Trichloroethylene	µg/l	10	10	3	N/A	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	3	N/A	N/A	No Further Action
Trichloromethane	µg/l	2.5	–	3	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	200	3	N/A	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Carbon Tetrachloride	µg/l	12	3	3	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	–	0.3	3	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. SUMMARY OF RESULTS

Leachate analysis has not identified any exceedances when compared to Drinking Water Standards (DWS) GAC values.

4.3.2. DISCUSSION

The primary receptor has been identified as the underlying Principal Aquifer (bedrock). No exceedances of DWS values have been found in the two leachate samples analysed. It has not been possible to obtain groundwater samples for a full appraisal due to boreholes either being dry or containing insufficient volumes of water.

The drift deposits across the site are variable. Given the presence of lower permeability fine grained soils which will reduce downward migration of contamination and the absence of any exceedances in the leachate, or shallow groundwater to mobilise soil contamination, the overall risk may be considered low.

Given the absence of a groundwater abstraction point or surface watercourse within close proximity to the site, there is not considered to be a complete pollutant linkage.

However, given the nature of the site and presence of deep Made Ground / landfill materials, it would be prudent to obtain water samples for assessment if resting water levels are found to rise over the monitoring period.

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 upon 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
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.

4.5. MONITORING METHODOLOGY

Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) (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 CH_4 and CO_2 , together with the lowest concentration of O_2 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	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.7	998	Rising	0.1	0.1	1.00-4.00	4.60	Dry
		25/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	998	Steady	0.1	0.1		4.60	Dry
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	974	Falling	0.1	0.1		4.70	Dry
		08/08/2023	0.1	0.1	0.0001	0.8	0.6	0.0008	20.5	1002	Falling	0.1	0.1		4.70	Dry
		15/08/2023	0.1	0.1	0.0001	1.2	1.2	0.0012	19.3	1003	Rising	0.1	0.1		4.70	Dry
WS102	MADE GROUND	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.7	999	Rising	0.1	0.1	1.00-2.00	1.85	Dry
		25/07/2023	0.1	0.1	0.0001	5.4	5.4	0.0054	13.2	999	Steady	0.1	0.1		1.90	Dry
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	999	Falling	0.1	0.1		1.94	Dry
		08/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	999	Falling	0.1	0.1		1.94	Dry
		15/08/2023	0.1	0.1	0.0001	6.3	6.3	0.0063	11.6	999	Rising	0.1	0.1		1.94	Dry
WS103	CLAY	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	998	Rising	0.1	0.1	2.00-5.00	Bung Stuck	
		25/07/2023	0.1	0.1	0.0001	5.3	5.3	0.0053	4.8	998	Steady	0.1	0.1			
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	975	Falling	0.1	0.1			
		08/08/2023	0.1	0.1	0.0001	5.4	5.3	0.0054	12.1	1002	Falling	0.1	0.1			
		15/08/2023	0.1	0.1	0.0001	3.4	3.4	0.0034	14.3	1004	Rising	0.1	0.1			
WS104	MADE GROUND	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1000	Rising	0.1	0.1	0.50-2.00	2.00	Dry
		25/07/2023	0.1	0.1	0.0001	8.2	8.1	0.0082	2.5	1000	Steady	0.1	0.1		1.90	Dry
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	975	Falling	0.1	0.1		2.05	1.50
		08/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	1001	Falling	0.1	0.1		2.05	1.37
		15/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1004	Rising	0.1	0.1		2.05	1.20



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)
WS105	SILT	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1000	Rising	0.1	0.1	2.50-4.50	4.10	3.90
		25/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	1000	Steady	0.1	0.1		3.30	2.90
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	976	Falling	0.1	0.1		3.25	2.54
		08/08/2023	0.1	0.1	0.0001	0.2	0.1	0.0002	20.1	1001	Falling	0.1	0.1		3.25	2.67
		15/08/2023	0.1	0.1	0.0001	0.3	0.1	0.0003	20.4	1005	Rising	0.1	0.1		3.25	2.75
WS106	CLAY/SILT	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1000	Rising	0.1	0.1	2.00-4.00	3.70	3.40
		25/07/2023	0.1	0.1	0.0001	9.1	7.4	0.0091	4.9	998	Steady	0.1	0.1		3.60	3.20
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	974	Falling	0.1	0.1		3.70	3.26
		08/08/2023	0.1	0.1	0.0001	0.9	0.8	0.0009	15.3	1001	Falling	0.1	0.1		3.70	3.10
		15/08/2023	0.1	0.1	0.0001	7.7	7.7	0.0077	1.2	1005	Rising	0.1	0.1		3.70	3.10

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



4.6. SUMMARY OF MONITORING RESULTS

4.6.1. GROUNDWATER

Groundwater was recorded between 2.54 m and 3.90 m bgl within WS105 and WS106.

Shallower water levels were recorded between 1.20 m and 1.50 m bgl within WS104, however this is likely perched and a result of heavy rainfall events, as the monitoring installation was installed at a shallow depth within Made Ground.

WS101 and WS102 were recorded as dry throughout the monitoring visits to date.

It should be noted that although water has been recorded in the boreholes, the maximum depth of the water column recorded to date is 0.71 m in WS105.

4.6.2. BAROMETRIC PRESSURE

Visits 1 and 6 were undertaken during periods of relatively high/rising pressure, with pressure recorded to be 1000 mbar and 1005 mbar, respectively.

Visit 2 was undertaken during a period of relatively high, steady pressure.

Visits 3 and 4 were undertaken during periods of falling pressure and visit 3 was also undertaken during a period of relatively low pressure, with pressure recorded to be 974 mbar.

It is therefore considered that the visits have been undertaken over representative conditions.

4.6.3. GAS FLOW

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

4.6.4. 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 9.1% v/v (WS106).

Concentrations of carbon dioxide have been recorded >5% in WS101, WS102, and WS106 on two occasions and WS104 on one occasion. Typically these occurred during Visit 2 (27/8/23 – steady low pressure 998-1000 mbar) and Visit 5 (15/8/23 – rapidly rising pressure 999-1005 mbar).

4.7. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit indicates that based on the peak flow rates the majority of the monitoring visits classify as Characteristic Situation (CS)1 – Very Low Gas Risk. However, E3P has assessed the variables and come to the following conclusions:



- ✳ The southern part of the site forms part of a larger historical landfill and deep Made Ground (up to 7.10m bgl in CP102), with degradable inclusions of wood and timber have been observed. Other degradable organic materials may be present at intervening locations and cannot be discounted.
- ✳ WS102, WS103, WS104 and WS106, predominantly in the south of the site and area of former landfill, have recorded carbon dioxide above 5% v/v threshold, however the GSV is noted to be within a CS1 classification due to the absence of flow.
- ✳ Given the presence of the recorded historical landfill that encroaches on the south of the site, and the elevated carbon dioxide concentrations recorded, it is recommended that precautionary allowances be made for CS2 gas protection measures.
- ✳ The final classification will be confirmed on completion of the full ground gas monitoring programme to enable an appraisal of the full dataset. The assessment should also include a ternary gas assessment to assess the gas composition.

4.8. POTABLE WATER SUPPLY

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

TABLE 4.7 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	<0.05
Total BTEX And MTBE	0.1	<0.05
Total SVOCs (Excluding PAH and those substances marked with an *)	2	0.5
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.2
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	157.8 (TP102 0.80m)
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	351
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?	None	
Is free product present in soil and groundwater?	None	



Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No hydrocarbon impact identified at a greater depth than current pipeline depth.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	Subject to cut/fill proposals.	
Will soils be imported to site as part of any future earth works	Currently unknown. The importation of materials may affect the WIR Risk Assessment which should be updated after completion.	

Notes

Pipe line depth normally between 0.75 m – 1.35 m

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



4.9. CONCEPTUAL SITE MODEL

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

TABLE 4.9 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground / Former Landfill)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	High	LOW
<p>Discussion: Heavy metals (arsenic, lead and mercury [potentially volatile]) were identified throughout Made Ground between depths of 0.80 m and 1.20 m bgl. Non-volatile PAHs have been identified throughout Made Ground between depths of 0.20 m and 1.00 m bgl.</p> <p>Recommendation: Cover system to garden and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.</p>						
PL3	ACM (Made Ground / Former Landfill)	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
<p>Assessment: Asbestos in the form of loose chrysotile/amosite (0.003% wt/wt) and chrysotile fibres (0.002 % wt/wt) have been identified in the Made Ground in TP102 at 0.80 m bgl and TP105 at 1.00 m bgl, respectively.</p> <p>Recommendation: The soils will require placement in accordance with the asbestos CSM. Construction works completed with PPE and provision of welfare.</p>						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons (Made Ground/Formal Landfill)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Likely	Moderate	LOW
<p>Assessment: Elevated concentrations of TPH C12-C16 have been identified in the Made Ground in TP102 at 0.80 m bgl. Mercury (potentially elemental / volatile, has also been encountered in TP101 at 1.20 m bgl (requiring speciation to confirm).</p> <p>Recommendation: During a process of cut/fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity. Speciation of mercury may determine this to be non-volatile, in which case it would be suitable to remain in-situ beneath a clean cover system.</p> <p>Visual and olfactory evidence of contamination has been identified in a number of locations, therefore a watching brief should be completed during remediation works to monitor the locations where visual or olfactory hydrocarbon impact has been identified during all phases of investigation completed to date.</p>						
PL4	Methane, carbon dioxide (Localised Made Ground, historical landfill to the south and infilled features on and within 250 m of the site)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Moderate	LOW
<p>Assessment: The southern part of the site forms part of a larger historical landfill and deep Made Ground (up to 7.10m bgl in CP102), with degradable inclusions of wood and timber have been encountered. Other degradable organic materials may be present at intervening locations and cannot be discounted.</p>						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
<p>WS102, WS103, WS104 and WS106, predominantly in the south of the site and area of former landfill, have recorded carbon dioxide above 5% v/v threshold, however the GSV is noted to be within a CS1 classification due to the absence of flow.</p> <p>Recommendation: Given the presence of the recorded historical landfill that encroaches on the south of the site, and the elevated carbon dioxide concentrations recorded, it is recommended that precautionary allowances be made for CS2 gas protection measures. The final classification will be confirmed on completion of the full ground gas monitoring programme to enable an appraisal of the full dataset. The assessment should also include a ternary gas assessment to assess the gas composition.</p>						
PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground / Landfill)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principal aquifer). Surface water (Moston Brook).	Likely	Moderate	LOW
<p>Assessment: The primary receptor has been identified as the underlying Principal Aquifer (bedrock). No exceedances of DWS values have been found in the two leachate samples analysed. It has not been possible to obtain groundwater samples for a full appraisal due to boreholes either being dry or containing insufficient volumes of water. The drift deposits across the site are variable. Given the presence of lower permeability fine grained soils which will reduce downward migration of contamination and the absence of any exceedances in the leachate, or shallow groundwater to mobilise soil contamination, the overall risk may be considered low. Given the absence of a groundwater abstraction point or surface watercourse within close proximity to the site, there is not considered to be a complete pollutant linkage.</p> <p>Recommendation: Given the nature of the site and presence of deep Made Ground / landfill materials, it would be prudent to obtain water samples for assessment if resting water levels are found to rise over the monitoring period.</p>						
PL6	Sulphate (Made Ground / Former Landfill)	Sulphate attack on concrete.	Building structure.	Likely	Low	LOW



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Assessment: The soils at the site meet class DS-1, AC-1s.						
Recommendation: Concrete should be designed in accordance with the chemical testing results.						
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Likely	Moderate	LOW
Assessment: Elevated concentrations of TPH 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 barrier pipe will be required. This will need to be confirmed with a UKWIR risk assessment post remediation.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
Assessment: Generally low concentrations of zinc, nickel and copper have been recorded in the soils at the site. Low risk to flora anticipated.						
Recommendation: Installation of a clean cover system within any areas of soft landscaping to prevent plant uptake of contaminants.						

