Stack, Manchester

Ground Investigation Report

Stantec

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Stack (Manchester) Ltd

Date:
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Prepared by:
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Executive Summary

Site Information and setting	
Site name and location	Stack Manchester, Oxford Road, Manchester, M1 7ED
Proposed development	The site development proposals are understood to comprise 'Stack' a street food market and live music venue comprising adjoined shipping containers which will form a ground and upper level, including a mezzanine level in the west of the site The development does not include any proposals for planting or landscaping, only the retention of the existing four London Plane trees in the north west
Site Description	The site comprises an irregularly shaped parcel of land approximately 0.26 hectares (Ha) in area. The site is currently occupied by Hatch, an urban street food market with shipping container units and associated seating within external areas, which has now been permanently closed. A water main easement is located in the north of the site as shown on drawing referenced 1162 Trunk Main/HV Main Overlay presented in Appendix A.
Desk study information	
Topography	The site is relatively flat.
Hydrology	The River Mersey is situated 150m north east flowing northerly.
Site history	From the site comprised a series of buildings comprising a school in the east and possible residential properties. From 1948 the east of the site is cleared possibly a result of a World War II bomb strike. The central area is occupied by a textile machinery works and a bank is in the west By 1969 the site is cleared of building and the elevated Mancunian Way A57 (M) has been developed across the southern half of the site. By 2018 Goggle imagery shows the former Hatch (a shipping container street-food market) onsite.
Geology	The superficial deposits are Glacial Till over bedrock of the Chester Formation.
Hydrogeology	The superficial deposits comprise a Secondary Undifferentiated Aquifer and the Chester Formation is a Principal Aquifer. The site is not underlain by groundwater Source Protection Zone.
UXO risk	A non-specialist UXO assessment indicates a moderate bomb risk in the east.
Preliminary conceptual site model based on desk study	
Potential contaminant sources	• Made Ground, associated with historical construction and demolition, potential source of metals, metalloids, asbestos fibres, asbestos containing materials (ACM), polycyclic aromatic hydrocarbons (PAH) and petroleum hydrocarbons. • Former textile machinery works – potential source of metals, metalloids, PAH, petroleum hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs) • Historical industrial land uses within the surrounding area, including former timber yard, works, depots and warehouses - potential sources of metals, metalloids, PAH, petroleum hydrocarbons, VOCs and SVOCs
Potential contaminant linkages (for receptors for which there is or will be a pathway)	• Ingestion and inhalation posing a risk to human health • Direct contact with water pipes. • Controlled Water- River Medlock

Ground model proven by investigation	
Ground and groundwater conditions encountered by investigation	The ground conditions as proven by the investigation undertaken at the site comprise: • Surface covering to 0.10m below ground level (bgl), comprising either concrete and asphalt hardstanding; • Made Ground – between 0.7m up to 3.0m bgl, comprising loose black gravelly SAND with cobbles of brick and gravel of brick, concrete and timber. There were occasional inclusions of oft dark grey sandy CLAY. • Glacial Till (granular) – between 0.7m and 1.2m bgl, comprising a medium dense gravelly SAND with a gravel content of sandstone; over • Glacial Till (cohesive) – between 1.9m and 4.9m bgl, comprising a stiff high strength slightly sandy gravelly CLAY with a gravel content of mudstone, sandstone and coal. Groundwater was not encountered.
Summary of geotechnical conclusions	
Groundwork	Obstructions associated with former development, including possible backfilled basements and existing foundations, should be anticipated. Excavation to proposed founding depth generally should be readily achievable with standard excavation plant. Heavy duty excavation plant/breaking equipment may be required to excavate the existing construction. Excavations within the granular Made Ground could become unstable if left open for long periods of time. Water seepages into excavations are likely to be adequately controlled by sump pumping.
Foundations	Based on the findings of the previous and recent ground investigation works, strip/trench foundations are considered suitable for the proposed Stack across the majority of the site, based wholly within the natural medium dense granular Glacial Till. A safe net bearing pressure of 75kN/m² is considered appropriate for reinforced strip foundations bearing onto the medium dense granular deposits. In areas where access is restricted due to the presence of existing trees or the water main easement in the north of the site, it is understood that a screw pile solution is being utilised founding into the medium dense granular Glacial Till or stiff high strength Glacial Till.
Roads and pavements	For pavement design, a design CBR of 2 % is recommended.
Sustainable drainage	Soakaway drainage is considered unsuitable for this site.
Buried concrete	Design Sulphate Class - DS-3 and ACEC Class AC-3.
Summary of geoenvironmental assessment	
Human health	Low concentrations of asbestos loose fibres were encountered in the Made Ground; the proposed development does not include any soft landscaping therefore any human health pathways will be severed.
Phytotoxicity	No planting is shown on the proposed development plan.
Controlled Waters	The site is considered to pose a low risk to controlled water due to the thickness of superficial deposits overlying the principal aquifer limiting downwards migration of contaminants. No groundwater was encountered during the investigation and therefore there is unlikely to any groundwater underlying the site which is providing baseflow to the River Medlock.
Radon	The site is in a Radon Affected Area (<1% of existing homes affected).
Potable water pipes	Brownfield site with organic contamination and barrier pipe is considered suitable for this site. However, confirmation should be sought from the water supply company at the earliest opportunity.

Ground gases or vapours	Very low risk from ground gases the site characterised as CS1, no ground has protection measures are required.
Remediation/mitigation works	
Proposed mitigation measures	Based on the current ground investigation, there are no potential source-pathway-receptor linkages requiring mitigation measures.
Earthworks	At this stage, Stantec is not aware of proposals for earthworks at the site. However, to avoid requirement for deep foundation a suitable option may be to be completed suitable compaction techniques or reengineer the Made Ground where necessary so its capable of supporting shallow strip foundations.
Waste management	Excavated soils to be disposed of as waste, are likely to be classed as Non-Hazardous.
Future considerations	
Further work	Following the ground investigation works undertaken to date, the following further works will be required: • discussion and agreement with utility providers regarding the materials suitable for pipework; and • site investigation monitoring wells (installed by NX Consulting) (where still present) should be decommissioned in line with relevant guidance where deemed appropriate by a qualified professional (for example the Environment Agency's Good Practice for Decommissioning Redundant Boreholes and Wells, 2012 or section 2.4.3.2 of NHBC NF94, 2023). In addition, the following works may be required: • production of a Materials Management Plan relating to reuse of soils at the site; and • verification of the earthworks and Materials Management.

This Executive Summary forms part of Stantec Hydrock Limited report number 333701845-STN-XX-XX-RP-GE-0002. and should not be used as a separate document.

1 Introduction

1.1 Terms of reference

In August 2025, Stantec Hydrock Limited (Stantec) was commissioned by Stack (Manchester) Limited, (the Client) to undertake a ground investigation at the proposed Stack, 103 Oxford Road, Manchester, M1 7ED.

A site location plan drawing reference 333701845-STN-XX-XX-DR-GE-0001 is presented in Appendix A.

The site comprises an irregularly shaped parcel of land approximately 0.26 hectares (Ha) in area. The site is currently occupied by Hatch, an urban street food market with shipping container units and associated seating within external areas, which has now been permanently closed.

Stantec understands that the proposed development is to comprise 'Stack', a street food market and live music venue comprising adjoined shipping containers which will form a ground and upper level, including a mezzanine level in the west of the site. The development does not include any proposals for planting or landscaping, only the retention of the existing four London Plane trees in the north west. The proposed development is shown on Dunwoodie Swift Architects Drawings, P0-(20)-000 and P1-(20)-101 presented in Appendix A.

The investigation works have been undertaken in accordance with Stantec's proposal referenced (33331-GE-FP-001-P3, dated July 2025) and the Client's instructions to proceed (signed fee proposal acceptance form, dated 4 August 2025).

1.2 Objectives

The works have been commissioned to support the planning application and to assist with the design of the development.

A review of existing desk study produced by Hydrock in April 2024 (Report referenced 33331-HYD-XX-XX-GE-RP-0001) and historical ground investigations have been undertaken to form the preliminary Ground Model an initial Conceptual Ground Model.

The objectives of the ground investigation are:

- to resolve geotechnical and geoenvironmental uncertainties identified in the Phase 1 Desk Study by refining and updating the preliminary Ground Model, based on the ground conditions encountered);
- to identify geo-environmental mitigation requirements to enable development to progress; and
- to provide preliminary geotechnical recommendations for design.

1.3 Scope

The scope of the ground investigation comprises:

- a ground investigation including windowless sampling to:

  - obtain data on the ground and groundwater conditions of the site;
  - allow collection of samples for geotechnical and chemical laboratory analysis;
  - allow geotechnical field tests to be undertaken;
- geotechnical and chemical laboratory analysis;
- updating of the preliminary Ground Model;
- preparation of a geotechnical risk register;
- presentation of an initial geotechnical design recommendations;
- formulation of an updated Conceptual Site Model (CSM), including identification of plausible contaminant linkages;
- completion of a generic quantitative risk assessment of identified chemical contaminants to establish 'suitability for use' under the current planning regime;
- discussion of potential environmental liabilities associated with land contamination (soil, water and gas); and
- identification of outline mitigation requirements to ensure the site is 'suitable for use'.

1.4 Available information

Hydrock Consultants Limited (currently trading as Stantec Hydrock Limited) has previously produced the following report for the proposed development:

- 'Phase 1 Desk Study' for Stack Manchester, ref. 33331-HYD-XX-XX-GE-RP-0001, dated 12th April 2024.

The following report has been sourced by Hydrock for use in the preparation of this report, a copy of which was obtained from the Manchester City Council planning portal, and relates to a previous on-site planning application:

- 'Phase 1 Geoenvironmental Desk Study and Preliminary Phase 2 Assessment' for The Hatch, Manchester Technology Centre, Oxford Road, Manchester M1 7ED by NX Consulting, Ref. 353, dated October 2018.

It is understood that the client does not hold reliance on the previous desk study and ground investigation therefore it has been used as information only and not relied upon.

