

Phase II Geoenvironmental Site Assessment

Site: Grey Mare Lane – Site 1

Reference: 16-908-R2-1

Date: June 24





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QUALITY ASSURANCE

Report Reference

16-908-R2

REV REF:	DESCRIPTION	AUTHOR	CHECKED	AUTHORISED	DATE
R1-1	First issue	LCC	EF	AS	05.06.2024
R1-2					

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EXECUTIVE SUMMARY

Site Address	Land off Grey Mare Lane, Beswick, Manchester, M11 3TF.
Grid Reference	E 386954, N 398294.
Site Area	0.47 Ha.
Proposed Development	E3P understands that Shape Consulting Engineers Limited are involved with the proposed construction of a 3–5 storey mid-rise residential development comprising a total of 51 apartments with associated communal areas, cycle store, landscaping and parking courtyard.
Current Site Use	The northern part of the site is currently covered with grass soft standing with a line of mature trees along the northern boundary. The southern portion of the site is currently unoccupied and covered in asphalt hardstanding. The central portion of the site was historically occupied by a former public house however since its demolition, the area has been left as concrete hardstanding. An area of the central section is currently used as car parking for local residents with street lighting. Curbs and street furniture are prevalent through this area along highway access to the former pub and car park. There are no structures currently present within the site boundary.
Site History	The site was recorded as residential housing in the north and south with an additional large building in the centre noted as ‘nurses home’. In circa 1930 residential housing in the west of the site was redeveloped into a Picture Theatre continuing off-site. The Nurses Home was fully redeveloped pre-1977 to construct the club (recently demolished). All buildings were demolished circa 2019 and the site has remained vacant since then.

ENVIRONMENTAL SETTING

Geology	Drift Geology	Glacial Till, Devensian – Diamicton.
	Bedrock Geology	Pennine Upper Coal Measures Formation – MUDSTONE, SANDSTONE and SILTSTONE.
	Faults	There are no recorded faults within 500.. Outcropping Coal seams are noted 44m north of the site and are noted as linear features.
Geomorphology	A review of relevant records indicates that the site has not been subject to significant anthropogenic changes with the current site topography broadly representing natural landform. From the main highway at the north of the site, the grassed area generally falls towards the site – the remainder has been largely regraded from previous development phases.	
Hydrogeology	A Secondary (undifferentiated) Aquifer has been recorded in the drift geology with a Secondary A Aquifer in the bedrock geology.	
	No groundwater abstractions are located within 500 m of the site.	



Hydrology	There are no surface water features within 250m of the subject site.
	The site is located within Flood Zone 1 - no risk of flooding.
Utility Locations	A formal drainage survey has not been completed; however, manholes were noted along the northern and eastern boundaries of the site. Additionally, the south of the site was previously used as a Public House and therefore it is assumed any drainage, sewers or services present will be in the south. A surface water sewer runs in a north-south direction through the east of the site, and a combined public sewer runs south-north through the north-west of the site. Both low voltage electricity and low pressure gas mains are recorded along the boundaries of the site, contained within Ashton New Road and Grey Mare Lane.
Landfill Sites and Waste Sites	No landfill sites (current or historic) are located within 250m of the site.
Radon	Radon Class 4 - 5-10% of homes are estimated to be at or above the Action Level. Basic radon protection measures are required.
Unexploded Ordnance	Moderate risk UXO area - recommendation for a desk-based UXO study to be undertaken.
PFAS	Significant sources of PFAS are unlikely given the sites previous uses.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.

PREVIOUS REPORTS

The following previous reports have been completed for the site:

- ✿ E3P – 16-908-R1 – Grey Mare Lane – Site 1 – Phase I GSA – June 2023.

A review of the attached report is summarised in Section 2.

E3P GROUND INVESTIGATION

Ground Works	Investigation	E3P has completed an intrusive ground investigation comprising: ✿ 3 x mechanically excavated trial pits, ✿ 6 x window sample boreholes, ✿ 3 x Environmental monitoring well installs; and ✿ 3 x Rotary open holes.
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Ground Conditions

Made Ground – 0.00 m bgl to 1.30 m bgl

Made Ground deposits were encountered within all exploratory hole locations to depths ranging between 0.50 m and 1.30 m bgl although, in general, Made Ground was encountered to a depth of less than 0.80 m bgl.

The Made Ground deposits comprise asphalt in the eastern sector underlain by sandy gravel and gravelly clay with fragments of brick, concrete, timber, plastic, slag and clinker.

Made Ground deposits across the majority of the site consist of a reworked topsoil of dark brown, clay with fragments of brick; this is underlain by dark greyish brown mottled black gravelly sand or gravelly clay with fragments of clinker, slag, coal and brick.

Concrete was encountered in RB101 and RB102 in the eastern sector of the site.

Drift – 0.50 m bgl to 15.10 m bgl

Drift deposits were encountered within all of the exploratory locations, generally comprising a stiff to very stiff, medium strength to very high strength, brown mottled grey CLAY with gravel of sandstone, mudstone and coal.

In RB101–RB103 the CLAY is locally interbedded with dense, brown fine to coarse SAND with gravel of sandstone and mudstone.

Ground Conditions cont.

Solid – 15.10 m bgl to 30.00 m bgl

The solid bedrock geology was encountered between 15.10 m and 16.10 m bgl, to a termination depth of 30.00m bgl.

The solid geology comprises grey to dark grey MUDSTONE interbedded with occasional beds of brownish grey sandstone. In RB103, in the western sector, the MUDSTONE is underlain by grey SANDSTONE with occasional bands of grey mudstone.

Groundwater – 0.60 m bgl

One groundwater strike was encountered as perched water within the Made Ground deposits in WS102 during the ground investigation.

Groundwater was encountered during the ground gas monitoring regime within two wells (WS101 and WS106), this was encountered between 1.17m bgl and 1.89m bgl within WS101 and between 1.24m bgl and 2.35m bgl in WS106. WS104 was noted to be dry.



CONTAMINATED LAND ASSESSMENT

Human Health	The results of a direct comparison of residential with plant uptake general acceptance criteria (GAC) indicates that exceedances of lead compounds were identified site wide in TP101, TP102, TP103, WS102, and WS105. Furthermore, an exceedance of mercury and arsenic were identified in the Made Ground deposits of TP103 and WS104 respectively. Additionally, multiple exceedances against GAC for low solubility PAHs within the Made Ground deposits across the site. The majority of identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils (PL2) and consumption of homegrown vegetables (PL1). The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the use of PPE for groundworkers, with the potential pathway severed for future end-users as no private gardens, or areas for homegrown vegetables are included within the proposed development. Elevated mercury has been identified within one area of the site (TP103, within shallow soils), these present a potential volatilisation to indoor air risk, and is therefore considered to be a localised hotspot. Therefore, 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.
Controlled Waters	The site is not considered to pose an unacceptable level of risk to controlled waters.
Ground Gas	Initial gas monitoring data suggests the site can be classified as CS1; however this needs to be confirmed following receipt of full ground gas monitoring. Radon measures will be required for the construction of proposed development as the site is classified within an areas where greater than 10% of properties are at or above the Action Level.
Potable Infrastructure Water	Based on the assessment of current site conditions it is likely that Polyethene (PE) pipe could be utilised at the proposed development following remedial works. This will need to be confirmed following the completion of a UKWIR risk assessment as post-remediation and enabling works ground conditions may differ from those identified during this site investigation.



COAL MINING ASSESSMENT

Preliminary Assessment	The Coal Authority (CA) search indicated the site is in an area that may be affected by ground instability attributed to coal mining. The site is located in a development high risk area. There are no mine entries located on site however one is situated 25m northeast of the site. The mine entry is known to be in association with the Bradford Colliery which is situated approximately 20m northeast of the site. Known workings have been recorded 114m bgl under the site. It is likely that the site may be influenced by unrecorded worked seams at a shallow depth given the position of shafts and outcrops in the area, putting the site at high risk from coal mining related land instability. Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within the site boundary. The Coal Authority, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on-site and to understand the nature of any coal workings.
Coal Mining Ground Investigation	Three exploratory rotary boreholes were drilled in accordance with the Coal Authority Permit identified bedrock at depths from 15.10 m and 30.00 m bgl. No evidence of viable coal seams was encountered during the investigation, with no voids, broken ground or loss of flush recorded that would typically be indicative of shallow workings.
Coal Mining Assessment	Based on the guidance provided in CIRIA 758, E3P has determined that shallow mine workings are unlikely to be found on site, due to the absence of any coal fragments or identified voids. The assessment also indicates that there is sufficient rock cover to void ratio to mitigate potential cavitation and subsidence based on an extraction thickness of 1.30m in the inferred shallow seams.
Recommendations	Based on the above information, the presence of sufficient rock cover and overlying stiff cohesive soils, it is considered the overall risk of historical coal mining on-site is unlikely to pose a hazard for the proposed development on account of the absence of shallow workings.



GEOTECHNICAL ASSESSMENT

Underground Obstructions & Subterranean hazards	Across the site, notable concrete obstructions have been discovered within the Made Ground. These findings suggest the presence of remnants from previous buildings. As part of the process of creating a suitable platform for development, all subterranean obstructions will need to be excavated and removed beneath new structures and infrastructure. This will facilitate the construction of the proposed plots with a piled foundation solution as intended.
Allowable Capacity Bearing	The underlying natural clay drift deposits have been evaluated and found to be of stiff, medium strength to very stiff high strength CLAY, with an ABC in excess of 130 kN/m² at an approximate depth of 1 meter below ground level (bgl). This net bearing pressure increases to a range of 155.46–452.37 kN/m² at around 2 meters bgl, becoming very stiff, very high strength CLAY.
Foundation Options	As the proposed development consists of three–five storey apartment block housing, an assessment of foundation options has been appraised based on confirmed soil mechanics, cost, and construction feasibility. In this instance, it is thought that the following foundation options for mid-rise housing:  Piled foundations bearing upon the stiff to very stiff clay. Within the site, there are areas of variable ground conditions and the ABC <150 kN/m² at 1.00m bgl that will preclude the use of a shallow spread foundation. Consideration could also be given to the use of Ground Improvement by Vibro Stone Column to ensure the treatment achieves a suitable design ABC to support a doubly reinforced strip foundation subject to proposed loadings.
Foundations Near Trees	Foundation depths within the conjectured influence of former, existing or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content.
Heave Precautions Near Trees	Given that the underlying clay is of low to medium volume change potential, heave precautions will not be required to the internal face of a foundation less than 1.5 m in depth. Heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) and pile ground beams are required within the modelled influencing distance of trees.
Building Floor Slabs	A ground bearing slab will be viable, but it will need to be constructed on a granular sub-base with the thickness designed by a structural engineer to ensure that settlement tolerance is taken into consideration.
Soakaway Drainage	Soakaways unlikely to be effective due to the presence of cohesive CLAY deposits across the majority of the site.



Sulphate Assessment	Concrete classification has been assessed within DS-1, AC-1s. All concrete design should be in accordance with this classification.
Highway Infrastructure Construction &	Where a proposed highway or infrastructure is to be constructed, remediation works will be required to ensure the site is engineered to a suitable geotechnical design specification.
CBR Design %	Granular soils can be re-engineered to ensure 5% within the subgrade during favourable climatic conditions. 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.
Enabling Earthworks	Development levels are unknown at this time; however, significant cut-and-fill works will be required to prepare the development platform. As part of the earthworks design, materials should be assessed and characterised prior to re-use in the construction of upfill to a geotechnical design. All future earthworks should be completed in accordance with a Geotechnical Design Report (GDR) that will consider the ground model within the context of the potential for settlement induced by surcharge from earthworks, dynamic and permanent loading of the development and all known hazards.
Civil Engineering Excavations	The E3P Intrusive Ground Investigation has not identified the presence of weathered/competent bedrock at a shallow depth.
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> . This can be done upon request and in line with the Environment Agency sampling frequencies.

RECOMMENDATIONS

Based on the findings of the Geoenvironmental site assessment and the various conclusions drawn, the following additional works are recommended to be completed in due course:

- ✿ Foundations to be designed by suitably qualified structural engineer upon receipt of layout.
- ✿ Arboricultural Survey.
- ✿ Remediation Strategy.
- ✿ Geotechnical Design Report (GDR).
- ✿ Geotechnical Earthworks Strategy (Infrastructure).



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16-908-R1-003 - Historical Features Plan
16-908-R1-004 - Site Features Plan
16-908-R1-005 - Exploratory Hole Location Plan
16-908-R1-006 - Depth of Made Ground Plan
16-908-R1-011 - Coal Mining Issues Plan
16-908-R1-012 - Depth to Bedrock Plan



1. INTRODUCTION

1.1. BACKGROUND

Shape Consulting Engineers Limited (the client) commissioned E3P to undertake a Phase II Geoenvironmental Site Assessment at the land off Grey Mare Lane, Beswick, Manchester, M11 3TF.; herein referred to as the site.

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

1.2. PROPOSED DEVELOPMENT

E3P understands that Shape Consulting Engineers Limited are involved with the proposed redevelopment, consisting of a 3–5 storey residential apartment block comprising a total of 51 apartments with associated communal areas, cycle store, landscaping and parking courtyard.

A snapshot of the Proposed Development Layout is indicated in Figure 1 below and Drawing 16-908-002 (APPENDIX IV)

Figure 1 Snapshot of Proposed Development





1.3. OBJECTIVES AND SCOPE

The objectives of the geoenvironmental investigation are as follows:

- ✳ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available to complete a desk study in line with Environment Agency (EA) document Land Contamination: Risk Management (LCRM) (updated June 2023).
- ✳ Undertake a phase of sampling and analysis to provide an overview of the environmental issues identified.
- ✳ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site concerning the site's future use and off-site receptors.
- ✳ Assess the geotechnical information and provide recommendations concerning foundations, pavement construction and floor slabs.
- ✳ Assess the coal mining-related information and provide recommendations regarding any future treatment; and,
- ✳ Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of works includes the elements included in Table 1.

Table 1 Scope of Works

GROUND INVESTIGATION
✳ Design of suitable ground investigation ✳ Window sample probeholes with the construction of environmental monitoring installations ✳ Mechanically excavated trial pits ✳ Soil and groundwater sampling ✳ Rotary boreholes
TESTING AND MONITORING
✳ In-situ geotechnical testing ✳ Chemical and geotechnical analysis ✳ Groundwater monitoring ✳ Ground gas monitoring
ASSESSMENT AND REPORTING
✳ Factual and interpretative reporting ✳ Contamination risk assessment and conceptual site model ✳ Geotechnical assessment and interpretation



1.5. LIMITATIONS

The limitations of this report are presented in APPENDIX I.

1.6. RISK CLASSIFICATION

The description of risk classification and the likely action required as set out in CIRIA C552 are included in APPENDIX III.

1.7. 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 report's contents, written approval must be sought from E3P; a charge may be levied against such consent.



2. E3P GROUND INVESTIGATION

2.1. PHASE I DESK STUDY SUMMARY

The following Phase 1 desk study was undertaken by E3P, the pertinent points are summarised below (Ref: E3P – 16-908-R1 – Grey Mare Lane – Site 1 – Phase I GSA – June 2023).

- ✳ The northern part of the site is currently covered with grass soft standing with a line of mature trees along the northern boundary. The southern portion of the site is currently unoccupied and covered in asphalt hardstanding. The central portion of the site used to contain the former public house however since its demolition to slab level, the area has been left as concrete hardstanding. An area of the central section is currently used as car parking for local residents. Curbs and street furniture are prevalent through this area along highway access to the former pub and car park.
- ✳ There are no structures currently present within the site boundary.
- ✳ The site was recorded as residential housing in the north and south with an additional large building in the centre noted as 'nurses home'. In circa 1930 residential housing in the west of the site was redeveloped into a Picture Theatre continuing off-site. The Nurses Home was fully redeveloped pre-1977 to construct the club (recently demolished). All buildings were demolished circa 2019 and the site has remained vacant since then.
- ✳ The site is underlain by Glacial Till and the Pennine Middle Coal Measures Formation of MUDSTONE, SANDSTONE and SILTSTONE. The drift deposits are classified as a secondary undifferentiated aquifer, with the bedrock being a secondary A aquifer.
- ✳ The nearest fault is located circa 650m east of the site recorded at rockhead between two geological stratum. Outcropping Coal seams are noted 44m north of the site and are noted as linear features.
- ✳ No landfill sites (current or historic) are located within 250 m of the site.
- ✳ Due to the previously developed nature of the site, it is likely that Made Ground deposits will underlie the site throughout, mainly associated with residential housing and the Public House. However, the picture theatre through the 1930's may have potential contaminants present similar to those of photographic processing industry. The DOE industry profiles suggest where this is the case, modern photographic materials are coated with gelatine layers containing silver halide salts including Silver Chloride, Silver Bromide and Silver Iodide. During exposure to light some of the chemicals included in the process reduce to silver and bromine or chlorine gas.
- ✳ Volatile contamination may be present within the Made Ground deposits associated with previous on-site development as identified in human health section. The presence of impermeable clay soil deposits may reduce the leachate produced from contaminated soils, and therefore reduce the impact to groundwater. Based on the presence of the underlying Secondary A Aquifer, risk to controlled waters is considered to be moderate. Though the risk to surface water features is considered low due to their distance from site.



- ✦ Infilled features are not anticipated to be encountered on site, and as such, limits the potential for ground gas. However, shallow Made Ground is anticipated on site and has the potential to produce hazardous ground gases such as methane and carbon dioxide in low levels. Given the site's location within a coal mining area there is a potential for mine related gases at the site, though currently there are no reports of significant emissions. Furthermore, based on the site's history there is a potential for bromine or chlorine gasses at very low levels that might occur as VOC, detectable during gas monitoring.
- ✦ The site is located in a development high risk area. There are no mine entries located on site however one is situated 25m north east of the site. The mine entry is known to be in association with the Bradford Colliery which is situated approximately 20m north east of the site. Known workings have been recorded 114m bgl under the site. It is likely that the site may be influenced by worked seams at a shallow depth given the position of shafts and outcrops in the area, putting the site at high risk from coal mining related land instability.

2.2. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources summarised in Section 4.0.

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

Exploratory fieldwork was completed between 21st February 2024 and 23rd February 2024. The works are summarised in Table 2.

2.3. SCOPE OF INVESTIGATION

A summary of the fieldwork completed are included in Table 2.

Table 2 Summary of Fieldwork

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (M BGL)	MONITORING WELLS RESPONSE ZONE (M BGL)
General Ground Conditions Including the Presence/Nature of Obstructions	TP103	Mechanically Excavated Trial Pit	1.70	N/A
	WS103	Window Sample Probehole	3.44	N/A
	WS104		3.43	0.50–1.00
	WS106		3.45	1.00–3.00
Former Buildings	WS101	Window Sample Probehole	3.13	1.00–2.70
	WS102		3.23	N/A
	WS105		3.44	N/A
	TP101	Mechanically Excavated Trial Pit	2.00	N/A
	TP102		1.90	N/A



POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (M BGL)	MONITORING WELLS RESPONSE ZONE (M BGL)
Former Coal Workings	RB101	Rotary Borehole	30.00	N/A
	RB102		30.00	
	RB103		30.00	

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



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

The series of rotary boreholes were advanced to investigate the potential presence of shallow mine workings. These boreholes were drilled in accordance with the CA permissions process and industry best practices.

The sampling locations are illustrated in Drawing 16-908-005 (APPENDIX IV). The ground conditions encountered are indicated on the logs, which are provided in APPENDIX VII.

The locations were recorded using hand-held GPS and what3words to an accuracy of 3 metres.

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

2.4. 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 VI, presented in Table 21 and discussed in Section 6.0.

2.5. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis, summarised in Table 3.

Table 3 Summary of Laboratory Analysis

CHEMICAL ANALYSIS

-  Metals
-  pH, total sulphate, water-soluble sulphate (2:1 extract)
-  Sulphide
-  Cyanide
-  Phenols
-  Total and speciated polycyclic aromatic hydrocarbons (PAHs)
-  Asbestos identification and quantification
-  Speciated and banded total petroleum hydrocarbons (TPHs)
-  Total Organic Carbon (TOC)

GEOTECHNICAL ANALYSIS

-  Atterberg limits determinations
-  Moisture content
-  Single-stage triaxial tests
-  Optimum Moisture Content
-  Particle size distribution



2.6. STORAGE, PRESERVATION AND TRANSPORT OF SAMPLES

Measures taken to ensure the quality and integrity of the collected samples, from collection to receipt of the samples by the laboratory, are summarised in Table 4.

Table 4 Sample Integrity Information

SUBJECT	CHEMICAL SAMPLING	
	Soil	Groundwater
Storage	Glass jars supplied by the laboratory were used for the collection of soil samples to be analysed for VOCs. Plastic tubs were used to collect soil samples for metals analysis, PFAS testing and asbestos screening.	Glass vials supplied by the laboratory were used for the collection of samples to be analysed for VOCs. Samples to be analysed for lower volatility compounds were stored in laboratory-prepared glass jars. Samples to be tested for PFAS compounds were stored in laboratory-supplied HDPE bottles.
Preservation	Soil and groundwater sample containers were filled to minimise headspace prior to sealing and stored at a low temperature within cool boxes with cooling aids to minimise the loss of volatile contaminants and reduce microbial activity during the collection of samples. Cooling aids that may contain PFAS compounds (such as blue ice) were not utilised to prevent cross-contamination with samples.	
	Soil	Groundwater
Sample Integrity	Dedicated disposable nitrile gloves were worn and changed between sample collections to prevent cross-contamination.	Groundwater samples were collected using dedicated plastic tubing, which was changed between monitoring well locations to prevent cross-contamination.
	Hand tools were decontaminated with PFAS free detergent and rinsed with PFAS free water between sampling events. PFAS free stationary was used to label all samples.	Interface probes were decontaminated with PFAS free detergent and rinsed with PFAS free water between monitoring wells. PFAS free stationary was used to label all samples.
Transport	Samples were stored and shipped in dedicated sample boxes provided by the laboratory. Sample details were recorded on the laboratory chain of custody form enclosed with the samples prior to dispatch. Scheduling information for the samples was confirmed with the laboratory via email.	

Chemical analysis has been undertaken by an accredited laboratory with the testing results summarised and discussed in Section 4 and the testing certificates included in APPENDIX VIII.

Geotechnical samples were collected as required per location immediately after excavation, labelled and sealed to minimise moisture loss. The geotechnical samples were collected and couriered by a dedicated courier to an accredited geotechnical testing laboratory. The testing results are summarised and discussed in Section 6 and the testing certificates included in APPENDIX IX.



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 5.

Table 5 Summary of Strata

HOLE	DEPTH TO STRATUM (M BGL)				
	MADE GROUND	STIFF CLAY	GRAVELLY SAND	MUDSTONE BEDROCK	SANDSTONE BEDROCK
TP101	0.00–1.20	1.20–2.00	–	–	–
TP102	0.00–0.90	0.90–1.90	–	–	–
TP103	0.00–0.80	0.80–1.70	–	–	–
WS101	0.00–0.50	0.50–3.13	–	–	–
WS102	0.00–0.80	0.80–3.23	–	–	–
WS103	0.00–0.65	0.65–3.44	–	–	–
WS104	0.00–1.30	1.30–3.43	–	–	–
WS105	0.00–1.05	1.05–3.44	–	–	–
WS106	0.00–0.70	0.70–3.45	–	–	–
RB101	0.00–0.70	0.70–12.00	12.00–16.10	16.10–24.00 25.40–30.00	24.00–25.40
RB102	0.00–0.80	0.80–12.00 12.80–15.50	12.00–12.80	15.50–23.40 27.20–30.00	23.40–27.20
RB103	0.00–0.60	0.60–15.10	–	15.10–25.50	25.50–30.00

3.2. MADE GROUND

Made Ground deposits were encountered within all exploratory hole locations from ground level to a proven depth of 1.30m bgl although, in general, Made Ground was encountered to a depth of less than 0.80 m bgl.

Made Ground deposits typically comprising asphalt in the upper 0.10m bgl in the eastern sector. This hardstand was generally underlain by sandy gravel and gravelly clay with fragments of brick, concrete, timber, plastic, slag and clinker from depths of 0.10m to 0.80m bgl.

Made Ground deposits across the majority of the site consist of a reworked topsoil of dark brown, clay with fragments of brick; this is underlain by dark greyish brown mottled black gravelly sand or gravelly clay with fragments of clinker, slag, coal and brick.

Concrete was encountered in RB101 and RB102 in the eastern sector of the site.

A Depth of Made Ground Plan is presented as Drawing 16-908-006 in APPENDIX IV.



3.3. DRIFT DEPOSITS

Drift deposits were encountered within all of the exploratory locations. The drift deposits generally comprised a stiff to very stiff, medium strength to very high strength, brown mottled grey CLAY with gravel of sandstone, mudstone and coal.

In RB101, RB102, and RB103 the CLAY is locally interbedded with dense, brown fine to coarse SAND with gravel of sandstone and mudstone.

3.4. SOLID GEOLOGY

The solid bedrock geology was encountered between 15.10 m and 16.10m bgl to a termination depth of 30.00 m bgl.

The solid geology comprises grey to dark grey MUDSTONE interbedded with occasional beds of brownish grey sandstone. In RB103, in the western sector, the MUDSTONE is underlain by grey SANDSTONE with occasional bands of grey mudstone.

3.5. GROUNDWATER

One groundwater strike was encountered in WS102. The depth of the water strike is shown on the exploratory hole records in APPENDIX VII and is summarised in Table 6.

Table 6 Summary of Groundwater Strikes

LOCATION	DEPTH TO STRIKE (M)	NOTES
WS102	0.60	Made Ground – perched

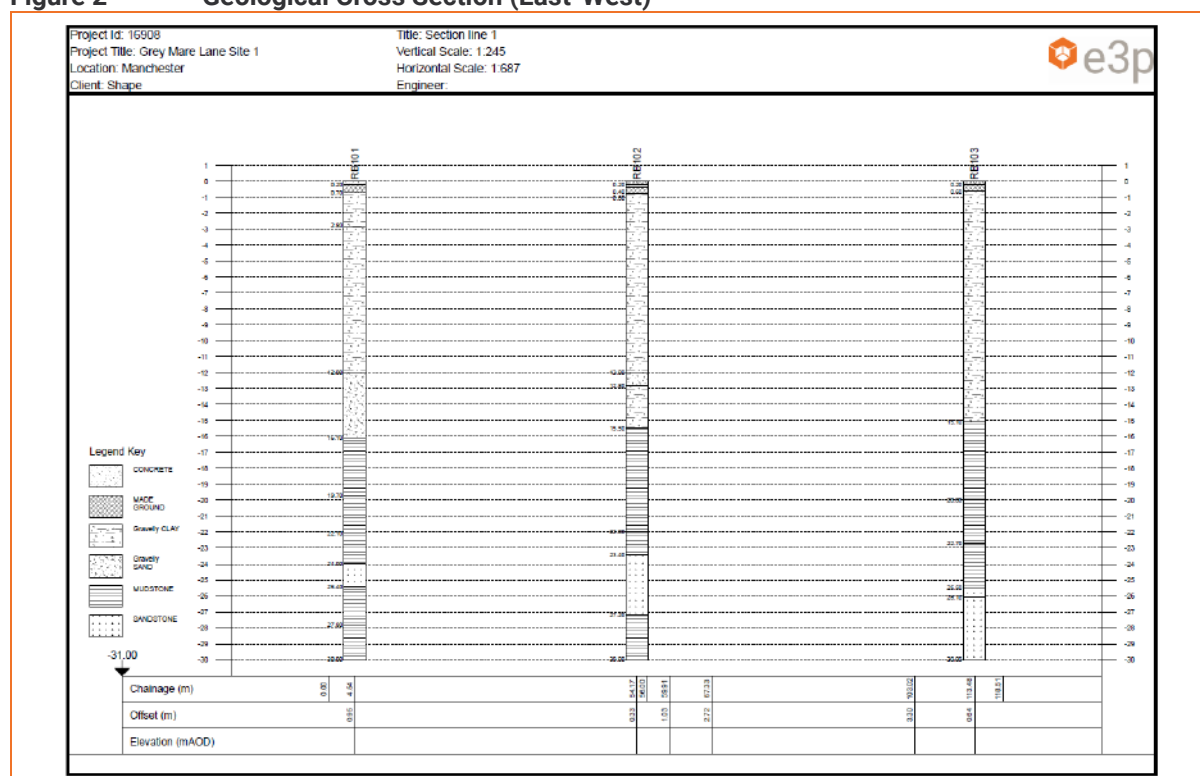
Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free-phase hydrocarbon product, if present. These results are summarised in Table 14.