Notes:

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. 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.
- ✦ 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 in areas of former structures. Relict slabs/cobble obstructions have also been observed in the landfill material in the southern sector. These should be excavated from below the proposed development footprint with the resulting void backfilled.
- ✦ The highwall of the former landfill will need to be accurately located and extent delineated. Foundations straddling the highwall will require an engineered foundation solution to tolerate potential differential settlement (raft foundation likely required).

5.2. FOUNDATION ASSESSMENT

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 ESTIMATED ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
Silty SAND with clay bands	8.00-9.95	Medium Dense	129
Sandy GRAVEL	12.00-12.45	Dense	372
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Soft-Firm SILT	2.00–5.45	22-50	43-100
Firm-Stiff Sandy SILT	3.00–5.45	39-75	80-150
Firm-Stiff Sandy CLAY	2.00–5.45	32-54	66-111
Very Stiff Sandy CLAY	6.50–11.45	193-204	398-420

Based on the above, 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 stiff CLAY or medium dense-dense silty SAND if encountered at founding depth.

Based on existing levels, the depth to suitable founding strata is generally greater than 2.50 m below existing ground level due to the presence of deep Made Ground and unsuitable soft low strength shallow SILT deposits.

However, prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels. Enabling works will also be required to delineate the highwall of the landfill in the southern sector.

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, given the ground conditions encountered and considering future potential cut/fill works to create a development platform, foundation options may include:

- ✿ Piled foundations in areas of tree influence where cohesive soils are present and in area of former landfill in the southern sector where fill extends to depths >7.0 m bgl.
- ✿ Ground improvement using VSC in areas of deep Made Ground outside of tree influence or landfill area.
- ✿ Raft foundations for plots straddling the landfill highwall to mitigate risks of potential differential settlement.
- ✿ In the centre of the northern sector, it may be possible to utilise deep mass trench foundations, where firm CLAY is present at depths shallower than 2.50 m bffl, outside of tree influence.

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	The limited CLAY soils identified were generally firm to stiff with a Cu > 50 kN. Soft/low strength CLAY was identified in one location with a Cu of 32 kN.	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	No peat deposits have been identified.	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	A former landfill is present in the southern sector of the site, containing inert industrial waste, obstructions and potential voids. Made Ground would require processing/re-engineering to render the site suitable for VSC. Affected plots will likely be subject to a piled foundation solution.	SIGNIFICANT RE-ENGINEERING OF MADE GROUND REQUIRED.
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	Limited groundwater encountered on site. Loose fill has unlikely been subject to rising or fluctuating water levels.	SIGNIFICANT RE-ENGINEERING OF MADE GROUND REQUIRED.
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.	A former landfill is present in the southern sector of the site, containing inert industrial waste including wood and timber and other potential degradable inclusions. Made Ground would require processing/re-engineering to render the site suitable for VSC. Affected plots will likely be subject to a piled foundation solution.	SIGNIFICANT RE-ENGINEERING OF MADE GROUND REQUIRED.
Fill, containing degradable material where organic material forms more than 15% of fill by volume	Potential to be present in former landfill in southern sector of site.	TBC
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS



RISK ITEM	COMMENT	PASS/FAIL
Cohesive soils with trees in influencing distance	An area of woodland is present in the centre of the site, occupying approximately 35-40% of the total site area. Plots within tree influence will either be subject to a piled or mass trench-fill solution.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		FURTHER ASSESSMENT REQUIRED ON RECEIPT OF PROPOSED FINISHED LEVELS

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 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.

5.3. 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.

5.4. 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 plasticity, heave precautions are not 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 5.3.

TABLE 5.3 SUMMARY OF HEAVE PRECAUTIONS

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

5.5. 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.

5.6. DRAINAGE

The presence of substantial 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.

As the lateral continuity of the Made Ground cannot be assured, it is not recommended that soakaways are utilised for disposal of surface water runoff.

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



5.7. 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).

5.8. EXCAVATIONS

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation in Made Ground and natural strata.

Site observations indicated that excavations should be feasible in the near surface with normal plant; however, obstructions were identified in the near surface, including concrete and brick obstructions associated with historical landfilling, 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 5.4 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	No groundwater was encountered during the site investigation. 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 identified.



5.9. 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).



5.10. GEOTECHNICAL RISK REGISTER

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils		South	50-100%	<p>Elevated total mercury encountered in the Made Ground in TP101 presents a potential volatilisation to indoor air risk (speciation required to confirm). Material deemed to have a potential vapour risk may require hotspot removal, resulting in the requirement to backfill the resulting void.</p> <p>Asbestos was detected within two samples of Made Ground. Remediation may include delineation as a hotspot and removal from site or placement at a depth of >1.00 m below finished level in residential plots, gardens or POS.</p> <p>Elevated concentrations of heavy metals, PAH compounds and heavy end TPH have been encountered in in samples taken from the southern sector of the site (associated with area of former landfill), however, given the sitewide spread of Made Ground, it would be considered prudent to apply the cover system to all plots where Made Ground remains at proposed development level.</p>
Bedrock		N/A	N/A	Shallow bedrock has not been identified.
Obstructions		All	50%	Site has been subject to historical development and infilling associated with the former residential properties to the north and the historical landfill to the south. Significant brick and concrete slabs were encountered in the southern sector and intact bricks and relict foundations were also encountered in the northern sector. All obstructions will require grubbing out and removal in their entirety.
Trench collapse		All	100	Made Ground present beneath the site may be prone to collapse.
Mature trees		Centre and boundaries	50	Arboriculture survey required to determine areas of potential tree influence. Piled foundations likely to be required in areas of tree influence.



POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Volume Change Potential Clay		All	100%	The clay soils are of low volume change potential. Arboriculture survey required to determine areas of potential tree influence. Piled foundations likely to be required in areas of tree influence.
Peat		N/A	N/A	Peat has not been identified within the site investigation.
Running Sands		N/A	N/A	Data searches indicate low risk.
Ground Dissolution		N/A	N/A	Data searches indicate no hazard.
Concrete Design		All	100%	The soils meet class DS-1, AC-1s.
Low-Permeability Ground		On site	70	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.
Services/Sensitive Structures		All	40	<p>A full ground penetrating radar (GPR) survey has not been undertaken for the site; however, a full review of the available service plans has identified the following services:</p> <ul style="list-style-type: none"> ✿ A low pressure gas main and water distribution main enter the site in the northeastern corner and run northwest (following same route). ✿ Low voltage electric cables enter the site in the east and run north and south towards a junction box. A further low voltage cable enters the site in the southwest and runs northeast. ✿ Foul and combined sewers (150 mm and 825 mm diameter) enter the site in the northeast and run along the north eastern boundary. Other surface water (225 mm) and combined (225 mm) sewers run north east through the site to join sewers in the main road. <p>Driven piling may be restricted within close proximity to sensitive infrastructure.</p>



POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Historically Infilled Features		South	30%	<p>There is an area of historical landfill which encroaches into the site from the south. The type of waste included inert and industrial waste. Deep boreholes have confirmed the fill extends to at least 7.10 m bgl.</p> <p>The highwall of the former landfill will need to be accurately located and extent delineated. Foundations straddling the highwall will require an engineered foundation solution to tolerate potential differential settlement (raft).</p>
Abnormal Foundation Solutions		All	100%	<p>Given the ground conditions encountered and considering future potential cut/fill works to create a development platform, foundation options may include:</p> <ul style="list-style-type: none"> ✿ Piled foundations in areas of tree influence where cohesive soils are present and in area of former landfill in the southern sector where fill extends to depths >7.0 m bgl. ✿ Ground improvement using VSC in areas of deep Made Ground outside of tree influence or landfill area. ✿ Raft foundations for plots straddling the landfill highwall to mitigate risks of potential differential settlement. ✿ In the centre of the northern sector, it may be possible to utilise deep mass trench foundations, where firm CLAY is present at depths shallower than 2.50 m bffl, outside of tree influence.
Areas Not Investigated		North and Centre	50%	<p>Several services are present within the site boundary, therefore easements had to be applied and exploratory hole locations could not be advanced within these areas.</p>



Kenyon Lane, Failsworth

Phase II Geoenvironmental Site Assessment

September 2023

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
				An area of woodland is also present in the centre of the site, occupying approximately 35-40% of the entire site area, therefore exploratory hole locations could only be advanced to the north and south.



5.11. FURTHER WORKS

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

- ✦ Further investigation in centre of site following tree removal (if proposed).
- ✦ Completion of ground gas monitoring programme.
- ✦ Collection of groundwater samples, subject to groundwater depth.
- ✦ Location/delineation of landfill highwall in southern sector.
- ✦ Plot-specific foundation schedule (upon receipt of the final development levels).
- ✦ Arboricultural survey.
- ✦ Geotechnical earthworks strategy (infrastructure).
- ✦ Remediation and enabling works strategy.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

<p>Human Health</p>	<p>A Tier II human health risk assessment identified exceedances of residential end use with plant uptake GAC values for the following contaminants in samples taken from the southern sector of the site (associated with area of former landfill):</p> <ul style="list-style-type: none"> ✳ Lead, arsenic and mercury [potentially volatile] ✳ Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene ✳ TPH Aromatic C12-C16 ✳ Chrysotile and Amosite asbestos fibres at 0.003% wt/wt and Chrysotile at 0.002% wt/wt <p>Elevated total mercury encountered in the Made Ground in TP101 presents a potential volatilisation to indoor air risk (speciation required to confirm). Material deemed to have a potential vapour risk may require hotspot removal, resulting in the requirement to backfill the resulting void.</p> <p>Asbestos was detected within two samples of Made Ground. Remediation may include delineation as a hotspot and removal from site or placement at a depth of >1.00 m below finished level in residential plots, gardens or POS</p> <p>Risks associated with heavy metals, PAH compounds and heavy end TPH can be mitigated through installation of a clean cover system in gardens and soft landscaped areas. These have been encountered in samples taken from the southern sector of the site (associated with area of former landfill), however, given the sitewide spread of Made Ground, it would be considered prudent to apply a cover system to all plots where Made Ground remains at proposed development level.</p> <p>Chemical analysis of natural subsoils has indicated 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.</p> <p>Two samples of the reworked topsoil (noted to contain brick and anthropogenic inclusions) were also submitted for chemical analysis (TP102 and WS106). Chemical analysis has indicated these soils to be acceptable for use as topsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Should material be found to be chemically suitable, inspection of the soil composition should be undertaken along with suitable screening of unsuitable anthropogenic inclusions.</p>
----------------------------	--



Controlled Waters	<p>The primary receptor has been identified as the underlying principal aquifer (bedrock). No exceedances of DWS values have been found in the two leachate samples analysed. It has not been possible to obtain groundwater samples for a full appraisal due to boreholes either being dry or containing insufficient volumes of water. The drift deposits across the site are variable. Given the presence of lower permeability fine grained soils which will reduce downward migration of contamination and the absence of any exceedances in the leachate, or shallow groundwater to mobilise soil contamination, the overall risk may be considered low. Given the absence of a groundwater abstraction point or surface watercourse within close proximity to the site, there is not considered to be a complete pollutant linkage.</p> <p>However, given the nature of the site and presence of deep Made Ground / landfill materials, it would be prudent to obtain water samples for assessment if resting water levels are found to rise over the monitoring period.</p>
Ground Gas	<p>The southern part of the site forms part of a larger historical landfill and deep Made Ground (up to 7.10 m bgl in CP102), with degradable inclusions of wood and timber have been encountered. Other degradable organic materials may be present at intervening locations and cannot be discounted. WS102, WS103, WS104 and WS106, predominantly in the south of the site and area of former landfill, have recorded carbon dioxide above 5% v/v threshold, however the GSV is noted to be within a CS1 classification due to the absence of flow.</p> <p>A precautionary allowance for CS2 gas protection measures is recommended at this stage. The final classification will be confirmed on completion of the full ground gas monitoring programme.</p>
Potable Water	<p>Barrier pipe likely to be required. 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.</p>



6.2. GEOTECHNICAL ASSESSMENT

Frequent concrete and brick obstructions have been identified, indicative of historical landfilling in the southern sector of the site and relict foundations in the northern sector. During a phase of cut-and-fill enabling works to create a developable platform, all obstructions (including redundant services) will require grubbing out to enable the construction of proposed plots.