In addition, the following information has been obtained from the client:

- 'Design and Access Statement' for Stack Manchester by Dunwoodie Swift Architects, Ref. 1162, dated March 2024.
- 'Existing Site Layout' for Stack Manchester by Dunwoodie Swift Architects, Ref. EW- (00)- 001, dated February 2024.
- 'Proposed Floor Plan – Ground Level' for Stack Manchester by Dunwoodie Swift Architects, Ref. P0- (20)- 100, dated February 2024.
- 'Proposed Floor Plan – Upper Level' for Stack Manchester by Dunwoodie Swift Architects, Ref. P1- (20)- 100, dated February 2024.

1.5 Regulatory context and guidance

The investigation work has been carried out in general compliance with recognised good practice, including (but not limited to) BS 5930:2015+A1:2020, BS 10175:2011+A2:2017 and the AGS (2006) 'Good Practice Guidelines for Site Investigations'.

The geo-environmental section of this report is written in broad accordance with BS 10175:2011+ A2:2017 and EA LCRM (2023).

Phase 2 comprises intrusive ground investigation work and testing. The factual information from the desk study and the ground investigation are used to develop the Conceptual Site Model (CSM). This CSM is based on a ground model of the site physical conditions and an identification of the possible contaminant linkages. The CSM forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines. This GQRA might lead to more Detailed Quantitative Risk Assessment (DQRA).

Professional judgement is then used to evaluate the findings of the risk assessments and to provide recommendations for the development.

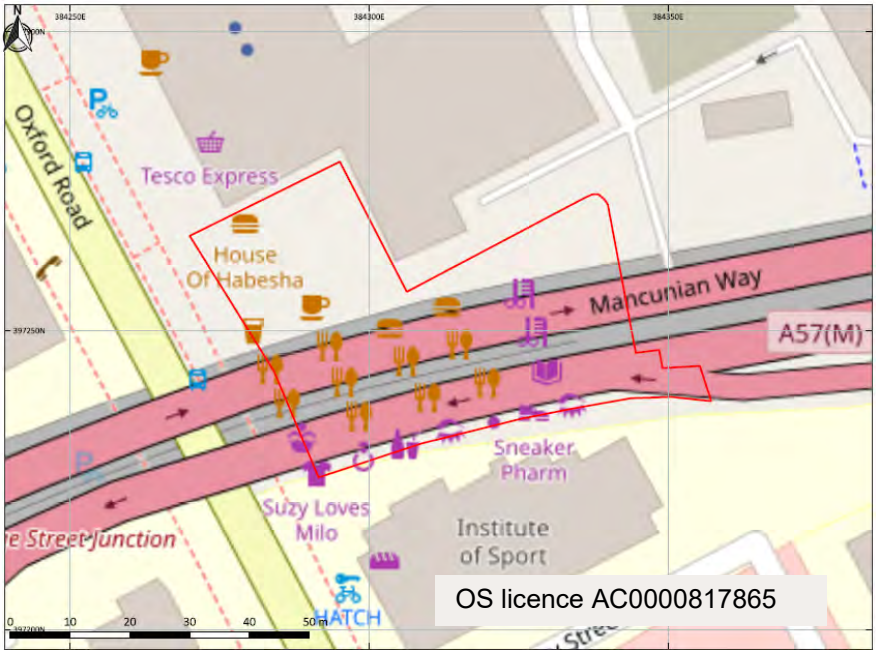
The geotechnical section of this report is prepared in general accordance with BS EN 1997-1+A1: 2013, BS EN 1997-2:2007 and BS 8004:2015+A1:2020. This report constitutes a Ground Investigation Report (GIR) as described in Part 2 of Eurocode 7 (BS EN 1997-2) (EC7). However, it is not intended to fulfil the requirements of a Geotechnical Design Report (GDR) as specified in EC7.

The geoenvironmental and geotechnical aspects are discussed in separate sections. Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). The term 'geoenvironmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation, and these two main aspects are inter-related. Designers should take all aspects of the investigation into account.

2 Desk study review

2.1 Site referencing

Table 2.1: Site referencing information

Item	Description
Site name	Stack Manchester
Site address	Stack Manchester, Oxford Road, Manchester, M1 7ED
Site location	The site is located in the south of Manchester city centre, approximately 300m south-east of Manchester Oxford Road train station. The site located partially beneath the elevated Mancunian Way (A57) inner ring road.
Site Dimensions	70m x 50m
Figure 2.1: Site location	

2.2 Site description

Table 2.2: Site description

Item	Description
Site access	The site can be accessed from the west via Oxford Road.
Elevation and topography	The topography of the site is generally flat, with the ground level at approximately 36m AOD.
Site boundaries and surrounding land use	The site is bound to the north by Manchester Technology Centre which includes several commercial premises. To the east lies a car park and to the south lies the Institute for Sport Building, part of Manchester Metropolitan University. The west is bound by Oxford Road with Manchester Metropolitan University buildings beyond.

Item	Description
	The site located partially beneath the elevated Mancunian Way (A57) inner ring road.
Present land use	The site is currently occupied by Hatch, an urban street food market with shipping container units and associated seating within external areas. External areas of the site are surfaced by a combination of concrete and asphalt hardstanding. Available information indicates Hatch is no longer in use and has been permanently closed. A water main easement is located in the north of the site as shown on drawing referenced 1162 Trunk Main/HV Main Overlay presented in Appendix A.
Surface cover and vegetation	Four large trees are located in the west of the site. The remainder of the site is surfaced by hardstanding with no further areas of soft landscaping present.
General Site Sensitivity	The site is located within a predominantly commercial area occupied by university buildings and recreational and retail premises.

2.3 Site history

Between 1848 and 1931 the site comprised a series of buildings comprising a school in the east and possible residential properties. Between 1948 and 1965 the east of the site is cleared, possibly a result of a World War II bomb strike. The central area is occupied by a textile machinery works and the west remains unchanged with one building occupying noted to be a bank (shown in Figure 2.1).



Figure 2.2: OS historical mapping between 1948-1950

By 1969 the site is cleared of buildings and the elevated Mancunian Way A57 (M) has been developed across the southern half of the site. The site remains unchanged until 1985 when two buildings are constructed in the south below the A57 (M). By 2018 Google imagery shows the former Hatch (a shipping container street-food market) onsite.

The surrounding area within 100m has included various uses including a timber yard, smithy, clothes factory, bakery, rubber footwear works, unnamed factories, schools, public houses, residential housing and Grosvenor Square.

2.4 Published geology

The geology of the site area is shown on the British Geological Survey (BGS) 1:50,000 geological map of Manchester (Sheet 85) and the 1:10,000 British Geological Survey (BGS) map (Sheet SJ89NW) which is summarised below in Table 2.3..

Table 2.3: Published Geological Sequence

Reference	Location	Stratigraphic Name	Description
Artificial Ground/Topsoil			
BGS mapping shows Made Ground present across the north of the site. This is considered to be associated with the site's development history and demolition of former buildings and structures.			
Superficial Deposits (Figure 2.3)			
1	On site	Glacial Till	BGS borehole records suggest they extend to 10.0m below ground level (bgl) and at shallow depths to 3.5m comprise granular SAND and GRAVEL over Stiff brown CLAY.
Solid Geology (Figure 2.4)			
1	On site	Chester Formation	Conglomerates and reddish brown, cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone. The BGS mapping shows the Chester Formation to be at least 100m in thickness.
Geological Features			
The West Manchester Fault is situated approximately 25m west, the site lies on the downthrow side of the fault. The edge of a buried valley of 10-20m thickness is recorded 150m to the west of the site.			
Figures			

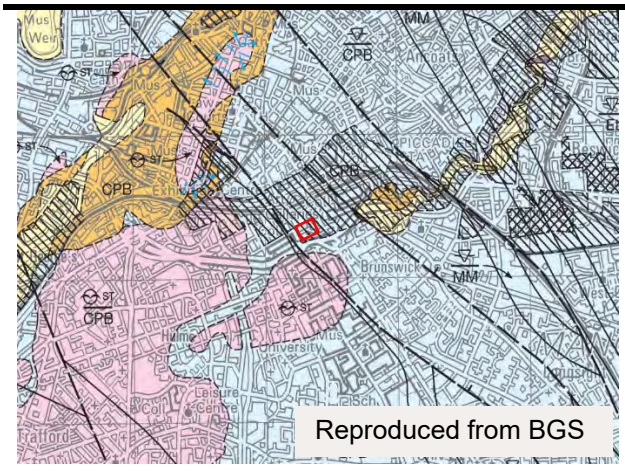


Figure 2.3: Superficial deposits

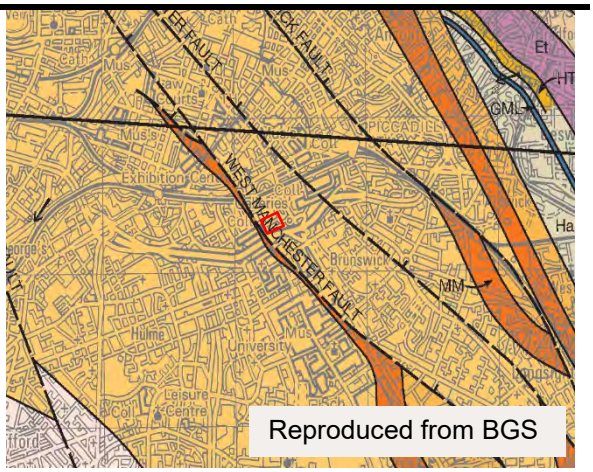


Figure 2.4: Solid geology

A number of borehole logs from the BGS archive (through GeoIndex) have been reviewed. Selected relevant records are summarised in Table 2.4.

Table 2.4: BGS archive borehole logs

Reference	Location	Strata and Groundwater Observations
SJ89NW331	Onsite	• Made Ground to 0.3m below ground level (m bgl), over • Soft sandy CLAY to 1.0m bgl (possible reworked natural), over • Brown SAND and GRAVEL to 3.5m bgl (Glacial Till - Granular) over, • Stiff brown CLAY to 10.0m bgl (Glacial Till – cohesive), over • Red SANDSTONE to 18.3m bgl (Chester Formation). • No groundwater was encountered.