3.6. GEOLOGICAL CROSS SECTION

A geological cross section is included in APPENDIX IV as Drawing 16-908-016, and a snapshot is shown below in Figure 2.



Figure 2 Geological Cross Section (East-West)



3.7. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation and these are summarised in Table 7.

Table 7 Summary of Visual and Olfactory Evidence of Contamination

LOCATION	DEPTH (M)	STRATUM	NOTES
TP101	0.20	Made Ground	Clinker
TP102	0.20	Made Ground	Clinker and slag
TP103	0.20	Made Ground	Clinker and slag
WS101	0.20	Made Ground	Clinker and slag
WS102	0.20	Made Ground	Clinker and slag
WS103	0.10	Made Ground	Clinker and slag
WS104	0.10	Made Ground	Clinker and slag
WS105	0.20	Made Ground	Clinker and slag
WS106	0.20	Made Ground	Clinker and slag

3.8. OBSTRUCTIONS

No obstructions were identified during the course of the intrusive investigation. However it cannot be discounted that obstructions are not present in areas where investigation was not undertaken.



4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 2 qualitative land risk assessment with respect to human health, controlled waters and ground gas to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. SAMPLE ANALYSIS POPULATION

Table 8 summarises the chemical analysis testing scheduled.

Table 8 Summary of Testing Schedule

TYPE OF SAMPLE	NO. OF SAMPLES	DETERMINANDS
Made Ground	8	Speciated PAH.
	8	pH, total metals, asbestos ID, TOC.
	8	Speciated TPH.
	2	Leachable metals.
Natural CLAY	4	Speciated PAH.
	4	Speciated TPH.
	4	TOC, pH, total metals.

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 Tier 2 screening values for residential with plant uptake have been utilised for this assessment due to the proposed development being a residential end use.

To remain conservative at an early stage, the screening values based on a 1% SOM have been utilised for this assessment.

The results of the comparison have been summarised in Table 9.



Table 9 Summary of Inorganic and Hydrocarbon Toxicity Assessment for a Residential End Use (with plant uptake)

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	P L	ASSESSMENT
Arsenic	mg/kg	37	12	45	WS104 (0.90m)	1	Further Action
Cadmium	mg/kg	11	12	0.7	–	1	No Further Action
Chromium (VI)	mg/kg	6.0	12	<1.8	–	1	No Further Action
Lead	mg/kg	200**	12	470	WS105 (0.90m) TP101 (0.90m) TP102 (0.80m) TP103 (0.10m) WS102 (0.60m)	1	Further Action
Mercury	mg/kg	1.2	12	21	TP103 (0.10m)	2	Further Action
Nickel	mg/kg	130	12	45	–	1	No Further Action
Selenium	mg/kg	250	12	1.5	–	1	No Further Action
Copper	mg/kg	2400	12	300	–	1	No Further Action
Zinc	mg/kg	3700	12	250	–	1	No Further Action
Cyanide – Total	mg/kg	791	12	3.8	–	1	No Further Action
Phenols – Total	mg/kg	120	12	<1.0	–	1	No Further Action
Asbestos	Fibres	NFD	8	NFD	–	3	No Further Action
Naphthalene	mg/kg	2.3	12	1.2	–	4	No Further Action
Acenaphthylene	mg/kg	170	12	0.51	–	2	No Further Action
Acenaphthene	mg/kg	210	12	4.6	–	1	No Further Action
Fluorene	mg/kg	170	12	3.6	–	1	No Further Action
Phenanthrene	mg/kg	95	12	29	–	2	No Further Action
Anthracene	mg/kg	2400	12	7.9	–	2	No Further Action
Fluoranthene	mg/kg	280	12	26	–	2	No Further Action
Pyrene	mg/kg	620	12	22	–	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	12	8.1	WS104 (0.90m)	2	Further Action
Chrysene	mg/kg	15	12	7.4	–	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	12	8.7	WS104 (0.90m) WS105 (0.90m) TP103 (0.10m) TP102 (0.80m) TP101 (0.50m)	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	12	3.3	–	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	12	7.7	TP101 (0.50m) TP102 (0.80m) TP103 (0.10m) WS104 (0.90m) WS105 (0.90m)	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	12	3.4	–	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	12	0.9	TP101 (0.50m) TP102 (0.80m) TP103 (0.10m) TP103 (0.50m) WS104 (0.90m) WS105 (0.90m)	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	12	3.9	–	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	12	<0.1	–	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	12	<0.1	–	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	12	<0.1	–	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	12	6.2	–	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	12	35	–	4	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	12	89	–	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	12	240	–	1	No Further Action



Notes

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation

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

The pathway noted in the table is the primary pathway, however it may not be the only pathway of that contaminant

* The Tier 2 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 2 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 2 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.

** Tier 2 GAC for lead taken from C4SL CL:AIRE

Referring to Table 9, the result of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

Inorganics

- ✳ Arsenic
- ✳ Lead
- ✳ Mercury

Organics

- ✳ Benzo(b)Fluoranthene
- ✳ Benzo(a)Anthracene
- ✳ Benzo(a)Pyrene
- ✳ Dibenzo(a,h)Anthracene

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

4.2.1. EXPOSURE PATHWAYS

The main exposure pathways based on the Tier 2 exceedances are:

- ✳ Soil ingestion (PL1)
- ✳ Dermal contact and ingestion (PL2)
- ✳ Consumption of homegrown vegetables (PL1)

4.2.2. HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

Inorganic Heavy Metals

the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils (PL2) and consumption of homegrown vegetables (PL1). The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed landscaping and public open space to remove any potential for direct exposure to impacted soils.

However, as no private gardens or spaces for homegrown vegetables have been included within the proposed development, the overall risk to the end-users is significantly reduced.

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



Organic Contamination

With regards to the elevated mercury, these present a potential volatilisation to indoor air risk. This elevated concentration has only been identified within one area of the site (TP103, within shallow soils) and is therefore considered to be a localised hotspot. Therefore, 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.

Total Organic Carbon analysis has also been completed of the 12 tested soils returning a range of 2.1% to 4.3% for Made Ground soils and 0.4% to 0.9% for natural soils.

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 10.

Table 10 Controlled Waters Conceptual Model and Sensitivity Profile

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground Made Ground was encountered in all exploratory hole locations across the site to a maximum proven depth of 1.30 m bgl. Evidence of contamination within the Made Ground was identified including clinker and slag which may act as a source.		Moderate
Pathway		
Vertical Migration Vertical migration is unlikely to occur due to the majority of the site being underlain by >5.0m bgl of low permeability cohesive CLAY deposits. The presence of this low permeability drift limit the vertical migration and offer some protection to the underlying aquifer.		Medium
Lateral migration Lateral migration of contaminants is likely limited due to the presence of low permeability cohesive deposits across the site and minimal groundwater strikes encountered.		Low
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary (undifferentiated) aquifer.	Low
Aquifer Classification in Bedrock	Secondary A Aquifer.	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected.	Low
Distance to the Closest Groundwater Abstraction Point	The closest groundwater abstraction point is 731 m east, utilised for horticultural watering.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	The nearest surface watercourse is located 760 m west.	Low

The ICSM developed within the context of the site setting has identified a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying secondary A aquifer. However, the overall sensitivity of the Secondary A Aquifer is reduced given the distance to the closest groundwater abstraction.

The Tier 2 assessment in line with LCRM (2023) has included a comparison of leachate analysis from samples of the Made Ground and groundwater samples to drinking water standards (DWS) and environmental quality standards (EQS).



DWS will be viewed as a priority given the potential receptor in this instance is the underlying secondary A aquifer and the absence of a nearby surface watercourse.

Water samples were obtained utilising a bailer, these are presented in Table 11.



Table 11 Comparison of Groundwater and Leachate Analysis with Tier 2 Screening Levels

DETERMINAND	UNIT	EQS ^{1, 2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Inorganics										
Arsenic	µg/l	50	10	1	0.6	–	2	3.1	–	No Further Action
Cadmium	µg/l	0.08-0.25	5	1	0.08	-	2	<0.08	–	No Further Action
Chromium (VI)	µg/l	3.4	–	1	<5.0	–	2	<5.0	–	No Further Action
Chromium (III)	µg/l	4.7	50	1	0.3	–	2	1.3	–	No Further Action
Copper	µg/l	1	2000	1	2.3	–	2	19	–	No Further Action
Total Cyanide	µg/l	1	50	1	<1.0	–	2	<1.0	–	No Further Action
Lead	µg/l	1.2	10	1	<0.2	–	2	6.5	–	No Further Action
Mercury	µg/l	–	1.0	1	<0.05	–	2	<0.5	–	No Further Action
Nickel	µg/l	4	20	1	2	–	2	1.2	–	No Further Action
Selenium	µg/l	–	10	1	<0.6	–	2	<4.0	–	No Further Action
Zinc	µg/l	10.9	–	1	6.3	–	2	9.8	–	No Further Action
pH	6–9			1	7.3	–	2	7.6–7.9	–	No Further Action
Polycyclic aromatic hydrocarbon										
Naphthalene	µg/l	2	10*	1	<0.01	–	2	<0.01	–	No Further Action
Anthracene	µg/l	0.1	10*	1	<0.01	–	2	<0.01	–	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	1	<0.01	–	2	<0.01	–	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	1	<0.01	–	2	<0.01	–	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	1	<0.01	–	2	<0.01	–	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	1	<0.01	–	2	<0.01	–	No Further Action
Fluoranthene	µg/l	0.0063	10*	1	<0.01	–	2	<0.01	–	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	1	<0.01	–	2	<0.01	–	No Further Action
Aromatic Hydrocarbons										
TPH C5-C7 (benzene)	µg/l	10	1	1	<1.0	–	2	<1.0	–	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	1	<1.0	–	2	<1.0	–	No Further Action
TPH C8-C10	µg/l	30	300	1	<1.0	–	2	<1.0	–	No Further Action



DETERMINAND	UNIT	EQS ^{1, 2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
(xylene)										
TPH C10-C12 (naphthalene)	µg/l	2	90	1	<10	–	2	<10	–	No Further Action
TPH C12-C16	µg/l	–	90	1	<10	–	2	<10	–	No Further Action
TPH C16-C35	µg/l	–	90	1	<10	–	2	<10	–	No Further Action
Aliphatic Hydrocarbons										
TPH C5-C6	µg/l	–	1000 ⁵	1	<1.0	–	2	<1.0	–	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	1	<1.0	–	2	<1.0	–	No Further Action
TPH C8-C10	µg/l	–	300	1	<1.0	–	2	<1.0	–	No Further Action
TPH C10-C12	µg/l	–	300	1	<10	–	2	<10	–	No Further Action
TPH C12-C16	µg/l	–	300	1	<10	–	2	<10	–	No Further Action
TPH C16-C21	µg/l	–	300**	1	<10	–	2	<10	–	No Further Action
TPH C21-C35	µg/l	–	300**	1	<10	–	2	<10	–	No Further Action
Volatile Organic Compounds										
Tetrachloroethylene	µg/l	0.4	10	1	<3.0	–	2	–	–	–
Trichloroethylene	µg/l	10	10	1	<3.0	–	2	–	–	–
Trichlorobenzene	µg/l	0.4	–	1	<3.0	–	2	–	–	–
Trichloromethane	µg/l	2.5	–	1	N/A	–	2	–	–	–
Dichloromethane	µg/l	20	200	1	N/A	–	2	–	–	–
Carbon Tetrachloride	µg/l	12	3	1	N/A	–	2	–	–	–
Vinyl Chloride	µg/l	–	0.3	1	N/A	–	2	–	–	–



4.3.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that no recorded data exceeds DWS values for any of the tested inorganic compounds.

In the absence of any exceedances for any contaminants of concern when compared to the DWS thresholds, the site is considered to pose a low risk to controlled waters.

4.4. GROUND GAS RISK ASSESSMENT

4.4.1. RATIONALE

Hazardous ground gas qualitative risk assessment is based on a conceptual site model (CSM) similar to that used for soil and groundwater contamination sources (i.e., source pathway receptor pollutant linkages).

The risk can be assessed based on knowledge of the ground conditions and CSM and a measure of hazardous gas concentrations and gas flow at the site within monitoring standpipes.

4.4.2. SOURCES AND PATHWAYS OF GROUND GAS

Table 12 summarises the potential sources and pathways of ground gas within the context of the recorded site setting and proposed development.

Table 12 Identified Potential Sources of Ground Gas

SOURCE

Made Ground

Made Ground was encountered within all exploratory hole locations to a maximum proven depth of 1.30 m bgl (WS104), however, typically Made Ground deposits were encountered at depths less than 0.80 m bgl.

The majority of locations comprised concrete or asphalt in the upper 0.15 m with the exception of TP103, WS103, WS104, WS105, WS106, RB102 and RB103 which comprised dark brown gravelly clay with frequent rootlets and dark brown gravelly sand.

The Made Ground deposits underlying concrete, and asphalt generally comprised sandy gravel and gravelly clay with fragments of brick, concrete, timber, plastic, slag and clinker.

As the Made Ground is shallow and there is little evidence of any putrescible materials, the potential for ground gas generation is limited.

Drift Strata

No potential sources of hazardous ground gas were identified in the drift deposits.

Solid Strata

MUDSTONE interbedded with SANDSTONE was encountered within three of the exploratory hole locations from 15.10 m to 30.00 m bgl.

The site is located within a Coal Mining Reporting Area. One mine entry is located 25m north east of the site. The mine entry is known to be in association with Bradford Colliery which is situated



approximately 20 m north east of the site. Known workings have been recorded 114 m bgl under the site.

The underlying coal measures are a potential source of mine / ground gases; however the overlying cohesive soils will serve to limit any upwards migration of gases.

Landfill Sites

There are no active or historical landfills within 250 m of the site.

Other Gases

5-10% of homes are estimated to be at or above the Action Level. Basic radon protection measures are required

PAH analysis has identified levels above the laboratory limits of detection (LOD) throughout the site.

The CIRIA C665 guidance on gas risk assessment includes recommendations for periods and frequencies for monitoring visits. These recommendations take into account the nature of the proposed development and the likely generation potential of the source.

The proposed development comprises private residential properties, which would be classified as a Type B development (high sensitivity) in accordance with BS8485:2015+A1:2019. However, it is considered that the likely generation potential of the identified gas sources (taking into account the likelihood of future increases in gas generation) would be best classified as low.

Therefore, within the context of the proposed residential end-use and ground gas generation potential, the gas assessment requires six visits over three months, with at least two sets of readings at low or falling atmospheric pressure.

4.4.3. 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 13.

Table 13 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.

It should be noted that in the first instance, this assessment has been carried out in accordance with BS8485:2015+A1(2019).

4.4.4. 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 300 seconds (5 minutes) at each location, increasing to 600 seconds if elevated concentrations identified, 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 14.

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.



4.4.5. SUMMARY OF MONITORING RESULTS

Table 14 presents of the ground gas and groundwater monitoring results to date.



Table 14 Summary of Ground Gas Monitoring Results

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	07/03/2024	0.10	0.10	0.0001	0.90	0.80	0.0009	16.4	1014	Falling	0.10	1.00–2.70	2.62	1.71
	25/03/2024	0.10	0.10	0.0259	2.40	2.40	0.0024	12.8	990	Falling	0.10		2.69	1.89
	11/04/2024	0.10	0.10	0.0001	3.50	3.50	0.0035	10.9	1016	Steady	0.10		2.69	1.50
	25/04/2024	0.10	0.10	0.0001	4.20	4.30	0.0043	10.9	996	Falling	0.10		2.67	1.21
	17/05/2024	0.10	0.10	0.0001	2.50	2.50	0.0025	14.8	1001	Steady	0.10		2.67	1.17
WS104	07/03/2024	0.10	0.10	0.0001	4.30	4.30	0.0043	12.8	1014	Falling	0.10	0.50–1.00	1.01	Dry
	25/03/2024	0.10	0.10	0.0001	4.70	4.60	0.0047	13.6	990	Falling	0.10		1.04	Dry
	11/04/2024	0.10	0.10	0.0001	5.00	5.00	0.0050	12.9	1015	Steady	0.10		1.04	Dry
	25/04/2024	0.10	0.10	0.0001	5.30	5.30	0.0053	12.2	995	Falling	0.10		1.04	Dry
	17/05/2024	0.10	0.10	0.0001	3.90	4.00	0.0040	18.0	1001	Steady	0.10		1.04	Dry
WS106	07/03/2024	0.10	0.10	0.0001	0.20	0.10	0.0002	20.4	1015	Falling	0.10	1.00–3.00	2.86	2.35
	25/03/2024	0.10	0.10	0.0001	0.40	0.40	0.0004	20.0	990	Falling	0.10		2.88	1.17
	11/04/2024	0.10	0.10	0.0001	0.20	0.50	0.0005	19.9	1016	Steady	0.10		2.89	1.49
	25/04/2024	0.10	0.10	0.0001	0.20	0.90	0.0009	19.7	995	Falling	0.10		2.89	1.24
	17/05/2024	0.10	0.10	0.0001	2.10	1.80	0.0021	19.2	1001	Steady	0.10		2.89	1.36



4.4.6. GROUNDWATER

Water was recorded within WS101 and WS106 but was not recorded to be above the top of the response zone (flooded).

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

WS104 was noted to be dry during the completed monitoring visits to date.

4.4.7. BAROMETRIC PRESSURE

Visits 1, 2 and 4 were undertaken during a period of relatively high but falling pressure, with pressure recorded to be falling from 1015 mbar and 990 mbar.

Visits 3 and 5 were undertaken during a period of relatively high steady pressure, with pressure recorded to be between 1001 mbar and 1016 mbar.

Therefore, to be considered that monitoring visits have yet to be undertaken over representative conditions, future sampling visits need to be undertaken during low pressure and rising pressure conditions.

4.4.8. GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.10 l/hr (limit of detection of the analyser).

4.4.9. GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 0.10% v/v (limit of detection of the analyser).

Carbon dioxide concentrations were recorded at concentrations ranging from 0.20% v/v to 5.30% v/v (WS104).

4.4.10. RADON RISK

A review of Radon Mapping indicated the site is in an area where between 5% and 10% of homes are above the Radon Action Level. Therefore, radon protection measures will need to be incorporated into any proposed new dwellings.

All sites registered from 1st December 2022 onwards will have been assessed against the updated radon maps by NHBC and will be required to have radon protection measures installed in accordance with the updated mapping.



Figure 3 indicates that based on the 5% - 10% area observed, the site falls under a Radon Potential Class of 4 within the User Guide for the HPA-BGS Joint Radon Potential Dataset for Great Britain (Ref: IR/11/044, dated 2011). A Radon potential class of 4 indicates that basic Radon Measures are required in all new dwellings, as shown in Figure 4.



Figure 3 Radon Affected Area Potential Class

Radon Potential Class*	Is the property in a Radon Affected Area?	Additional information
1	No	The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). The property is not in a radon affected area.
2	Yes	The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
3	Yes	The property is in an Intermediate probability radon area (3 to 5% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
4	Yes	The property is in an Intermediate probability radon area (5 to 10% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
5	Yes	The property is in a Higher probability radon area (10 to 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
6	Yes	The property is in a Higher probability radon area (more than 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.

*The Radon Potential Class number should not be included in answers.

Source: User Guide for the HPA-BGS Joint Radon Potential Dataset for Great Britain (Ref: IR/11/044, dated 2011)

Figure 4 Radon Affected Area Measures Required

Radon Potential Class*	What level of radon protective measures are required for new buildings in England and Wales?	What level of radon protective measures are required for new dwellings in Scotland?
1	None**	None**
2	None	Stage 1
3	Basic	Stage 1
4	Basic	Stage 1
5	Full	Stage 2
6	Full	Stage 2

*The Radon Potential Class number should not be included in answers.

** in 2008 HPA recommended that building regulations be amended to ensure that all new buildings, extensions etc. include basic radon protective measures. At the time of writing, relevant UK authorities were considering this advice.

Source: User Guide for the HPA-BGS Joint Radon Potential Dataset for Great Britain (Ref: IR/11/044, dated 2011)



Basic radon protection measures are required to be installed as Section 5.1 of BRE211_2015: Radon Guidance on protective measures for new buildings. Section 5.1 of BRE211_2015 states:

"For basic protection measures, the damp-proof course (DPC) to a cavity wall should be in the form of a cavity tray to prevent radon from entering the building through the cavity. Sealing of joints in the barrier and sealing around service penetrations are also required. It is important that attention is paid to detailing and workmanship in jointing of the barrier."

If good standards of design and workmanship are applied to the provision of a 1200 gauge damp-proof barrier to the floor sealed to a DPC/cavity tray through the walls, adequate protection from radon will be provided along with the general function of excluding moisture."

For all new dwellings constructed after 1st September 2023, in line with changes to the British Board of Agrément (BBA) building standards, plots requiring basic radon measures will require a specialized Radon Membrane, with minimum thickness of 0.4mm thick (1600 gauge) suitably installed and validated.

4.4.11. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is presented in Table 15.

This indicates that based on the peak flow rates the majority of the monitoring visits classify as Characteristic Situation (CS)1 – Very Low Gas Risk.

Table 15 Gas Risk Profile and Location

WELL	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH ₄ (%V/V)	MAX CH ₄ Q _{hg} (l/hr)	MAX CO ₂ (%V/V)	MAX CO ₂ Q _{hg} (l/hr)	CHARACTERISTIC SITUATION
WS101	1.17	0.10	0.10	0.0001	4.30	0.0043	CS1
WS104	Dry	0.10	0.10	0.0001	5.30	0.0053	CS1
WS106	2.35	0.10	0.10	0.0001	2.10	0.0021	CS1

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

- ✿ Ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas it is considered that gas protection measures will not be required.
- ✿ In the vicinity of WS104, carbon dioxide has been identified above the 5% v/v threshold, however the GSV is noted to be within a CS1 classification.
- ✿ The site is predominantly glacial till of stiff to very stiff CLAY at depths of 0.50m bgl to 15.10 m bgl.
- ✿ Made Ground has been encountered at shallow depths of less than 1.30m bgl, with little evidence of any putrescible materials, and therefore the potential for ground gas generation is limited.

It is recommended that the full ground gas assessment and recommended protection measures (if applicable) are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.



As the radon risk is classified within Radon Class 4, the proposed development will require a specialised Radon Membrane, with minimum thickness of 0.40mm thick (1600 gauge) suitably installed and validated.

4.5. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework.

The assessment in Table 16 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 16 Pipeline Selection PE Threshold Concentrations

CONTAMINANT GROUP	PE-THRESHOLD (MG/KG)	CONCENTRATIONS AT CURRENT PIPELINE DEPTH (MG/KG)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	41.5
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	315
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	N/A
Ethers*	0.5	N/A
Nitrobenzene*	0.5	N/A
Ketones*	0.5	N/A
Aldehydes*	0.5	N/A
Amines	Fail	N/A
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	Yes at TP103 at 0.50m bgl of EC10-16 at 17.4 mg/kg.	
Is free product present in soil and groundwater?	None identified.	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No – low solubility PAH impact has been identified within Made Ground deposits across the site. No significant source of groundwater was identified during the investigation.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	No.	
Will soils be imported to site as part of any future earth works	Currently unknown, however it is unlikely soils will be required to be imported to site.	

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

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

This will need to be confirmed following the completion of a UKWIR risk assessment, as post-remediation and enabling works ground conditions may be different from those identified during this site investigation.



4.6. DEVELOPED CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 17 has been prepared for the site.

Table 17 **Developed Conceptual Model**

CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
SOIL						
HUMAN HEALTH						
Made Ground Heavy Metals and non-volatile PAH	Accidental ingestion and/or dermal contact with contaminated soil and/or leachate. PL1/PL2 Inhalation of contaminated dust. PL3	Human Health – construction workers Human Health – end users	Likely	High	Elevated concentrations of heavy metals and non-volatile PAHs have been identified throughout the Made Ground deposits across the site. Recommendation: Construction works to be completed with appropriate PPE and welfare facilities. Cover system to landscaped areas will prevent exposure to future site users. However, the PL1/PL2 is considered unlikely as no private gardens are included within the proposed development	Low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
Made Ground Mercury	Inhalation of vapours. PL4	Human Health – end users	Unlikely	Medium	The elevated mercury concentration has only been identified within one area of the site (TP103, within shallow soils) and is therefore considered to be a localised hotspot. 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.	Low
Made Ground Sulphate from potential ash within the Made Ground.	Sulphate attack on concrete. PL6	Building concrete	Unlikely	Low	All tested samples are within the threshold of DS1 AC-1s concrete classification. Recommendation: Construction works to be completed with appropriate PPE and welfare facilities.	Low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
Made Ground Organic contaminants such as hydrocarbons, solvents	Ingestion of tainted water supply. PL7	Human Health – End Users Water pipeline	Low likelihood	Low	A localised exceedance of TPH C10-C16 was identified in TP102 at 0.80m against potable water thresholds. However, this was not site wide and is likely to be removed following remedial works. Recommendation: Based on the assessment of current site conditions, it is likely that PE pipe could be utilised. This will need to be confirmed with a UKWIR risk assessment post remediation.	Low
Made Ground Phytotoxic contaminants	Direct contact (plant uptake). PL8	Flora	Low likelihood	Medium	Likely probability as elevated concentrations of heavy metals and non-volatile PAHs across the site which may be taken up by flora in soft landscaping/gardens. Recommendation: Cover system to landscaped areas will prevent exposure to future site users.	Low
CONTROLLED WATERS						
Made Ground Lead and Copper	Leaching of contaminants from Made Ground through	Controlled waters, underlying	Likely	Low	The development of the proposed road (hardstanding and drainage) will reduce the	Low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
Groundwater	infiltration and percolation of rainwater. PL5	Secondary aquifer A			leachate potential from contaminated soils.	
		Infrastructure and services	Unlikely	Low	Infrastructure and services shall be designed to resist chemical attack and ingress.	Low
	Contact with contaminated groundwater. PL2	Human Health – site personnel	Low likelihood	Low	Groundwater is known to be below construction level and as such, is expected to not rise above ground level or the final level of the road.	Low
	Contaminants leached from the Made Ground and from off-site sources may be mobilised to greater distances through advective flow. PL5	Human Health – end users	Low likelihood	Low	Impacted groundwater is unlikely to transport contaminants vertically and horizontally through permeable strata.	Low
GROUND GAS						
Made Ground Ground gases (methane and carbon dioxide)	Inhalation of ground gas. PL4	Human Health – site personnel	Low likelihood	Medium	During excavation work, removal of confining strata may expose workers to volumes of pocketed gas. Protective measures during the works required.	Low
	Accumulation of ground gas in confined spaces (asphyxiation or explosion)	Human Health – end users	Low likelihood	Medium	An allowance for CS2 protection measures should be provided for at this time until the full ground gas monitoring period is	Low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
					complete, where the final ground gas regime will be confirmed.	
Coal Worked coal seam beneath site.	Inhalation of ground gas. PL4	Human Health – site personnel	Low likelihood	Medium	During excavation work, removal of confining strata may expose workers to volumes of pocketed gas. Protective measures during the works required.	Low
	Accumulation of ground gas in confined spaces (asphyxiation or explosion)	Human Health – end users	Low likelihood	Medium	An allowance for CS2 protection measures should be provided for at this time until the full ground gas monitoring period is complete, where the final ground gas regime will be confirmed.	Low
Radon	Inhalation of ground gas. PL4 Accumulation of ground gas in confined spaces (carcinogenic)	Human Health – end users	Low likelihood	Medium	Radon Class 4 - 5-10% of homes are estimated to be at or above the Action Level. Recommendation Basic radon protection measures are required.	Low

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.

LEVEL OF RISK

Very Low	
Low	



Low/Moderate	
Moderate	
Moderate/High	
High	



5. MINING ASSESSMENT

Based on the preliminary coal mine risk assessment detailed within Section 5.0 of the Phase 1 desk study (Ref: 16-908-R1; June 2023), an intrusive coal mining assessment is required to determine the potential risk of shallow coal workings, with the details provided within the following section.

5.1. SCOPE OF INTRUSIVE GROUND INVESTIGATION

Four coal seams formerly associated with the Bradford Colliery are recorded to dip below the application site and the potential for shallow mine workings cannot be discounted.

Three rotary boreholes have been advanced in accordance with Coal Authority Permission ref: 27290 to assess the potential presence of shallow workings within this seam and the potential for ground instability to induce a future subsidence event within the proposed development.

5.1.1. SUMMARY OF GROUND INVESTIGATION WORKS

Three rotary boreholes have been advanced at the locations detailed within the E3P exploratory borehole location plan at positions to intersect the potential coal seams and assess the potential for any workings.