The suitable target founding stratum has been identified as the underlying firm to stiff CLAY or medium dense silty SAND (if encountered). Based on existing levels, the depth to suitable founding strata is generally greater than 2.50 m bgl due to the presence of deep Made Ground and unsuitable soft low strength shallow SILT deposits.

In addition, there is an area of historical landfill which encroaches into the site from the south, with fill extending to at least 7.10 m bgl. The highwall of the former landfill will need to be accurately located and extent delineated.

An area of woodland is also present in the centre of the site, occupying approximately 35-40% of the entire site area, therefore exploratory hole locations could only be advanced to the north and south. The clay soils are of low volume change potential. An arboriculture survey is required to determine areas of potential tree influence.

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, given the ground conditions encountered and considering future potential cut/fill works to create a development platform, foundation options may include:

- ✿ Piled foundations in areas of tree influence where cohesive soils are present and in area of former landfill in the southern sector where fill extends to depths >7.0 m bgl.
- ✿ Ground improvement using VSC in areas of deep Made Ground outside of tree influence or landfill area.
- ✿ Raft foundations for plots straddling the landfill highwall to mitigate risks of potential differential settlement.
- ✿ In the centre of the northern sector, it may be possible to utilise deep mass trench foundations, where firm CLAY is present at depths shallower than 2.50 m bffl, outside of tree influence.

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.

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



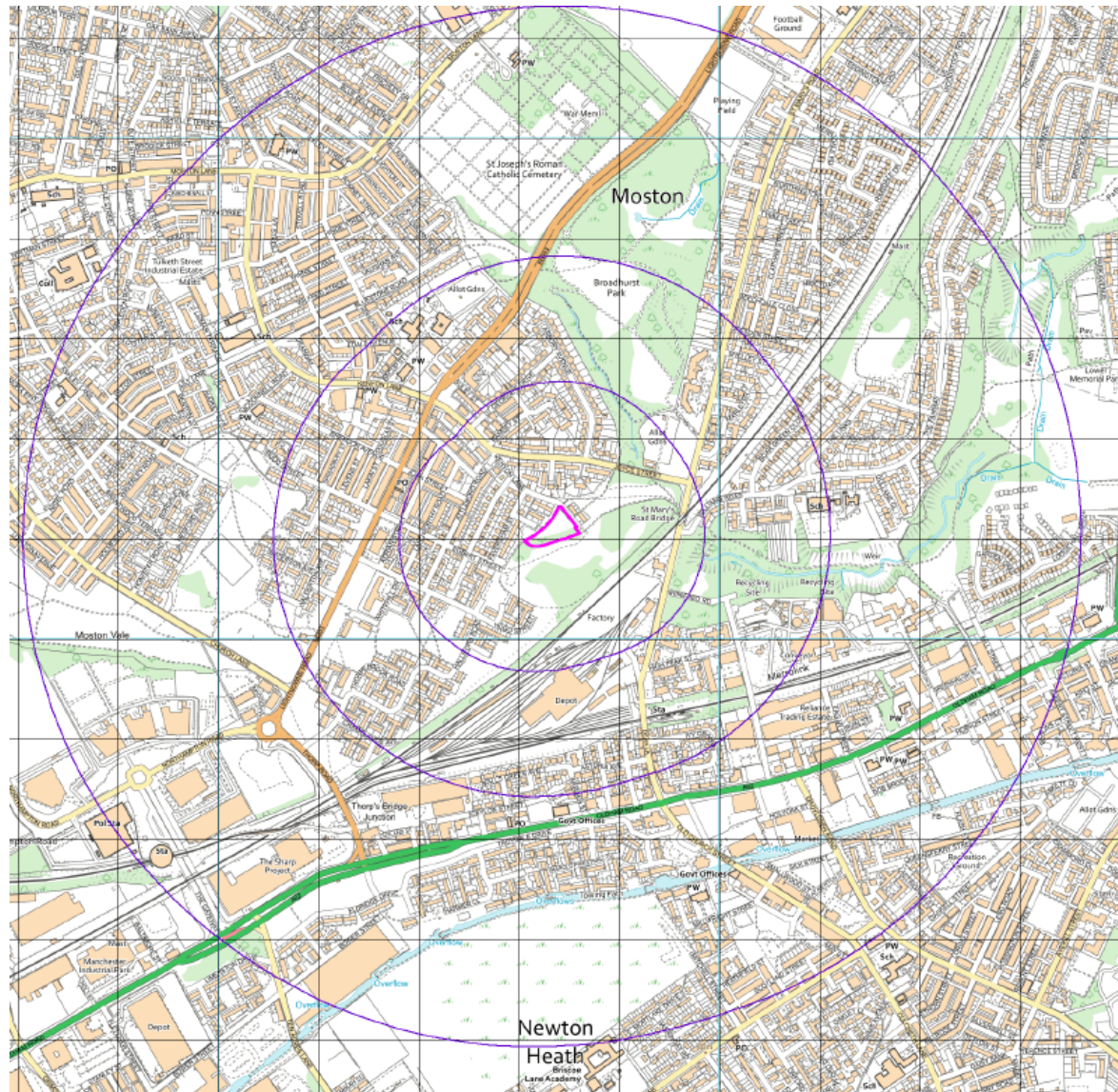
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance 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 16-717-001 – SITE LOCATION PLAN





<div>Historical Features</div> <div><div></div>Former Buildings</div> <div><div></div>Dense Vegetation</div> <div><div></div>Former Earthworking/Excavation</div>	Notes:					Client:		Job No:		Date:		<div><div></div><div>e3p</div></div> <div>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</div>
						Jigsaw Homes		Drawing No:		Scale:		
								003		NTS@ A3		
						Job Title:		Drawing Title:		<div>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.</div>		
					Kenyon Lane, Failsworth		Historical Features Plan					
P1	REVB	11.09.2023	OW	JS								
P1	REVA	24.08.2023	OW	EC								
Phase	Issue	Date	Drawn	Checked								

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.



Site Features

- Mature Trees
- Grass
- Mature Trees/Woodland
- Footpath
- Field Gate
- Electric Box
- Manholes

Notes:

P1	REVC	14.09.2023	OW	JS
P1	REVB	12.09.2023	OW	JS
P1	REVA	24.08.2023	OW	EC
Phase	Issue	Date	Drawn	Checked

Client:

Jigsaw Homes

Job Title:

Kenyon Lane, Failsworth

Job No:

16-718

Drawing No:

004

Date:

14.09.2023

Scale:

NTS@ A3

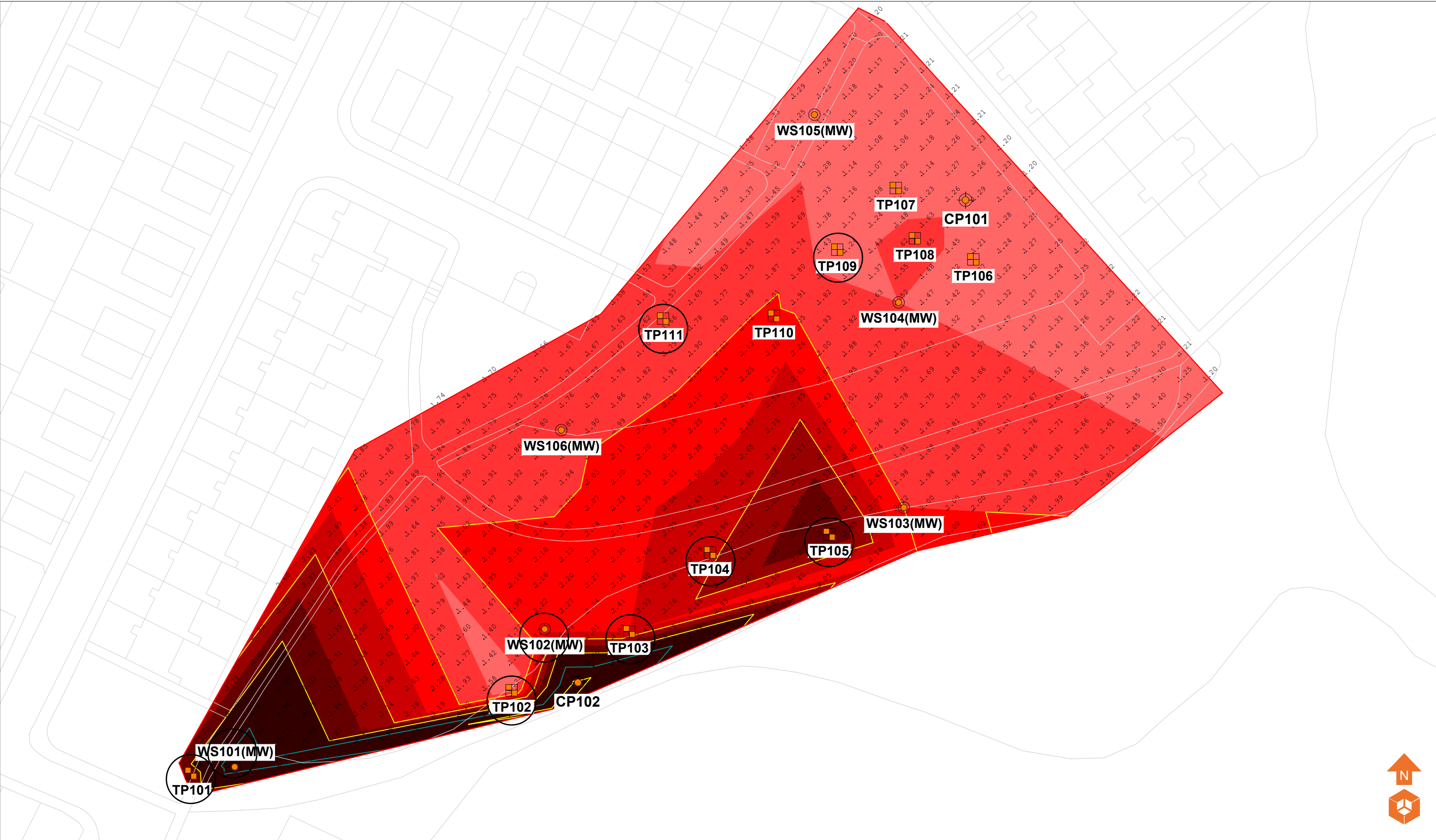


Environmental Engineering
Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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.