2.5 Previous ground investigation

The BGS archive boreholes generally align with the finding the ground investigation completed by NX Consulting Limited onsite in October 2018 to support the design of the now closed Hatch.

The NX Consulting Limited Ground Investigation found the following:

- Hardstanding of ASPHALT/ TARAMACDAM to 0.1m bgl; over
- MADE GROUND; comprising brown/black silty sandy clayey GRAVEL occasionally a stuff brown clay with fragments of brick, ash, slate, concrete, timber and clinker generally to 1.0m bgl deeper in the south to 1.4 and 2.8m bgl; over
- GLACIAL TILL – GRANULAR; comprising medium dense brown SAND and GRAVEL. Gravel content of sandstone base confirmed to 2.5m in the north east and 2.9 and 3.5m in the south; over
- GLACIAL TILL – COHESIVE; comprising stiff high strength brown slightly gravelly CLAY base unproven at 5.45m bgl;
- No groundwater encountered.



Figure 2.5: NX Consulting – Exploratory Hole Location Plan extract

The thickness of the GLACIAL TILL- GRANULAR is generally 1.5m to 2.5m, however in the south west of the site in WS7 (location shown in Figure 2.5) it appears to thin, possibly becoming absent at 0.4m.

The Made Ground includes evidence of buried relict road and brick walls; in the centre (WS8) a buried tarmac road was present between 0.1 and 0.2m. In WS5, in the north east, granite cobble setts were present between 0.5m and 0.7m bgl.

In the south, at WS7, there is potential evidence of a former basement with Made Ground extending to 1.5m bgl underlain by a brick obstruction at 1.5 to 1.8m recovered as brick cobble possibly suggesting a former cellar floor.

In WS2, a void was present between 2.8m and 3.0m directly underlain by natural soils. The overlying Made Ground included heterogenous layers of granular and cohesive Made Ground suggesting a backfilled cellar in which the bottom 200mm was not fully compacted where the floor was removed.

2.6 Hydrogeology

Information relating to the hydrogeological setting of the site is summarised in Table 2.5 through to Table 2.8.

Table 2.5: Aquifer system

Stratum	Aquifer Designation	Comments
Artificial Ground		
Made Ground	Unclassified	Artificial ground not included in the classification system. Likely to be moderate to high porosity because of unconsolidated nature, but permeability is likely to be constrained to low, or low to moderate because of poor sorting and clay content.
Superficial Deposits		
Glacial Till	Secondary Undifferentiated Aquifer	Secondary undifferentiated are aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.
Solid Geology		
Chester Formation	Principal Aquifer	May provide significant quantities of drinking water, and water for business needs. May also support rivers, lakes and wetlands. Based on the information within the previous ground investigation logs and BGS borehole site, the risk posed to the principal aquifer from downward migration of contamination is considered to be low due to at least 7.0m of overlying low permeability Glacial Till.

Table 3.6: Active licenced groundwater abstractions (within 250m)

Location	Details
170m south west	Manchester Metropolitan University - General Use for Ground Source Heat Pumps

Table 2.7: Groundwater Vulnerability and Source Protection Zones

Item	Details
Groundwater Vulnerability	Low risk considered due to 3-10m of superficial coverage
Source Protection Zone	The site is not underlain by a Source Protection Zone

Table 2.8: Other groundwater information

Item	Details
Groundwater levels	Approximately 3.5m bgl at the interface of the granular and cohesive Glacial Till as indicated in borehole NZ36SE315 60m south.
Groundwater recharge	Low
Groundwater flow	North west towards the River Medlock
Groundwater quality	Poor due to Quantitative Status element
Groundwater flooding	Low

2.7 Hydrology

Information relating to the hydrological setting of the site is summarised in Table 2.9 through to Table 2.12.

Table 2.9: Surface water features

Feature	Location	Flow direction
River Medlock	150m north east	North

Table 2.10: Active licenced surface water abstractions (within 250m)

Location	Details
N/A	None recorded within 250m

Table 2.11: Active licenced surface water discharges (within 250m)

Location	Details
210m north west	Combined Sewage Overflow to the River Medlock
220m north west	Combined Sewage Overflow to the River Medlock
250m north west	Combined Sewage Overflow to the River Medlock

Table 2.12: Other surface water information

Item	Details
Surface water quality	Moderate due to supporting elements.
Surface water flooding	The site lies within a Flood Zone 1.

2.8 Mining and mineral extraction

Reference to the Mining Remediation Authority online Interactive Map indicates that the site is within a as a Coal Mining Reporting Area; however, is not within a Development High Risk Area.

In addition, no mine entries (shafts or adits) or past or probable shallow coal mine workings are recorded in the vicinity of the Site.

BGS borehole records in the area have confirmed the Chester Formation to extend to at least 90m with the full thickness unproven in select records.

The risk posed by past coal mining is considered to be low following a review of the Mining Remediation Authority viewer and considering the significant thickness of rock coverage overlying the Pennine Middle Coal Measures, therefore no further assessment is considered necessary.

2.9 Waste management

There are no current or historical waste management sites recorded within 250m of the site.

2.10 Regulatory information

The Hydrock desk study concluded that there were no regulatory controls recorded within the Envirocheck report which were considered to pose a potential risk to the site.

2.11 Radon

The radon risk is reported by reference to the Indicative atlas of radon potential for Great Britain version 3 (https://www.ukradon.org/information/ukmaps) is less than 1% of homes are affected by radon, therefore no radon protection measures are required.

2.12 Unexploded ordnance

2.12.1 Preliminary UXO Risk Assessment

A Preliminary UXO Risk Assessment (reference PA19760-00) was obtained as part of the desk study in April 2024. This indicates that a fire bomb strike is recorded approximately 50m west of the site and a high explosive bomb strike is recorded approximately 60m east of the site. Damage is recorded to some of the structures on site and to several structures immediately north and east of the site.

It was also noted that after damage had been caused to the structures on site and within close proximity to the site, it is believed that the frequency of access to the site would have significantly decreased, increasing the likelihood that any evidence of UXO could have been missed and gone unreported.

Based on the above, 1st Line Defence recommended more research or the use of UXO mitigation measures on site. The preliminary UXO risk assessment is presented in Appendix G.

2.12.2 Detailed UXO Risk Assessment

Following recommendations made by 1st Line Defence, a Detailed UXO Risk Assessment (reference DA19760-00) was commissioned and completed by 1st Line Defence and concluded:

- That during World War II the site was located within the County Borough of Manchester, which sustained an overall low density of bombing;
- A high explosive (HE) bomb is plotted approximately 40m east of the site and a 'fire bomb' approximately 20m west and another immediately wets of this bomb.
- Multiple structures in the northern and eastern areas of the site areas of the site are recorded as partially damaged structures. Manchester Bomb Damage Cards record multiple structures within and adjacent to the site as so badly damaged they required demolition.

The risk in the east of the site has been assessed as **Medium Risk** from German and anti-aircraft ordnance driven by the bomb damage in the east. In the western section, the risk is considered to **Low Risk**.

During the construction phase especially in the east of the site there will be a requirement for watching briefs during excavations, possible cone penetration with magnetometer clearance for any piles/columns. All construction workers will be required to undertake a UXO toolbox talk prior to commencing works and fully understand the UXO emergency procedures.

The detailed UXO risk assessment is presented in Appendix G.

3 Preliminary Ground Model

The preliminary ground model is based on the information on the ground conditions presented in Section 3 and integrates site-specific data (where available) with regional geological desk-based information.

Table 3.1: Preliminary Ground Model

Strata	Expected Thickness (m)	Description	Comments
Artificial Ground/Topsoil			
Made Ground	1.0m thickness	Brown/black silty sandy clayey GRAVEL occasionally a stiff brown clay with fragments of brick, ash, slate, concrete, timber and clinker.	Possibly deeper in the east. Anticipated to encounter compact layers, relict brick walls and former road surfaces.
Superficial Deposits			
Glacial Till	9.0m thickness	Present as granular soils to 3.0m comprising a medium dense SAND and GRAVEL transitioning into a stiff brown CLAY to 10.0m bgl.	The previous ground investigation shows a consistent density in the granular soils and strength of the cohesive soils.
Solid Geology			
Chester Formation	90m	Recorded as Red SANDSTONE in the BGS borehole archives.	Deep BGS boreholes in proximity to the site has proven the Chester Formation to at least 92m. BGS mapping indicates the formation is at least 100m in thickness.

The ground investigation completed by NX Consulting did not encountered any groundwater during the ground investigation or the four post fieldwork monitoring visits.

The Made Ground appears to be deepen in the east of the site, potentially associated with the formerly demolished buildings including cellars/basements. The Made Ground in the east is inherently variable with a high cobble content of bricks.

Obstructions associated with former walls/ compact Made Ground or road surfaces are anticipated to be present across the site.

The Made Ground NX Consulting encountered was predominantly demolition materials with no observations of degradable organics.

As shown in Figure 3.1 the ground conditions across the centre of the site appear quite consistent with a consistent depth of Made Ground (circa 1.0m) underlain by medium dense sand in turn underlain by stiff clays.

Across the south the granular Glacial Till appears to thin in the west where the Made Ground is deeper. The ground conditions appear more variable than the centre with deeper Made Ground in the east and west. The Made Ground is likely associated with former structures and the construction of the A57 (M).