Table 18 Rotary Boreholes

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB101	16.10	N/A	N/A	No coal encountered
RB102	15.50	N/A	N/A	No coal encountered
RB103	15.10	N/A	N/A	No coal encountered

5.2. SUMMARY OF COAL MINING ISSUES

E3P has reviewed the historical BWB *Desk Study Coal Workings Risk Assessment*, completed a desk-based Coal Mining Risk Assessment, BGS geological mapping and CA information, in addition to completing three 30 m rotary boreholes to investigate shallow mine workings.

The intrusive ground investigations comprising three, deep, rotary boreholes with none identifying any evidence of shallow coal seams or indicators of historic mine workings to the base of the boreholes.

The Coal Authority report state the shallow seams in the area, in the Bradford four feet seam has an extraction of 1.20m to 1.30m. This would suggest 13m of rock cover is required to confirm suitable rock cover to void ratio. The E3P rotary investigation indicates greater than 14m of rock cover with stiff clay overlying and therefore the potential for successive cavitation to cause subsidence is very low.

Based on this assessment, no further mitigation measures are recommended.



6. GEOTECHNICAL ASSESSMENT

6.1. SOIL CONSISTENCY

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained triaxial tests. Results of the tests are presented in Table 19 and Table 20, respectively, which indicate the clay soils to vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

Table 19 Summary of Hand Shear Vane Tests

LOCATION	DEPTH	SHEAR STRENGTH (KPA)	CALCULATED ALLOWABLE BEARING CAPACITY (KN/M ²)
TP101	1.50	124	291.4
TP102	1.50	110	258.5
TP103	1.50	115	270.3

Notes: ABC Calculated using Stroud and Butler et al 1974.* granular content within soil tests may underestimate true shear strength.

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 21.

Table 20 Summary of Undrained Shear Strength in Triaxial Compression – Laboratory Test

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
WS102	1.50–2.00	Firm, brown, slightly gravelly, very sandy CLAY	59	Firm

6.2. SIDE STABILITY AND EASE OF EXCAVATION

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



Table 21 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 CAPACITY (kN/m ²)*
WS101	1.00	CLAY	15	15.12	N/A	High Strength	Very Stiff	75.61	155.46
	2.00	CLAY	43	39.28	N/A	Very High Strength	Very Stiff	196.41	403.82
	2.70	CLAY	50	44.01	N/A	Very High Strength	Very Stiff	220.03	452.37
WS102	1.00	CLAY	21	21.17	N/A	High Strength	Very Stiff	105.86	217.64
	2.00	CLAY	39	35.63	N/A	Very High Strength	Very Stiff	178.14	366.26
	2.80	CLAY	50	43.82	N/A	Very High Strength	Very Stiff	219.10	450.48
WS103	1.00	CLAY	15	15.12	N/A	High Strength	Very Stiff	75.61	155.46
	2.00	CLAY	24	21.92	N/A	High Strength	Very Stiff	109.62	225.39
	3.00	CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00
WS104	2.00	CLAY	31	28.32	N/A	High Strength	Very Stiff	141.60	291.13
	3.00	CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00
WS105	2.00	CLAY	33	30.15	N/A	Very High Strength	Very Stiff	150.73	309.91
	3.00	CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00
WS106	1.00	CLAY	13	13.11	N/A	Medium Strength	Stiff	65.53	134.73
	2.00	CLAY	30	27.41	N/A	High Strength	Very Stiff	137.03	281.74
	3.00	CLAY	50	43.48	N/A	Very High Strength	Very Stiff	217.41	447.00

NOTES

* The Allowable Bearing Capacity (ABC) 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 capacity on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996.



6.3. PARTICLE SIZE DISTRIBUTION

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

The results are included in Table 22. The full results can be found in APPENDIX IX.

Table 22 Summary of Particle Size Distribution Test Results

LOCATION	DEPTH (M)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP102	1.50 (Made Ground)	29	37	21	13
TP103	1.50 (Natural)	0	2	31	67
WS101	1.00 (Natural)	0	4	31	65
WS102	1.00 (Natural)	0	2	24	74
WS104	1.00 (Made Ground)	0	23	27	50
WS105	1.00 (Natural)	0	7	21	72
WS106	2.00 (Natural)	0	2	26	72

6.4. SOIL DENSITY/MOISTURE CONTENT RELATIONSHIP

Dry density / moisture content relationship analysis has been conducted on soils using via utilising proctor compaction tests utilising a 2.5kg rammer. The results of the tests has been summarised in Table 23. The full test results can be found in APPENDIX IX.

Table 23 Summary of 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 (%)
TP102	Brown mottled grey slightly gravelly very sandy CLAY.	1.50	2.5kg	25	22	43	1.57	9
TP103	Brown slightly gravelly clayey silty SAND.	1.50	2.5kg	20	17	0	1.77	0

The proctor compaction tests have indicated that the material in TP102 and TP103 as being wet of the optimum. It should be noted that if this material is excavated for use in a cut/fill operation careful consideration should be taken in the stabilisation of this material.

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



6.5. SOIL PLASTICITY

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

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

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

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

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

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

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

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

The Atterberg limits determinations, summarised in Table 24, show the clay to be of predominantly moderate plasticity clay.

Table 24 Summary of Plasticity Index Test results

LOCATION	DEPTH (M)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 MM SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS103	2.00	30	23	47	24	96	23.04	Medium
WS105	2.00	19	19	37	18	94	16.92	Low
WS106	1.00	23	23	46	23	97	22.31	Medium

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



6.6. PH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in APPENDIX VIII (summarised in Table 25), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

Table 25 Summary of pH and Sulphate Data

LOCATION	DEPTH (M)	SO ₄ IN 2:1 WATER/SOIL (G/L)	PH VALUE	CLASSIFICATION
TP101	0.50	0.0732	8.1	DS-1, AC-1s
TP102	0.80	0.445	9.0	DS-1, AC-1s
TP103	0.10	0.00881	7.8	DS-1, AC-1s
TP103	0.50	0.0293	8.1	DS-1, AC-1s
TP103	1.30	0.0444	7.4	DS-1, AC-1s
WS101	1.20	0.0394	8.3	DS-1, AC-1s
WS102	0.60	0.0369	7.9	DS-1, AC-1s
WS103	1.80	0.0358	8.4	DS-1, AC-1s
WS104	0.90	0.019	7.4	DS-1, AC-1s
WS105	0.90	0.0176	8.1	DS-1, AC-1s
WS106	0.50	0.0217	8.3	DS-1, AC-1s
WS106	1.10	0.0586	7.9	DS-1, AC-1s

6.6.1. HIGHWAYS AND CONCRETE

MCHW Series 600 provides a criteria of 1500mg/l for water-soluble sulphate within 500mm of any concrete structure. A second criteria of 300 mg/l is given with respect to soils within 500mm of steel structures.

6.7. GROUNDWATER

Table 26 Summary of Groundwater Strikes

LOCATION	DEPTH (M BGL)	DESCRIPTION OF STRIKE	STRATA	EVIDENCE OF CONTAMINATION
Site Investigation Waterstrike Information				
WS102	0.60	Perched	Made Ground	Slag and clinker
Location	Depth Range (m bgl)	Period of monitoring (March-May)	Weather conditions during monitoring	Comments
Groundwater Monitoring Summary from Installations				
WS106	2.35	N/A	Sunny	N/A
WS101	1.71	N/A	Sunny	N/A

The presence of groundwater in WS102 encountered at a depth of 0.60 m bgl and was localised to the Made Ground deposits.

During the groundwater monitoring, groundwater was encountered at depths ranging from 1.71–2.35 m bgl. However, this will be confirmed upon completion of the ground and gas monitoring regime.



6.7.1. INFLUENCING FUNCTIONAL WATERBODIES

Only two months of monitoring groundwater has been conducted at the time of writing this report, with three months scheduled as a part of this investigation. Therefore, the interpreted levels are approximate and may be dependent on seasonal variation. It should be noted that seasonal variation is likely to result in potentially significant changes in groundwater levels beneath the site.

The water table can have significant effects on the foundation of a building, including:

- ✳ **Soil settlement:** Changes in the water table can cause soil to expand or contract, which can result in foundation settlement or movement. This can lead to cracks in the foundation, walls, or floors of a building.
- ✳ **Soil erosion:** High water tables can cause soil erosion, which can lead to the loss of soil support beneath the foundation. This can result in foundation settling or movement, which can be dangerous for the stability of the structure.
- ✳ **Hydrostatic pressure:** When the water table rises, the water exerts hydrostatic pressure on the foundation. This can cause foundation walls to crack or bow, which can compromise the structural integrity of the building.
- ✳ **Moisture infiltration:** High water tables can result in moisture infiltration into the foundation and surrounding soil. This can lead to mould growth, decay, and deterioration of building materials.
- ✳ **Drainage problems:** Poor drainage around a building can cause water to pool around the foundation, increasing the likelihood of soil erosion and hydrostatic pressure. This can lead to foundation settling or movement, and can also cause flooding in the basement or crawl space.

It is important to consider the effects of the water table on the foundation when designing and constructing a building. Proper drainage and foundation waterproofing can help to mitigate the effects of the water table on the foundation and improve the longevity and stability of the structure.

6.8. SITE PREPARATION

Our assessment has been based on the fact that the site will be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual of Contract Documents for Highway Works (MCHW)*. This should include the following:

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



6.9. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the safe allowable bearing capacity (ABC) 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 27.

Table 27 Summary of ABC

COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Capacity (kN/m ²)
Stiff to very stiff high to very high strength CLAY	0.80–2.00	65.53–141.60	134.73–291.4
Very stiff very high strength CLAY	2.00–3.00	150.73–220.03	309.91–452.37

Based on the assessment of the relative undrained shear strength, and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying stiff medium strength to very stiff very high strength CLAY.

6.10. FOUNDATIONS OPTIONS APPRAISAL

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe allowable bearing capacity, the following recommendations have been developed for the site of the potential foundation solutions that may be adopted for the future residential development. The suitable target founding stratum has been identified as the underlying stiff to very stiff glacial clays and localised areas of medium dense sands.

Following this assessment, the following foundation recommendations have been determined:

- ✦ Piled Foundations to support five-storey development and account for additional loadings;
- ✦ Within the site, there are areas of variable ground conditions that will preclude the use of a shallow spread foundation. Therefore, consideration should be given to the use of Ground Improvement by Vibro Stone Column to ensure the treatment achieves a suitable ABC to support a doubly reinforced strip foundation or construction of piled foundations.

To determine if VSC is viable at the subject site, E3P has completed a Ground Improvement Design Risk Matrix that is summarised in Table 28.

Table 28 Ground Improvement Design Risk Matrix

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m ²	CLAY soils are generally stiff to very stiff with Cu > 65.53 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	Peat was not identified during the intrusive investigation.	PASS



RISK ITEM	COMMENT	PASS/FAIL
single layer or the sum of the thicknesses of individual layers throughout the length of the stone column		
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground across the site will require removal and processing to render the site suitable for VSC.	PASS – on completion of enabling works
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified.	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	None identified – The site was levelled in excess of 50 years ago with minimal volumes of MADE GROUND (<1.50m bgl).	PASS
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None identified.	PASS
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS
Cohesive soils with trees in influencing distance	Plots where tree influence has been modelled and will either be subject to a piled or mass trench-fill solution.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS

It is advisable to consult with geotechnical engineers and foundation specialists who can assess the specific ground conditions and design an appropriate Vibro Stone Column system to meet the project's requirements. They will consider factors such as soil composition, depth, and spacing of the stone columns to ensure effective ground improvement and proper load distribution for the proposed foundations.

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

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

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

-  Driven piled foundations to support additional loadings of medium-rise apartment block.

Foundations which encounter coal, should be brought to a depth below the coal. The sides of foundations should be protected when they are in contact with coal. However, during this investigation, no evidence of coal has been identified within the upper 30m.



6.11. GROUND FLOOR SLABS

Given the nature of the proposed mid-rise residential development (up to five storey) is it recommended that a ground bearing floor slab be utilised.

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

6.12. 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 conjectures zones of influence.

The clay has been determined as being of medium volume change potential. Table 29 shows where heave precautions are required for a trench fill, pier and beam and pile and beam foundation types which are in the zone of influence of trees which are to remain or be removed.

Table 29 Position of Heave Precautions

SITUATION	TRENCH FILL	PIER AND BEAM	PILE AND BEAM
External trench fill and pier foundations. Unless NHBC is satisfied that the soil is not desiccated compressible material should be provided to the:	Inside faces of external wall foundations deeper than 1.5m, based on the appropriate tree height.	All faces of pier foundations deeper than 1.5m, based on the appropriate tree height.	N/A
External ground beams. Unless NHBC is satisfied that the soil is not desiccated, compressible material or void formers should be provided to the:	N/A	Inside faces	Inside faces
Internal trench fill foundations and ground beams. Compressible material required:	No	No	No
External and internal ground beams. Compressible material, void former or void should be provided to the underside of:	N/A	All	All
Heave precautions required for proposed trees where the soil is not desiccated:	No	No	No

Note: Information taken from NHBC Standards 2024, Chapter 4.2, Table 8 – Position of heave precautions

A summary of heave precautions is presented in Table 30.



Table 30 Summary of Heave Precautions

VOLUME CHANGE POTENTIAL	VOID DIMENSION AGAINST SIDE OF FOUNDATION AND GROUND BEAM	VOID DIMENSION UNDER GROUND BEAMS, AND SUSPENDED IN-SITU CONCRETE GROUND FLOOR	VOID DIMENSION UNDER SUSPENDED PRECAST CONCRETE AND TIMBER FLOORS⁽¹⁾
High	35mm	150mm	300mm
Medium	25mm	100mm	250mm
Low	0mm	50mm	200mm

In addition to the requirements of the 'Drainage' section, drainage near trees should incorporate additional provisions. Where there is a volume change potential within the ground, the provisions include:

- ✳ Increased falls to cater for any ground movement.
- ✳ Deeper and wider backfill of granular material.
- ✳ A drainage system that is capable of movement should heave and shrinkage occur.
- ✳ Drainage pipes should not be encased in concrete.
- ✳ Additional clearance is required where drains pass through the structure of a building to allow for additional movement.

6.13. HIGHWAYS CONSTRUCTION

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

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

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

6.14. DRAINAGE

Where loose or soft materials have been identified at drainage invert levels, there will need to be consideration for the use of reinforced pipe bedding.

Shrinkage and heave of clay soils can affect pipelines. To protect against the effects of heave, drainage should be designed:

- ✳ To take account of potential ground movement as shown in Table 31 , including where pipes and services pass through substructure walls or foundations.
- ✳ With gradients which may need to be steeper.



-  To use alternative means of catering for the movement when sufficient falls cannot be provided, for example, by deepening the excavation and laying pipework on a granular bedding of suitable thickness to reduce the extent of potential movement.

Table 31 Potential Ground Movement for Drainage

VOLUME CHANGE POTENTIAL	HIGH	MEDIUM	LOW
Potential ground movement	150mm	100mm	50mm

6.15. EXCAVATIONS

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

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

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

Table 32 Civil Engineering Excavation Risk Matrix

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	Minor water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure.
Shallow Bedrock	No	Bedrock has been identified at depths greater than 15.10 m below current ground levels.



6.16. CONSTRUCTION ACTIVITY AND INSPECTION

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

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

6.17. DEVELOPED GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of Contaminated Soils	Site	5	Site wide elevated concentrations of lead and some PAH compounds were identified within both natural and Made Ground deposits. However, these can be mitigated via the use of cover systems across the site in proposed landscaping areas. The elevated mercury concentration has only been identified within one area of the site (TP103, within shallow soils) and is therefore considered to be a localised hotspot. 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.
Bedrock	Site	N/A	Bedrock was encountered in RB101, RB102 and RB103 at depths ranging from 15.10m and 16.10m bgl to a maximum proven depth of 30.00m bgl.
Obstructions	Site	100	Site has been subject to historical development and, while above-ground structures have been removed, potential subsurface obstruction from relict foundations and slabs remain.
Artificially Levelled And Filled Platforms	Site	100	The site appears to have been artificially levelled from historic developments. The site is at a lower level than Newcombe Lane to the north.
Trench Collapse	All	100	Although the excavations were stable during the intrusive investigation, Made Ground present beneath the site are likely to be loosely compacted and possibly prone to collapse.
Drainage Invert Levels	Site	100	Loose materials present at drainage invert levels – reinforced pipe bedding will be required.
Mature Trees	North	25	The northern boundary of the site is bordered by mature trees. Arboriculture survey required to determine areas of potential tree influence.
Volume Change Potential Clay	On site	100	The site is underlain by predominantly cohesive CLAY deposits. The cohesive deposits have been assessed as having medium-volume change potential across the site. Heave precautions may be required.

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Peat	N/A	N/A	No peat deposits were identified during the intrusive investigation.
Concrete Design	Site	100	The soils meet class DS-1, AC-1s.
Low-Permeability Ground	Site	100	Soakaways unlikely to be effective in areas where low permeability cohesive deposits are present or where areas of potentially contaminated soil and groundwater are present.
Services/Sensitive Structures	Site	90	A formal drainage survey has not been completed; however, manholes were noted along the northern and eastern boundaries of the site. A surface water sewer runs in a north-south direction through the east of the site. A combined public sewer runs south-north through the north-west of the site. Street lighting is present along the northern and eastern boundaries of the site. Piling may not be possible within close proximity to any sensitive infrastructure.
Abnormal foundation solutions	Site	TBC	It is assumed that a piled foundation will be required due to the medium rise development load.
Slope	Site	N/A	From the main highway at the north of the site the grassed area generally falls in towards the site – the remainder has been largely regraded from historical development phases. However, this is unlikely to significantly impact the proposed development.
Enabling Earthworks	Site	100	All proposed earthworks will need to be designed by a suitably qualified geotechnical engineer in accordance with NHBC Chapter 4.6. The earthworks design will incorporate a Geotechnical Specification for Earthworks that will define protocols to ensure no unacceptable future risk.



6.18. FURTHER WORKS

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

- ✧ Foundations to be designed by suitably qualified structural engineer upon receipt of final layout.
- ✧ Arboricultural Survey.
- ✧ Remediation Strategy.
- ✧ Geotechnical Design Report (GDR).
- ✧ Geotechnical Earthworks Strategy (infrastructure).

END OF REPORT

APPENDIX I

LIMITATIONS



GENERAL

1. This report and any associated works (together comprising the "Services") were compiled and carried out by E3P for the client (as present in Section 1) under the E3P "Terms of Business" or with those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under E3P Standard Terms and Business as included within our proposal to the Client.
3. Project-specific appointment documents may be agreed upon at our discretion and a charge may be levied for both the time to review and finalise appointment documents and also for associated changes to the appointment terms. E3P reserves the right to amend the fee should any changes to the appointment terms create an increased risk to E3P.
4. The report needs to be considered in light of the proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEOENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

5. Coverage: This section covers reports with the following titles or combination of titles: Phase 1; Desktop Study; Geoenvironmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Baseline Environmental Assessment; Project Scope Summary Report (PSSR), Program Environmental Impact Report (PEIR), Geotechnical Development Risk Register; Agricultural Land Assessment; Mineral Safeguarding Assessment; Desk Top Coal Mining Risk Assessment; Hydrogeological Appraisal; Construction Environmental Management Plan; and Site Water Management Plan.
6. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walkover inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. E3P cannot be held responsible for any disclosures that are provided post-production of our report and will not automatically update our report.
7. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, E3P reserves the right to review such information and, if warranted, to modify the opinions accordingly.
8. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.
9. 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 does not constitute or replace full and proper surveys completed by suitably qualified and experienced specialists in these fields.
10. E3P does not warrant work/data undertaken/provided by others.



INTRUSIVE INVESTIGATION REPORTS

11. Coverage: The following report titles (or combination) may cover this category of work: Geoenvironmental Site Investigation; Geotechnical Assessment; GIR (Ground Investigation Reports); Preliminary Environmental And Geotechnical Risk Assessment; Preliminary Summary; Coal Mining Risk Assessment, Ground Gas Addendum; and Geotechnical Risk Register.
12. The investigation has been undertaken to provide information concerning either:
 - I. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
 - II. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
13. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
14. Unless otherwise specified in the scope of works, any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
15. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
16. For geotechnical investigations, the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
17. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.
18. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
19. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, E3P has used reasonable skill and care to extrapolate conditions between these points based on assumptions to develop our interpretation and conclusions.



20. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation and at the time of the investigation.
21. Conditions can change between investigation points both spatially and over time and these interpretations should therefore be considered indicative. The assessment of extreme weather events and their impact on ground conditions is not within the scope of E3P's work.
22. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the risk assessment process have been outlined within the body or associated appendix of the report.
23. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
24. Where soil contamination concentrations recorded as part of this investigation are used for commentary on the potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed and the waste classification and any subsequent disposal option agreed upon with licenced subcontractors and/or the relevant regulators.
25. The results of the asbestos testing are factually reported and interpretation is given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.
26. If costs have been included in relation to additional site works, and/or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

EUROCODE 7: GEOTECHNICAL DESIGN

27. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
28. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.



DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIATION AND ENABLING WORK STRATEGY REPORTS

29. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected based on the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.
30. The outputs of the Detailed Quantitative Risk Assessments are based upon the manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.
31. Before adoption on-site, assessment criteria will need to be discussed and agreed upon with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of E3P. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.
32. E3P does not accept liability for any subcontract work that has not been completed in strict accordance with an approved E3P Remediation and Enabling Works Strategy.

GEOTECHNICAL DESIGN REPORT (GDR)

33. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.

MONITORING (INCLUDING REMEDIATION MONITORING REPORTS AND BUILD PHASE MITIGATION)

34. These reports are factual and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of earthworks or remedial works.
35. The data is presented and will be compared with assessment criteria.

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	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

RISK CLASSIFICATION



RISK CLASSIFICATION

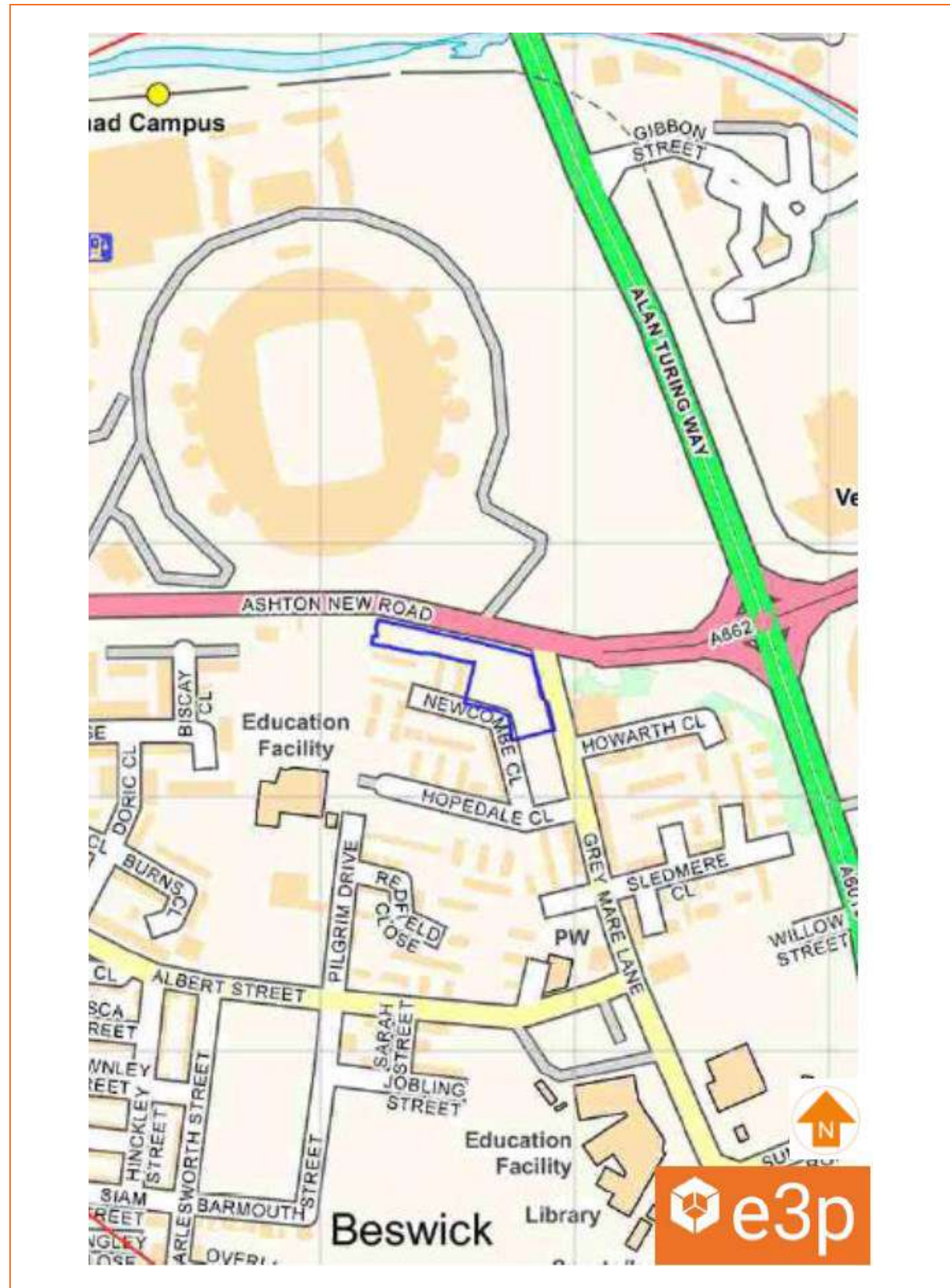
RISK	DEFINITION
Low	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property.
Low Moderate	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property with regard to the proposed use. However, minor issues may require further consideration in the event of future redevelopment of the Site.
Moderate	Some potential contaminated land liabilities/geotechnical constraints are likely to affect the property as a result of historical and/or current activities. The risks identified are unlikely to pose an immediate significant issue but the purchaser/developer may wish to make further enquiries of the vendor or undertake further environmental improvements. Redevelopment of the Site will likely require further site investigation.
Moderate High	Some potentially significant contaminated land liabilities/geotechnical constraints have been identified at the property that requires further assessment, including intrusive ground investigations.
High	Significant potential contaminated land liabilities/geotechnical constraints have been identified at the property. Further assessment including intrusive ground investigation will be required to determine the level of risk and associated liability.