<div>Location Symbols</div> <div><div></div>Approximate Window Sample Probehole Location with Install</div> <div><div></div>Approximate Trial Pit Location</div> <div><div></div>Approximate Cable Percussive Borehole Location</div>	Notes:					Client:	Job No:	Date:	<div>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</div>		
						Jigsaw Homes	16-718	11.09.2023			
							Drawing No:	Scale:			
							005	NTS@ A3			
					P1	REVC	11.08.2023	OW	JS	<div>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.</div>	
					P1	REVB	01.08.2023	EB	EC		
					P1	REVA	27.06.2023	OW	EC		
					Phase	Issue	Date	Drawn	Checked		
					Job Title:					Drawing Title:	
					Kenyon Lane, Failsworth					Exploratory Hole Location Plan	



- Location Symbols
- Approximate Window Sample Probehole Location with Install
 - Approximate Trial Pit Location
 - Approximate Cable Percussive Borehole Location

- Made Ground Depth (m)
- Depth of Made Ground 1.00 - 1.49m
 - Depth of Made Ground 1.50 - 1.99m
 - Depth of Made Ground 2.00 - 2.49m
 - Depth of Made Ground 2.50 - 2.99m
 - Depth of Made Ground 3.00 - 3.49m
 - Depth of Made Ground 3.50 - 3.99m
 - Depth of Made Ground >4.00m

Notes:				
P1	REVB	07.08.2023	EB	EC
P1	REVA	01.08.2023	EB	EC
Phase	Issue	Date	Drawn	Checked

Client:

AJP

Job Title:

Kenyon Lane, Failsworth

Job No:

16-718

Drawing No:

006

Date:

07.08.2023

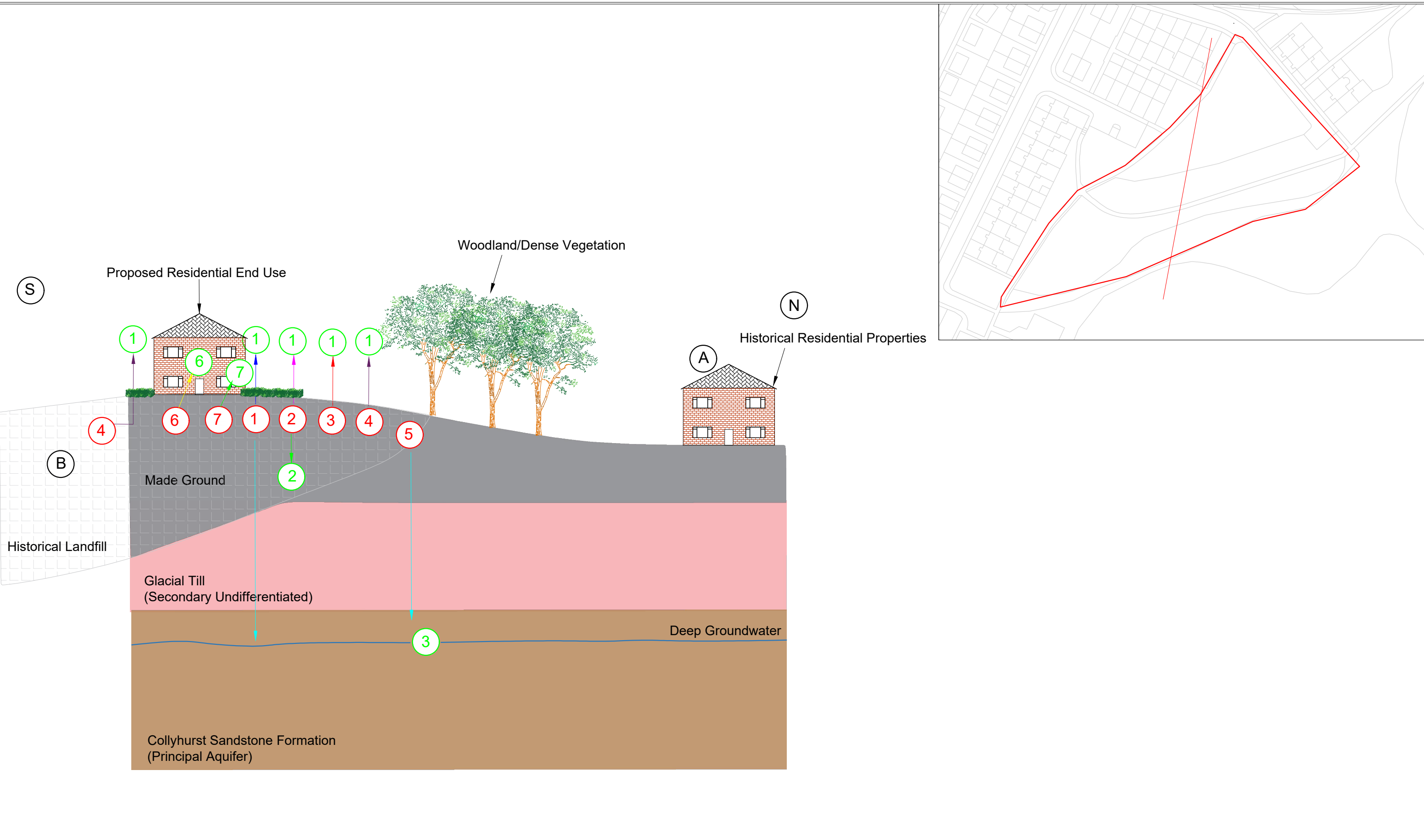
Scale:

NTS@ A3



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.



<div>Geology Key</div> <div><div>Made Ground</div><div>Landfill</div><div>Groundwater</div><div>Collyhurst Sandstone Formation</div><div>Glacial Till</div></div>	<div>Sources</div> <div><div>1Heavy Metals, Non Volatile PAH's, Non Volatile TPH's (Made Ground, Landfill)</div><div>2Asbestos (Made Ground, Landfill)</div><div>3Volatile Contaminants (-TPH, VOC)</div><div>4Ground Gases (Made Ground, Landfill)</div><div>5Mobile Contaminants (TPH, VOC)</div><div>6Sulphate (Made Ground)</div><div>7Phytotoxic Contaminants (Made Ground)</div></div>	<div>Pathways</div> <div><div>Dermal Contact / Ingestion</div><div>Vapour Inhalation</div><div>Inhalation / Accumulation</div><div>Tainting of Water Supplies</div><div>Dust Inhalation</div><div>Vertical / Lateral Migration</div><div>Sulphate Attack on Concrete</div><div>Plant Uptake</div></div>	<div>Receptors</div> <div><div>1Future End Users</div><div>2Water Pipes</div><div>3Groundwater (Principal B Aquifer)</div><div>4Surface Water Features</div><div>5Off-site Receptors</div><div>6Building Structure</div><div>7Flora</div></div>	<div>Site Features</div> <div><div>AHistorical Residential Building</div><div>BHistorical Landfill</div></div>	<div>Notes:</div>	<div>Client:</div> <div>Jigsaw Homes</div>	<div>Job No:</div> <div>16-718</div>	<div>Date:</div> <div>14.09.2023</div>	<div><div><div></div><div>e3p</div></div><div>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</div></div>
						<div>Job Title:</div> <div>Kenyon Lane, Failsworth</div>	<div>Drawing No:</div> <div>010</div>	<div>Scale:</div> <div>NTS</div>	
					<div>P1</div> <div>P1</div>	<div>REVB</div> <div>REVA</div>	<div>14.09.2023</div> <div>24.08.2023</div>	<div>OW</div> <div>OW</div>	
<div>Phase</div>	<div>Issue</div>	<div>Date</div>	<div>Drawn</div>	<div>Checked</div>					



- Site Features**
- Mature Trees
 - Grass
 - Mature Trees/Woodland
 - Footpath
 - Field Gate
 - Electric Box
 - Manholes
- Location Symbols**
- Approximate Window Sample Probehole Location with Install
 - Approximate Trial Pit Location
 - Approximate Cable Percussive Borehole Location
- Development Constraints**
- Concrete Slab
 - Surface Water
 - Combined
 - Distribution Main
 - Delineation Extent/Highwall of Landfill

Notes:				
P1	REVB	14.09.2023	OW	JS
P1	REVA	24.08.2023	OW	EC
Phase	Issue	Date	Drawn	Checked

Client:	Jigsaw Homes
Job Title:	Kenyon Lane, Failsworth

Job No:	16-718
Drawing No:	015
Date:	14.09.2023
Scale:	NTS@ A3
Drawing Title:	Development Constraints Plan



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

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



Location Symbols

- Approximate Window Sample Probehole Location with Install
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location

Contamination Issues

- Asbestos
- TPH C12 - C16
- Heavy Metals
- Non Volatile PAH
- Mercury

Notes:

Client:

AJP

Job No:

16-718

Date:

24.08.2023

Drawing No:

018

Scale:

NTS@ A3



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

P1	REVA	24.08.2023	OW	EC
Phase	Issue	Date	Drawn	Checked

Job Title:

Kenyon Lane, Failsworth

Drawing Title:

Contaminations Issues 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.

APPENDIX IV PHOTOGRAPHS

PLATE 1 SITE ENTRANCE VIA KENYON LANE



PLATE 2 VIEW OF SOUTH OF SITE FACING EAST



PLATE 3 VIEW OF NORTH OF SITE FACING KENYON LANE AND BACKILLED TRIAL PIT



PLATE 4 SOUTH WEST CORNER OF THE SITE AND BACKFILLED TP101



PLATE 5 FOOTPATH RUNNING ALONG WESTERN AND NORTHERN BOUNDARY



PLATE 6 TP101 EXCAVATION AND ARISING



PLATE 7 TP103 EXCAVATION AND ARISING



PLATE 8 TP107 EXCAVATION AND ARISING



PLATE 9 TP109 EXCAVATION AND ARISINGS



PLATE 10 WS102 ARISINGS AND MONITORING WELL



PLATE 11 WS104 ARISINGS AND MONITORING WELL



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387579.00 - 401148.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 2.00 Depth 3.60		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
							MADE GROUND: Brown sandy reworked clay.	
	1.20	ES		0.90			MADE GROUND: Light grey slightly gravelly clayey fine to medium sand with pockets of orangish pink silty clay. Gravel is fine to medium subangular to angular of brick and clinker.	1
	2.00	B						2
				3.40				3
				3.60			MADE GROUND: Orangish greyish brown slightly gravelly silty clay. Gravel is fine to medium subangular to angular of ash, wood, and organic matter. End of Pit at 3.60m	4

Trial Pit Photographs



Trial Pit 101



Trial Pit 101 Spoil

Remarks: 1. Complete. 2. Depth of Made Ground unproven.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387630.00 - 401161.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 2.20 Depth 1.20		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			MADE GROUND: Greyish black slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
	0.80	ES		1.10 1.20			MADE GROUND: Greyish brown clayey gravelly medium to coarse sand with pockets of black silty clay and frequent cobbles. Gravel is fine to coarse subangular to subrounded of brick, mudstone and plastic. Cobbles are subangular to angular of intact bricks. MADE GROUND: Concrete. (Recovered as a greyish brown sandy gravel) End of Pit at 1.20m	1 2 3 4

Trial Pit Photographs



Trial Pit 102

Trial Pit 102 Spoil

Remarks: 1. Terminated on concrete slab at 1.20 m bgl. 2. Strong hydrocarbon odour encountered from 0.70 m bgl.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387648.00 - 401171.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 2.20 Depth 2.50		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
	2.00	ES					MADE GROUND: Greyish brown clayey gravelly medium to coarse sand with frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, glass and brick. Cobbles are subangular to angular of bricks, metal, plastic and wood.	1
				2.50			End of Pit at 2.50m	2
								3
								4

Trial Pit Photographs



Trial Pit 103



Trial Pit 103 Spoil

Remarks: 1. Terminated at 2.50 m bgl due to large concrete blocks restricting excavation. 2. Slight organic odour encountered within Made Ground.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387661.00 - 401182.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 2.20 Depth 2.90		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.25			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
	0.80	ES					MADE GROUND: Greyish brown clayey gravelly medium to coarse sand with pockets of dense black fine to medium sand and frequent cobbles. Gravel is fine to coarse subangular to subrounded of brick, plastic, asphalt, slate, clinker, metal, glass and cloth. Cobbles are subangular to angular of concrete and intact bricks.	1
				2.90			End of Pit at 2.90m	2
								3
								4

Trial Pit Photographs



Trial Pit 104

Trial Pit 104 Spoil

Remarks: 1. Complete. 2. Large concrete block encountered within the northern wall. 3 Depth of Made Ground unproven. 4. Slight hydrocarbon odour encountered.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387680.00 - 401186.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 2.00 <div style="display: flex; align-items: center;"> 0.60 <div style="border: 1px solid black; width: 100px; height: 40px; margin-left: 10px;"></div> </div>		Scale 1:30
Client: AJP	Depth 4.00		Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
	1.00	ES					MADE GROUND: Greyish brown clayey gravelly medium to coarse sand with frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, brick and glass. Cobbles are subangular to angular of concrete flagstones, intact bricks, metal, plastic, wood and rope.	1
	1.50	B						2
				3.20			MADE GROUND: Greyish brown slightly gravelly silty reworked clay with occasional cobbles and rare large boulder. Cobbles are angular bricks and boulder is subrounded mudstone.	3
				4.00			End of Pit at 4.00m	4