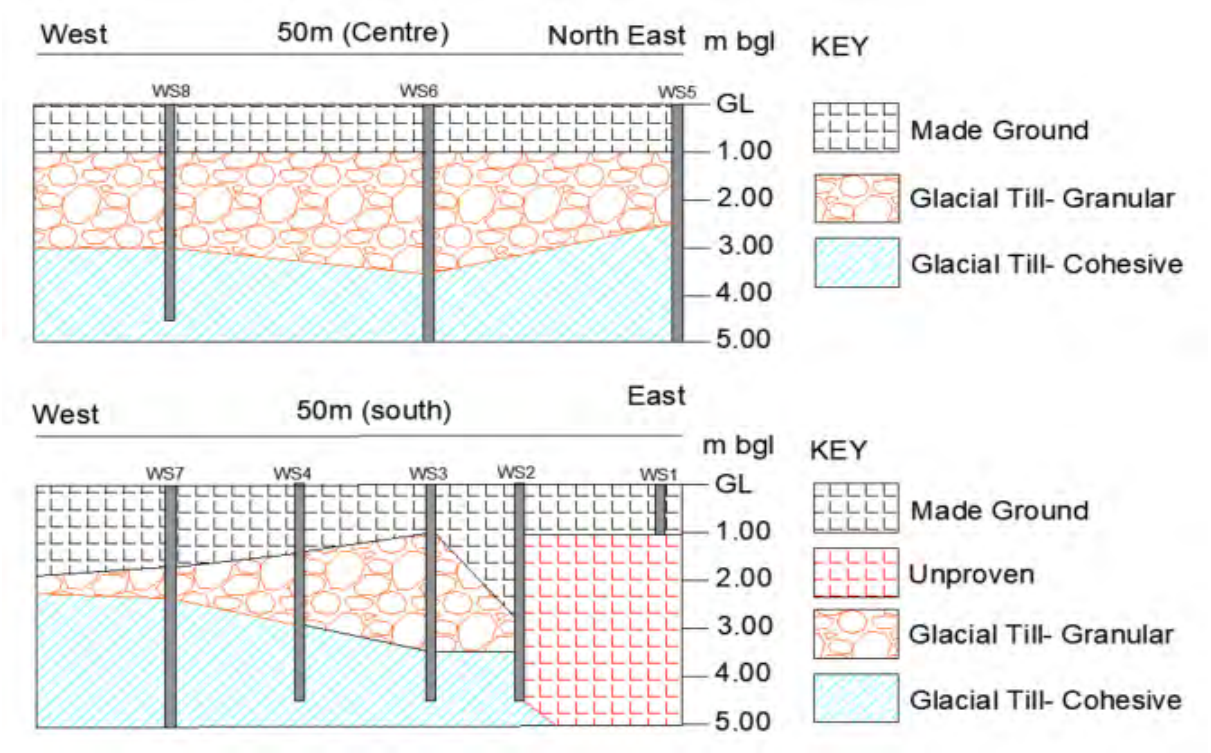


Figure 3.1: Cross Section through the NX Consulting boreholes.

3.1.1 Geo-environmental findings - NX Consulting

- There were no elevated concentrations of metals/metalloids or TPHs.
- Four samples of Made Ground within the upper 1.0m contained asbestos loose fibres (chrysotile and locally amosite) at trace concentrations of <0.001% w/w.
- There was no visual or olfactory evidence of contamination within the Made Ground.
- The risk to controlled water was considered to be low due to the thickness of underlying low permeability clays.
- Four ground gas monitoring visits were completed. Carbon dioxide ranged between 0.1-2.2%, methane < 0.1% and flow rates <0.1%. The maximum gas screening values (GSVs) are <0.05l/hr and the site was classified as CS1.

3.1.2 Geotechnical findings - NX Consulting

- The Glacial Till – Granular is consistently medium dense with N values in the order of 10-26 a locally loose SPT was encountered in the north east in WS5. The underlying clays are stiff SPTs in the order of 20-25.
- The Glacial Till is of a low to medium volume change with a medium plasticity designation.
- Particle size distribution (PSD) tests completed on the granular Glacial Till were grading as a sandy to very sandy clayey GRAVEL.
- The soluble sulphate concentrations were in the order of 50mg/l and 240mg/l, pH of 6.8-8.4 classifying as DS-1 AC-1.
- In-situ CBR tests completed on the Made Ground yielded results in the order of 5-11%, NX consulting recommended a CBR of 2% be used as design.

- NX Consulting recommended that shallow pad or strip foundation should be suitable bearing at 1.0m to 3.0m bgl. Alternatively, they stated Made Ground could be removed and replaced with a stone layer compacted to support the containers.

4 Ground hazards

4.1 Natural ground instability

Based on the findings of the previous ground investigation and review of the background information the cohesive Glacial Till is at a depth of >3.0m bgl, therefore its likely below the zone of influence from tree roots and therefore the risk of shrink and swell is low.

Locally in the north east the granular Glacial Till is loose and therefore this could pose excavation instability for excavations left open for a long period of time.

4.2 Anthropogenic ground instability

The Made Ground across the south of the site is inherently heterogenous and foundations will either need to be below the Made Ground or supported in improved Made Ground. The Made Ground could be prone to settlement due to the presence of compressible layers. Its differing density could also pose a risk to excavation stability.

The Made Ground appears to contain relict brick walls/compacted layers or buried roads and therefore obstructions may require removal to allow for the installation of infrastructures in the Made Ground.

The Made Ground does not appear to contain elevated soluble sulphate concentrations which could impact concrete below ground.

4.3 Potential development elements affected

Development elements potentially affected by geotechnical hazards have been identified as:

- Building foundations.
- Services.
- Construction staff, vehicles and plant operators.

Health and safety risks to site Contractors and maintenance workers have not been assessed and will need to be considered separately during design.

The above plausible geotechnical hazards and development elements affected have been carried forward for investigation and assessment.

5 Initial Conceptual Site Model and Preliminary Risk Assessment

5.1 Introduction

The initial Conceptual Site Model (CSM) and Preliminary Risk Assessment incorporates evidence from the site walkover, the Desk Study, and previous investigations carried out at the site. The formulation of an initial CSM is a key component of the LCRM methodology for assessing geoenvironmental risk, and incorporates the Preliminary Ground Model of the site physical conditions (Section 5) and the identification of potential contaminant linkages.

The available information has used to identify geo-environmental hazards and to establish potential contaminant linkages based on the source-pathway-receptor (S-P-R) approach. A viable contaminant linkage requires all the components of an S-P-R to be present. If only one or two are present, there is no linkage and no further assessment is required.

Health and safety risks to site development contractors and maintenance workers have not been assessed as part of this study and will need to be considered separately.

5.2 Potential contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from an on-site or off-site source.

5.2.1 Potential on-site sources of contamination

- Made Ground, associated with historical construction and demolition, potential source of metals, metalloids, asbestos fibres, asbestos containing materials (ACM), polycyclic aromatic hydrocarbons (PAH) and petroleum hydrocarbons (S01).
- Former textile machinery works – potential source of metals, metalloids, PAH, petroleum hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs) (S02).

The previous ground investigation confirmed the site is CS1 with low gas concentrations and low flows encountered. Therefore, ground gases are not considered to pose a risk to the proposed development.

5.2.2 Potential off-site sources of contamination

- Historical industrial land uses within the surrounding area, including former timber yard, works, depots and warehouses - potential sources of metals, metalloids, PAH, petroleum hydrocarbons, VOCs and SVOCs (S03).

5.3 Potential receptors

The following potential receptors in relation to the proposed land use have been identified.

- Human health; People (site end users, users of adjacent sites) (R01).
- Controlled waters: River Medlock (R02).

- Development end use (utilities and buildings) (R03).

The Principal Aquifer within the Chester Formation is not considered to be at risk from possible contaminants on the site due to the overlying 7m thickness of low permeability limiting the downwards migration of contaminants or possible perched groundwater.

5.4 Potential pathways

The following potential pathways have been identified.

- Ingestion of dust, skin contact, inhalation of dust and outdoor air by people (P01).
- Contaminated surface runoff (P02).

5.5 Potential implications of climate change

Climate change has the potential to change the risk profile for conceptual site models and associated contaminant linkages. The impact of climate change on the CSM is site-specific, and a qualitative assessment of the potential impact of climate change on the CSM for this site is summarised below. The assessment has primarily utilised the guidance in Environment Agency (2010) and SoBRA (2022) which set out the UK context to climate change and land contamination. Both guidance documents advocate a "what if" scenario approach in the context of changes in ambient temperatures, an increase in the frequency of extreme rainfall/storm events and heatwaves/droughts, and long-term changes in groundwater and sea levels.

Those "what if" scenarios that are relevant to this CSM are:

- Increased long-term rainfall leading to increased infiltration and seasonally higher groundwater and water levels in surface waters – *no groundwater Is present on the site and the existing site conditions limit infiltration.*
- Increased frequency and/or magnitude of storm events leading to short-term drops in barometric pressure and/or high winds- the previous ground investigation did not measure any elevated flows and ground gas concentrations. The Made Ground does not contain any degradable organics.
- Occurrence of extreme cold and hot weather events leading to changes in ground conditions such as soil temperature, evapo(trans)piration, and soil moisture (for example freeze-thaw effects and desiccation), decreased infiltration and fall in groundwater and surface water levels.- *the cohesive soils are >3.0m bgl and unlikely to impacted by temperature driven moisture changes in the sub surface.*
- Long-term decrease in rainfall leading to lower infiltration and fall in groundwater and surface water levels. -no groundwater is present underlying the site, drops in groundwater within the principal aquifer are unlikely to impacts the CSM.

In considering the potential impact of climate change, the following factors have been considered:

- The design life of the proposed development is 60-80 years.
- The sites lies within a Flood Zone 1.
- The projected yearly chance of flooding by rivers and sea between 2036-2069 is very low.
- There is no groundwater within the Made Ground or superficial deposits.
- The superficial deposits and underlying geology at the site are unlikely to be physically adversely affected by desiccation, subsidence or erosion.

The UK Climate Predictions published by the Met Office indicate that over the lifetime of the proposed development average:

- Precipitation is forecast to decrease from 12 days to 9 days a month;
- Temperature is forecast to increase by 4°;
- Groundwater recharge is decrease by 50% change in summer months.

No foreseeable impacts of climate change on the CSM have been identified.

5.6 Summary of potential contaminant linkages

The above sources, pathways and receptors have been identified as part of a Preliminary Risk Assessment in accordance with Stage 1 of LCRM (2023). These are considered to be plausible in the context of this site and the available information and have been carried forward for investigation and assessment.