APPENDIX IV

DRAWINGS



DRAWING 16-908-001 – SITE LOCATION PLAN





Notes:				
P1	REVA	23.06.2023	OW	PW
Phase	Issue	Date	Drawn	Checked

Client:	Shape
Job Title:	Grey Mare Lane - Site One

Job No:	16-908
Drawing No:	002
Date:	23.06.2023
Scale:	1:1000 @ A3
Drawing Title:	Proposed Development 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

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- Site Features
- Asphalt Hardstanding
 - Grass Softstanding
 - Mature Trees
 - Metal Fencing
 - Former Building with Relict Foundations and Service Infrastructures
 - Footpaths

Notes:				
P1	REVA	23.06.2023	OW	PW
Phase	Issue	Date	Drawn	Checked

Client:
Shape
Job Title:
Grey Mare Lane - Site One

Job No:
16-908
Drawing No:
004
Date:
23.06.2023
Scale:
1:1000 @ A3
Drawing Title:
Site Features 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

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Location Symbols

-  WS101 Approximate Window Sample Probehole Location (E3P Location - February 2024)
-  WS104(MW) Approximate Window Sample Probehole Location with Install (E3P Location - February 2024)
-  TP101 Approximate Trial Pit Location (E3P Location - February 2024)
-  RB101 Approximate Rotary Borehole Location (E3P Location - February 2024)

Notes:

P1	REVC	20.09.2023	EB	PW
P1	REVB	13.09.2023	OW	PW
P1	REVA	22.08.2023	EB	PW
Phase	Issue	Date	Drawn	Checked

Client:

Shape

Job Title:

Grey Mare Lane -
Site One

Job No:

16-908

Drawing No:

005

Date:

28.03.2024

Scale:

NTS@ A3

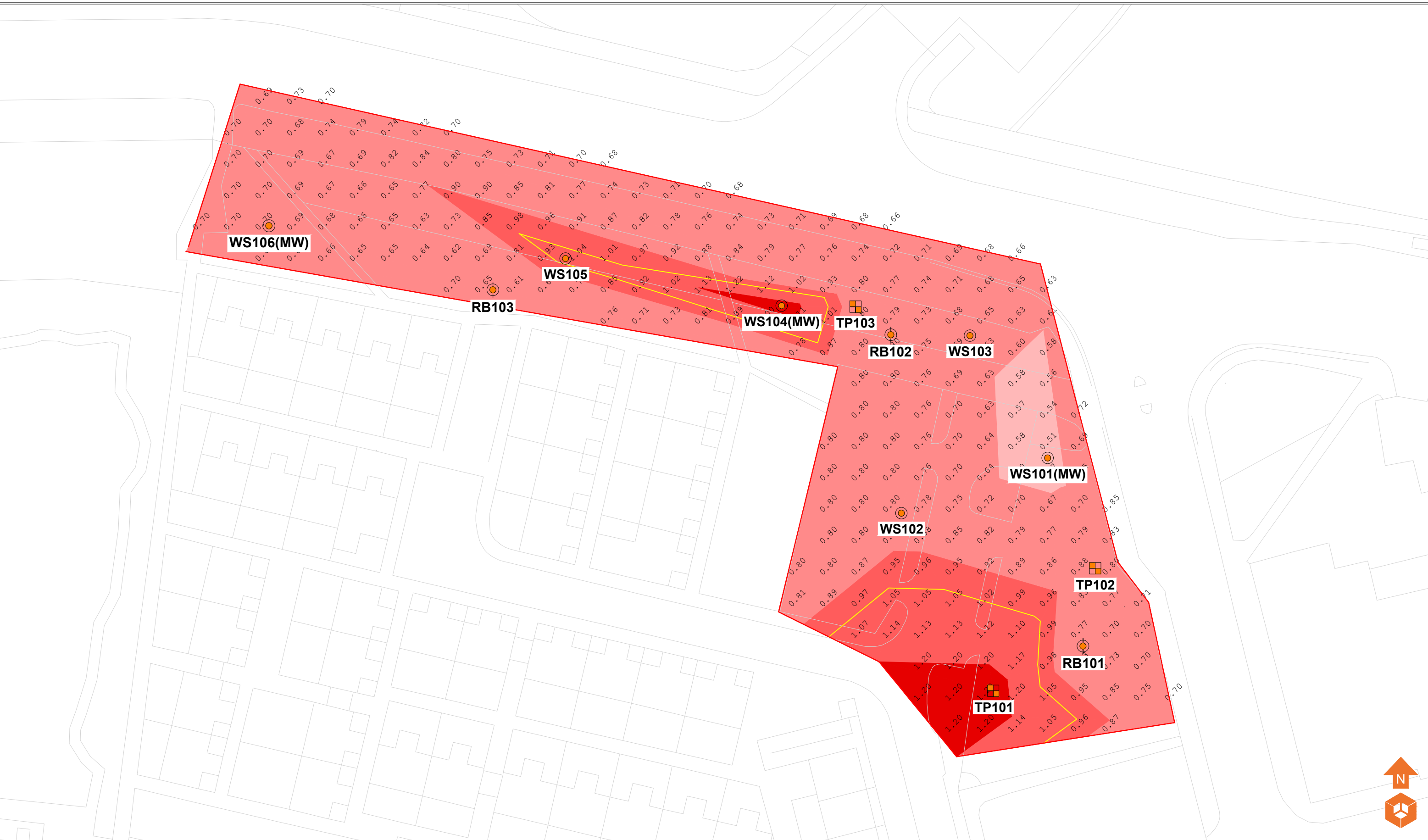


Environmental Engineering
Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Drawing Title:

Exploratory Hole Location Plan

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Location Symbols

- Approximate Window Sample Probehole Location (E3P Location - February 2024)
- Approximate Window Sample Probehole Location with Install (E3P Location - February 2024)
- Approximate Trial Pit Location (E3P Location - February 2024)
- Approximate Rotary Borehole Location (E3P Location - February 2024)

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.29m
- Depth of Made Ground 0.30 - 0.59m
- Depth of Made Ground 0.60 - 0.89m
- Depth of Made Ground 0.90 - 1.19m
- Depth of Made Ground >1.20m

Notes:

P1	REVA	28.03.2024	CB	LC
Phase	Issue	Date	Drawn	Checked

Client:

Shape

Job Title:

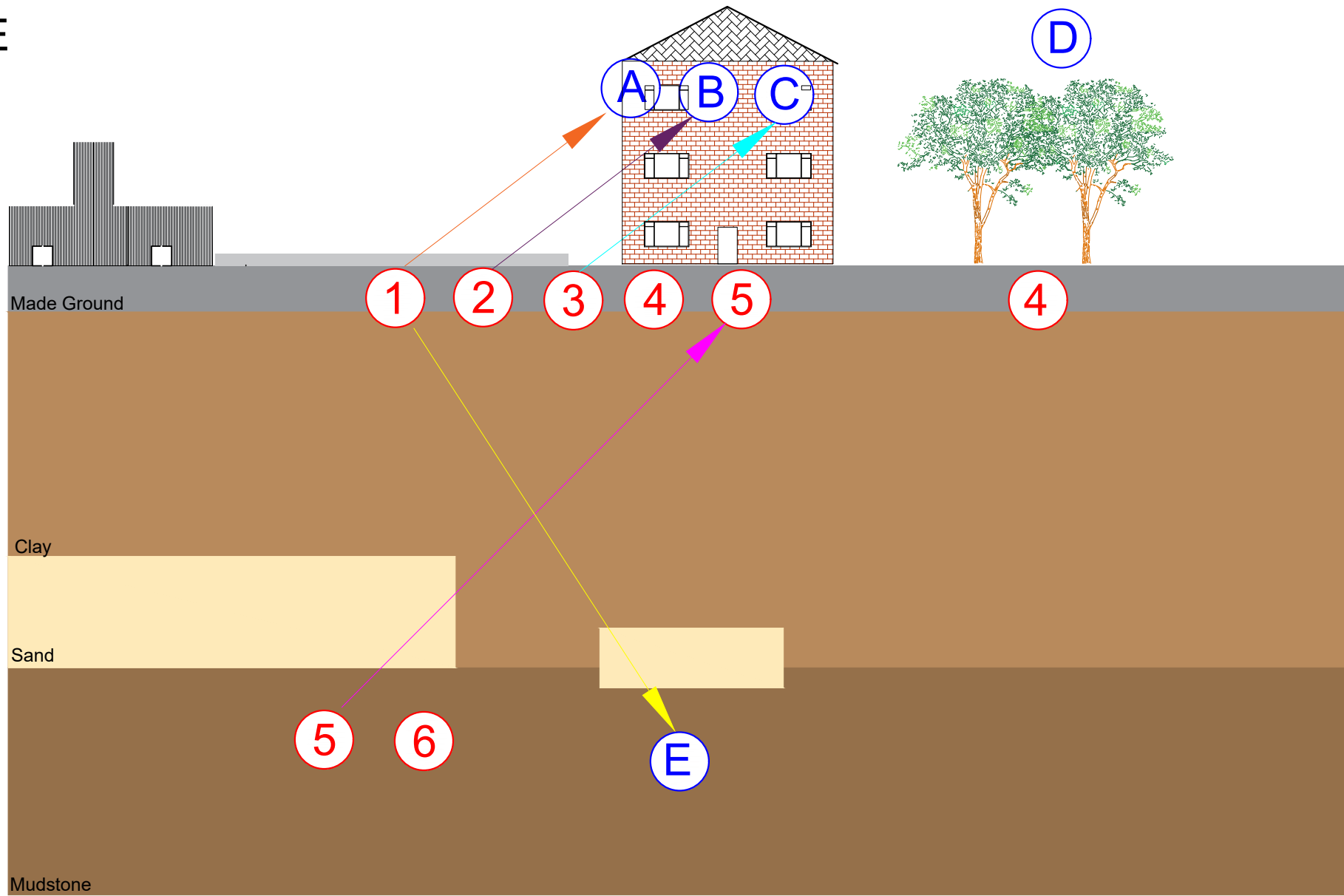
Grey Mare Lane - Site One

Job No:	16-908	Date:	28.03.2024
Drawing No:	006	Scale:	NTS@ A3

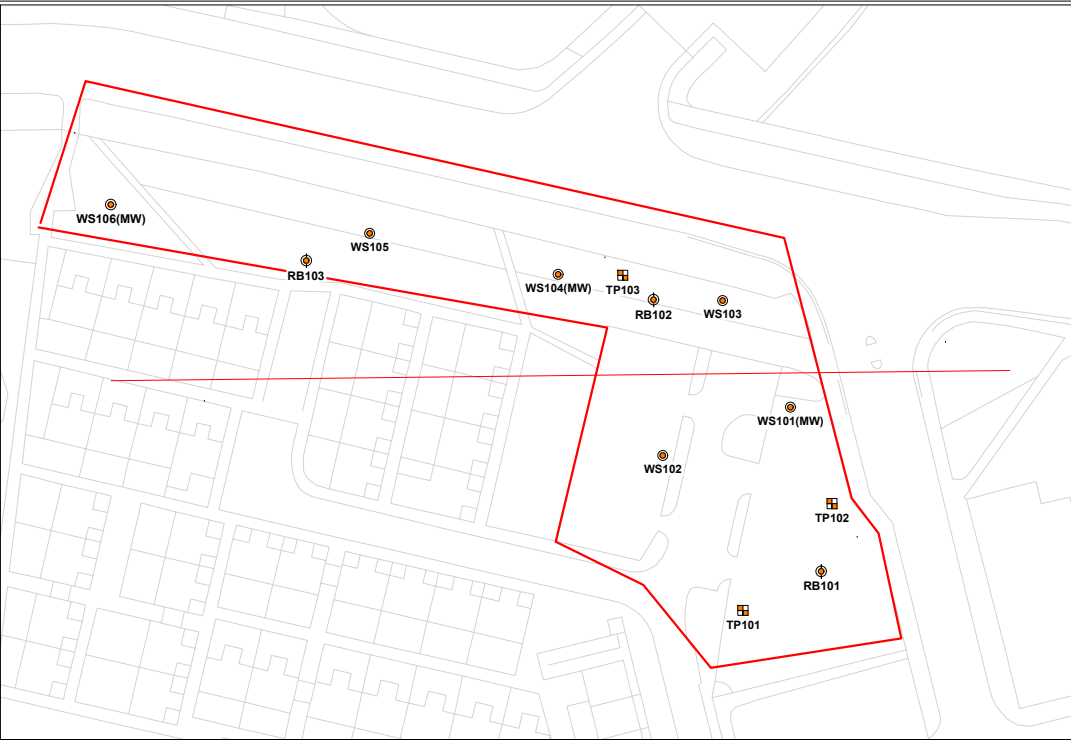
Environmental Engineering Partnership Ltd
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Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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E



W



Geology Key

- Made Ground
- Clay
- Sand
- Mudstone

Sources

- ① Made Ground(Heavy Metals and PAH)
- ② Made Ground (Sulphate's)
- ③ Made Ground(Org Contam)
- ④ Phytotoxic Contam
- ⑤ Made Ground/Coal (Ground Gas)
- ⑥ Radon

Pathways

- Ingestion and Contact
- Sulphate Attack
- Ingestion of Tainted Water
- Direct Contact
- Leaching of Contam
- Inhalation of Gas

Receptors

- A End Users - Residential
- B Building
- C Pipe Line
- D Flora
- E Secondary A Aquifer

Notes:

Client:

Shape

Job No:

16-908

Date:

15.04.2024

Drawing No:

010

Scale:

NTS



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

Job Title:

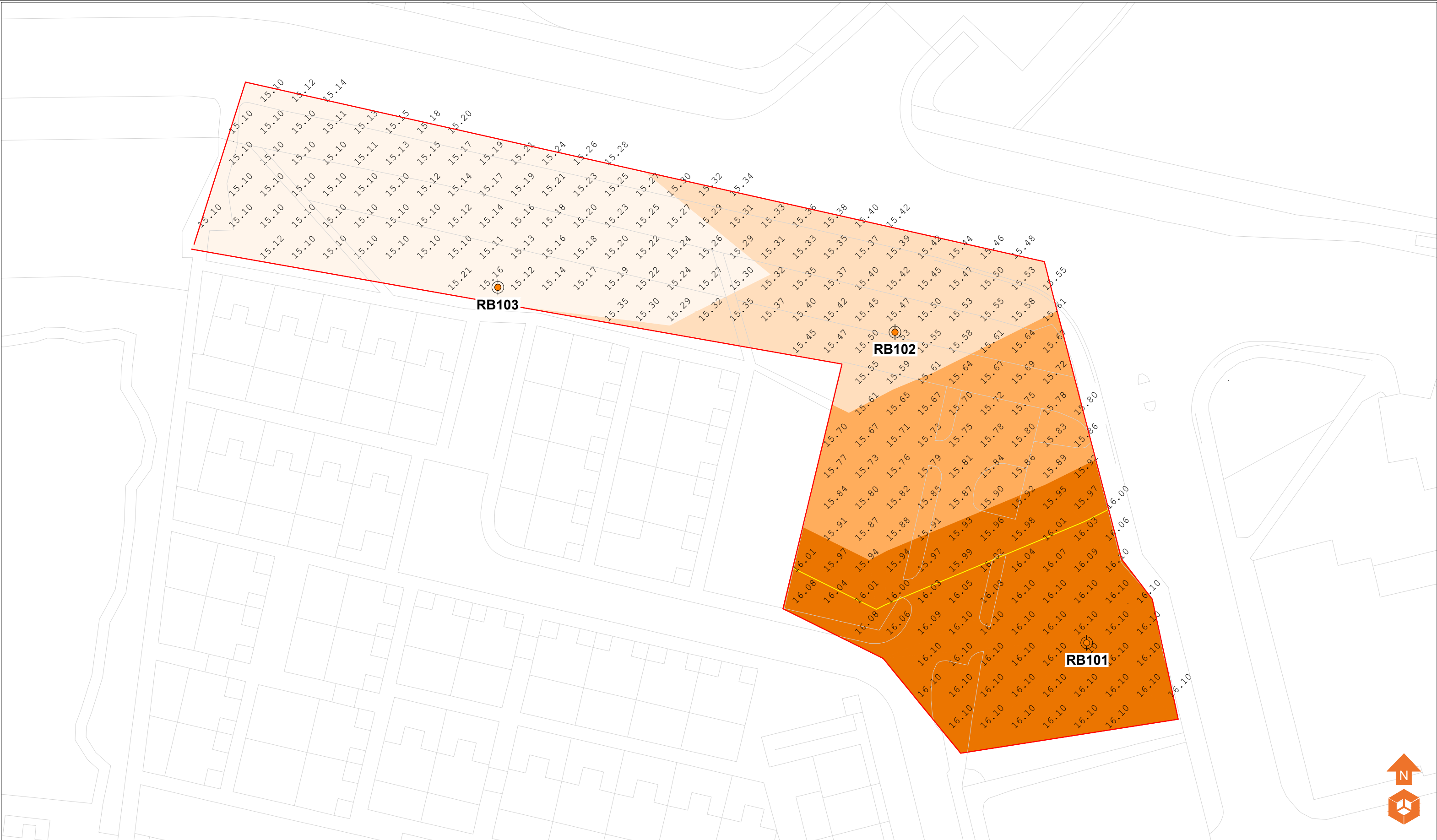
Grey Mare Lane -
Site One

Drawing Title:

Conceptual Site
Model

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P1	REVA	15.04.2024	OW	EF	EF
Phase	Issue	Date	Drawn	Checked	PM



Location Symbols Approximate Rotary Borehole Location (E3P Location - February 2024)		Depth to Bedrock (m) Depth to Bedrock 15.00 - 15.29m Depth to Bedrock 15.30 - 15.59m Depth to Bedrock 15.60 - 15.89m Depth to Bedrock >15.90m					Notes:					Client: Shape		Job No: 16-908	Date: 28.03.2024	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
							Job Title: Grey Mare Lane - Site One		Drawing No: 012		Scale: NTS@ A3		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.				
							Drawing Title: Depth to Bedrock Plan										
P1	REVA	28.03.2024	CB	LC													
Phase	Issue	Date	Drawn	Checked													

APPENDIX V

PHOTOGRAPHS



PLATE 1 **CENTRAL SECTOR – RELICT FOUNDATIONS AND SLAB**



PLATE 2 **VIEW OF SITE FACING SOUTH**





PLATE 3 **WESTERN BRANCH OF SITE**



PLATE 4 **VIEW FROM CARPARK – FACING EAST**



APPENDIX VI

HISTORICAL MAPS

Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series Town Plan

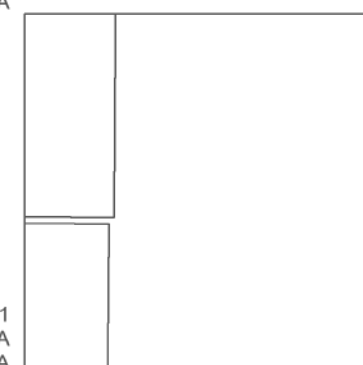
Map date: 1891

Scale: 1:500

Printed at: 1:1,000



Surveyed 1891
 Revised N/A
 Edition N/A
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 Levelled N/A



Surveyed 1891
 Revised N/A
 Edition N/A
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1889-1893

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1893
Revised N/A
Edition 1893
Copyright N/A
Levelled N/A

Surveyed 1893
Revised N/A
Edition 1893
Copyright N/A
Levelled N/A

Surveyed 1889
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1908

Scale: 1:2,500

Printed at: 1:2,500



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 Revised 1905
 Edition 1908
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 Revised 1905
 Edition 1908
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 Levelled N/A

Surveyed 1891
 Revised 1905
 Edition 1908
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 Edition 1908
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1922

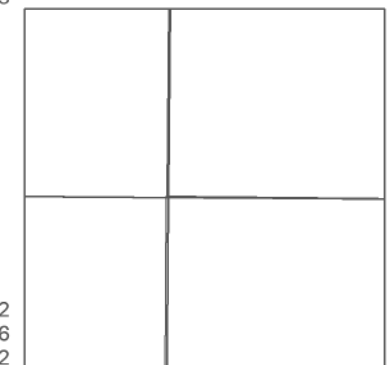
Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1922
 Revised 1916
 Edition 1922
 Copyright N/A
 Levelled 1915

Surveyed 1922
 Revised 1916
 Edition 1922
 Copyright N/A
 Levelled 1915



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 Revised 1916
 Edition 1922
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 Revised 1916
 Edition 1922
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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1931-1933

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1873
Revised 1931
Edition N/A
Copyright N/A
Levelled 1927

Surveyed 1873
Revised 1932
Edition N/A
Copyright N/A
Levelled 1927

Surveyed 1873
Revised 1932
Edition N/A
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Surveyed 1873
Revised 1933
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Site Details:

386954, 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1948-1949

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1948
Revised 1948
Edition N/A
Copyright 1948
Levelled 1929

Surveyed 1949
Revised 1949
Edition N/A
Copyright 1949
Levelled 1949

Surveyed 1949
Revised 1949
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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1950

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1949
 Revised 1949
 Edition N/A
 Copyright 1950
 Levelled 1949

Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright N/A
 Levelled N/A

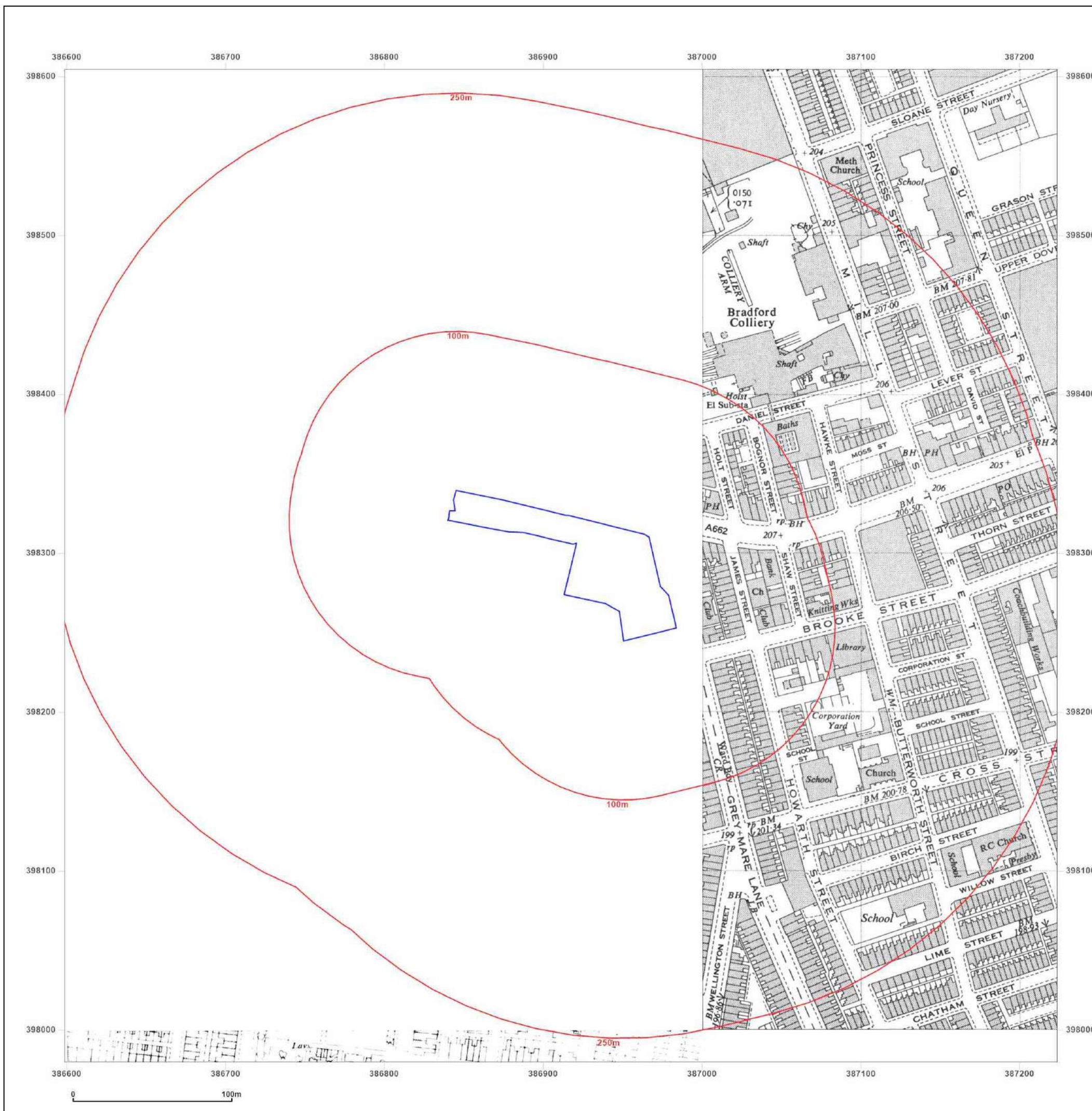


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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1949-1951

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1948
Revised 1948
Edition N/A
Copyright 1949
Levelled 1929

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1951
Levelled N/A

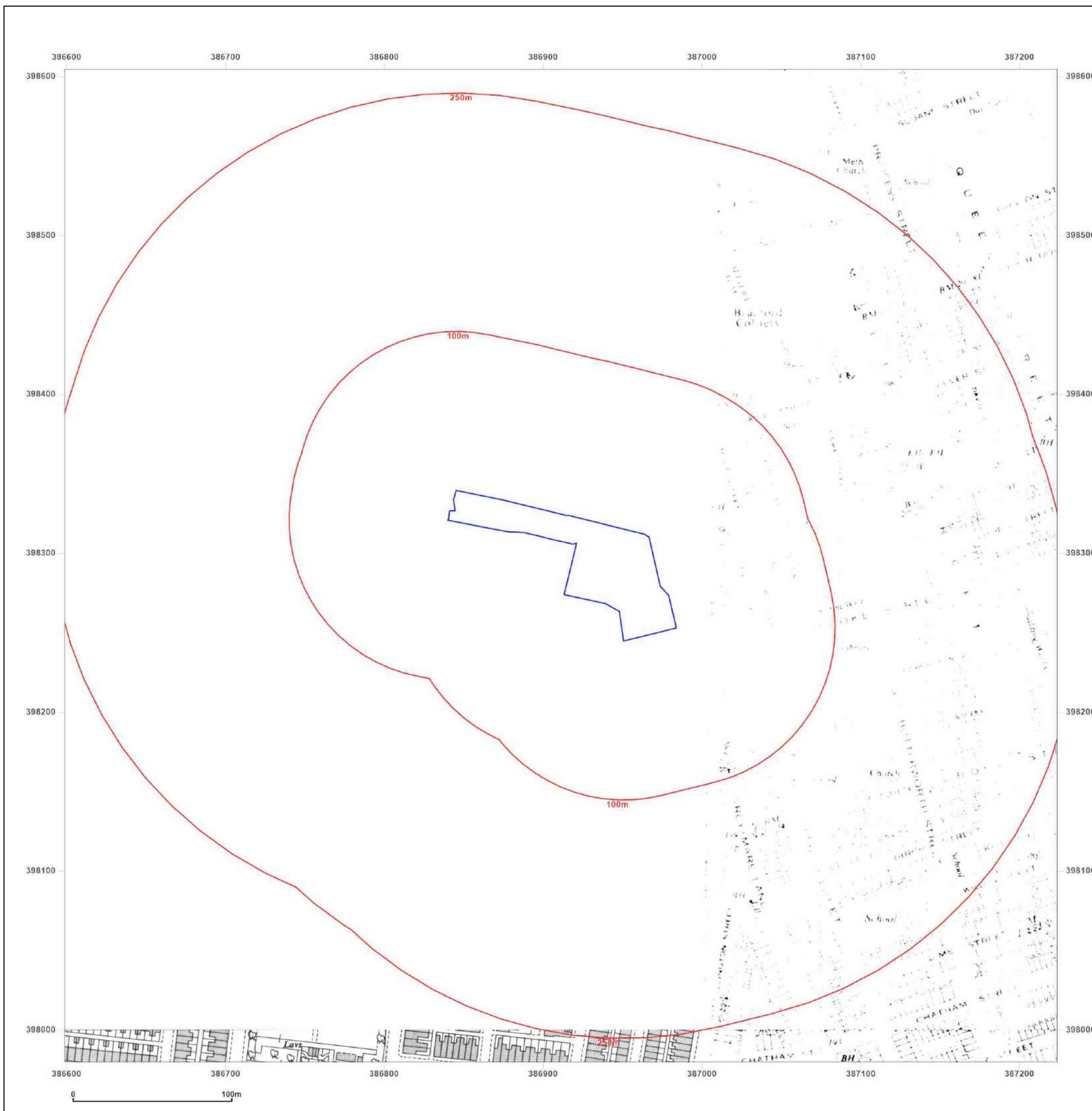


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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

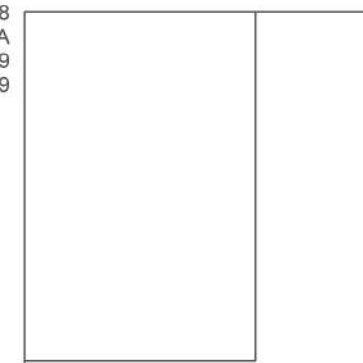
Map date: 1959

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1958
 Revised 1958
 Edition N/A
 Copyright 1959
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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1977-1979

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1979
Levelled 1964

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1979-1980

Scale: 1:1,250

Printed at: 1:2,000



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 Revised 1978
 Edition N/A
 Copyright 1979
 Levelled 1963

Surveyed 1949
 Revised 1979
 Edition N/A
 Copyright 1980
 Levelled 1964



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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1983-1987

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1966
 Revised 1987
 Edition N/A
 Copyright 1987
 Levelled 1966

Surveyed 1964
 Revised 1985
 Edition N/A
 Copyright 1985
 Levelled 1964

Surveyed 1963
 Revised 1983
 Edition N/A
 Copyright 1983
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1989-1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1991
 Revised 1991
 Edition N/A
 Copyright 1991
 Levelled N/A

Surveyed 1949
 Revised 1988
 Edition N/A
 Copyright 1989
 Levelled 1964

Surveyed 1992
 Revised 1992
 Edition N/A
 Copyright 1992
 Levelled N/A

Surveyed 1964
 Revised 1991
 Edition N/A
 Copyright 1991
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1994-1995

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1995
 Revised 1995
 Edition N/A
 Copyright 1995
 Levelled N/A

Surveyed 1994
 Revised 1994
 Edition N/A
 Copyright 1994
 Levelled N/A

Surveyed 1994
 Revised 1994
 Edition N/A
 Copyright 1994
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1995

Scale: 1:1,250

Printed at: 1:2,000



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Revised 1995
Edition N/A
Copyright 1995
Levelled N/A

Surveyed 1995
Revised 1995
Edition N/A
Copyright 1995
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Production date: 24 May 2023

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1995

Scale: 1:1,250

Printed at: 1:2,000



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 Edition N/A
 Copyright 1995
 Levelled N/A

Surveyed 1995
 Revised 1995
 Edition N/A
 Copyright 1995
 Levelled N/A



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1992-1995

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1992
 Revised 1992
 Edition N/A
 Copyright 1992
 Levelled N/A