Trial Pit Photographs



Remarks: 1. Complete. 2. Frequent concrete flagstones encountered to 2.00 m bgl. 3 Depth of Made Ground unproven.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387703.00 - 401230.00 Level:	Date 22/06/2023
Location: Failsworth		Dimensions (m): 2.00 Depth 3.50	Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.35	ES		0.40			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick, rare plastic and mudstone. (Topsoil)	
				1.20			MADE GROUND: Greyish brown clayey gravelly medium to coarse sand with pockets of black gravel and frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, brick and ash. Cobbles are subangular to angular of bricks and concrete.	1
	1.50	ES					Brown slightly silty SAND with occasional black streaks.	
	2.00	B		2.20			Orangish brown medium to coarse SAND.	2
				3.00			Greyish brown SILT.	3
				3.50			End of Pit at 3.50m	4

Trial Pit Photographs



Trial Pit 106



Trial Pit 106 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387691.00 - 401241.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 1.80 Depth 3.00 0.60		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
				1.00			MADE GROUND: Greyish brown clayey gravelly fine to medium sand. Gravel is fine to coarse subangular to subrounded of mudstone, brick, cloth and plastic.	
				1.40			Brown slightly sandy CLAY.	1
				1.80			Orange slightly clayey medium to coarse SAND.	
				2.70			Light brown medium to coarse SAND.	2
	3.00	ES		3.00			Greyish brown clayey SILT.	
							End of Pit at 3.00m	3
								4

Trial Pit Photographs



Trial Pit 107



Trial Pit 107 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387694.00 - 401233.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): Depth 2.80		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.00	ES		0.25			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
				1.80			MADE GROUND: Greyish brown clayey gravelly fine to medium sand with frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone and brick. Cobbles are subangular bricks.	
				2.00			Orange silty SAND.	
				2.40			Greyish brown silty SAND.	
				2.80			Greyish brown clayey SILT with black traces.	
							End of Pit at 2.80m	

Trial Pit Photographs



Trial Pit 108



Trial Pit 108 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387681.00 - 401231.00 Level:	Date 22/06/2023
Location: Failsworth	Dimensions (m): 1.80 Depth 1.20		Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
				1.20			MADE GROUND: Greyish brown sandy gravelly reworked clay with frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, brick and ceramic. Cobbles are subangular to angular of brick, mudstone, asphalt and plastic.	1
							End of Pit at 1.20m	2
								3
								4

Trial Pit Photographs



Trial Pit 109

Trial Pit 109 Spoil

Remarks: 1. Terminated at 1.20 m bgl due to concrete slab.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387671.00 - 401220.00 Level:	Date 22/06/2023
Location: Failsworth		Dimensions (m): 2.00 Depth 3.00	Scale 1:30
Client: AJP			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	ES		0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
				1.70			MADE GROUND: Greyish brown clayey gravelly fine to medium sand with occasional cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, metal and brick. Cobbles are subangular intact bricks.	1
				2.10			MADE GROUND: Black slightly gravelly clayey fine to medium sand. (Slight hydrocarbon odour)	2
				2.70			Firm greyish brown silty sandy CLAY with black streaks.	
	2.80	ES		2.80			Orange medium to coarse SAND.	
				3.00			Greyish brown sandy SILT.	3
							End of Pit at 3.00m	4

Trial Pit Photographs



Trial Pit 110



Trial Pit 110 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Kenyon Lane	Project No. 16717	Co-ords: 387654.00 - 401220.00 Level:	Date 22/06/2023
Location: Failsworth		Dimensions (m): 2.10 0.60	Scale 1:30
Client: AJP		Depth 1.60	Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.10	ES		0.35			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
				1.00			MADE GROUND: Greyish brown clayey gravelly fine to medium sand with frequent cobbles. Gravel is fine to coarse subangular to subrounded of mudstone, ceramic and brick. Cobbles are subangular intact bricks and concrete.	1
				1.20			MADE GROUND: Black slightly silty reworked clay with wood fragments.	
				1.60			MADE GROUND: Brown sandy clay with ceramic drain encountered in western wall.	
							End of Pit at 1.60m	2
								3
								4

Trial Pit Photographs



Trial Pit 111

Trial Pit 111 Spoil

Remarks: 1. Terminated at 1.60 m bgl due to potential drain. 2. Concrete obstruction encountered in western wall of trial pit at 1.20 m bgl.

Stability: Stable.

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387586.00 - 401149.00

Hole Type
WS

Location: Failsworth

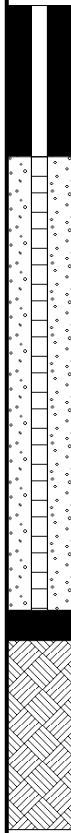
Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
		1.00		N=6 (2,2/1,1,2,2)	1.00			MADE GROUND: Brown clayey gravelly fine to medium sand. Gravel is fine to coarse subangular to angular of concrete.	1
					1.50			MADE GROUND: Black gravelly fine to medium sand. Gravel is fine to medium subangular to angular of ash and clinker.	
		2.00		N=5 (2,2/1,1,2,1)	2.00			MADE GROUND: Grey sandy gravel. Gravel is fine to coarse subangular to angular of concrete and clinker.	2
					2.45			MADE GROUND: Black gravelly fine to medium sand. Gravel is fine to medium subangular to angular of ash and clinker.	
		3.00		N=4 (1,1/1,1,1,1)				MADE GROUND: Grey sandy clayey gravel with black bands. Gravel is fine to coarse subangular to angular of concrete and clinker.	3
		4.00		N=3 (1,0/1,1,0,1)					4
		5.00		N=4 (1,2/1,1,1,1)	4.95			MADE GROUND: Soft orangish brown sandy clay.	5
					5.45			End of borehole at 5.45 m	

Remarks

1. Complete. 2. Monitoring well installed- response zone (1.00 m to 4.00 m bgl).

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387635.00 - 401171.00

Hole Type
WS

Location: Failsworth

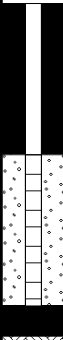
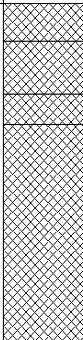
Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
			ES	N=15 (3,4/3,4,4,4)	0.25			<p>MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)</p> <p>MADE GROUND: Brown slightly sandy gravelly reworked clay. Gravel is fine to coarse subangular to angular of brick, coal and mudstone.</p> <p>MADE GROUND: Black clayey gravelly fine to medium sand. Gravel is fine to coarse subangular to subrounded of mudstone, sandstone and brick.</p> <p>MADE GROUND: Greyish brown slightly silty gravelly reworked clay with frequent cobbles. Gravel is fine to coarse subangular to angular of brick and mudstone. Cobbles are subangular of concrete and brick.</p> <p>End of borehole at 2.26 m</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p>
		0.70			0.60				
		1.00			0.80				
		2.00			2.26				

Remarks

1. Refusal within Made Ground on 2.26 m bgl. 2. Monitoring well installed- response zone (1.00 m to 2.00 m bgl).

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387692.00 - 401189.00

Hole Type
WS

Location: Failsworth

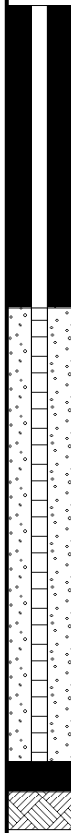
Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30			0.30			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets with rare cobble. Gravel is fine to coarse subangular to angular of brick and mudstone. Cobble is subangular of concrete. (Topsoil)	
		1.00		N=10 (2,3/3,2,2,3)				MADE GROUND: Greyish brown sandy gravelly reworked clay becoming silty from 1.50 m bgl, with cobble encountered at 0.90 m to 1.00 m bgl. Gravel is fine to coarse subangular to angular of brick, concrete and coal. Cobbles is subangular of clinker.	1
		2.00 2.00	SPT	N=2 (1,0/1,0,1,0)	2.00			No recovery.	2
		3.00 3.00	SPT	N=12 (1,0/2,3,3,4)	3.00			Stiff medium strength greyish brown silty CLAY.	3
		4.00 4.00	SPT	N=12 (1,2/2,2,3,5)					4
		5.00 5.00	SPT	N=13 (1,2/3,3,4,3)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (2.00 m to 5.00 m bgl).

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387692.00 - 401223.00

Hole Type
WS

Location: Failsworth

Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=40 (3,6/9,10,8,13)	0.20			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	1
					0.40			MADE GROUND: Brown gravelly reworked clay with rare cobble.	
		1.00			1.00			MADE GROUND: Brick fill.	
					1.20			MADE GROUND: Black slightly gravelly sandy clay. Gravel is fine to medium subangular to angular of ash, brick and concrete.	
					1.50			MADE GROUND: Brown gravelly sandy reworked clay with rare cobble. Gravel is fine to coarse subangular to angular of brick and concrete. Cobbles is subangular of clinker.	
		2.00	N=11 (4,3/3,3,3,2)		1.60			Orange medium to coarse SAND.	2
								Stiff medium strength brown sandy SILT.	
			N=5 (1,0/0,1,2,2)		2.70			Brown slightly silty fine to medium SAND.	3
		3.00			2.80			Firm low strength greyish brown SILT. Becoming stiff medium strength from 4.00 m bgl.	
									
		4.00	N=11 (2,2/2,3,3,3)						4
		5.00	SPT	N=13 (2,3/3,3,3,4)	4.80			Stiff medium strength greyish brown CLAY.	5
		5.00							
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (0.50 m to 2.00 m bgl). 3. Water strike encountered at 3.00 m bgl.

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387678.00 - 401252.00

Hole Type
WS

Location: Failsworth

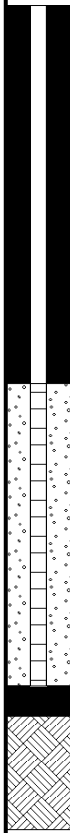
Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.35			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
					0.60				
					0.70			MADE GROUND: Greyish brown sandy gravelly clay. Gravel is fine to coarse subangular to angular of brick and mudstone.	
		0.90	ES	N=6 (1,2/1,2,1,2)	1.20			MADE GROUND: Orangish brown fine to medium sand with brick cobble.	1
		1.00			1.45			MADE GROUND: Greyish brown reworked clay with black band of concrete and bitumen from 0.80 m to 0.95 m bgl.	
					1.50				
		2.00		N=6 (1,2/1,1,2,2)	2.50			Loose light greyish brown fine to medium SAND. Orange mottled black SAND. Loose greyish brown silty fine to medium SAND.	2
		2.00 - 5.00	B						
									
									
		3.00		N=9 (1,1/1,3,2,3)					3
									
		4.00		N=12 (2,2/3,3,3,3)					4
									
		5.00		N=13 (2,3/3,3,3,4)					5
					5.45				
								End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (2.50 m to 4.50 m bgl). 3. Slight hydrocarbon odour encountered from 0.70 m to 1.00 m bgl.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387638.00 - 401203.00

Hole Type
WS

Location: Failsworth

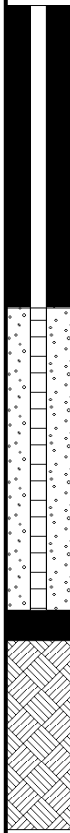
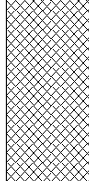
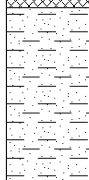
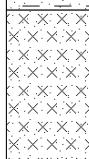
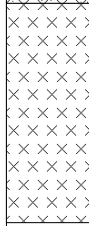
Level:

Scale
1:50

Client: AJP

Dates: 22/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.25			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of glass, brick and ash. (Topsoil)	1
		1.00		N=9 (2,1/2,3,2,2)				MADE GROUND: Greyish brown slightly sandy gravelly reworked clay. Gravel is fine to coarse subangular to angular of brick, ash and concrete.	
		1.90 2.00 2.00	ES SPT		1.80			Firm low strength orangish brown sandy CLAY with occasional black sandy streaks.	2
		3.00		N=9 (2,3/2,2,2,3)	3.00			Firm low strength orangish brown sandy SILT with black streaks from 3.80 m to 4.00 m bgl.	3
		4.00		N=11 (1,2/2,2,3,4)	4.00			Stiff medium strength greyish brown SILT.	4
		5.00		N=12 (2,2/3,3,3,3)	5.45			End of borehole at 5.45 m	5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (2.00 m to 4.00 m bgl). 3. Water strike encountered at 3.60 m bgl.