Table 5.1: Initial CSM

Source	Pathway	Receptor	Risk Level	Comment
Made Ground, associated with historical construction and demolition, potential source of metals, metalloids, asbestos fibres, ACM, PAH and petroleum hydrocarbons (S01).	Ingestion or inhalation	Human Health	Low	The site is covered by hardstanding or containers with limited to no landscaping, contact with the Made Ground is unlikely. Risk from asbestos loose fibres will be suitably managed during the construction phase.
	Migration through the unsaturated zone	Controlled Water- River Medlock	Low	The previous ground investigation found no groundwater underlying the site which could be in hydraulic continuity with the River Medlock. The limited landscaping restricts infiltration of surface water and possible contaminant migration.
	Direct contact	Water Pipes	Moderate	Petroleum hydrocarbons or total VOCs could be above the threshold for standard PE pipes.
Former textile machinery works – potential source of metals, metalloids, PAH, petroleum hydrocarbons, VOCs and SVOCs (S02).	Ingestion	Human Health	Low	The previous ground investigation found no evidence visual or olfactory contamination. The ground investigation covers large areas of the site prior to the development of the Hatch. These conditions are considered unlikely to have changed since the fairly recent development of the Hatch.
	Inhalation of vapours migration through gaps in construction	Human Health	Low	
		Buildings	Low	

Source	Pathway	Receptor	Risk Level	Comment
Continued: Former textile machinery works – potential source of metals, metalloids, PAH, petroleum hydrocarbons, VOCs and SVOCs (S02).	Migration through the unsaturated zone	Controlled Water- River Medlock	Low	The previous ground investigation found no groundwater underlying the site which could be in hydraulic continuity with the River Medlock. The limited landscaping restricts infiltration of surface water and possible contaminant migration.
	Direct contact	Water Pipes	Moderate	Petroleum hydrocarbons or total VOCs could be above the threshold for standard PE pipes.
Historical industrial land uses within the surrounding area, including former timber yard, works, depots and warehouses - potential sources of metals, metalloids, PAH, petroleum hydrocarbons, VOCs and SVOCs (S03).	Ingestion	Human Health	Low	Given that the area is underlain by low permeability Glacial Till it is unlikely that leachable or migratable contamination from offsite source will reach and impact the subject site.
	Inhalation of vapours migration through gaps in construction	Human Health	Low	
		Buildings	Low	

6 Ground investigations

6.1 Site works

The ground investigation works, including the rationale which was based on the findings of the preliminary risk assessment is summarised in Table 6.1.

The fieldwork took place on the 29th of August 2025. The ground investigation locations were surveyed in using a topographic survey quality GPS and are shown on the Exploratory Hole Location Plan (Stantec Drawing 333701845-STN-XX-XX-DR-GE-0002 in Appendix B.

The logs, including details of ground conditions, soil sampling, in situ testing and any installations, are also presented in Appendix B.

Table 6.1: Summary of site works

Activity	Method	No.	Name	Depth Max. / Range (m bgl)	In situ tests	Rationale/Comment
Drilling, Pitting and Probing						
Boreholes	Windowless sampler	2	WS101-WS102	3.0-4.9	SPT	For confirm ground conditions for foundation design.
Trial pits	Hand-excavated	1	WS103	0.5	-	Compact Made Ground limited hand dug pit.

6.2 Geo-environmental testing

6.2.1 Sampling strategy and protocols

Exploratory hole positions were determined by reference to the site conditions and uncertainties identified in the Initial Conceptual Model.

No specific sampling statistics or grid were utilised in this instance.

Samples were taken, stored and transported in general accordance with BS 10175:2011+A2:2017.

6.2.2 Geo-environmental laboratory analyses

The chemical test certificates for testing undertaken as part of Stantec's investigation are provided in Appendix D and summarised in the table below. Wherever possible, UKAS and MCERTS accredited procedures have been used.

The geo-environmental analyses undertaken on soils are summarised in Table 6.2.

Table 6.2: Geo-environmental analyses of soils or other solids

Determinand Suite	Made Ground
Stantec minimum suite of determinands for solids	4
Speciated aliphatic and aromatic banding Total petroleum hydrocarbons by HS-GC/MS and GC/FID (Stantec Tier 2 TPH Suite)	4
Benzene, toluene, ethylbenzene and xylene (BTEX) by HS-GC/MS	4
MTBE (Methyl Tertiary Butyl Ether) by HS-GC/MS	4
*Stantec minimum soil suite comprises: As, B (water soluble), Be, Cd, Cr (total), Cr (VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polynuclear aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon	

6.3 Geotechnical testing

6.3.1 Geotechnical laboratory testing

The geotechnical tests undertaken by Stantec are summarised in Table 6.3 and the test certificates are provided in Appendix C. Wherever possible, UKAS accredited procedures have been used.

Table 6.3: Summary of sample numbers for geotechnical tests

Test	Made Ground	Glacial Till-Granular	Glacial Till-Cohesive
Natural moisture content	1	-	3
Atterberg limits	1	-	3
Particle size distribution (wet sieve)	1	1	-
Water soluble sulphate and pH	1	-	-
Sulphate and aggressive chemical environment classification for buried concrete classification (full BRE SD1 suite)	2	-	-

6.4 Constraints

The majority of the development area is constrained by the existing Hatch, with boreholes completed where access between the existing development or under the A57 (M) could be achieved.

In the north of the site, the investigation locations had to be carefully placed between services and avoiding the existing electricity cable easement that crosses the north west of the site from west to east.

7 Ground investigation records and data

7.1 Physical ground conditions

7.1.1 Summary of strata encountered

The following presents a summary of the properties of the ground and groundwater conditions encountered, based on field observations, interpretation of the field data and laboratory test results, taking into account drilling, excavation and sampling methods, transport, handling and specimen preparation.

All relevant data from the Stantec investigation discussed in Section 6 is used from this point forward.

Details of the Stantec ground investigation works are provided in the logs in Appendix B, a summary of the ground encountered in the investigation is presented in Table 7.1 and the individual strata are described in the sections below.

Table 7.1: Strata encountered

Stratum	Depth to top (m bgl)	Depth to base (m bgl)	Thickness (m) (range)	Thickness (m) (average)
Surface Cover – Concrete hardstanding	0.1	0.1	0.1	0.1
Surface Cover Asphalt hardstanding	0.1	0.1	0.1	0.1
'General' Made Ground	0.1	0.7 - >3.0	0.5 - >3.0	0.7 where proven
Glacial Till – Granular	0.7	1.9	1.2	1.2
Glacial Till - Cohesive	1.9	>4.9	>3	>3

7.1.2 Surface covering

In the north west of the site, the surface covering comprises a grey unreinforced CONCRETE to 0.1m bgl and elsewhere was a back ASPHALT directly underlain by a grey Type 1 MOT of limestone taking the full build up to 0.2m.

7.1.3 Made Ground

In the north west the CONCRETE is underlain by a grey Type 1 MOT of limestone to 0.4m, the underlying Made Ground is an orangish brown gravelly clayey SAND with rare brick fragments.

In the south west. deep Made Ground is present possibly associated with backfilled former cellars or the construction of the A57(M) comprising loose black gravelly SAND with cobbles of brick and gravel of brick, concrete and timber. There were occasional inclusions of oft dark grey sandy CLAY.

In the south/south east the similar black gravelly SAND was present, however the granular soils were heavily compacted limiting excavation extent.

7.1.4 Glacial Till – Granular

The granular Glacial Till directly underlies the Made Ground in the north west and comprise a medium dense gravelly SAND with a gravel content of sandstone.

7.1.5 Glacial Till – Cohesive

The cohesive Glacial Till is present below the granular soils at 1.9m bgl and comprises a stiff high strength slightly sandy gravelly CLAY with a gravel content of mudstone, sandstone and coal.

7.2 Obstructions

Obstructions were encountered during the investigation. These intrusive locations are summarised in Table 7.2.

Table 7.2: Obstructions encountered

Stratum	Location	Depth (m bgl)	Description
Made Ground	WS102	1.2	High cobble content of brick
Made Ground	WS103	0.5	Compact and suspected relict brick wall

7.3 Groundwater

Groundwater was not encountered during the investigation.

7.4 Updated ground model

The initial ground model, presented in Section 6 has been updated based on the Stantec ground investigation. Strata encountered did reflect the anticipated model and succession including Made Ground over granular Glacial Till in turn over cohesive Glacial Till.

The Made Ground is generally granular in nature as a gravelly SAND with occasional inclusion of sandy CLAY in discrete thin layers. Deep Made Ground appears to be present in the south west of site to 3.0m possibly indicating the presence of a potential backfilled basement or grubbed out basement. This may explain the thinning the granular Glacial Till in the west shown in Figure 3.1.

As expected, the underlying granular Glacial Till is dry and there is no evidence of seepages within the Made Ground.

There was no visual or olfactory evidence of contamination in the Made Ground or Glacial Till.

The granular Glacial Till is of a medium density, and the underlying cohesive Glacial Till is of high strength and the strength remain consistent over depth.



Figure 7.1: WS101 1.2m to 4.9m bgl

The anticipated typical ground conditions in the north are shown in Figure 7.1 where medium dense gravelly SAND is present to 2.0m underlain by stiff high strength CLAYs to 4.9m bgl.



Figure 7.2: WS102 1.2m to 3.0m bgl

Figure 7.2 shows the ground conditions in south west including deep Made Ground associated with a possibly backfilled basement including gravelly SAND with an increasing cobble content of brick and an inclusion of sandy CLAY between 1.4 and 1.6m bgl.

8 Geotechnical data

8.1 Introduction

Laboratory test results are contained in Appendix C with *in situ* test results shown on the relevant exploratory hole log or datasheet in Appendix B. The following sections summarise the main findings and provide interpretation where appropriate.

8.2 Water Content

The soil water content data obtained from the laboratory results is summarised in Table 8.1.

Table 8.1: Water Content

Stratum	No of Tests	Natural Water Content Range (%)	Average Water Content (%)
Made Ground	1	28	28
Glacial Till - cohesive	3	12-15	14

8.3 Plasticity

The volume change potentials in terms of BRE Digest 298 with respect to building near trees have been determined from the results of plasticity index tests on samples of soil. These are summarised in Table 8.2.