Surveyed 1992
 Revised 1992
 Edition N/A
 Copyright 1992
 Levelled N/A

Surveyed 1995
 Revised 1995
 Edition N/A
 Copyright 1995
 Levelled N/A

Surveyed 1992
 Revised 1992
 Edition N/A
 Copyright 1992
 Levelled N/A



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1994-1995

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1995
 Revised 1995
 Edition N/A
 Copyright 1995
 Levelled N/A

Surveyed 1994
 Revised 1994
 Edition N/A
 Copyright 1994
 Levelled N/A

Surveyed 1995
 Revised 1995
 Edition N/A
 Copyright 1995
 Levelled N/A

Surveyed 1994
 Revised 1994
 Edition N/A
 Copyright 1994
 Levelled N/A



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Production date: 24 May 2023

Map legend available at:
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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: LandLine

Map date: 2003

Scale: 1:1,250

Printed at: 1:1,250



2003



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1848

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1845
Revised N/A
Edition 1848
Copyright N/A
Levelled N/A

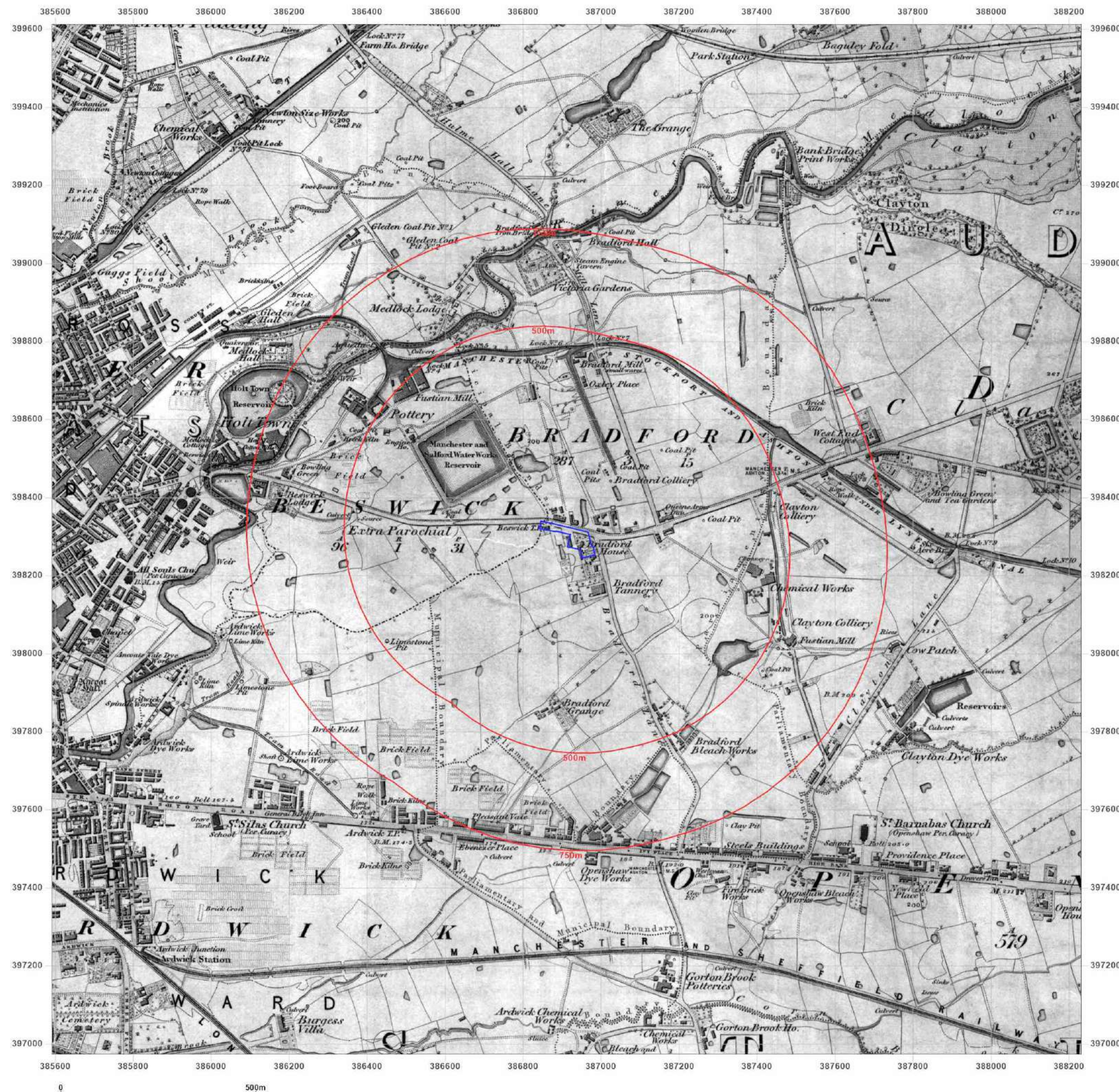


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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1890-1891

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1891
 Revised 1891
 Edition 1891
 Copyright N/A
 Levelled N/A

Surveyed 1890
 Revised 1890
 Edition 1890
 Copyright N/A
 Levelled N/A



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1905-1906

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1844
Revised 1906
Edition 1906
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1905
Edition 1905
Copyright N/A
Levelled N/A

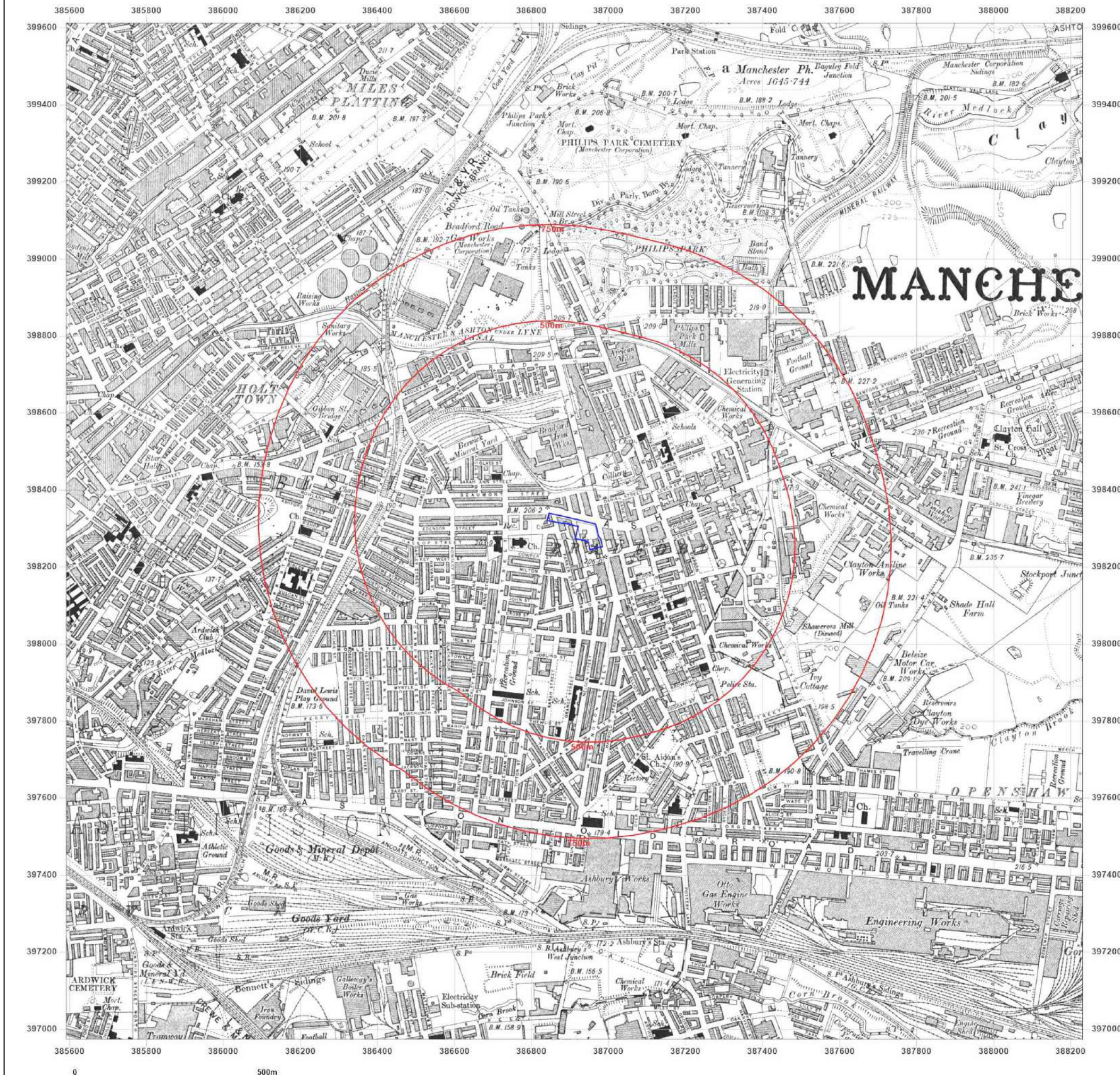


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Production date: 24 May 2023

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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1923

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1844
Revised 1921
Edition 1923
Copyright N/A
Levelled 1906

Surveyed 1844
Revised 1915
Edition 1923
Copyright N/A
Levelled 1915

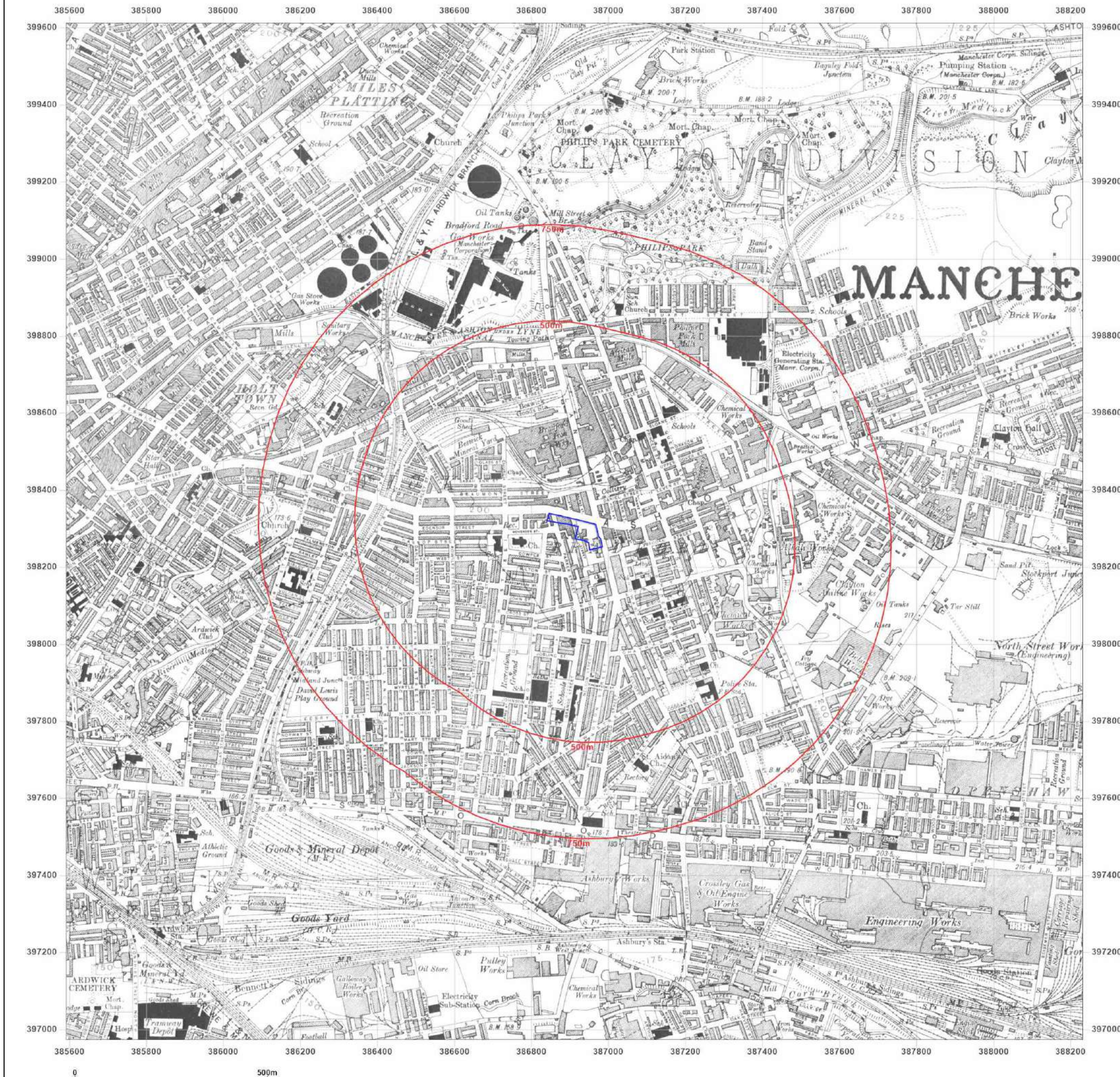


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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1933-1934

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1844
 Revised 1933
 Edition 1933
 Copyright N/A
 Levelled 1927

Surveyed 1844
 Revised 1934
 Edition 1934
 Copyright N/A
 Levelled 1927



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1844
 Revised 1938
 Edition 1938
 Copyright N/A
 Levelled 1927

Surveyed 1844
 Revised 1938
 Edition 1938
 Copyright N/A
 Levelled 1927



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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: Provisional

Map date: 1956

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1956
Revised 1956
Edition N/A
Copyright 1956
Levelled N/A

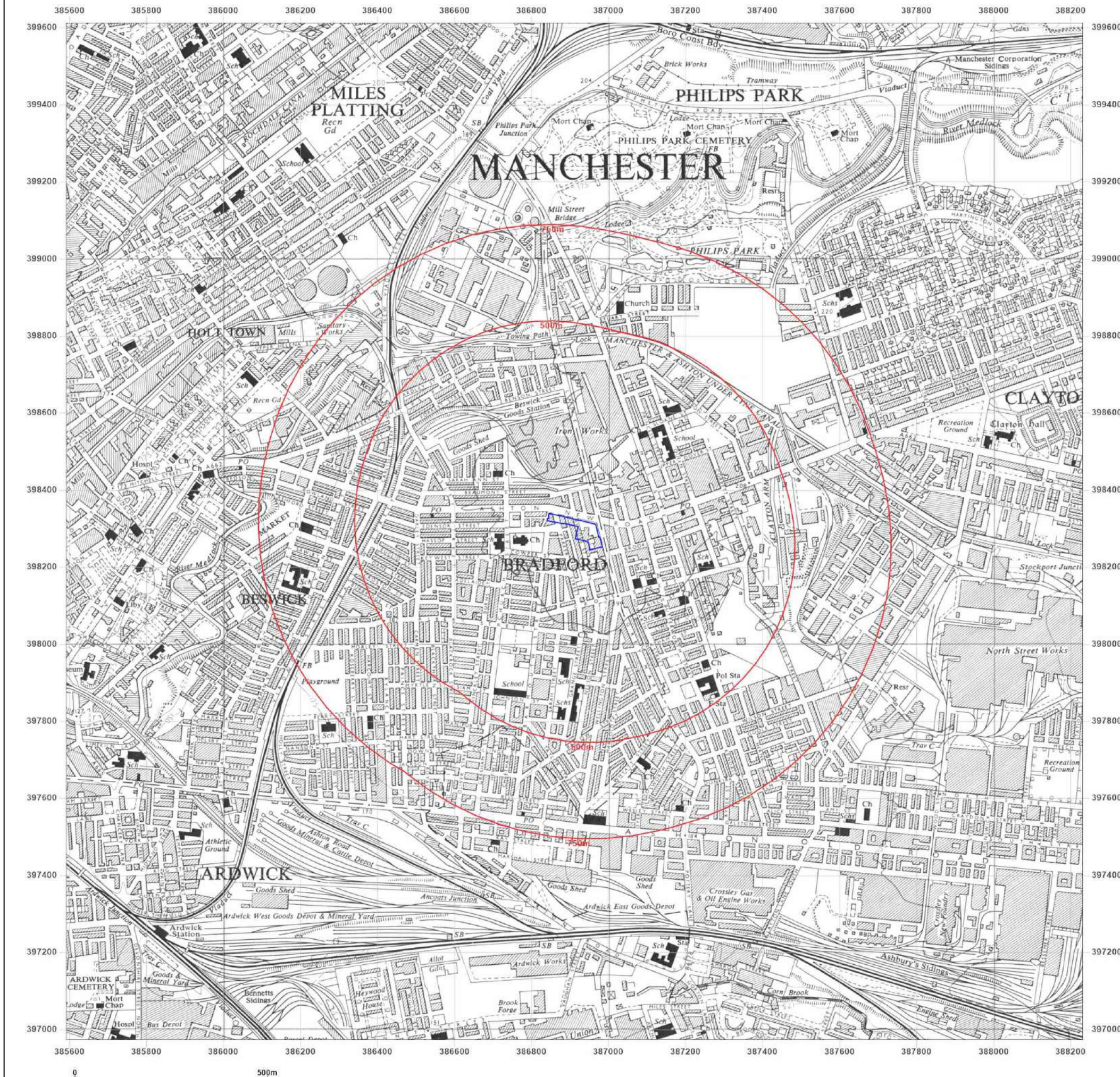


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Production date: 24 May 2023

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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: Provisional

Map date: 1968

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1968
 Revised 1968
 Edition N/A
 Copyright 1968
 Levelled N/A

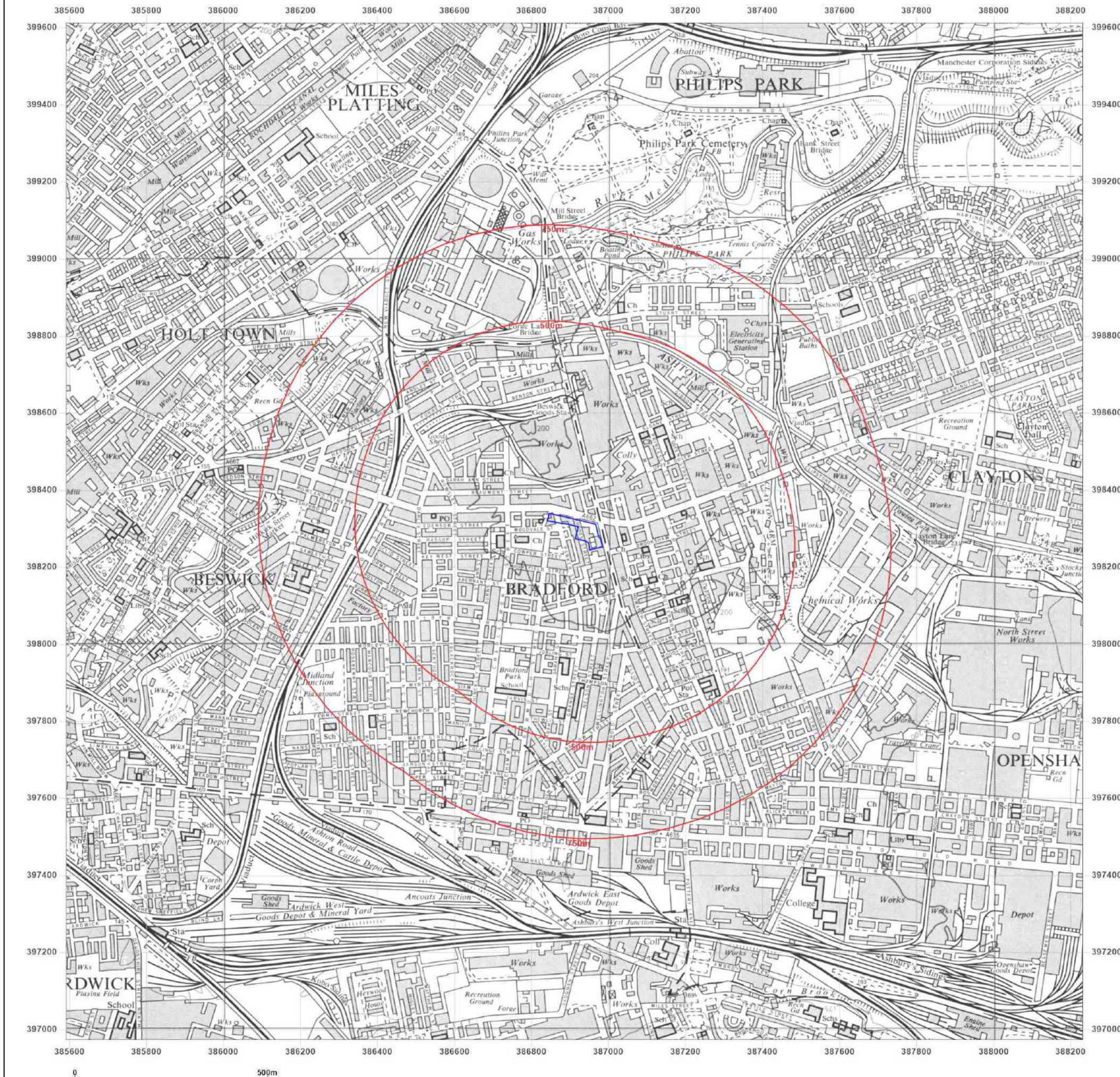


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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1981

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1976
 Revised 1980
 Edition N/A
 Copyright 1981
 Levelled 1976



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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1985

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1985
 Revised 1985
 Edition N/A
 Copyright 1985
 Levelled 1981

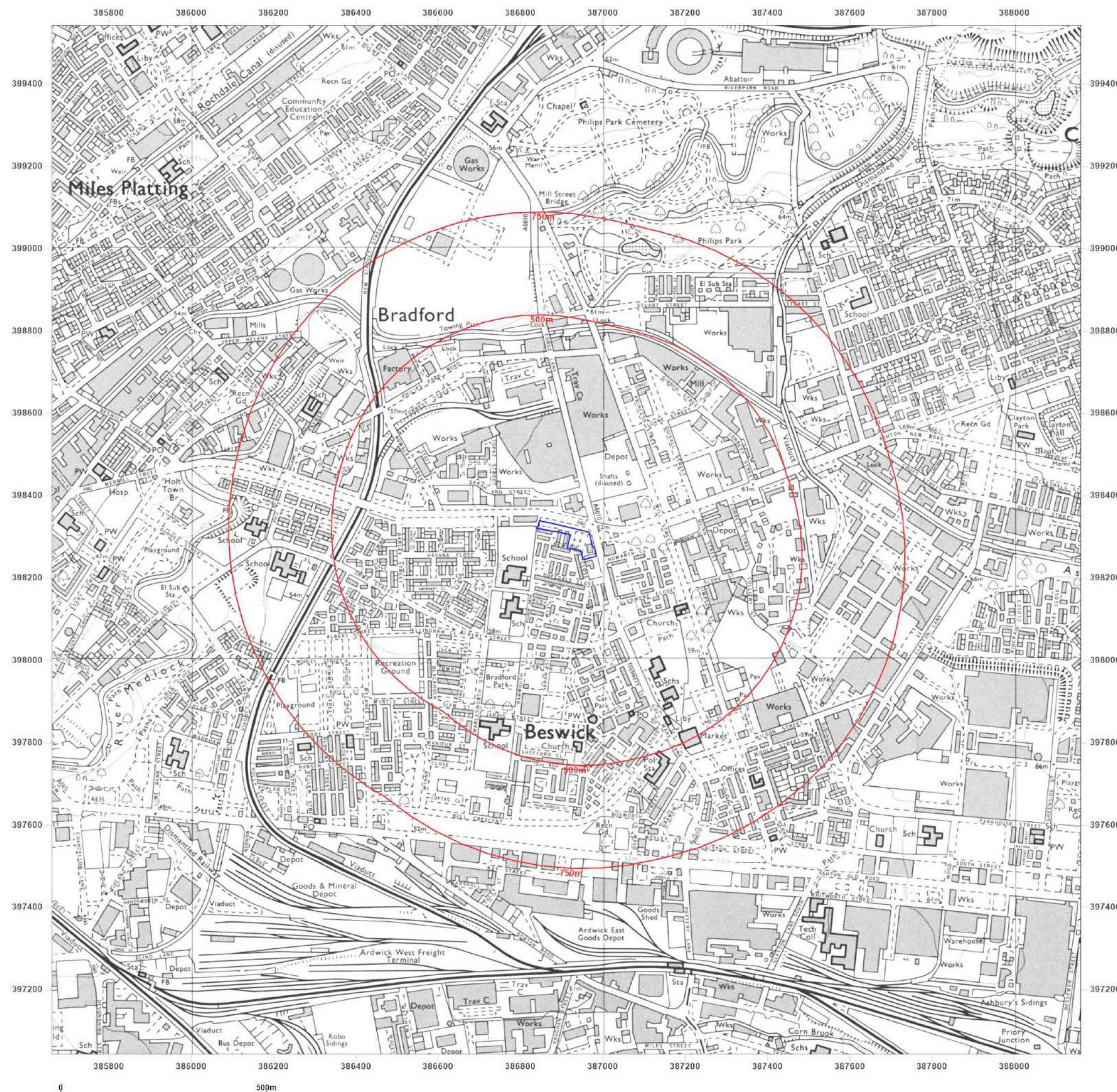


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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 1991

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1985
 Revised 1991
 Edition N/A
 Copyright 1991
 Levelled 1981

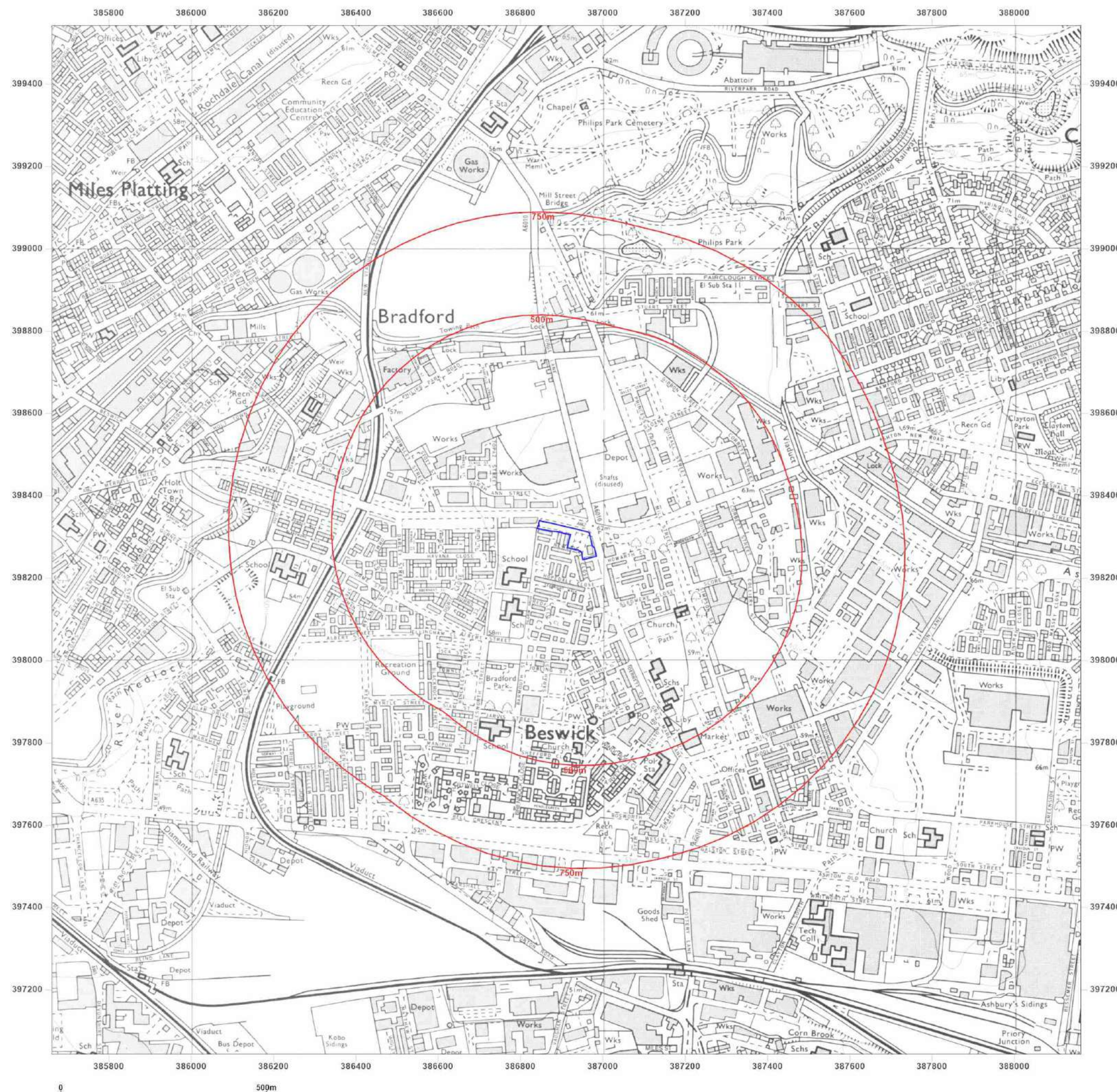


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Site Details:

386954 , 398294

Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 2001

Scale: 1:10,000

Printed at: 1:10,000



2001



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Site Details:

386954 , 398294

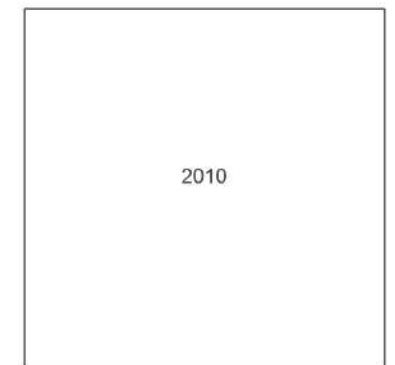
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Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000



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Production date: 24 May 2023

Map legend available at:
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Site Details:

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Client Ref: 004945
Report Ref: GS-7XT-B48-62P-SYQ
Grid Ref: 386911, 398292

Map Name: National Grid

Map date: 2023

Scale: 1:10,000

Printed at: 1:10,000



2023

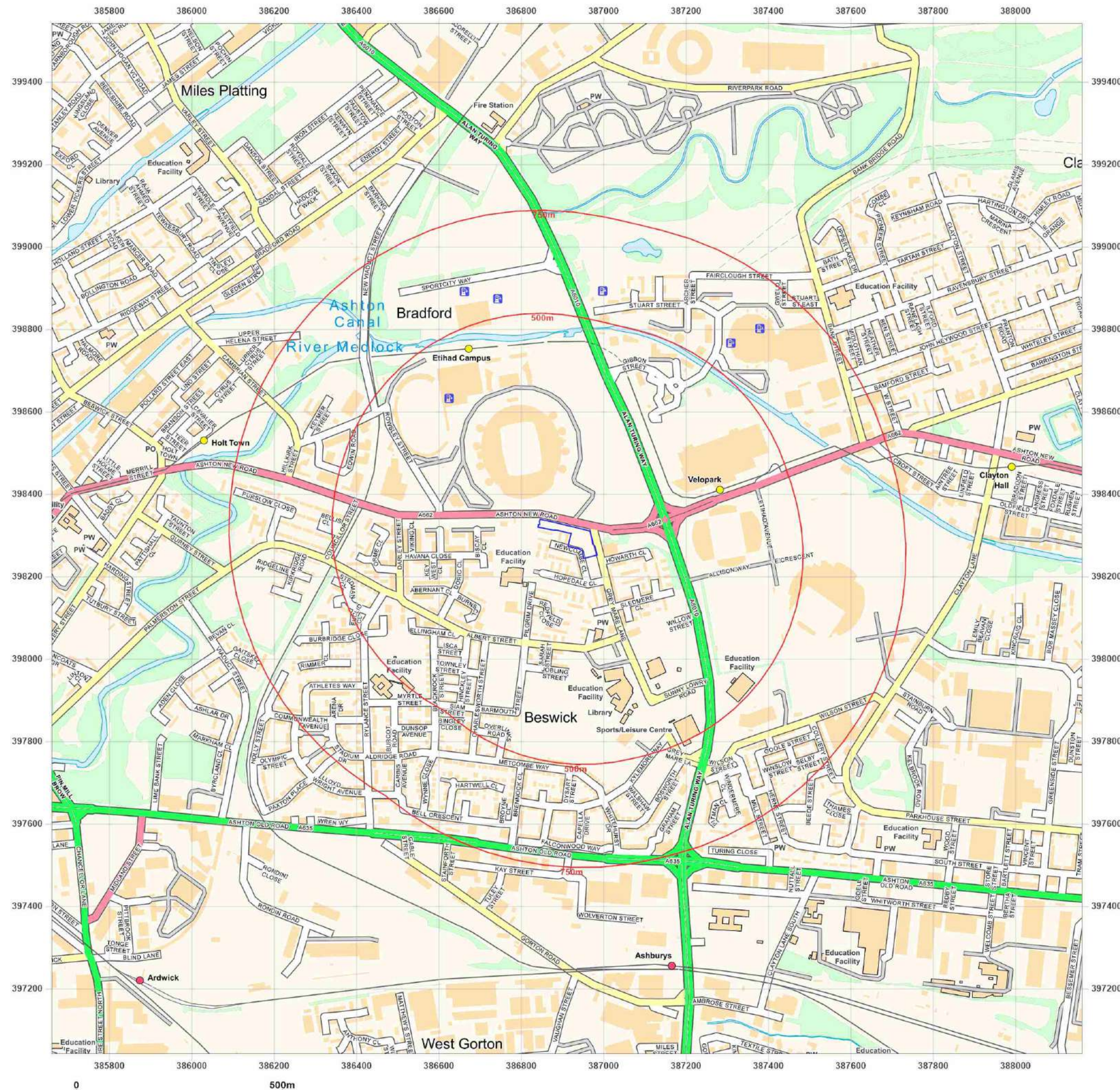


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Production date: 24 May 2023

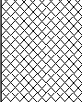
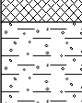
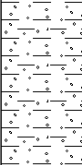
Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



APPENDIX VII

EXPLORATORY HOLE LOGS

				Trial Pit Log				TrialPit No TP101 Sheet 1 of 1		
Project Name: Grey Mare Lane Site 1				Project No. 16908		Co-ords: 386957.00 - 398260.00		Date 21/02/2024		
Location: Manchester						Dimensions (m): 1.80		Scale 1:30		
Client: Shape						Depth 2.00		Logged M.Dimes		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.50 0.50 1.50 1.50	HVP	124	0.10			MADE GROUND: Asphalt.			1 2 3 4
				0.20			MADE GROUND: Brownish grey slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of limestone and sandstone.			
							MADE GROUND: Black mottled dark greyish brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone, brick, concrete, timber, plastic, and clinker.			
				0.80			MADE GROUND: Black mottled dark greyish brown slightly sandy gravelly clay with frequent cobbles. Gravel is fine to coarse angular to subrounded of sandstone, brick, concrete, timber, plastic, and clinker. Cobbles are angular to subrounded of brick.			
				1.20			Stiff high strength brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone.			
									2.00	
Trial Pit Photographs										
										
Trial Pit 101					Trial Pit 101 Spoil					
Remarks: 1. Complete.										
Stability: Stable										
										

				Trial Pit Log				TrialPit No TP102 Sheet 1 of 1		
Project Name: Grey Mare Lane Site 1				Project No. 16908		Co-ords: 386971.00 - 398280.00 Level:		Date 21/02/2024		
Location: Manchester						Dimensions (m): 1.80		Scale 1:30		
Client: Shape						Depth 1.90		Logged M.Dimes		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.10			MADE GROUND: Asphalt.			1 2 3 4
				0.20			MADE GROUND: Brownish grey slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of limestone and sandstone.			
							MADE GROUND: Dark greyish brown clayey sandy gravel with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick, asphalt, concrete, clinker, and slag. Cobbles are angular to subrounded of brick and concrete.			
	0.80			0.90			Stiff high strength brown mottled grey slightly gravelly CLAY with rare coal fragments. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.			
	1.50 1.50 1.80	HVP	110	1.90			End of Pit at 1.90m			
Trial Pit Photographs										
 21/02/2024 15° N 16-908 Grey Mare Ln Site 1 TP102					 21/02/2024 39° NE 16-908 Grey Mare Ln Site 1 TP102					
Trial Pit 102					Trial Pit 102 Spoil					
Remarks: 1. Complete.										
Stability: Stable										
										

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386936.00 - 398312.00
Level:

Date
21/02/2024

Location: Manchester

Dimensions (m): 1.80

Scale
1:30

Client: Shape

Depth
1.70

Logged
M.Dimes

[illegible]

Trial Pit Photographs



Trial Pit 103



Trial Pit 103 Spoil

Remarks: 1. Complete.

Stability:	Stable
------------	--------

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386965.00 - 398296.00

Hole Type
WS

Location: Manchester

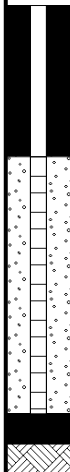
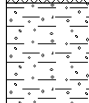
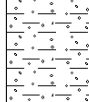
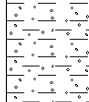
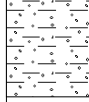
Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

Logged By
M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30			0.10 0.20 0.50			MADE GROUND: Asphalt.	
		1.00						MADE GROUND: Brownish grey slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of limestone and sandstone.	
		1.00		N=15 (3,2/2,3,4,6)				MADE GROUND: Dark greyish brown clayey sandy gravel. Gravel is fine to coarse angular to subrounded of brick, asphalt, concrete, clinker, and slag.	1
		1.20						Very stiff high strength brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone. Very stiff very high strength from 2.00 m bgl.	
		2.00							2
		2.00		N=43 (4,5/7,8,13,15)					
		2.70							
		2.70		50 (8,8/50 for 275mm)					
		3.00							3
					3.13			End of borehole at 3.13 m	

Remarks

1. Terminated on very stiff CLAY at 3.13 m bgl. 2. Monitoring well installed - response zone 1.00-2.70 m bgl.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386944.00 - 398288.00

Hole Type
WS

Location: Manchester

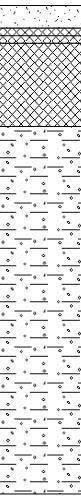
Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

Logged By
M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15			MADE GROUND: Concrete.	
		0.20			0.20			MADE GROUND: Light grey sandy gravel.	
		0.25			0.25			Gravel is fine to coarse angular to subrounded of limestone and concrete.	
		0.60			0.80			MADE GROUND: Black mottled grey sandy gravel. Gravel is fine to coarse angular to subrounded of clinker, slack, and brick.	
		1.00						MADE GROUND: Dark greyish brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick and clinker.	1
		1.00		N=21 (2,2/4,5,6,6)				Very stiff high strength light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone. Very stiff very high strength from 2.00 m bgl.	2
		1.50 - 2.00							
		2.00							
		2.00		N=39 (5,6/7,9,11,12)					
		2.50							
		2.80							
		3.00		50 (7,8/50 for 275mm)					3
					3.23			End of borehole at 3.23 m	4
									5
									6
									7
									8
									9
									10

Remarks

1. Terminated on very stiff CLAY at 3.23 m bgl. 2. Water strike encountered at 0.50 m bgl.

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386953.00 - 398308.00

Hole Type
WS

Location: Manchester

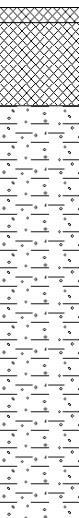
Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

Logged By
M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30		N=15 (1,2/2,3,4,6)	0.10			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick. MADE GROUND: Dark grey mottled dark brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick, clinker, and slag. Very stiff high strength light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone. Very stiff very high strength from 3.00 m bgl.	1 2 3 4 5 6 7 8 9 10
					0.65				
		1.00							
		1.00							
		1.80		N=24 (3,4/4,5,7,8)					
		2.00							
		2.00							
		3.00		50 (7,8/50 for 285mm)					
		3.00							
			3.44				End of borehole at 3.44 m		

Remarks

1. Terminated on very stiff CLAY at 3.44 m bgl.

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386929.00 - 398315.00

Hole Type
WS

Location: Manchester

Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

Logged By
M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick.	
		0.90						MADE GROUND: Dark grey mottled dark brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick, clinker, and slag.	1
		1.00							
		1.00		N=9 (2,3/2,3,2,2)	1.30				
		1.80						Very stiff high strength light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone. Very stiff very high strength from 3.00m bgl.	2
		2.00							
		2.00		N=31 (3,4/6,6,8,11)					
		3.00							3
		3.00		50 (6,8/50 for 280mm)	3.43				
								End of borehole at 3.43 m	4
									5
									6
									7
									8
									9
									10

Remarks

1. Terminated on very stiff CLAY at 3.43 m bgl. 2. Monitoring well installed - response zone 0.50-1.00 m bgl.

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386894.00 - 398322.00

Hole Type
WS

Location: Manchester

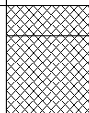
Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

Logged By
M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick.	
		0.90			0.95			MADE GROUND: Black sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick, clinker, slag, and coal.	1
		1.00		1 (1,/,1,,)	1.05			MADE GROUND: Greyish brown clayey sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, clinker, and brick.	
		1.00						Very stiff very high strength light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone.	2
		2.00		N=33 (2,4/6,8,9,10)					
		2.00							
		2.80							3
		3.00		50 (7,9/50 for 290mm)					
		3.00			3.44				
								End of borehole at 3.44 m	4
									5
									6
									7
									8
									9
									10

Remarks

1. Terminated on very stiff CLAY at 3.44 m bgl.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Grey Mare Lane Site 1

Project No.
16908

Co-ords: 386851.00 - 398329.00

Hole Type
WS

Location: Manchester

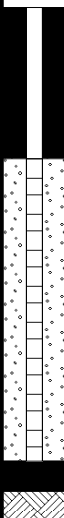
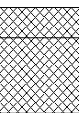
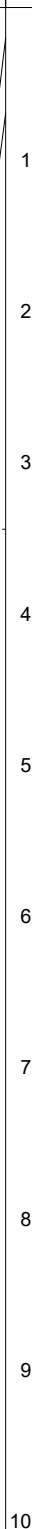
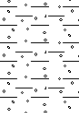
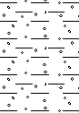
Level:

Scale
1:50

Client: Shape

Dates: 21/02/2024 -

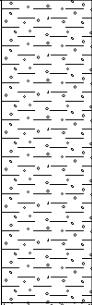
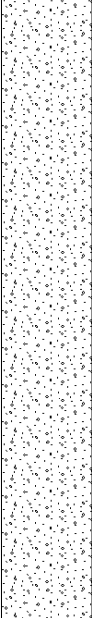
Logged By
M.Dimes

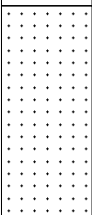
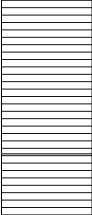
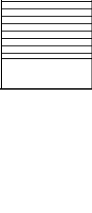
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.40 0.50		N=13 (1,1/2,3,4,4)	0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick.			
		0.70									
		1.00 1.00 1.10					MADE GROUND: Black sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick, clinker, slag, and coal. Stiff medium strength light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone and rare coal fragments. Very stiff high strength from 2.00 m bgl. Very stiff very high strength from 3.00 m bgl.				
		2.00 2.00									
		3.00 3.00									
				50 (4,5/50 for 295mm)	3.45		End of borehole at 3.45 m				

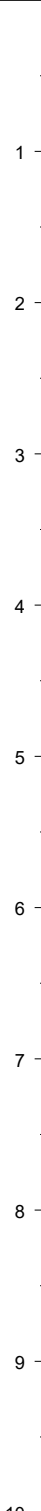
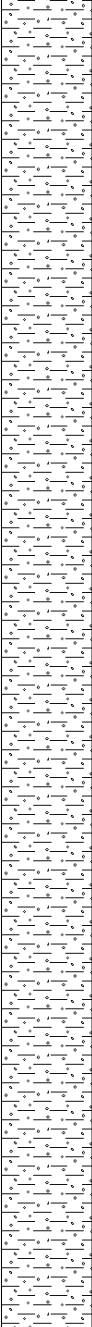
Remarks

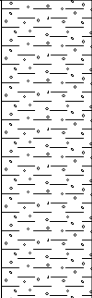
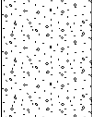
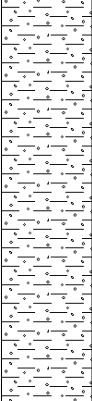
1. Terminated on very stiff CLAY at 3.45 m bgl. 2. Monitoring well installed - response zone 1.00-3.00 m bgl.

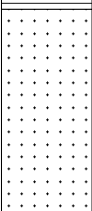
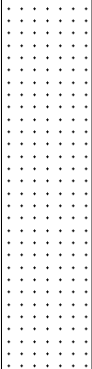
					Borehole Log			Borehole No. RB101 Sheet 1 of 3		
Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386969E - 398268N		Hole Type BH	
Location: Manchester					Level:			Scale 1:50		
Client: Shape					Dates: 21/02/2024			Logged By M.Dimes		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.20			MADE GROUND: Concrete.		
					0.70			MADE GROUND: Black mottled dark greyish brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone, brick, concrete, timber, plastic, and clinker.	1	
								Brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone.		
										2
										
										
										
										
										3
									Light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone.	
									4	
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										
										

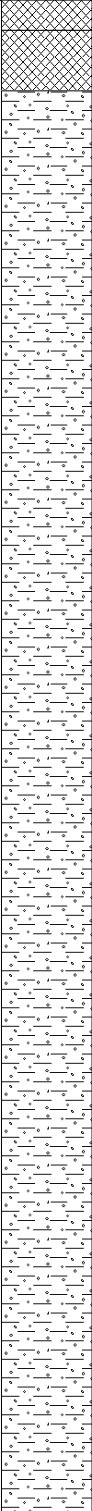
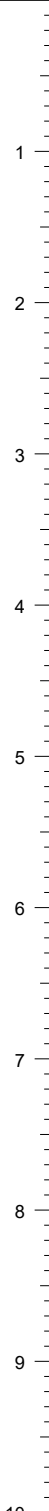
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Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386969E - 398268N		Sheet 2 of 3	
Location: Manchester					Level:			Hole Type BH		
Client: Shape					Dates: 21/02/2024			Scale 1:50		
								Logged By M.Dimes		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					12.00			Light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mudstone.	11	
								Brown gravelly fine to coarse SAND. Gravel is fine to coarse subangular to rounded of sandstone and mudstone.	12	
									13	
									14	
					16.10			Grey MUDSTONE.	15	
									16	
									17	
									18	
									19	
					19.70			Dark grey MUDSTONE.	20	
Remarks										
1. Complete.										

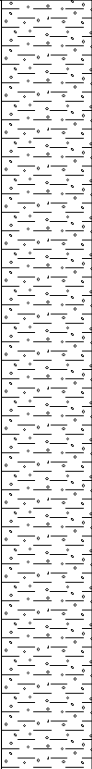
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Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386969E - 398268N		Hole Type BH	
Location: Manchester					Level:			Scale 1:50		
Client: Shape					Dates: 21/02/2024			Logged By M.Dimes		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					22.10			Dark grey MUDSTONE.	21	
								Grey MUDSTONE with occasional bands of SANDSTONE.	22	
									23	
									24	
									25	
									26	
									27	
									28	
									29	
									30	
					30.00			End of Borehole at 30.00m	30	
Remarks 1. Complete.										

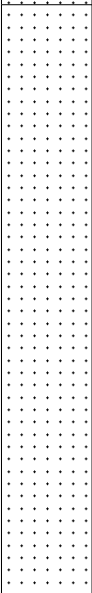
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Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386941E - 398309N		Sheet 1 of 3	
Location: Manchester					Level:			Hole Type BH		
Client: Shape					Dates: 22/02/2024			Scale 1:50		
								Logged By M.Dimes		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick. MADE GROUND: Concrete. MADE GROUND: Dark greyish brown mottled black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of brick, clinker, and slag. Brown mottled grey slightly gravelly CLAY with occasional bands of fine to coarse SAND. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.		
					0.40					
					0.80					
										
Remarks										
1. Complete.										

				Borehole Log				Borehole No. RB102	
Project Name: Grey Mare Lane Site 1				Project No. 16908		Co-ords: 386941E - 398309N		Sheet 2 of 3	
Location: Manchester				Level:				Hole Type BH	
Client: Shape				Dates: 22/02/2024				Scale 1:50	
								Logged By M.Dimes	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Brown mottled grey slightly gravelly CLAY with occasional bands of fine to coarse SAND. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.	11
								Brown gravelly fine to coarse SAND. Gravel is fine to coarse subangular to rounded of sandstone and mudstone.	12
								Brown mottled grey slightly gravelly CLAY with occasional bands of fine to coarse SAND. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.	13
								Grey MUDSTONE.	14
									15
									16
									17
									18
									19
									20
Remarks 1. Complete.									

					Borehole Log			Borehole No. RB102 Sheet 3 of 3									
Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386941E - 398309N		Hole Type BH								
Location: Manchester					Level:			Scale 1:50									
Client: Shape					Dates: 22/02/2024			Logged By M.Dimes									
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					22.00			Grey MUDSTONE.	21								
									Dark grey MUDSTONE.	22							
											23						
											Grey SANDSTONE with occasional bands of grey MUDSTONE.	24					
													25				
													Grey MUDSTONE.	27			
															28		
																29	
																	30
																	End of Borehole at 30.00m
Remarks 1. Complete.																	

					Borehole Log			Borehole No. RB103 Sheet 1 of 3	
Project Name: Grey Mare Lane Site 1				Project No. 16908		Co-ords: 386883E - 398320N		Hole Type BH	
Location: Manchester						Level:		Scale 1:50	
Client: Shape						Dates: 23/02/2024		Logged By M.Dimes	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets (reworked topsoil). Gravel is fine to coarse angular to subrounded of sandstone, mudstone, and brick. MADE GROUND: Dark greyish brown mottled black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of brick, clinker, and slag. Brown mottled grey slightly gravelly CLAY with occasional bands of fine to coarse SAND. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.	
					0.60				
Remarks									
1. Complete.									
									

					Borehole Log			Borehole No. RB103 Sheet 2 of 3		
Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386883E - 398320N		Hole Type BH	
Location: Manchester					Level:			Scale 1:50		
Client: Shape					Dates: 23/02/2024			Logged By M.Dimes		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					15.10			Brown mottled grey slightly gravelly CLAY with occasional bands of fine to coarse SAND. Gravel is fine to medium subangular to subrounded of mudstone and sandstone.	11	
					20.00			Grey MUDSTONE.	15	
									20	
Remarks 1. Complete.										

					Borehole Log			Borehole No. RB103 Sheet 3 of 3						
Project Name: Grey Mare Lane Site 1					Project No. 16908		Co-ords: 386883E - 398320N		Hole Type BH					
Location: Manchester					Level:			Scale 1:50						
Client: Shape					Dates: 23/02/2024			Logged By M.Dimes						
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description						
		Depth (m)	Type	Results										
					22.70			Dark grey MUDSTONE.	21					
									Grey MUDSTONE.	22				
										23				
										24				
										25				
											Grey SANDSTONE.	26		
													Grey SANDSTONE with occasional bands of grey MUDSTONE.	27
														28
														29
										30.00				End of Borehole at 30.00m
Remarks 1. Complete.														

APPENDIX VIII

CHEMICAL TESTING

RESULTS



e3p
Taylor Road
Urmston
Manchester

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

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

e: mdimes@e3p.co.uk

Analytical Report Number : 24-005540

Replaces Analytical Report Number: 24-005540, issue no. 1
Client sampling date amended.
Sample Date Added To All Samples Per Clients Request

Project / Site name:	Grey Mare	Samples received on:	22/02/2024
Your job number:	16-908	Samples instructed on/ Analysis started on:	27/02/2024
Your order number:	007511	Analysis completed by:	01/03/2024
Report Issue Number:	2	Report issued on:	21/03/2024
Samples Analysed:	12 soil samples - 2 leachate samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

Analytical Report Number: 24-005540

Project / Site name: Grey Mare

Your Order No: 007511

Lab Sample Number	128656	128658	128659	128660	128661
Sample Reference	TP101	TP102	TP103	TP103	TP103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.80	0.10	0.50	1.30
Date Sampled	21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
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	79.9	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	9.9	16	33	20	15
Total mass of sample received	kg	0.1	NONE	1.3	1.2	0.3	0.2	0.3

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	DBU	DBU	DBU	DBU	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.1	9	7.8	8.1	7.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	3.8	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1000	2400	790	830	240
Water Soluble SO ₄ 1hr extraction	mg/kg	2.5	MCERTS	150	890	18	59	89
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	73.2	445	8.81	29.3	44.4
Sulphide	mg/kg	1	MCERTS	13	15	1.5	2.7	< 1.0
Total Sulphur	mg/kg	50	MCERTS	740	1200	650	1000	140
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.7	2.1	4.6	4.3	0.6

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	1.2	< 0.05	0.7	0.41	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.51	< 0.05	0.08	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.67	0.55	0.48	0.15	< 0.05
Fluorene	mg/kg	0.05	MCERTS	1.1	0.41	0.35	0.15	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	7.4	5	4.5	1.3	< 0.05
Anthracene	mg/kg	0.05	MCERTS	1.9	1.2	0.95	0.25	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	7.5	8.9	6.3	1.4	0.07
Pyrene	mg/kg	0.05	MCERTS	7.5	8.6	5.7	1.5	0.08
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.4	4	2.8	1	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.5	4.2	3	0.98	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.3	4.4	3.2	1.1	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.4	1.9	1.4	0.49	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.1	3.7	2.9	1.2	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.4	2	1.6	0.68	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.44	0.58	0.53	0.29	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.8	2.3	2	1.1	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	46	47.6	36.6	12.1	< 0.80
-----------------------------	-------	-----	-----------	----	------	------	------	--------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	18	35	30	9.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13	20	58	23	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	44	73	82	150	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	310	210	200	64	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	< 0.3	21	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	24	17	45	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.5	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	160	250	83	52



Analytical Report Number: 24-005540
Project / Site name: Grey Mare
Your Order No: 007511

Lab Sample Number				128656	128658	128659	128660	128661
Sample Reference				TP101	TP102	TP103	TP103	TP103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.80	0.10	0.50	1.30
Date Sampled				21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Petroleum Hydrocarbons								
TPH (>C5 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C5 - C6) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (>C6 - C8) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C8 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	3.4	6.2	< 2.0	< 2.0	< 2.0
TPH (>C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	14	35	< 4.0	< 4.0	< 4.0
TPH (>C16 - C21) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	50	65	21	< 10	< 10
TPH (>C21 - C35) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	240	160	64	11	< 10
TPH (>C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	130	90	18	< 10	< 10
TPH Total >C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	440	350	110	24	< 10
TPH (C10 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	440	350	110	24	< 10

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

Analytical Report Number: 24-005540
Project / Site name: Grey Mare
Your Order No: 007511

Lab Sample Number				128662	128663	128664	128665	128666
Sample Reference				WS101	WS102	WS103	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	1.80	0.90	0.90
Date Sampled				21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
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	43.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	26	15	13	17
Total mass of sample received	kg	0.1	NONE	0.3	0.2	0.2	0.3	0.2

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	-	DBU	-	DBU	DBU

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.3	7.9	8.4	7.4	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	2.6
Total Sulphate as SO ₄	mg/kg	50	MCERTS	230	480	250	620	1300
Water Soluble SO ₄ 1hr extraction	mg/kg	2.5	MCERTS	79	74	72	38	35
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	39.4	36.9	35.8	19	17.6
Sulphide	mg/kg	1	MCERTS	< 1.0	5.9	< 1.0	1.3	35
Total Sulphur	mg/kg	50	MCERTS	110	560	130	360	1500
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.8	2.2	0.9	1.2	1.4

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.44	0.24
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.09
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	4.6	0.52
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	3.6	0.32
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.1	0.13	29	3.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	7.9	0.8
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.11	0.14	26	7.2
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.12	0.12	22	6.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.06	0.06	8.1	3.3
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.08	0.08	7.4	3.4
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.08	0.08	8.7	4.4
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	3.3	1.6
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	7.7	3.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	3.4	1.8
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.9	0.54
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	3.9	2.1

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	136	40.2
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	6.8	19	8.9	45	32
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	22	30	30	37
Copper (aqua regia extractable)	mg/kg	1	MCERTS	24	48	29	72	300
Lead (aqua regia extractable)	mg/kg	1	MCERTS	12	470	15	120	330
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.7	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	24	35	38	36
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	52	69	64	140	180



Analytical Report Number: 24-005540
Project / Site name: Grey Mare
Your Order No: 007511

Lab Sample Number				128662	128663	128664	128665	128666
Sample Reference				WS101	WS102	WS103	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	1.80	0.90	0.90
Date Sampled				21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Petroleum Hydrocarbons								
TPH (>C5 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C5 - C6) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (>C6 - C8) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C8 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (>C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	2.1	2.2
TPH (>C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	29	13
TPH (>C16 - C21) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	89	42
TPH (>C21 - C35) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	88	89
TPH (>C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	17	22
TPH Total >C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	230	170
TPH (C10 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	230	170