Borehole Log

Borehole No.

CP101

Sheet 1 of 1

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387699.00 - 401236.00

Hole Type
CP

Location: Failsworth

Level:

Scale
1:50

Client: AJP

Dates: 04/07/2023 -

Logged By
DP Drilling

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
		1.00		N=10 (1,2/2,3,2,3)	1.30			MADE GROUND: Brown gravelly sandy reworked clay. Gravel is fine to coarse subangular to angular of brick and concrete.	1
		2.00		N=7 (1,2/2,1,2,2)					2
		3.00 3.00	SPT	N=14 (2,2/3,3,4,4)					3
		4.00 4.00	SPT	N=15 (3,3/3,4,4,4)					4
		5.00 5.00	SPT	N=18 (3,3/4,4,5,5)					5
					6.00				6
		6.50 6.50 6.50	B SPT	50 (4,5/50 for 230mm)				Very stiff very high strength brown sandy boulder CLAY.	7
		8.00 8.00	SPT	50 (7,10/50 for 260mm)					8
					8.41			End of borehole at 8.41 m	9
									10

Remarks

1. Refusal within stiff brown boulder clay at 8.41 m bgl.



Borehole Log

Borehole No.

CP102

Sheet 1 of 2

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387639.00 - 401164.00

Hole Type
CP

Location: Failsworth

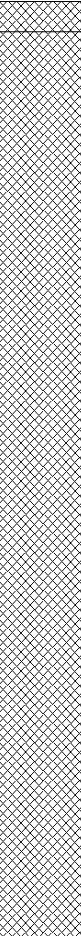
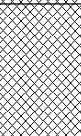
Level:

Scale
1:50

Client: AJP

Dates: 03/07/2023 -

Logged By
DP Drilling

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Brown slightly gravelly clayey medium to coarse sand with frequent roots and rootlets. Gravel is fine to coarse subangular to angular of brick and mudstone. (Topsoil)	
		1.00		N=12 (1,2/2,5,3,2)				MADE GROUND: Greyish brown slightly silty gravelly reworked clay with frequent cobbles. Gravel is fine to coarse subangular to angular of brick and mudstone. Cobbles are subangular of concrete and brick.	1
		2.00 2.00	B	N=12 (2,2/3,2,3,4)					2
		3.00		N=17 (2,3/2,4,8,3)					3
		4.00		N=13 (2,2/3,3,4,3)					4
		5.00		N=14 (2,2/3,4,3,4)					5
		6.20			6.20			MADE GROUND: Black silty fine to medium sand with clay bands.	6
		6.50 6.50	B	N=10 (2,2/2,3,2,3)					7
		7.10			7.10			Medium dense grey silty SAND with CLAY bands.	8
		8.00 8.00	SPT	N=16 (3,3/4,3,4,5)					9
		9.95	SPT						10

Continued on next sheet

Remarks

1. Refusal within dense sandy gravel at 12.35 m bgl.





Borehole Log

Borehole No.

CP102

Sheet 2 of 2

Project Name: Kenyon Lane

Project No.
16717

Co-ords: 387639.00 - 401164.00

Hole Type
CP

Location: Failsworth

Level:

Scale
1:50

Client: AJP

Dates: 03/07/2023 -

Logged By
DP Drilling

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		9.95	B	N=16 (2,3/4,4,4,4)					11		
		11.00 11.00		50 (3,4/50 for 270mm)			10.90				Very stiff very high strength brown CLAY.
							11.60				Dense brown sandy GRAVEL.
		12.00		50 (4,5/50 for 200mm)			12.35	End of borehole at 12.35 m			12
									13		
									14		
									15		
									16		
									17		
									18		
									19		
									20		

Remarks

1. Refusal within dense sandy gravel at 12.35 m bgl.



APPENDIX VI

CHEMICAL TESTING

RESULTS

Eleanor Canham

e3p
Taylor Road
Urmston
Manchester
M41 7JQ

e: ecanham@e3p.co.uk

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

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

Analytical Report Number : 23-41374

Project / Site name:	Kenyon Lane	Samples received on:	23/06/2023
Your job number:	16 717	Samples instructed on/ Analysis started on:	26/06/2023
Your order number:	005318	Analysis completed by:	04/07/2023
Report Issue Number:	1	Report issued on:	04/07/2023
Samples Analysed:	2 leachate samples - 9 soil samples		


Signed:

Dominika Warjan
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

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: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number	2726458	2726459	2726460	2726461	2726462
Sample Reference	TP101	TP102	TP102	TP104	TP105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.20	0.20	0.80	0.80	1.00
Date Sampled	22/06/2023	22/06/2023	22/06/2023	22/06/2023	22/06/2023
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	16	13
Total mass of sample received	kg	0.001	NONE	0.6	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile & Amosite	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	0.003	-	0.002
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	0.003	-	0.002
Asbestos Analyst ID	N/A	N/A	N/A	PDO	SSZ	SSZ	PDO	SSZ

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.5	7.6	8.9	8.3	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	1.7	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	42000	560	1500	1600	910
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.14	0.047	0.37	0.25	0.061
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	280	94	750	500	120
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	141	46.8	374	249	60.6
Sulphide	mg/kg	1	MCERTS	< 1.0	1.1	24	8.1	4.2
Total Sulphur	mg/kg	50	MCERTS	19000	470	1900	880	520
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.5	3.3	1.9	1.6	1.3

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	0.18	-	0.77	0.12
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.07	-	0.25	0.09
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.66	-	1.8	0.42
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.5	-	1.4	0.28
Phenanthrene	mg/kg	0.05	MCERTS	0.39	6.4	-	12	3
Anthracene	mg/kg	0.05	MCERTS	0.08	1.6	-	2.7	0.71
Fluoranthene	mg/kg	0.05	MCERTS	0.66	10	-	16	5.4
Pyrene	mg/kg	0.05	MCERTS	0.6	9.1	-	15	5.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.26	4.6	-	6.9	2.6
Chrysene	mg/kg	0.05	MCERTS	0.31	4.2	-	6.3	2.2
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.31	4.8	-	8	2.8
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.16	2.3	-	2.2	1.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.19	4.2	-	5.9	2.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.14	1.9	-	3.3	1.1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.67	-	0.6	0.34
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.17	2.4	-	3.6	1.4

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	3.38	53.8	-	86.6	29
-----------------------------	-------	-----	-----------	------	------	---	------	----

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number	2726458	2726459	2726460	2726461	2726462
Sample Reference	TP101	TP102	TP102	TP104	TP105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.20	0.20	0.80	0.80	1.00
Date Sampled	22/06/2023	22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

	mg/kg	1	MCERTS	130	12	15	70	12
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Barium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	0.8
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	28	21	20	21	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	100	58	51	110	130
Lead (aqua regia extractable)	mg/kg	1	MCERTS	560	110	120	260	320
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	3.3	< 0.3	< 0.3	0.5	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	7.9	23	21	22	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	25	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	30	190	120	170	580

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	7.8	< 2.0	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0	4.1	150	5.2	5.4
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	1.6	29	210	32	20
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	10	60	130	78	52
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	11	19	12
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	14	92	510	130	90

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	NONE	-	-	< 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	-	-

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number				2726458	2726459	2726460	2726461	2726462
Sample Reference				TP101	TP102	TP102	TP104	TP105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.20	0.80	0.80	1.00
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
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	-	-
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	NONE	-	-	< 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	ISO 17025	-	-	< 0.2	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Hexachloroethane	mg/kg	0.05	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	-	-	0.37	-	-

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number				2726458	2726459	2726460	2726461	2726462
Sample Reference				TP101	TP102	TP102	TP104	TP105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.20	0.80	0.80	1.00
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
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	-	-	0.6	-	-
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	-	-	1.5	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	< 0.2	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	0.5	-	-
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	-	-	1.4	-	-
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	-	-	6.8	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	2.6	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	0.6	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	< 0.2	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	< 0.3	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	12	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	11	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	< 0.3	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	5.1	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	4.7	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	5.5	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	2.4	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	4.7	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	2.2	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	0.62	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	2.8	-	-

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

Analytical Report Number: 23-41374
 Project / Site name: Kenyon Lane
 Your Order No: 005318

Lab Sample Number				2726463	2726464	2726465	2726466
Sample Reference				TP107	TP108	TP110	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	1.00	2.80	0.20
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	22	14	13	15
Total mass of sample received	kg	0.001	NONE	0.3	0.8	0.3	0.3

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	SSZ	N/A	SSZ

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	8.3	-	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	190	-	520
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	0.011	-	0.096
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	22	-	190
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	10.8	-	95.9
Sulphide	mg/kg	1	MCERTS	-	< 1.0	-	54
Total Sulphur	mg/kg	50	MCERTS	-	210	-	1000
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.6	1	0.3	1

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.33
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.32
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.44	< 0.05	2.5
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.11	< 0.05	0.54
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.75	< 0.05	3.9
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.79	< 0.05	3.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.29	< 0.05	1.7
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.29	< 0.05	1.7
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.28	< 0.05	1.9
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.09	< 0.05	0.72
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.26	< 0.05	1.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.12	< 0.05	0.8
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.22
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.21	< 0.05	0.87

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	3.63	< 0.80	20.3
-----------------------------	-------	-----	-----------	--------	------	--------	------

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number				2726463	2726464	2726465	2726466
Sample Reference				TP107	TP108	TP110	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	1.00	2.80	0.20
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.9	8.8	3.5	9.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	42	-	46	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.68	-	0.31	-
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.5
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	12	-	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	28	11	33
Lead (aqua regia extractable)	mg/kg	1	MCERTS	11	66	17	80
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	24	12	8.1	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	19	-	8	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	58	50	20	170

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 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
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 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
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	14
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	38
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	55

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	NONE	-	-	-	-
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	-	-	-	-

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number				2726463	2726464	2726465	2726466
Sample Reference				TP107	TP108	TP110	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	1.00	2.80	0.20
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
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	-	-	-	-
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	NONE	-	-	-	-
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	ISO 17025	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-
Hexachloroethane	mg/kg	0.05	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	-	-	-	-

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

Lab Sample Number				2726463	2726464	2726465	2726466
Sample Reference				TP107	TP108	TP110	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	1.00	2.80	0.20
Date Sampled				22/06/2023	22/06/2023	22/06/2023	22/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
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	-	-	-	-
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



Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane
Your Order No: 005318

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
2726460	TP102	0.80	133	Loose Fibres	Chrysotile & Amosite	0.003	0.003
2726462	TP105	1.00	148	Loose Fibres	Chrysotile	0.002	0.002

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

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane

Your Order No: 005318

Lab Sample Number	2726467	2726468
Sample Reference	TP105	TP108
Sample Number	None Supplied	None Supplied
Depth (m)	1.00	1.00
Date Sampled	22/06/2023	22/06/2023
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	8.4	8.4
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	6.4	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	1	1.8
----------------------------	------	---	-----------	---	-----

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	0.51	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	0.35	< 0.01
Fluorene	µg/l	0.01	ISO 17025	0.2	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	0.29	< 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	1.4	< 0.2
-------------------	------	-----	------	-----	-------

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0	2.1
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	3.3	1.1
Copper (dissolved)	µg/l	0.7	ISO 17025	7.3	5
Lead (dissolved)	µg/l	1	ISO 17025	6.3	2.3
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.1	0.8
Selenium (dissolved)	µg/l	4	ISO 17025	5.4	5.4
Zinc (dissolved)	µg/l	0.4	ISO 17025	7.7	3.5

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10

Analytical Report Number: 23-41374
Project / Site name: Kenyon Lane

Your Order No: 005318

Lab Sample Number	2726467	2726468
Sample Reference	TP105	TP108
Sample Number	None Supplied	None Supplied
Depth (m)	1.00	1.00
Date Sampled	22/06/2023	22/06/2023
Time Taken	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection
		Accreditation Status

Petroleum Hydrocarbons

TPH1 (C10 - C40) _{EH, ID, TOTAL, MS}	µg/l	10	NONE	< 10	< 10
---	------	----	------	------	------

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

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

Analytical Report Number : 23-41374

Project / Site name: Kenyon Lane

* 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 *
2726458	TP101	None Supplied	1.2	Brown gravelly clay with clinker
2726459	TP102	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
2726460	TP102	None Supplied	0.8	Brown loam and clay with rubble and brick.
2726461	TP104	None Supplied	0.8	Brown loam and clay with gravel and vegetation.
2726462	TP105	None Supplied	1	Brown loam and clay with gravel and vegetation.
2726463	TP107	None Supplied	3	Brown clay and sand.
2726464	TP108	None Supplied	1	Brown sandy clay with gravel and brick.
2726465	TP110	None Supplied	2.8	Brown sandy clay with gravel.
2726466	WS106	None Supplied	0.2	Brown clay and sand with gravel and vegetation.