Table 8.2: Volume change potential

Stratum	No. of tests	Plasticity Index			Modified Plasticity Index			Plasticity designation	Volume Change Potential
		Min.	Max.	Av.	Min.	Max.	Av.		
Glacial Till - cohesive	3	16	20	17	10	18	14	Low to Medium	Low

8.4 Particle size distribution

Particle size distribution (PSD) test results are summarised in Table 8.3 and summary descriptions and PSD plots of the material analysed are presented in Appendix C.

Table 8.3: PSD results summary

Stratum	No. of tests	Silt/Clay %	Sand %	Gravel %	General description
Made Ground	1	15	39	46	very sandy clayey GRAVEL.

Stratum	No. of tests	Silt/Clay %	Sand %	Gravel %	General description
Glacial Till – granular	1	20	55	25	very gravelly clayey SAND.

8.5 Soil strength

Table 8.4 summarises information pertaining to the shear strength of the soils according to geological stratum. Factual results are summarised for laboratory tests, field tests (e.g. hand shear vane) and uncorrected Standard Penetration Tests (SPT N_{60}). Where the SPT N_{60} is used to infer shear strength by published correlation, this is also tabulated.

Table 8.4: Soil strength results and derived values

Stratum	No. of tests	SPT N_{60} (N-value) (range)	c_u (kPa)	c' (kPa)**	phi' (°)	Method
Glacial Till - cohesive	4	23 - 34	120-190	3.0	26 - 27	SPT – windowless sampler boreholes.

*An f_1 value of 0.55 has been used based on a plasticity index of 17. (Tomlinson (2001), after Stroud)).
**cohesion estimated from using BS1377-7:1990 correlation with effective friction angle.

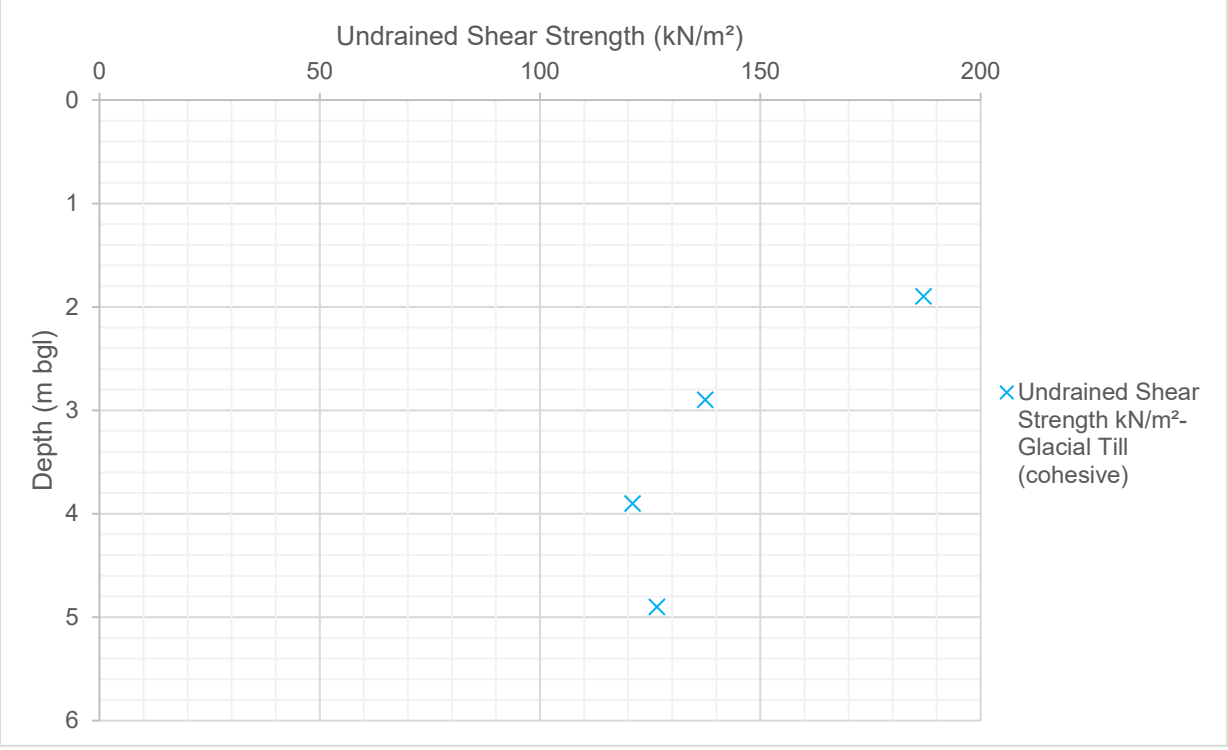


Figure 8.1: Undrained Shear Strength versus depth

As shown in Figure 8.1 the strength of the cohesive Glacial Till over depth remains high and generally consistent >150kN/m^2. This consistent strength profile is similar to the previous investigation findings.

8.6 Relative density

Table 8.5 summarises information pertaining to the relative density of the granular soils according to geological stratum. Factual results are summarised for laboratory tests, field tests (e.g. SPT).

Table 8.5: Relative density results and derived values

Stratum	No. of tests	Method	SPT N_{60} (N-value) (Range)	phi' (°)
Made Ground	2	SPT – windowless sampler boreholes (Peck et. al. (1967).	5 - 11	29 - 30
Glacial Till - granular	1		24	35

8.7 Compressibility

Table 8.6 presents a summary of the derived parameters for coefficient of consolidation and compressibility.

Table 8.6: Summary of compressibility

Stratum	No. of tests / results	Method	Coefficient of volume compressibility (m_v) (m²/MN)	Comments
Glacial Till - cohesive	4	Correlation with SPT N_{60}*	0.08 - 0.05	Low compressibility

* An f_2 value of 0.55 has been used based on a plasticity index of 18. (Tomlinson (2001), after Stroud)).

8.8 Sulphate content

In accordance with BRE (Special Digest 1), the Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in Table 8.8. The assessment summary sheet is presented in Appendix C.

Table 8.7: Aggressive chemical environment concrete testing results

Stratum	No. tests	Water Soluble Sulphate (mg/l SO_4)	Total Potential Sulphate	pH
Made Ground	4	39 - 1990	0 - 0.5	7.2 - 7.9

Table 8.8: Aggressive chemical environment concrete classification

Stratum	No. tests (soil)	DS	ACEC
Made Ground	2	DS-3	AC-3

8.9 Derived values of ground properties

In accordance with BS EN ISO 1997-1 (EC 7), Stantec consider the proposed structures would be classified as Category 2 structures. As part of the separate geotechnical design, the designer should determine the geotechnical design values.

Table 8.9 provides characteristic geotechnical values to assist the designer. These are based on laboratory testing, *in situ* testing and by professional judgement using published data together with knowledge and experience of the ground conditions. Care should be exercised in using these assumed soil strength parameters for any purpose beyond the scope of this report because it may be that additional sampling and testing are required for certain purposes. The reader should refer to the original test results summarised in Section 10 and provided in Appendix C.

Table 8.9: Characteristic geotechnical values

Parameter **Stratum**	**Bulk unit weight** **kN/m³**	**Effective angle of internal friction** **°**	**Effective cohesion** **kN/m²**	**Undrained shear strength** **kN/m²**	**Coefficient of compressibility** **m²/MN**	**Modulus of subgrade reaction (IAN73/06)** **MN/m²/m**	**Concrete classification**
	γ [a]	**φ' [b c]**	**c' [d]**	**c_u [e]**	**m_v [f]**	**k [g]**	
Made Ground – granular	16	30	0	-	0.05	25*	AC-3
Glacial Till – granular	17	35	0	-	0.05	25*	-
Glacial Till - cohesive	19	26	3	120	0.08	-	-

a Measured as part of the triaxial strength test and estimated based on the recommendations of BS 8004-2015+A1:2020.
b Internal friction (φ') values for the granular in situ material derived from SPT data following the recommendations of Peck et al., (1967).
c Internal friction (φ') values for the cohesive in-situ material derived from BS 8004-2015+A1:2020, where φcv' is derived from plasticity index. The use of φcv' in the analysis is considered to provide a conservative estimate of φ'.
d BS 8002:1994 Code of practice for Earth retaining structures, British Standards institution.
e Site measurements and laboratory data.
f Assumed based on previous ground Investigation in-situ testing.
g Based upon the equilibrium long term CBR from CD255.

9 Geotechnical assessment

9.1 Geotechnical categorisation of the proposed development

Eurocode 7, Section 2 advocates the use of geotechnical categorisation of the proposed structures to establish the design requirements.

To avoid excessive foundation depths the existing Made Ground will likely reengineering in accordance with an earthworks specification to form a structural fill suitable of supporting shallow strip foundations.

Based on the above, for the purposes of this investigation, the proposed structures have been classed as Geotechnical Category 2.

9.2 Groundwork

9.2.1 Site preparation

The redevelopment will involve breaking out of existing hardstanding. This should be undertaken to an appropriate Specification to ensure any asset materials generated are geotechnically suitable for use.

Buried obstructions associated with services or relict brick walls can be expected, and there is a possibility of further such obstructions being encountered due to the heterogeneity of the Made Ground.

9.2.2 Groundworks

Following breaking out of hardstanding and obstructions, excavation of shallow soils should be readily undertaken by conventional plant and equipment. However, excavation through any buried construction may require the use of specialist breaking equipment.

The Made Ground is heterogenous and of variable density with loose density SPTs recorded during the ground investigation works.

Random and sudden falls should be expected from the faces of near vertically sided excavations put down at the site.

Temporary trench support, or battering of excavation sides, is recommended for all excavations that are to be left open for any length of time and will definitely be required where man entry is required. Particular attention should be paid to excavation at, or close to, adjacent buildings/ road and infrastructure which supports the A57 (M), where collapse of excavation faces could have a disproportionate effect.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be obtained from the Construction Design and Management Regulations (2015); Construction Information Sheet 47: Inspections and Reports (2005) and HSG47: Avoiding Danger from Underground Services.