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

Analytical Report Number: 24-005540

Project / Site name: Grey Mare

Your Order No: 007511

Lab Sample Number				128667	128668
Sample Reference				WS106	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.50	1.10
Date Sampled				21/02/2024	21/02/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection
				Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	20
Total mass of sample received	kg	0.1	NONE	0.3	0.2

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	DBU	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.3	7.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	800	340
Water Soluble SO ₄ 1hr extraction	mg/kg	2.5	MCERTS	43	120
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	21.7	58.6
Sulphide	mg/kg	1	MCERTS	2.2	1.3
Total Sulphur	mg/kg	50	MCERTS	500	110
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.5	0.5

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	0.08	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.31	0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.35	0.06
Pyrene	mg/kg	0.05	MCERTS	0.35	0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.18	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.2	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.21	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.16	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.84	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	24	11
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	62	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	160	14
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	33	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	64	34



Analytical Report Number: 24-005540
Project / Site name: Grey Mare
Your Order No: 007511

Lab Sample Number				128667	128668
Sample Reference				WS106	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.50	1.10
Date Sampled				21/02/2024	21/02/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection
Accreditation Status					
Petroleum Hydrocarbons					
TPH (>C5 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0
TPH (>C5 - C6) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1
TPH (>C6 - C8) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0
TPH (>C8 - C10) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0
TPH (>C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH (>C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0	< 4.0
TPH (>C16 - C21) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10
TPH (>C21 - C35) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10
TPH (>C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10
TPH Total >C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	< 10	< 10
TPH (C10 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10	< 10

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



Analytical Report Number: 24-005540
Project / Site name: Grey Mare

Your Order No: 007511

Lab Sample Number				128657	128669
Sample Reference				TP101	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.50	0.40
Date Sampled				21/02/2024	21/02/2024
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	7.6	7.9
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1.0	< 1.0

Total Phenols

Total Phenols (monohydric) low level	µg/l	1	NONE	2.3	2.2
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Speciated PAHs

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

Total PAH

Total EPA-16 PAHs	µg/l	0.16	NONE	< 0.16	< 0.16
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	2.8	3.2
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	1	1.3
Copper (dissolved)	µg/l	0.7	ISO 17025	19	16
Lead (dissolved)	µg/l	1	ISO 17025	6.5	6.5
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.2	1.1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	9.8	7.6

Petroleum Hydrocarbons

TPH - Aliphatic >C5 - C6 HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >C6 - C8 HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >C8 - C10 HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aliphatic >C10 - C12 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >C12 - C16 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >C16 - C21 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >C21 - C35 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH - Aliphatic >C5 - C35 HS+EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10

TPH - Aromatic >EC5 - EC7 HS_1D_AR	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 HS_1D_AR	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 EH_1D_AR_MS	µg/l	1	NONE	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10



Analytical Report Number: 24-005540
Project / Site name: Grey Mare

Your Order No: 007511

Lab Sample Number				128657	128669
Sample Reference				TP101	WS106
Sample Number				None Supplied	None Supplied
Depth (m)				0.50	0.40
Date Sampled				21/02/2024	21/02/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		
TPH - Aromatic >EC12 - EC16 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC16 - EC21 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH - Aromatic >EC21 - EC35 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH (C10 - C40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10

VOCs

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

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



Analytical Report Number : 24-005540
Project / Site name: Grey Mare

* 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 *
128656	TP101	None Supplied	0.5	Brown clay and loam with stones and brick
128658	TP102	None Supplied	0.8	Brown loam and clay with gravel and tar
128659	TP103	None Supplied	0.1	Brown loam and clay with gravel and vegetation
128660	TP103	None Supplied	0.5	Brown loam and sand with gravel and ash
128661	TP103	None Supplied	1.3	Brown clay and sand with gravel and vegetation
128662	WS101	None Supplied	1.2	Brown clay with gravel and vegetation
128663	WS102	None Supplied	0.6	Brown clay and loam with brick and gravel
128664	WS103	None Supplied	1.8	Brown clay with gravel
128665	WS104	None Supplied	0.9	Brown clay and sand with gravel and brick
128666	WS105	None Supplied	0.9	Brown clay and loam with gravel and brick
128667	WS106	None Supplied	0.5	Brown clay and sand with gravel and brick
128668	WS106	None Supplied	1.1	Brown clay and sand with gravel

Analytical Report Number : 24-005540

Project / Site name: Grey Mare

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
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, 2021	A001B	D	ISO 17025
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
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	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
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.	L019B	D	NONE
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	L038B	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038B	D	MCERTS
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	L039B	W	ISO 17025
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-MS/GC-MS HS in leachate	Determination of total petroleum hydrocarbons in leachate by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B/L088	W	NONE
Total petroleum hydrocarbons by GC-MS/GC-MS HS in leachate	Determination of total petroleum hydrocarbons in leachate by GC-MS/GC-MS HS	In-house method	L070B/L088	W	NONE
BTEX and/or Volatile organic compounds in leachate	Determination of volatile organic compounds in leachate by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	NONE
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088	D/W	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	W	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	W	MCERTS

Analytical Report Number : 24-005540
Project / Site name: Grey Mare

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
Monohydric phenols (low level) in leachate	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	L080	W	NONE
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	L080	W	MCERTS
Total cyanide (low level) in leachate	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	W	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS
pH at 20°C in leachate (automated)	Determination of pH in leachate by electrometric measurement	In-house method	L099	W	ISO 17025
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in leachate	SVOCs and PAHs in leachate	In-house method	L102B	W	ISO 17025
Organic 2:1 Leachate		In-house method	L020B	W	NONE

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 aravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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



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Analytical Report Number : 24-007645

Project / Site name:	Grey Mare Lane	Samples received on:	07/03/2024
Your job number:	16908	Samples instructed on/ Analysis started on:	07/03/2024
Your order number:		Analysis completed by:	14/03/2024
Report Issue Number:	1	Report issued on:	15/03/2024
Samples Analysed:	1 water sample		

Signed:

Joanna Szwagrak
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: 24-007645
Project / Site name: Grey Mare Lane

Lab Sample Number				138158
Sample Reference				WS106
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				07/03/2024
Time Taken				0900
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L099)	pH Units	N/A	ISO 17025	7.3
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	3.96

Total Phenols

Total Phenols (Monohydric) Low Level 1µg/l	µg/l	1	NONE	1
--	------	---	------	---

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.6
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.08
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.3
Copper (dissolved)	µg/l	0.5	ISO 17025	2.3
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	140
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	2
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6
Zinc (dissolved)	µg/l	0.5	ISO 17025	6.3

Calcium (dissolved)	mg/l	0.012	ISO 17025	170
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0

Petroleum Hydrocarbons

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



4041



Analytical Report Number: 24-007645
Project / Site name: Grey Mare Lane

Lab Sample Number				138158
Sample Reference				WS106
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				07/03/2024
Time Taken				0900
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
TPH - Aromatic >EC5 - EC7 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC7 - EC8 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC8 - EC10 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC10 - EC12 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC12 - EC16 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC16 - EC21 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC21 - EC35 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC35 HS+EH_ID_AR_MS	µg/l	10	NONE	< 10

TPH (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	NONE	< 10
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VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0##
Chloroethane	µg/l	3	ISO 17025	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0##
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0##
Trans 1,2-dichloroethylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0
2,2-Dichloropropane	µg/l	3	NONE	< 3.0
Chloroform	µg/l	3	ISO 17025	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0
Carbontetrachloride	µg/l	3	ISO 17025	< 3.0##
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
Styrene	µg/l	3	ISO 17025	< 3.0
Bromoform	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
Isopropylbenzene	µg/l	3	ISO 17025	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	NONE	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0

Analytical Report Number: 24-007645
Project / Site name: Grey Mare Lane

Lab Sample Number				138158
Sample Reference				WS106
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				07/03/2024
Time Taken				0900
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
n-Propylbenzene	µg/l	3	ISO 17025	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	< 0.05
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	< 0.05
4-Nitroaniline	µg/l	0.05	NONE	< 0.05
Azobenzene	µg/l	0.05	NONE	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05



Analytical Report Number: 24-007645
Project / Site name: Grey Mare Lane

Lab Sample Number				138158
Sample Reference				WS106
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				07/03/2024
Time Taken				0900
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05
Carbazole	µg/l	0.05	NONE	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05
Anthraquinone	µg/l	0.05	NONE	< 0.05
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05
3+4-Methylphenol	µg/l	0.1	NONE	< 0.10

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

Analytical Report Number : 24-007645
Project / Site name: Grey Mare 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 water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW, GW, Hg=SW, PW, Al=SW, PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Total petroleum hydrocarbons with carbon banding by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total petroleum hydrocarbons by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS	In-house method	L070B	W	NONE
BTEX and/or Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW	L080	W	ISO 17025
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
Total cyanide (low level) in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
Total petroleum hydrocarbons by GC-MS HS in water	Determination of total petroleum hydrocarbons in water by GC-MS HS	In-house method	L088	W	ISO 17025
pH at 20°C in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method	L099	W	ISO 17025
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAH) in leachate by extraction in dichloromethane followed by GC-MS	In-house method based on USEPA 8270	L102B	W	ISO 17025
Phenols in water by GC-MS	Determination of phenols in water by GC-MS	In-house method	L102B	W	NONE
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices: SW, GW, PW, PrW (Al, Cu, Fe, Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

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

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

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

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

- 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 IX GEOTECHNICAL TESTING RESULTS



LABORATORY REPORT



Contract Number: PSL24/1484

Report Date: 14 March 2024

Client's Reference: 16-908

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Nick Gregory

Contract Title: Grey Mare Lane

Date Received: 28/2/2024

Date Commenced: 28/2/2024

Date Completed: 14/3/2024

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins
(Managing Director)

R Berriman
(Associate Director)

S Royle
(Laboratory Manager)

L Knight
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP102		B	1.50		MADE GROUND grey very sandy clayey gravel with cobbles.
TP103		B	1.50		Brown slightly gravelly very sandy CLAY.
WS101		D	1.00		Brown slightly gravelly very sandy CLAY.
WS102		D	1.00		Brown slightly gravelly very sandy CLAY.
WS102		U	1.50	2.00	Firm brown slightly gravelly very sandy CLAY.
WS103		D	2.00		Brown slightly gravelly sandy CLAY.
WS104		D	1.00		MADE GROUND brown very gravelly very sandy clay.
WS105		D	1.00		Brown slightly gravelly very sandy CLAY.
WS105		D	2.00		Brown slightly gravelly sandy CLAY.
WS106		D	1.00		Brown slightly gravelly sandy CLAY.
WS106		D	2.00		Brown slightly gravelly very sandy CLAY.



Grey Mare Lane

Contract No:

PSL24/1484

Client Ref:

16-908

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

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



Grey Mare Lane

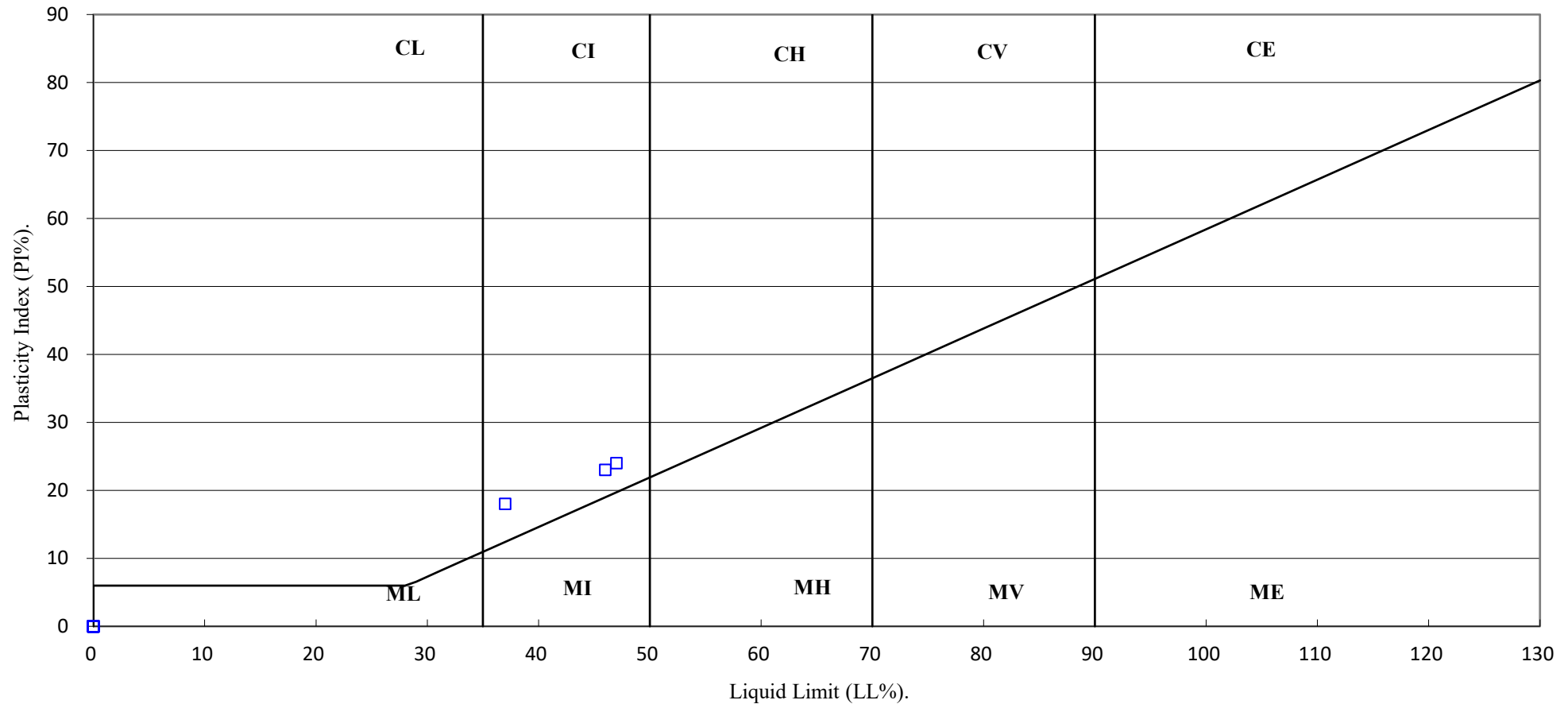
Contract No:

PSL24/1484

Client Ref:

16-908

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Grey Mare Lane

Contract No:

PSL24/1484

Client Ref:

16-908

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

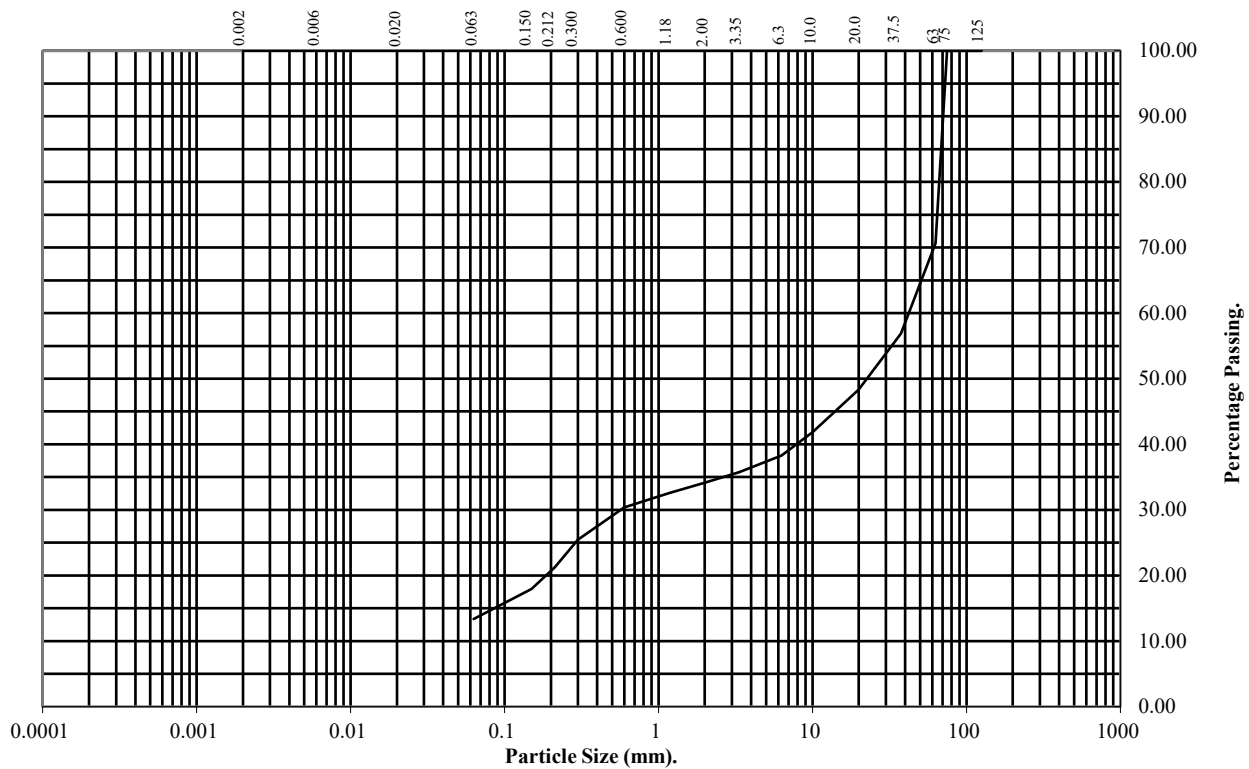
Hole Number: TP102

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	71
37.5	57
20	48
10	42
6.3	38
3.35	36
2	34
1.18	33
0.6	30
0.3	25
0.212	21
0.15	18
0.063	13

Soil Fraction	Total Percentage
Cobbles	29
Gravel	37
Sand	21
Silt/Clay	13

Remarks:

See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

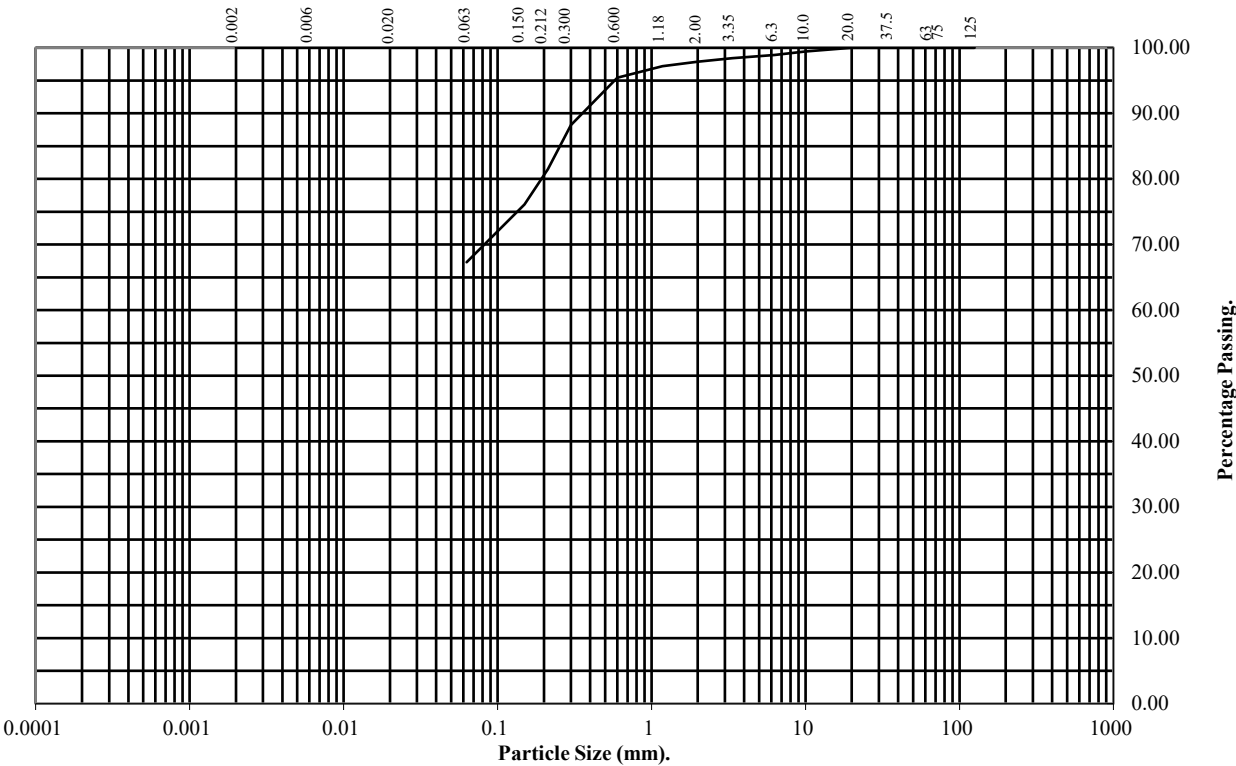
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP103 Top Depth (m): 1.50

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	98
2	98
1.18	97
0.6	95
0.3	88
0.212	81
0.15	76
0.063	67

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	31
Silt/Clay	67

Remarks:
See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

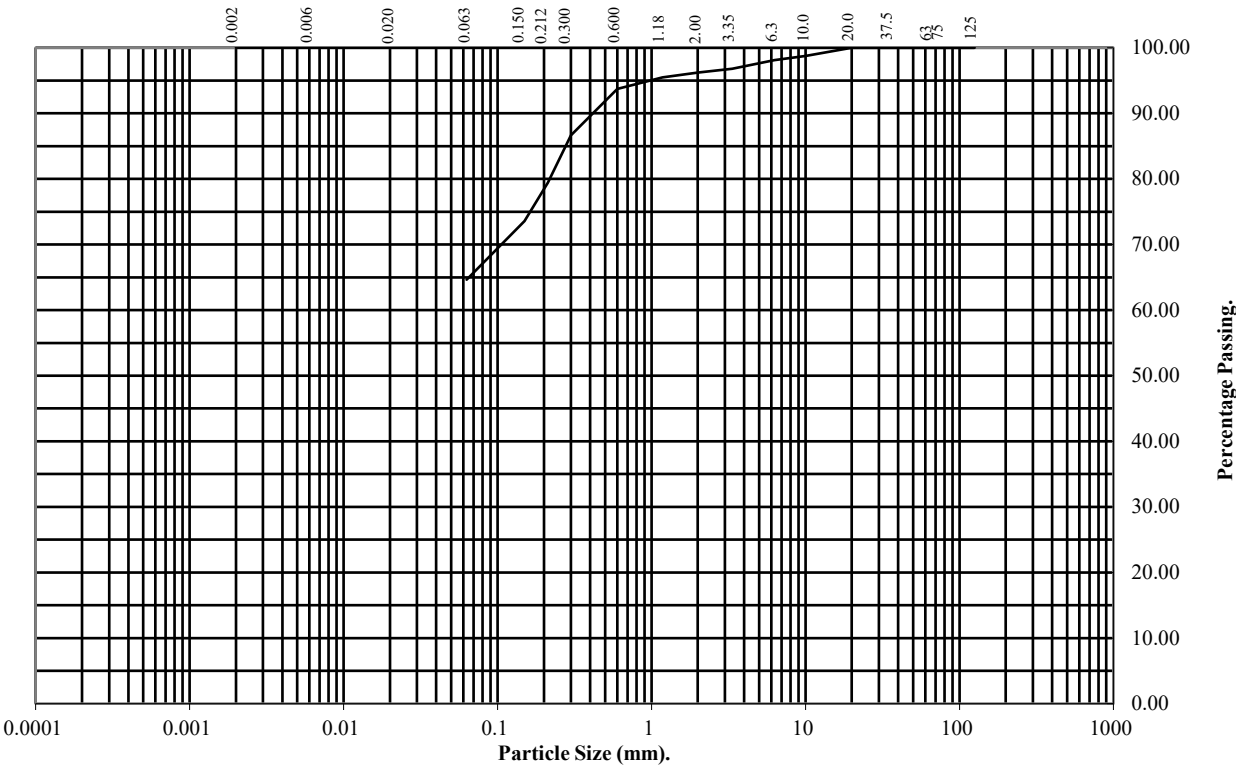
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: WS101 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	98
3.35	97
2	96
1.18	95
0.6	94
0.3	87
0.212	79
0.15	74
0.063	65

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	31
Silt/Clay	65

Remarks:

See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

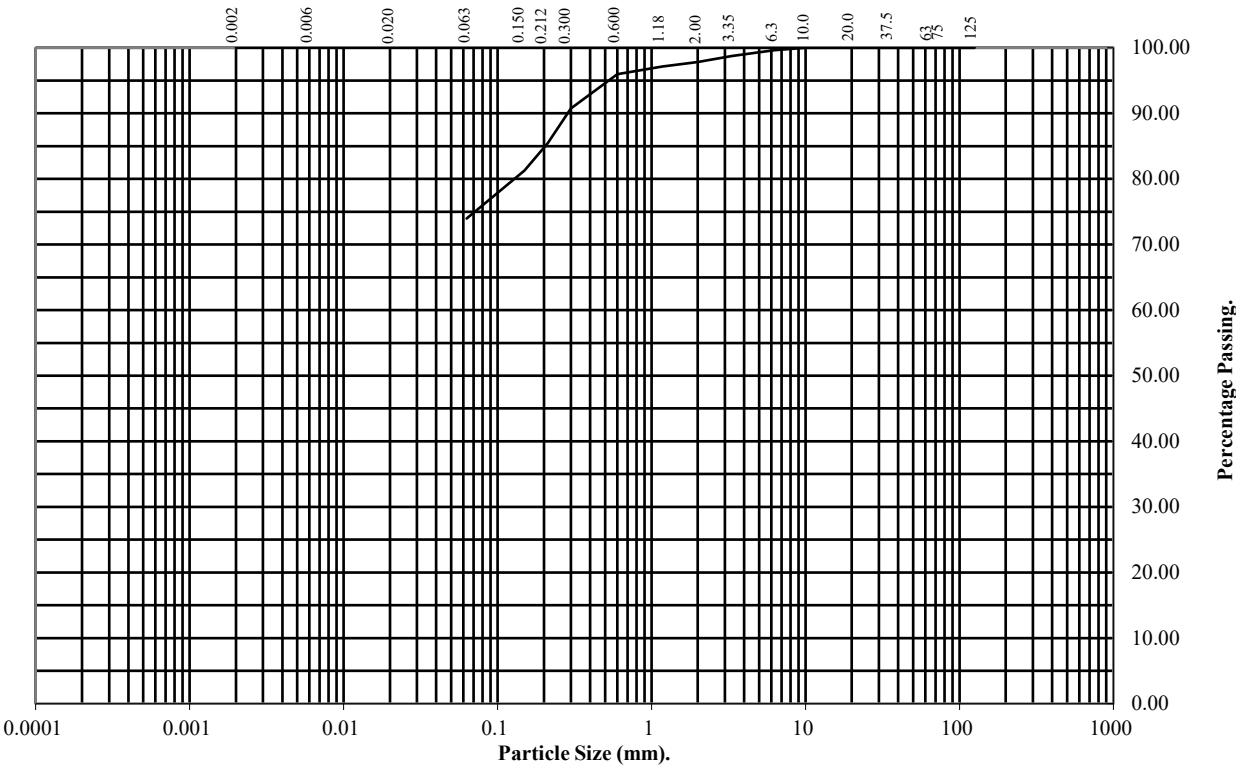
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: WS102 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	97
0.6	96
0.3	91
0.212	85
0.15	81
0.063	74