Analytical Report Number : 23-41374

Project / Site name: Kenyon Lane

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 soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with 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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
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

Analytical Report Number : 23-41374

Project / Site name: Kenyon Lane

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
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
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

Analytical Report Number : 23-41374
Project / Site name: Kenyon Lane

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 (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 gravimetrically 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
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

##Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

APPENDIX VII

ORIGIN OF TIER 2 GENERIC ASSESSMENT CRITERIA

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



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS

TEST REPORT

Client e3p

Address Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

Contract Kenyon Lane

Job Number MRN 4588/80

Date of Issue 27 July 2023

Page 1 of 7

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.
- 5 The results included within the report are representative of the samples submitted for analysis.
- 6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

Murray Rix is the trading name of Murray Rix (Northern) Limited. Registered in England 2878361

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD

PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

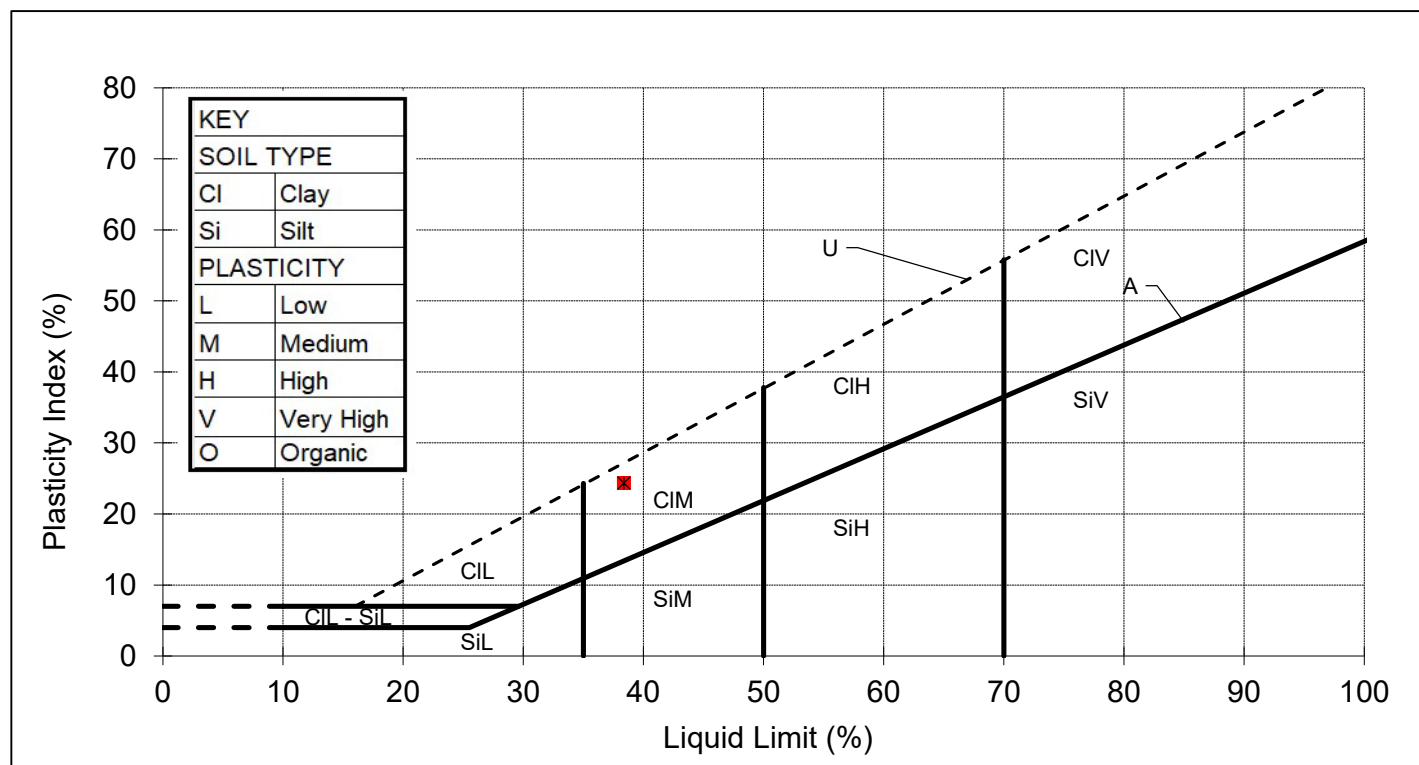
CLIENT	e3p
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	WS103 2	DATE SAMPLED	Not advised
SAMPLE No.	127963	DATE RECEIVED	04-Jul-23
DATE TESTED	10-Jul-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	18.9	37.6	1.016	
Determination 2 (avg)	19.0	37.9		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17.9	38	14	24	79



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

27-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD

PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

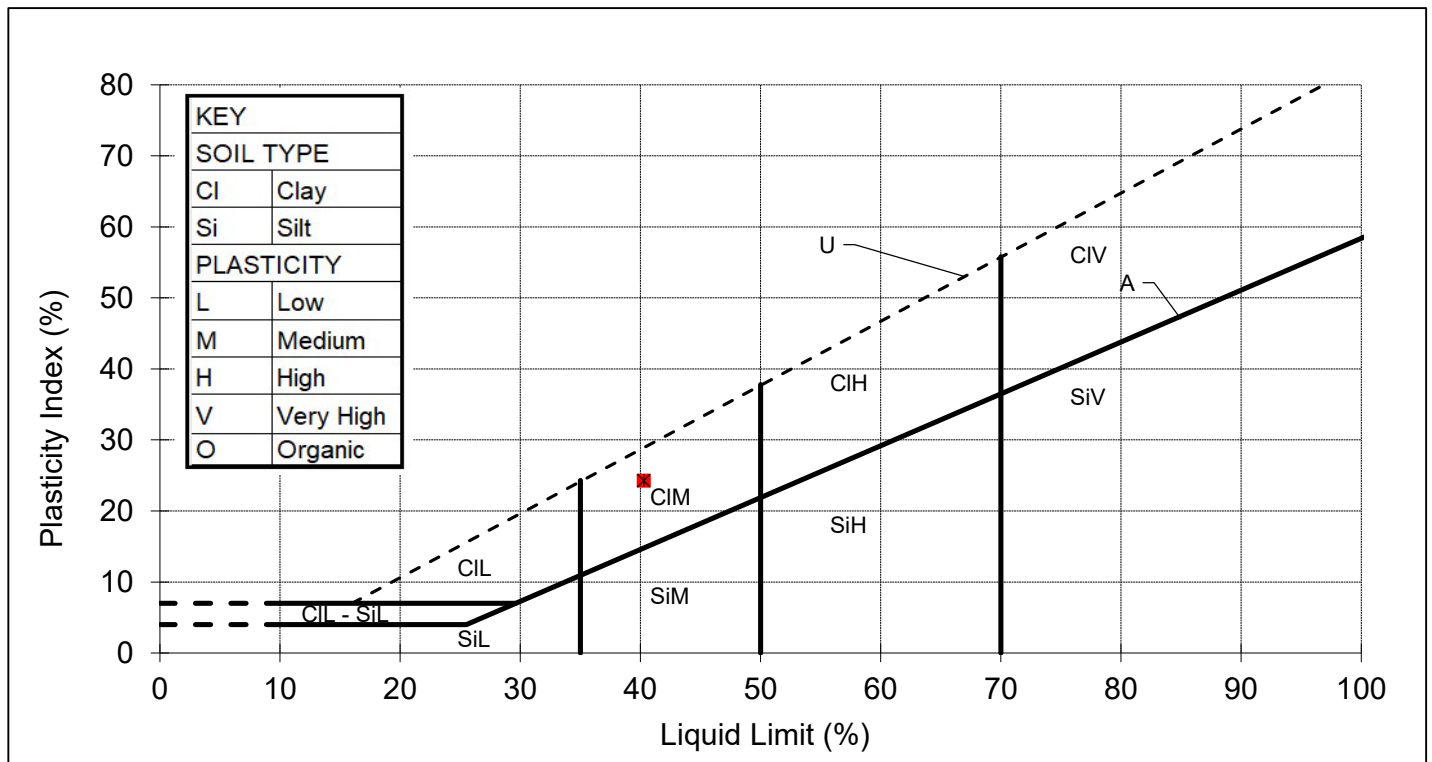
CLIENT	e3p
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	WS103 3	DATE SAMPLED	Not advised
SAMPLE No.	127964	DATE RECEIVED	04-Jul-23
DATE TESTED	10-Jul-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	19.4	39.8	1.012	
Determination 2 (avg)	19.4	39.8		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
18.8	40	16	24	68



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

27-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD

PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

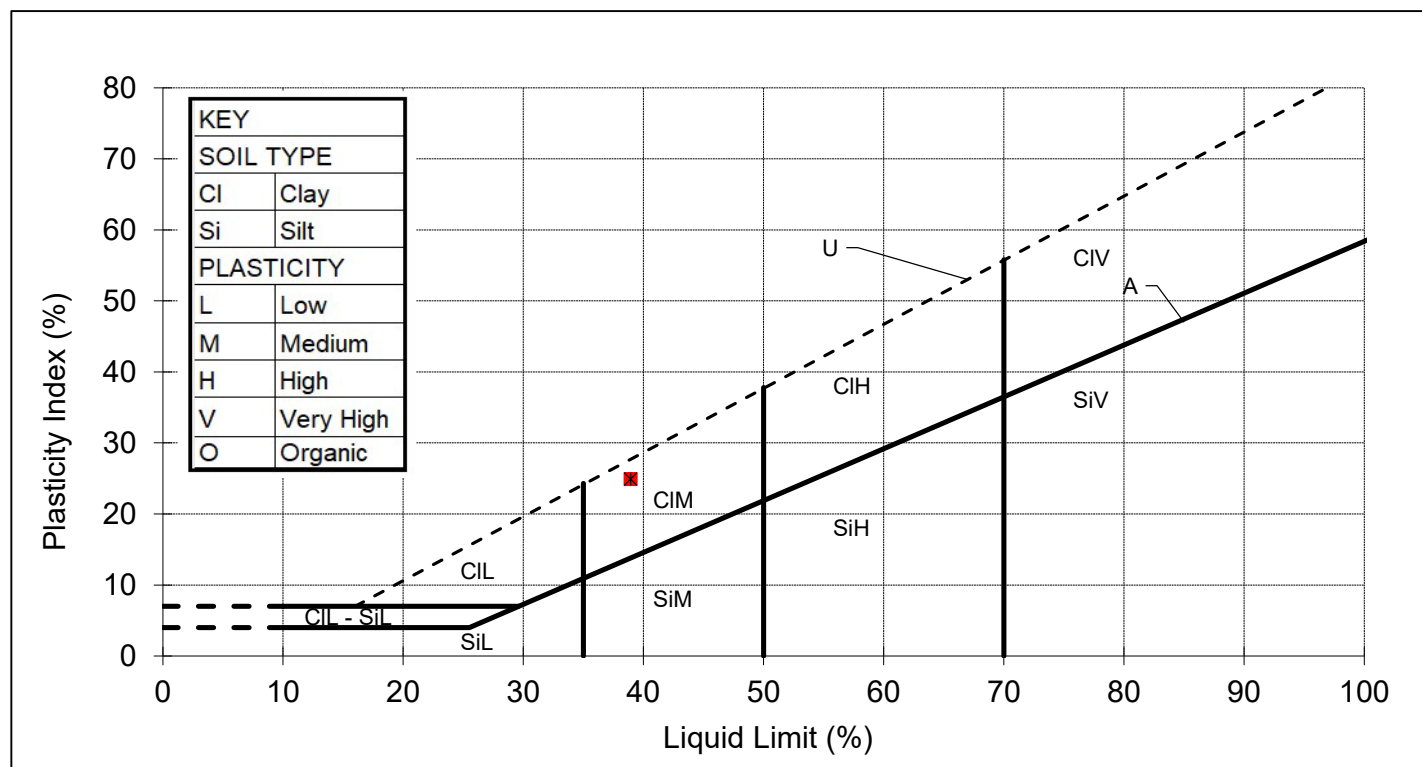
CLIENT	e3p
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	WS106 2	DATE SAMPLED	Not advised
SAMPLE No.	127968	DATE RECEIVED	04-Jul-23
DATE TESTED	10-Jul-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	19.0	38.2	1.018	
Determination 2 (avg)	19.2	38.3		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
19.1	39	14	25	78