To ensure no loads are imposed on the sides of the excavation, spoil should not be placed immediately adjacent to the excavation. Spoil should be placed a suitable distance from the side of the excavation (as assessed by a competent person).

Based on site observations, the rate of water ingress to the proposed excavations is likely to be slow. In these circumstances, groundwater control by sump pumping is likely to be sufficient.

9.2.3 Earthworks/reuse of site-won materials

At this stage, Stantec is not aware of proposals for earthworks at the site.

However, to avoid requirement for deep foundation a suitable option may be to be completed suitable compaction techniques or reengineer the Made Ground where necessary so its capable of supporting shallow strip foundations.

Should earthworks be required, supplementary earthworks testing and an earthworks Specification will be necessary to ensure the appropriate management and reuse of the existing soils.

If significant earthworks are required, the works may be Category 2 in accordance with BS EN ISO 1997-1 (EC 7) and further geotechnical design may be necessary. Once site proposals have been further defined more specific consideration will need to be given to the reuse of materials and reference should be made back to this office.

9.3 Foundation recommendations

Based on the findings of the previous and recent ground investigation works, strip/trench foundations are considered suitable for the proposed Stack across the majority of the site, based wholly within the natural medium dense granular Glacial Till.

A safe net bearing pressure of 75kN/m² is considered appropriate for reinforced strip foundations bearing onto the medium dense granular deposits.

In areas where access is restricted due to the presence of existing trees or the water main easement in the north of the site, it is understood that a screw pile solution is being utilised founding into the medium dense granular Glacial Till or stiff high strength Glacial Till.

Foundation formations should be inspected by a geotechnical engineer or other suitably competent person to ensure the founding conditions are suitable and as indicated in this report. Any formation materials deemed as unsuitable should be excavated and replaced with lean mix concrete or deepened to suitable strata.

As the ground conditions at formation level are likely to be of variable type and stiffness, it is recommended that foundation concrete should be suitably reinforced with mesh.

Foundation excavations should be protected from rainfall, inflow of surface water, frost and freezing conditions. They should also be protected from drying out in hot dry weather.

9.4 Roads and pavements

Based on available information, it is considered likely an equilibrium CBR of 2.0% will be achievable over the site.

Proof rolling of the formation level will be required, and any loose or soft spots should be removed and replaced with an engineered fill, in accordance with a suitable Specification. The formation level will also need to be protected during inclement weather from deterioration; all slopes should be trimmed to falls to shed rain water and the surface sealed to limit infiltration.

Prior to the placement of the founding materials and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 to confirm that the ground conditions at time of construction are consistent with the previous design parameters.

9.5 Drainage

Soakaways are considered unsuitable for the site due to the depths of Made Ground circa 1.0m up to 1.8m bgl and limited unsaturated zone. Although natural granular soils are present, they represent a limited saturated zone of 1.0m thickness constrained by the overlying Made Ground and underlying low permeability cohesive Glacial Till.

9.6 Buried concrete

Based on guidelines provided in BRE Special Digest 1 (BRE 2005) and the information presented in Section 8.8, the shallow soils (Made Ground) can be classified as Design Sulphate Class DS-3 and ACEC Class AC-3.

The designer should check and confirm the classification of concrete using the information presented in Section 8.8 and Appendix C during the design.

10 Geo-environmental assessment

10.1 Objectives

The objectives of the geo-environmental assessment presented in the following sections are to:

- undertake a generic quantitative risk assessment in accordance with LCRM using published generic assessment criteria;
- screen out contaminant linkages that don't potentially pose an unacceptable risk to defined receptors;
- identify whether the ground conditions are suitable for the proposed land use from a land contamination perspective; and
- identify contaminant linkages that potentially pose an elevated risk or are associated with a level of uncertainty that warrants further consideration.

10.2 Updated conceptual site model

The initial CSM developed from the desk study and field reconnaissance survey has been updated using the findings of the ground investigation. This updated CSM is the basis for the geo-environmental assessment presented in this section.

Following the ground investigation, the plausible contaminant sources, receptors and pathways identified in the preliminary geo-environmental risk assessment (Section 5) have been updated or confirmed as follows.

10.2.1.1 Sources

The ground investigation has confirmed the presence of the following sources identified in the initial CSM:

No potential sources have been removed from, or added to, the model.

10.2.1.2 Receptors

No potential receptors have been removed from, or added to, the model.

Pathways

The ground investigation has confirmed the presence of the following pathways identified in the initial CSM.

No potential pathways have been removed from, or added to, the model.

10.3 Risk assessment approach

Using the updated CSM, a Stage 1 Tier 2 generic quantitative risk assessment (GQRA) for identified receptors based on all media sampled has been undertaken in accordance with the principles of LCRM.

Firstly, the risks associated with the identified potential contaminant linkages have been estimated using standardised methods (typically involving comparison of site data with published 'screening values'). Secondly, where screening values are exceeded, the result has been evaluated in an authoritative review of the findings with other pertinent information to determine whether or not the exceedance is or is not acceptable in the site-specific circumstances.

The data sets used in the assessment comprise the analytical results obtained by Stantec as listed in Section 6 together with any reliable data from previous investigations as listed in Section 4.

In cases where potentially unacceptable risks are indicated and/or the land is potentially unsuitable for its intended use, actions such as more advanced stages of risk assessment (Tier 3, detailed quantitative risk assessment (DQRA)) or remediation are proposed in Section 13.

10.4 Data Sets

The data set used in this report is based on the conceptual site model and the proposed development, with the data relating to the Made Ground.

GAC based on a soil organic matter (SOM) of 1% for Made Ground based on the laboratory results summarised in Section 7.

10.5 Human health risk assessment

10.5.1 Generic Assessment Criteria

The soil screening values used are Generic Assessment Criteria (GAC) (i.e. derived in accordance with EA CLEA guidance (2009) using the updated exposure model detailed in Defra SP1010 (2014), with the exception of published C4SLs. The term 'GAC' used in this report is inclusive of all generic soil screening values.

Based on the proposed development, generic assessment criteria (GAC) based on a commercial CLEA land use scenarios have been adopted.

GAC are selected based on the following hierarchy:

- Category 4 Screening Levels (C4SL), where available.
- SoBRA Acute GAC for free cyanide, as acute dose toxicity is the primary risk driver.
- Stantec GAC, derived by Stantec as detailed in Appendix D.

10.5.2 Assessment of results

Soil and groundwater data assessment sheets are presented in Appendix D.

As an initial screen, all soil samples have been compared to the GAC irrespective of depth. It is recognised that depth is a relevant consideration when evaluating the plausibility of exposure, and this is considered in the evaluation of the outcome of the GAC screening.

Based on the data comparison against the GAC the results indicate that all chemicals of potential concern (CoPC) including metals, metalloids, PAHs and petroleum hydrocarbons are below the relevant GAC.

Asbestos

There was no visual evidence of asbestos containing materials (ACMs) at the site during the site investigation works. During the laboratory analysis completed there was asbestos identified in samples which is summarised in Table 10.1.

Table 10.1: Asbestos in soil samples (laboratory testing)

Stratum	Depth (m bgl)	% Asbestos (w/w)	Comment
Made Ground	0.3	<0.001	Loose Fibres (Chrysotile)
	0.8	<0.001	Loose Fibres (Amosite)
	0.3	0.035	Loose Fibrous Debris (Chrysotile and Crocidolite)

10.5.3 Risk evaluation

The screening exercise has identified asbestos loose fibres in Made Ground. These are considered further here to assess if the exceedance may be acceptable with respect to the proposed development. The phrase ‘further assessment’ does not necessarily mean that the soil is ‘contaminated’ or not fit for use.

No clearly identifiable ACM has been seen during the site walkover or during the ground investigation and the laboratory testing has only identified at low concentrations of asbestos fibres (<0.001% to 0.035% w/w) in the soils.

All site staff should be made aware of the possibility to encounter asbestos within the Made Ground soils anywhere on the site at any stage of the development. It is advised that the Contractor should consider supplying suitable and sufficient ‘Asbestos Awareness’ training (specific to asbestos in soils) to all site staff who could foreseeably encounter asbestos containing materials during the course of their work.

The risk posed to future site users is considered to be low due to the proposed development including hardstanding with no proposed landscaped areas.

The Contractor for each stage of works must assess the risks in accordance with Regulation 6 of the Control of Asbestos Regulations 2012 (CAR2012) and if considered necessary compile a Plan of Work in accordance with Regulation 7 of CAR2012.

It is the responsibility of the Contractor to ensure that mitigation measures are suitable and sufficient to prevent exposure to airborne asbestos so far as is reasonably practicable in accordance with Regulation 11 of CAR2012. However, the asbestos fibres detected at the site are at a very low concentration and within a soil matrix. As such, if the soils are kept damp and appropriate site hygiene measures are in place, this should assist in minimising the risk of the release of airborne fibres.

10.6 Controlled Waters Risk Assessment

10.6.1 Risk evaluation

The site is considered to pose a low risk to controlled waters and does not require further assessment for the following reasons:

- The existing and proposed development restrict any infiltration of surface water through the Made Ground and therefore risk of mobilising leachable contaminants is low;
- The Made Ground has been found to contain low concentrations have contaminants of potential concern and therefore is not considered to pose a source of leachable contaminants;
- The available BGS records adjacent to the site, existing and previous ground investigation data support the presence of at least 7m of low permeability clay overlying the Principal Aquifer in the Chester Formation will restrict vertical contaminant migration;
- During the ground investigation, no shallow groundwater was identified underlying the site and therefore no risk of groundwater being in hydraulic continuity with the River Medlock; due to the presence of thick low permeability Glacial Till; and
- The Glacial Till is a Secondary Undifferentiated Aquifer, with low water storage potential.

10.7 Ground gas risk assessment

The potential risk from ground gas has been assessed in accordance with CL:AIRE RB17 and has been based on the relevant data identified and summarised in Section 7, namely factual information from the boreholes logs and TOC results for assessment against RB17.

10.7.1 Assessment criteria

Gas monitoring has not been undertaken at the site on the basis of the desk study and preliminary risk assessment identifying a very low risk from ground gas. The CL:AIRE RB17 alternative approach to gas monitoring on low risk sites has therefore been adopted, and the limiting values for TOC set out in Table 1 of this guidance have been used in conjunction with the wider decision framework set out in Figure 2 of RB17.