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	24
Silt/Clay	74

Remarks:
See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

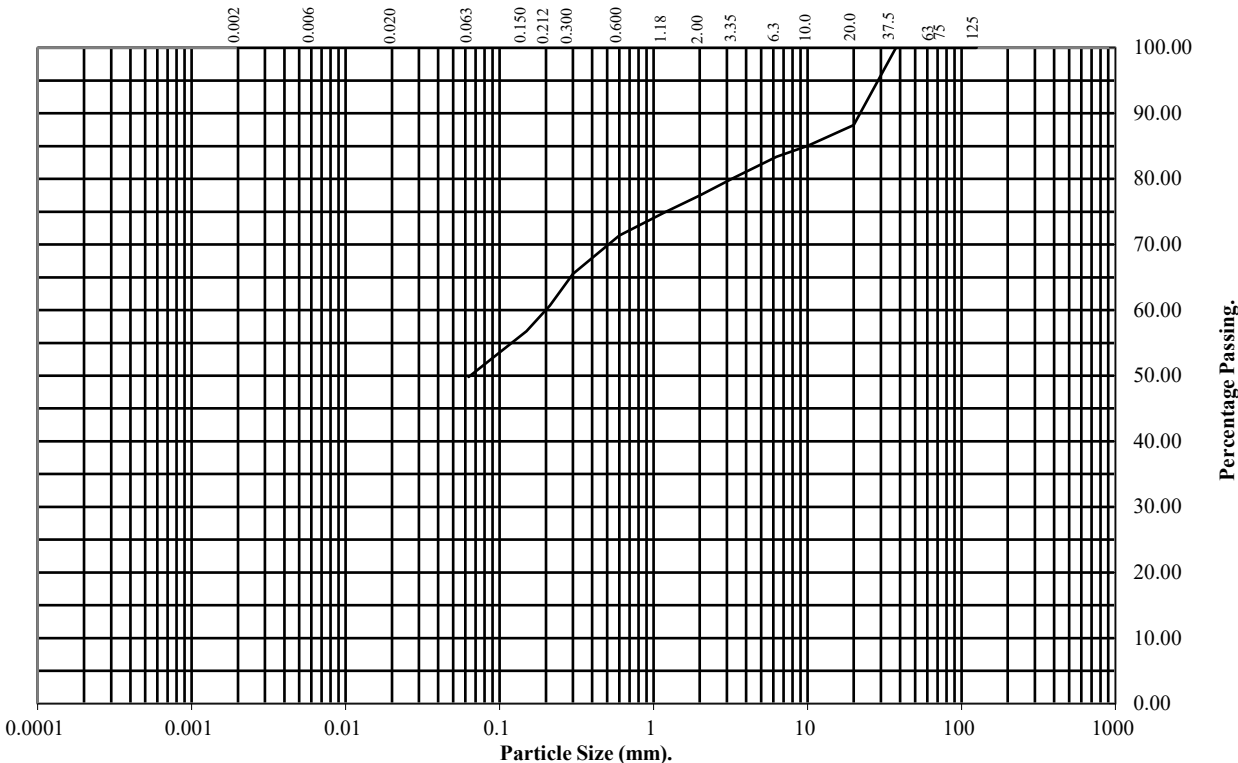
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: WS104 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	88
10	85
6.3	83
3.35	80
2	77
1.18	75
0.6	71
0.3	66
0.212	61
0.15	57
0.063	50

Soil Fraction	Total Percentage
Cobbles	0
Gravel	23
Sand	27
Silt/Clay	50

Remarks:
See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

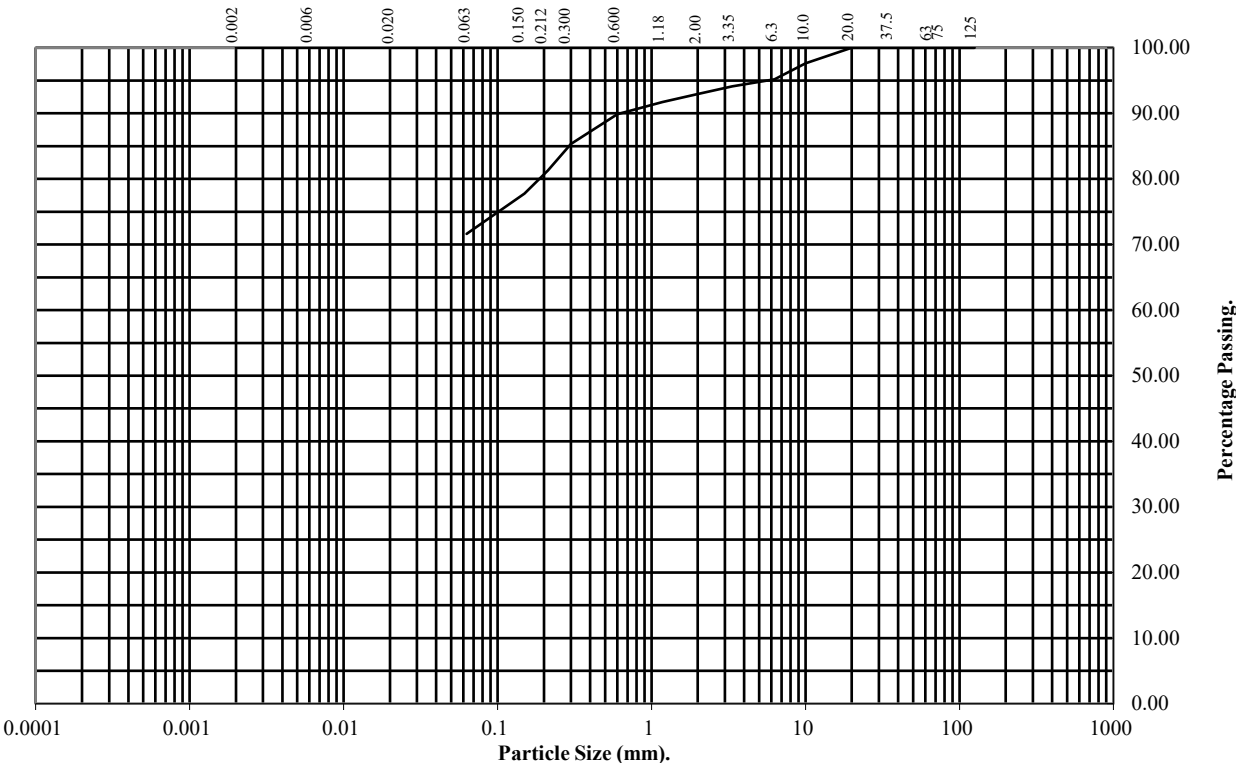
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: WS105 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	95
3.35	94
2	93
1.18	92
0.6	90
0.3	85
0.212	81
0.15	78
0.063	72

Soil Fraction	Total Percentage
Cobbles	0
Gravel	7
Sand	21
Silt/Clay	72

Remarks:
See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

PARTICLE SIZE DISTRIBUTION TEST

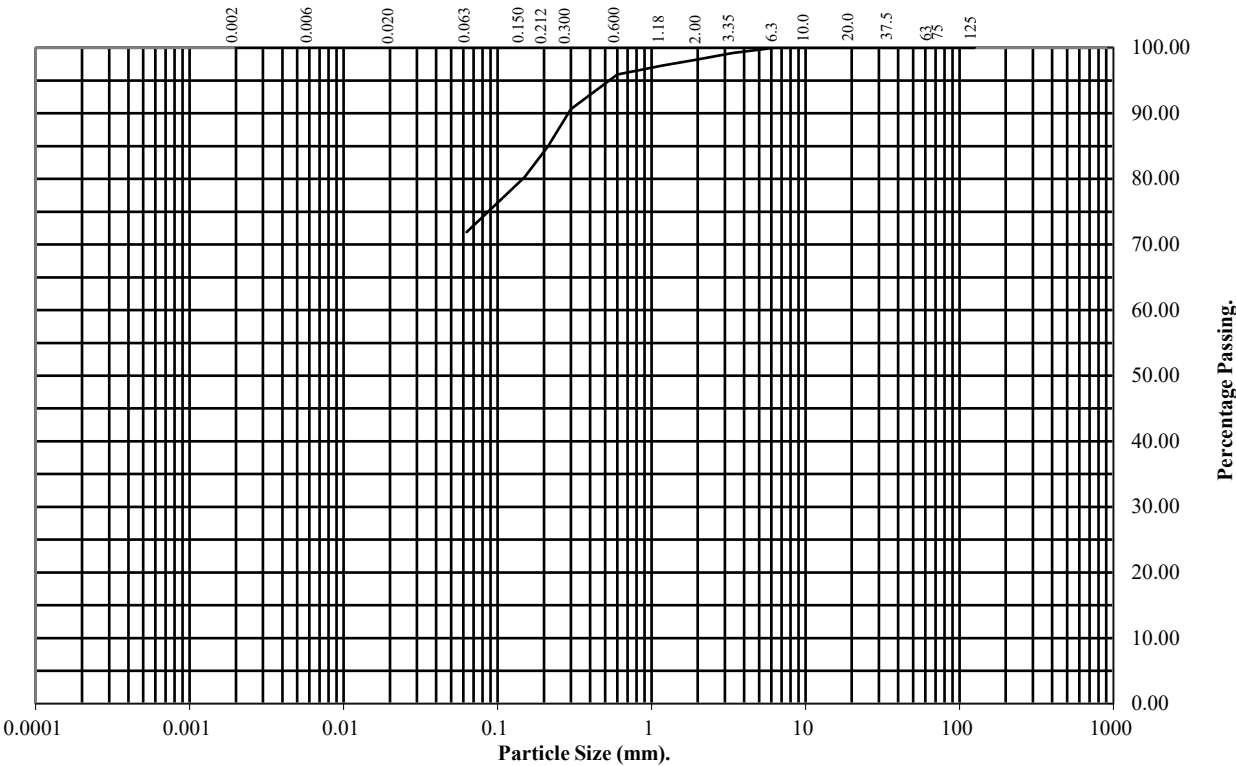
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: WS106 Top Depth (m): 2.00

Sample Number: Base Depth(m):

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	97
0.6	96
0.3	91
0.212	85
0.15	80
0.063	72

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	26
Silt/Clay	72

Remarks:
See Summary of Soil Descriptions



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

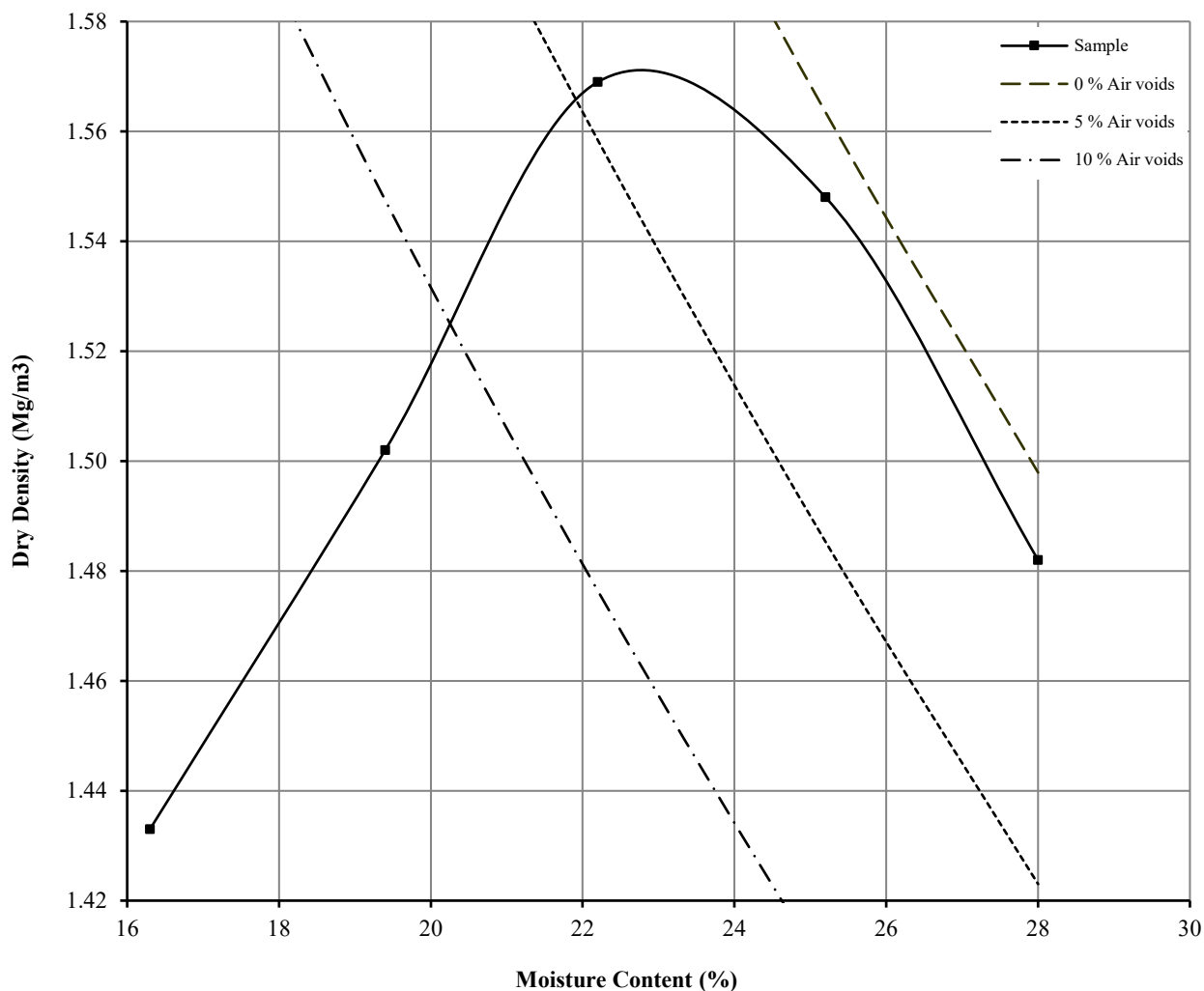
Hole Number: TP102

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	25	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.58	Assumed	Material Retained on 37.5 mm Test Sieve (%):	43
Maximum Dry Density (Mg/m ³):	1.57		Material Retained on 20.0 mm Test Sieve (%):	9
Optimum Moisture Content (%):	22			
Remarks See summary of soil descriptions				

 	Grey Mare Lane			Contract
				PSL24/1484
				Client Ref
				16-908

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

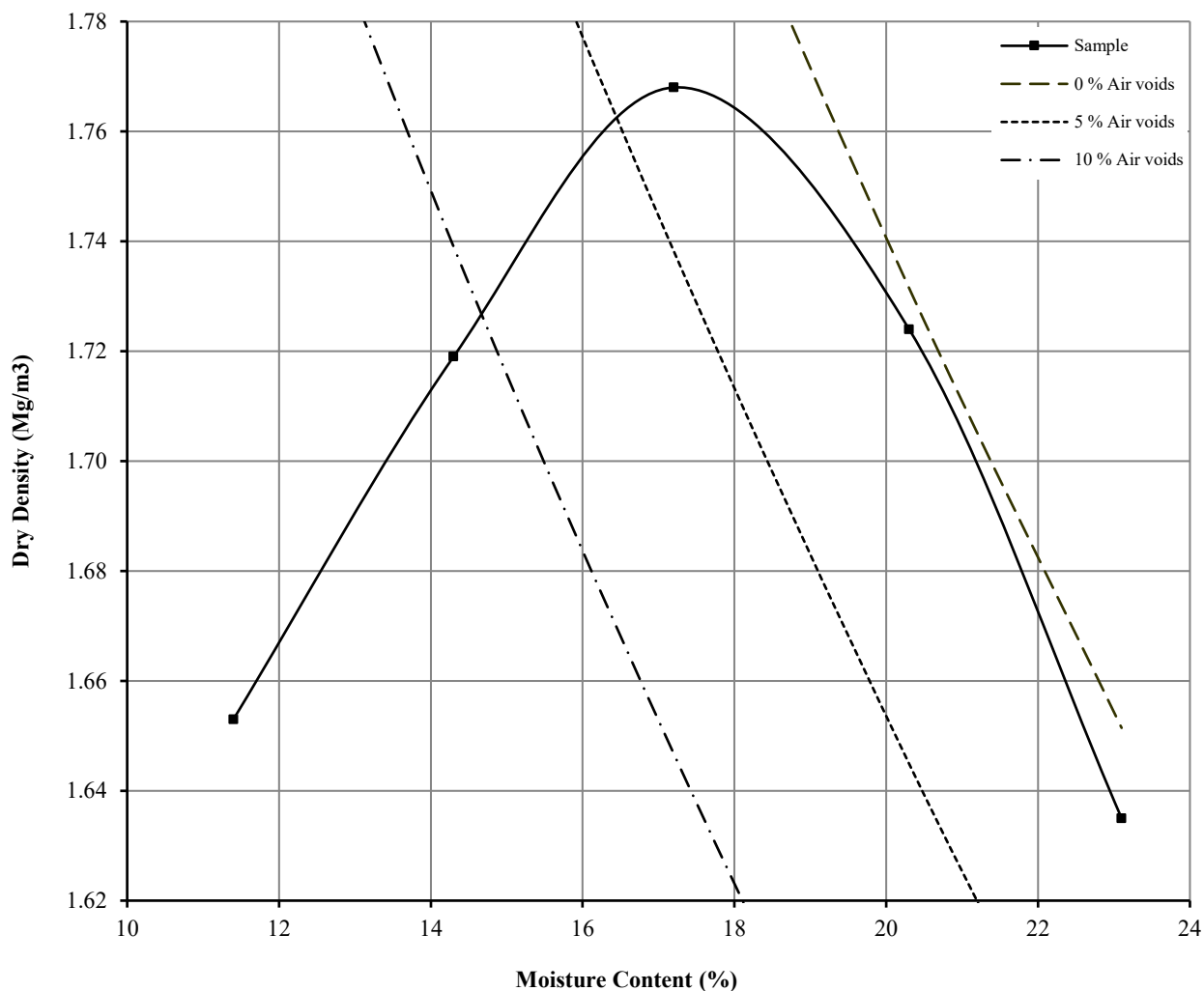
Hole Number: TP103

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	20	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.77		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	17			
Remarks See summary of soil descriptions				

 4043	 A PHENNA GROUP COMPANY	Grey Mare Lane	Contract
			PSL24/1484
			Client Ref
			16-908

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

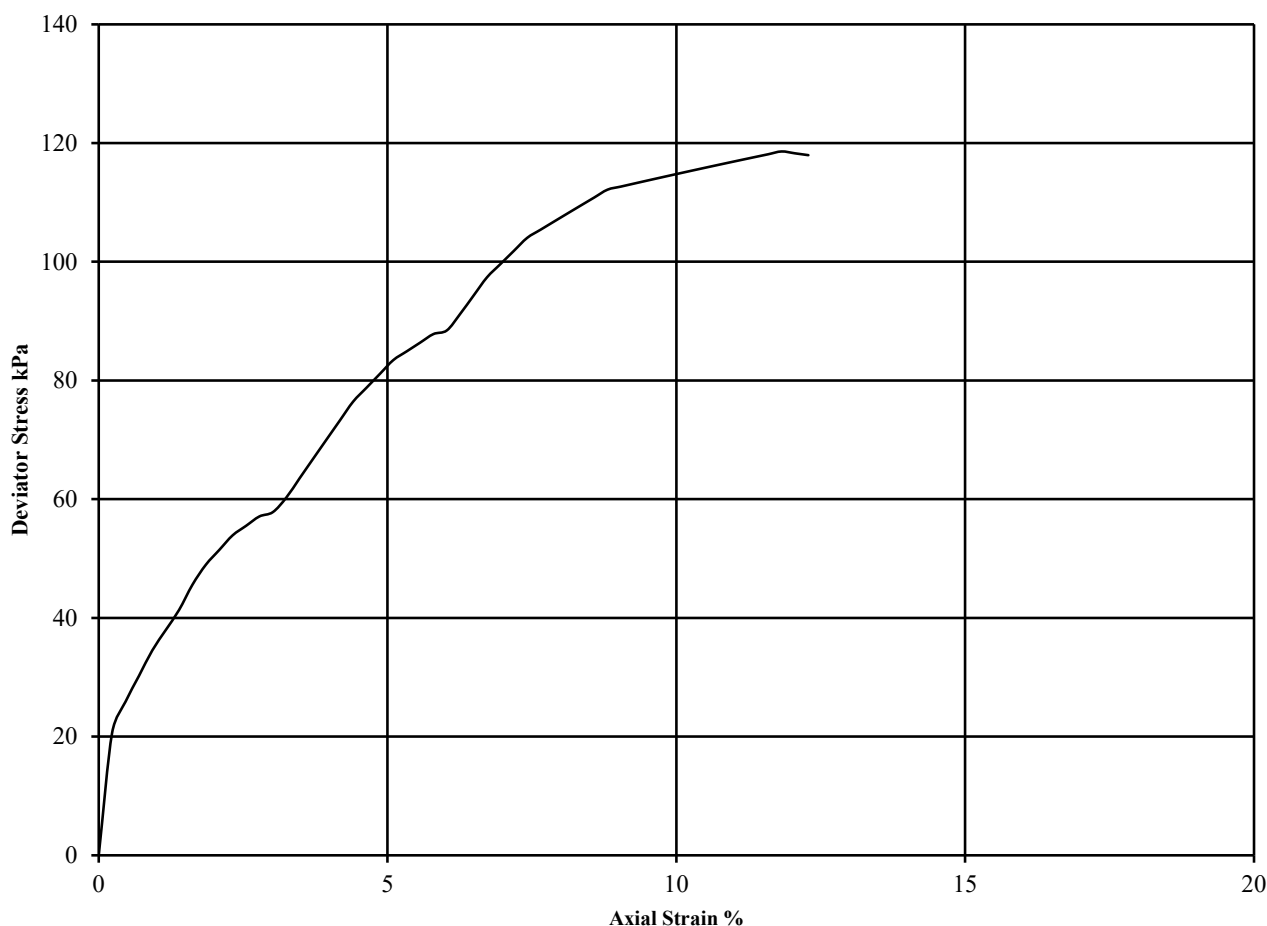
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number: WS102 Top Depth (m): 1.50

Sample Number: Base Depth (m): 2.00

Sample Type U



Diameter (mm):		70	Height (mm):		151	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa) 0.53 0.53 0.51 See summary of soil descriptions
1	18	2.21	1.87	15	58	29	3.0		
				30	88	44	6.0		
				60	119	59	11.8	Plastic	



Grey Mare Lane

Contract No:
PSL24/1484
Client Ref:
16-908

APPENDIX X

ORIGIN OF CHEMICAL 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 XII COAL AUTHORITY REPORT AND MINING INFORMATION



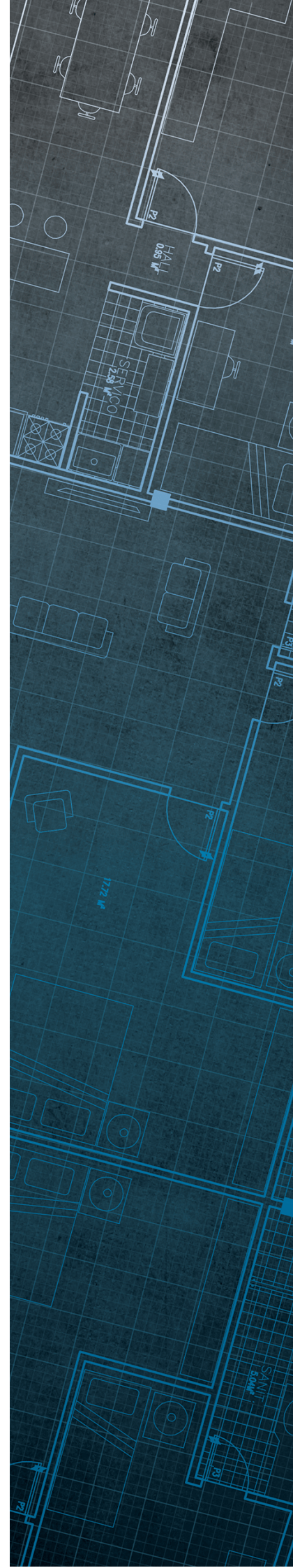
The Coal
Authority

Consultants Coal Mining Report

107 Newcombe Close
Manchester
M11 3TF

Date of enquiry:	24 May 2023
Date enquiry received:	24 May 2023
Issue date:	24 May 2023

Our reference:	51003357117001
Your reference:	16908



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

E3P

Enquiry address

107 Newcombe Close
Manchester
M11 3TF

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

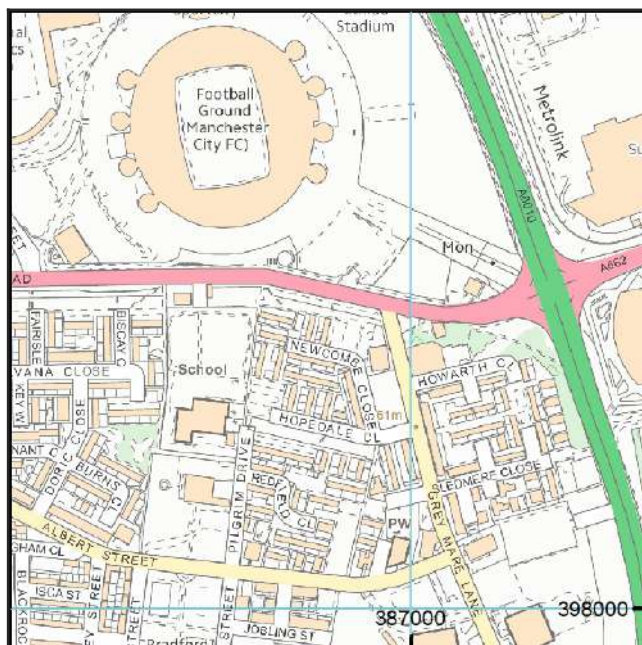
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	BRADFORD FOUR FEET	Coal	35D6	114	Beneath Property	14.0	South-West	130	1880
unnamed	BRADFORD FOUR FEET	Coal	35CS	121	Beneath Property	18.4	South-West	120	1760
unnamed	BRADFORD FOUR FEET	Coal	35D4	143	South	14.0	South-West	130	1880
unnamed	BRADFORD FOUR FEET	Coal	35CZ	147	Beneath Property	18.4	South-West	120	1760
unnamed	YARD	Coal	35CR	206	Beneath Property	18.0	South-West	90	1880
unnamed	PARKER	Coal	35BS	479	North	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BL	517	North	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BU	552	Beneath Property	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BT	559	Beneath Property	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BP	568	North	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BX	569	Beneath Property	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BN	570	North	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BM	584	North	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BV	586	South	18.4	South-West	80	1935
unnamed	TWO FEET	Coal	35CG	595	East	32.3	South-West	100	1880
unnamed	TWO FEET	Coal	35CH	615	East	34.0	South-West	100	1880
unnamed	TWO FEET	Coal	35CI	627	South-East	18.0	South-West	100	1880
unnamed	PARKER	Coal	35BO	648	Beneath Property	18.0	South-West	80	1935
unnamed	ROGER	Coal	35AT	722	North	16.9	South-West	170	1956
unnamed	CROMBOUK E	Coal	359J	729	North-East	16.0	South-West	120	1933
unnamed	INCE NEW	Coal	35BF	760	East	18.4	South-West	120	1900
unnamed	CROMBOUK E	Coal	359G	761	North-East	13.5	South-West	120	1914

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	ROGER	Coal	35AU	773	North	18.7	South-West	170	1956
unnamed	CROMBOUK E	Coal	359F	796	North	21.0	South-West	120	1924
unnamed	ROGER	Coal	35AX	808	East	19.5	South-West	170	1945
unnamed	ROGER	Coal	35AV	810	North	19.4	South-West	170	1956
unnamed	CROMBOUK E	Coal	359O	813	East	14.3	South	120	1915
unnamed	ROGER	Coal	35AW	819	East	19.6	South-West	170	1945
unnamed	ROGER	Coal	35B7	831	East	17.2	South-West	180	1948
unnamed	ROGER	Coal	35AZ	861	North	20.8	South-West	180	1957
unnamed	CROMBOUK E	Coal	359Q	869	South-East	16.6	South-West	120	1929
unnamed	CROMBOUK E	Coal	359H	870	North	17.4	South-West	120	1913
unnamed	ROGER	Coal	35B0	877	North	19.0	South-West	180	1958
unnamed	CROMBOUK E	Coal	359P	898	Beneath Property	16.5	South-West	120	1929
unnamed	CROMBOUK E	Coal	359I	900	Beneath Property	17.0	South-West	120	1913
unnamed	CROMBOUK E	Coal	359E	908	Beneath Property	16.5	South-West	120	1932
unnamed	CROMBOUK E	Coal	359K	928	South	13.3	South-West	120	1948
unnamed	ROGER	Coal	35B5	940	South-West	17.3	South-West	180	1950
unnamed	ROGER	Coal	35B1	954	West	17.5	South-West	180	1958
unnamed	ROGER	Coal	35B4	956	South-West	17.4	South-West	180	1943
unnamed	CROMBOUK E	Coal	359S	974	South	10.7	South	120	1951
unnamed	ROGER	Coal	35B6	1007	South	12.8	South-West	180	1940
unnamed	ROGER	Coal	35B3	1010	South-West	15.9	South-West	180	1958

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	386398-015	386991 398319		Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

11471	NW1168	NW643
NW1171	14917	NW1172
NW1170	989	NW437

Our records show we have more plans than those shown above which could affect the enquiry boundary.

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
OPENSHAW	Coal	Yes	45.4	North-East	142
OPENSHAW	Coal	Yes	44.5	North-East	325

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
16.7	North
17.8	North

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is in an area where a notice to withdraw support was given in 1955.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown 
- Disused mine shaft 
- Outcrop (Conjectured) 
- Site investigations 

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