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

27-Jul-23

TEST CERTIFICATE
PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4:2016

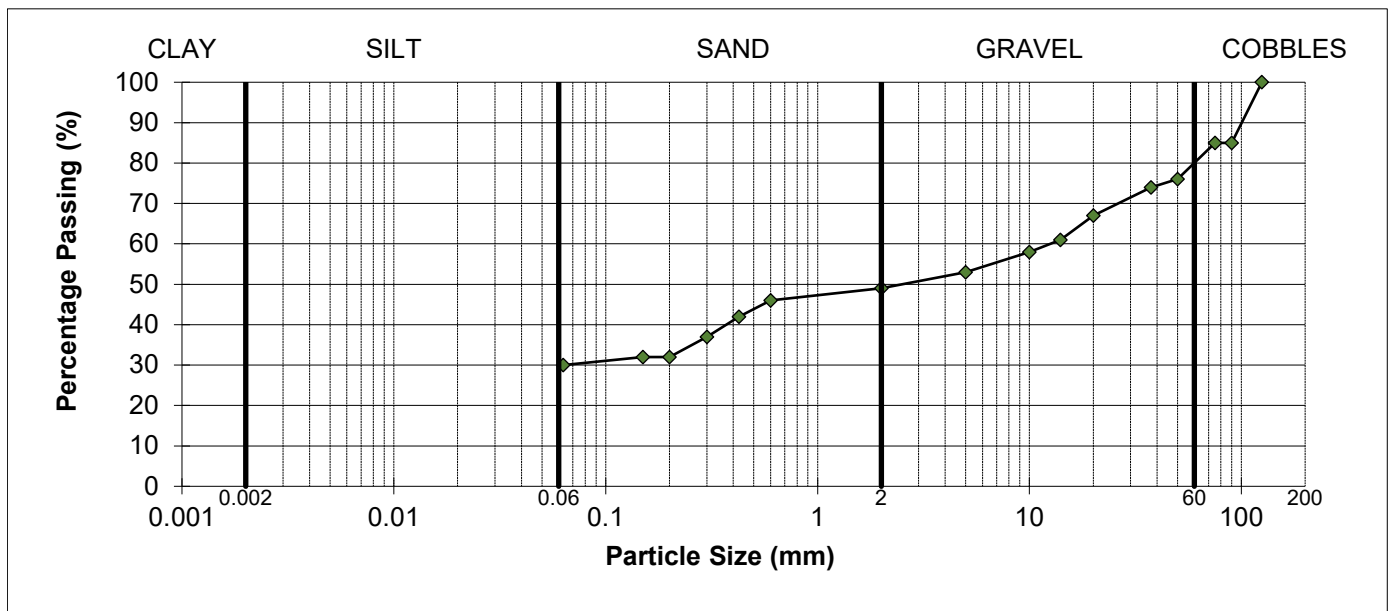
Determination of Water Content in accordance with BS EN ISO 17892-1:2014+A1:2022 (Oven Dry)

CLIENT	e3p
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	TP105 1.5	DATE SAMPLED	Not advised
LAB SAMPLE No	127961	DATE RECEIVED	04-Jul-23
DATE TESTED	01-Jun-19	SAMPLED BY	Client

MATERIAL	Brown clay bound silty SAND & GRAVEL
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		5	53	
90	85		2	49	
75	85		0.6	46	
50	76		0.425	42	
37.5	74		0.3	37	
20	67		0.2	32	
14	61		0.15	32	
10	58		0.063	30	



REMARKS

As received water content = 16.8%

SIGNED



NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

27-Jul-23

TEST CERTIFICATE
PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4:2016

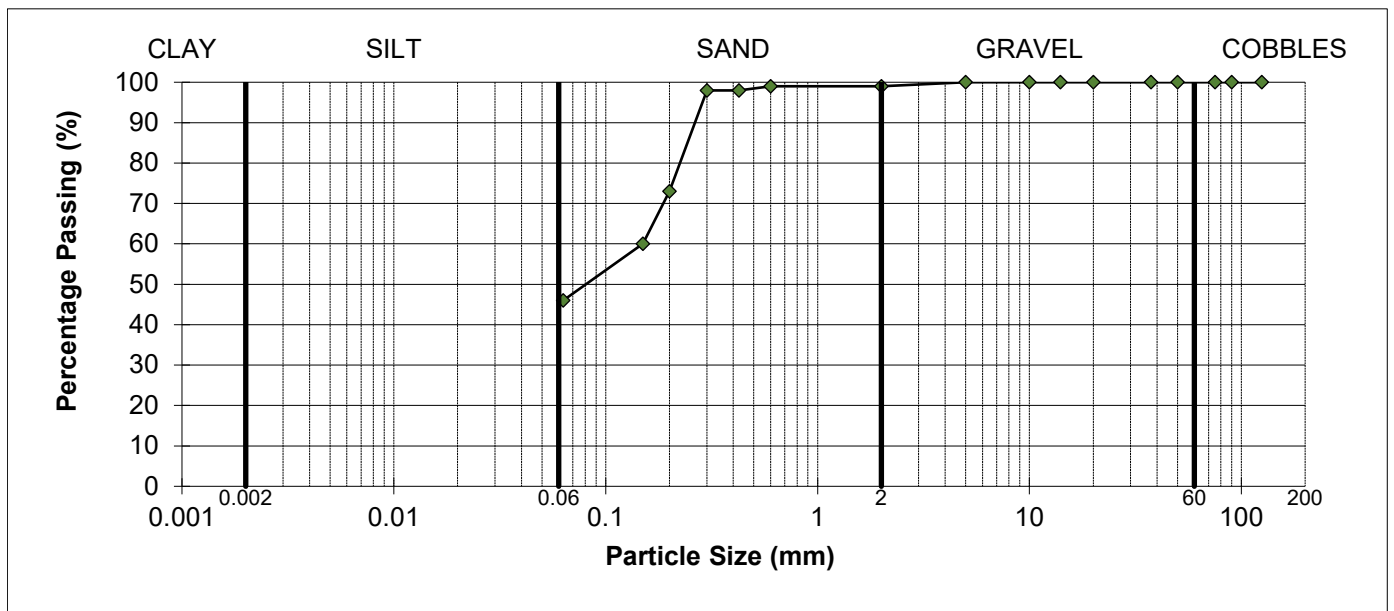
Determination of Water Content in accordance with BS EN ISO 17892-1:2014+A1:2022 (Oven Dry)

CLIENT	e3p
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	TP106 2	DATE SAMPLED	Not advised
LAB SAMPLE No	127962	DATE RECEIVED	04-Jul-23
DATE TESTED	01-Jun-19	SAMPLED BY	Client

MATERIAL	Brown clay bound silty SAND
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		5	100	
90	100		2	99	
75	100		0.6	99	
50	100		0.425	98	
37.5	100		0.3	98	
20	100		0.2	73	
14	100		0.15	60	
10	100		0.063	46	



REMARKS

As received water content = 21.6%

SIGNED



NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

27-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

DRY DENSITY/WATER CONTENT RELATIONSHIP 2.5kg RAMMER

BS 1377-2:2022 Cl.11

PARTICLE DENSITY METHOD BS 1377-2:2022 Cl.9.2

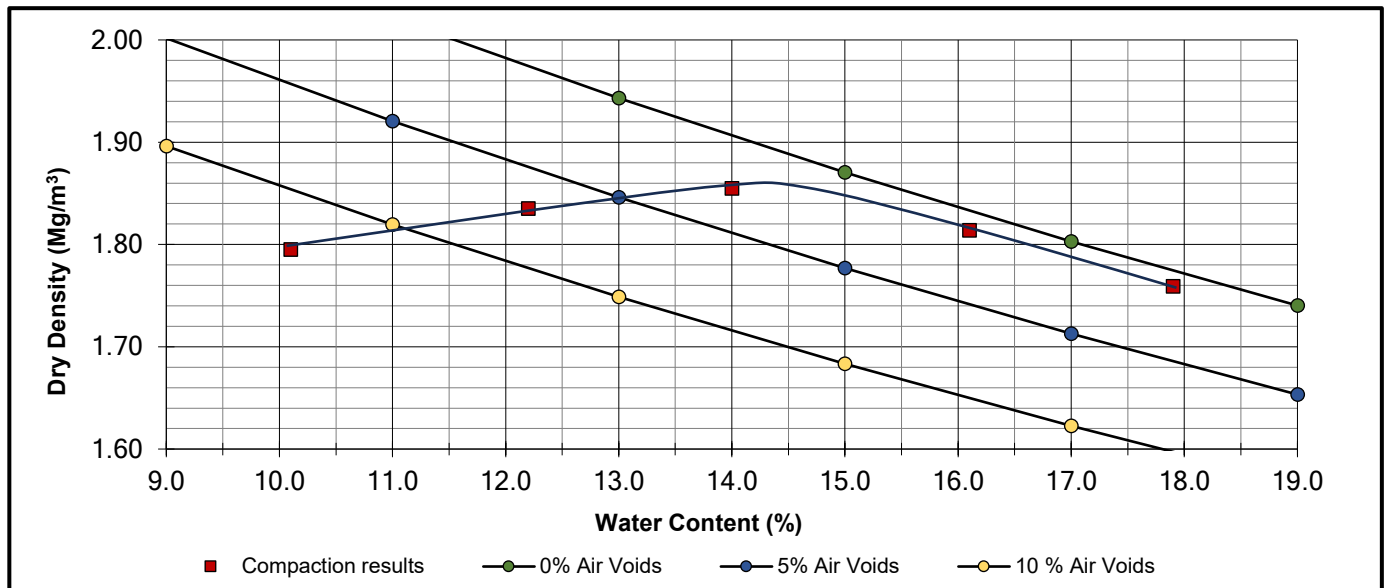
CLIENT	E3P
SITE	Kenyon Lane
JOB NUMBER	MRN 4588/80

SAMPLE LABEL	TP105 15	DATE SAMPLED	05-May-23
SAMPLE NUMBER	127962	DATE RECEIVED	05-May-23
DATE TESTED	12-Jul-23	SAMPLED BY	

MATERIAL	Brown clay bound silty SAND & GRAVEL
ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried / Separate Batches

RETAINED 37.5mm	26 %	GRADING ZONE	Zone X
RETAINED 20mm	33 %	PARTICLE DENSITY	2.60 Mg/m ³ (Assumed)

POINT NUMBER	WATER CONTENT (%)	DRY DENSITY (Mg/m ³)
1	10.1	1.795
2	12.2	1.835
3	14.0	1.855
4	16.1	1.814
5	17.9	1.759



OPTIMUM WATER CONTENT	14 (%)
MAXIMUM DRY DENSITY	1.86 (Mg/m ³)

REMARKS

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

SIGNED

DATE 27-Jul-23