10.7.2 Assessment results

CL:AIRE RB17 (Card et al 2012) states that where there are natural soils with low organic content and 1m to 5m of Made Ground (average <3m) that comprises general infill materials TOC less than 1%, no gas protection is required as this represents CS1. As such, no ground gas protection is required.

Also, the nature of the development will not include any permanent buildings, the risk is from ground gas is considered to be low.

10.8 Construction materials risk assessment

10.8.1 Water pipelines

A formal water pipe investigation and risk assessment is beyond the scope of this report. However, the findings of this investigation have been compared to the threshold values in Water UK HBF (2014), Table 1 as far as is practicable.

The site is brownfield and organic contamination (petroleum hydrocarbons EC<10-16 at 12.9mg/kg) has been identified in exceedance of the threshold values. Therefore, Stantec believe that barrier pipe is required; however, confirmation should be sought from the water supply company at the earliest opportunity.

Because the requirements from individual water companies can vary, confirmation of pipeline requirements should be sought from the relevant water supply company at the earliest opportunity.

10.8.2 Other construction materials

Plastic pipes for drains and sewers are manufactured from unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) or polyethylene (PE). These materials may be affected by the presence of organic compounds in the soil.

In accordance with the British Plastics Federation Guidance (August 2018), as the concentrations of PAH, and BTEX are below 100mg/kg and the concentrations of petroleum hydrocarbons (TPH) are below 200 mg/kg, PVC-U, PP or PE pipework is considered suitable.

The implications for buried concrete are discussed in Section 9.

10.9 Contamination risk to construction workers

Whilst risks to construction workers are not discussed in detail, the following section discusses potential risks that should be considered in the preparation of Risk Assessments, Method Statements, Plans of Work, or equivalent.

Information presented is provided to assist in managing the risk associated with contamination in soil and groundwater at the site but is not definitive. Contractors are responsible for undertaking their own assessments and assessing what risks are present and what control measures are required.

Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate PPE and, if required, RPE should be provided and utilised.

10.9.1 Asbestos

The risk posed by low concentrations of asbestos loose fibres and required control measures are discussed in Section 10.5.3.

10.10 Consideration of climate change

No foreseeable impacts of climate change on the CSM have been identified.

10.11 Updated Conceptual Site Model

A summary of the Source-Pathway-Receptor (S-P-R) contaminant linkages for which the risks may be unacceptable and require mitigation (those that are moderate or higher) are identified in Table 10.2 below. The S-P-R linkages that warrant further assessment and/or mitigation are:

Table 10.2: Updated plausible contaminant linkages

Source	Pathway	Receptor	Risk Level	Comment
Asbestos fibres within Made Ground.	Ingestion and dermal contact. Inhalation	Human Health - Construction workers	Moderate	The ground investigation completed to date has found low concentrations of asbestos loose fibres and no ACMs. The risk to construction works is to be controlled by wearing appropriate PPE and dampening down of soils.
		Human Health - End users	Low	Given that the majority of the site will be surfaced by hardstanding, it is considered that this will break the exposure pathway between future site users and the impacted soils.
Elevated concentrations of petroleum hydrocarbons within site soils.	Direct contact	Water Pipes	Moderate	Petroleum hydrocarbons are above the threshold for standard PE pipes. It's recommended that liaison with United Utilities is undertaken, and a formal water pipeline risk assessment is carried out to confirm if barrier pipes are required in the construction phase.

10.12 Mitigation measures

Based on the current ground investigation, there are no potential source-pathway-receptor linkages requiring mitigation measures.

As mentioned above the requirement for possible barrier pipes would be assessed within a United Utilities water pipeline risk assessment and not require a remedial strategy.

11 Waste and materials management

11.1 Introduction

The Waste Framework Directive (WFD) (2009/98/EC) defines waste as 'any substance which the holder discards or intends to discard.' In a geo-environmental context, the waste is most often 'soil' and the two main scenarios are offsite disposal of the material as a waste and/or reuse of the material on site. For cost and sustainability reasons, reuse is preferred to off-site disposal.

Section 11.2 below describes the key issues relating to off-site disposal to landfill and Section 11.4 considers requirements relating to reuse of soils and materials management.

11.2 Waste disposal

11.2.1 Principles

Based on the WFD, any material excavated on site may be classified as waste and it is the responsibility of the producer of a material to determine whether or not it is waste. Where off-site disposal is undertaken, the following guidance applies.

Classification is a staged process:

A hazardous waste is defined under the WFD as one which possesses one or more of fifteen defined hazardous properties. If a waste is not defined as hazardous, then it is non-hazardous.

Where the materials are soil, it is then be assigned using the 'List of Waste Codes', which classifies the material as either:

- hazardous (17-05-03), which is defined as "soil and stones containing hazardous substances"; or
- non-hazardous (17-05-04), which is defined as "soil and stones other than those mentioned in 17-05-03".
- Stantec utilise the proprietary assessment tool, HazWasteOnline™ to undertake this assessment.

Waste Acceptance Criteria (WAC) testing is then undertaken if required, and are only applicable following classification of the waste, and only where the waste is destined for disposal to landfill. The WAC are both qualitative and quantitative. The WAC and the associated laboratory analyses (leaching tests) are not suitable for use in the determination of whether a waste is hazardous or non-hazardous.

It should be noted that some non-hazardous wastes may be suitable for disposal at an inert landfill as non-hazardous waste, subject to meeting the appropriate waste acceptance criteria.

It should be noted that classification must be undertaken on the waste produced, by the waste producer. Necessary sampling frequency to adequately characterise a soil population is defined within WM3.

Contaminated or potentially contaminated sites

If the site is brownfield, contaminated or potentially contaminated, the waste must undergo an initial waste classification exercise using background information on the source and origin of the waste and assessment of chemical test data in accordance with Environment Agency Technical Guidance WM3.

If following the initial waste classification exercise, the soils are acceptable for disposal to a non-hazardous landfill, further qualitative Waste Acceptance Criteria (WAC) testing is not required.

However, if soils are potentially able to be disposed to an inert landfill as non-hazardous waste, or require testing to determine if they can be disposed of to a stable non-reactive hazardous or hazardous class of landfill, the next stage of assessment is to undertake qualitative WAC testing. This will determine the Basic Characterisation and the landfill category at which the soils can be accepted.

Hazardous material must be subjected to WAC testing to determine whether it requires treatment before it can be accepted at the hazardous landfill, while non-hazardous material can be tested to determine whether it may be suitable for placement in an inert landfill.

11.2.2 HazWasteOnline™ assessment

As the site is brownfield, in order to inform the preliminary waste characterisation process, Stantec has undertaken an exercise using the proprietary web-based tool HazWasteOnline™. The output of the HazWasteOnline™ assessment is provided in Appendix E and a summary of the preliminary waste classification is provided below.

WAC testing

11.2.3 Preliminary waste disposal options

The site is brownfield and based on the site history, the HazWasteOnline™ assessment and the WAC testing, if suitable segregation of different types of waste is put in place, for soils to be disposed of, it is considered that:

- The ‘General’ Made Ground is likely to be classified as Non-Hazardous waste.
- The natural soils are likely to be classified as Non-Hazardous waste, WAC testing will be required to confirm is the soils are suitable for disposal to an ‘inert’ landfill.

11.2.4 General waste comments

It should be noted that the preliminary waste assessment presented above is subject to the following:

- Any soils containing > 0.1% asbestos or visible asbestos containing materials would be considered as hazardous.
- It is the waste producer’s responsibility to segregate the waste at source and waste producers must not mix waste materials/streams or dilute hazardous components, for example by mixing with less or non-hazardous waste on site to meet WAC limit values.
- The above preliminary assessment has been made on the basis of the soils tested as part of the ground investigation, using the HazWasteOnline™ assessment. However, the formal classification of waste can only be undertaken on the material to be disposed of, and by the waste producer and the receiving landfill as license conditions vary from landfill to landfill.

- Basic Characterisation should be undertaken in accordance with Environment Agency guidance by the waste producer. Stantec can assist if required and this report will assist the characterisation. However, Basic Characterisation does not form part of the current commission and would require further assessment and testing on the wastes actually to be disposed.
- Once the waste producer has undertaken an initial Basic Characterisation on each waste stream, they can manage the soils as part of the on-site processing programme (for example, stockpiling, treatment, screening and separation). The waste producer and landfill operator will then need to agree the suite of compliance testing for regularly generated waste to demonstrate compliance with the initial Basic Characterisation prior to disposal.
- At the time of disposal, additional testing on the excavated soils to be disposed of, will likely be necessary.
- Non-hazardous and hazardous soils require pre-treatment (separation, sorting and screening) prior to disposal.
- The costs for disposal of non-hazardous and hazardous soils are significant compared to disposal of inert material.

In addition to disposal costs, landfill tax will be applicable. Non-hazardous and hazardous waste will generally be subject to the Standard Rate Landfill Tax. Inert or inactive waste will generally be subject to the Lower Rate Landfill Tax. The landfill tax value changes each April and can be found at https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013.

Before a waste producer can move waste to a landfill site for disposal, they need to check the landfill site has the appropriate permit and must have completed the following :

- Duty of care transfer note / Hazardous Waste consignment note, including comment as to if pre-treatment has been undertaken; and

Basic Characterisation of the waste, to include description of the waste; waste code (using list of wastes); composition of the waste (by testing, if necessary) and; WAC testing (if required).

11.3 Materials management

11.3.1 Introduction

Soils that are to remain on site, should be managed and reused in accordance with a Materials Management Plan (MMP), prepared in accordance with 'The Definition of Waste: Development Industry Code of Practice', Version 2 (CL:AIRE), known as the DoWCoP. Where all aspects of the DoWCoP are followed the soils are considered not to be waste, because they were never discarded in the first place. It should be noted that Version 3 of the DoWCoP is undergoing preliminary consultation, and recommendations within this report with regard to waste and re-use of soils will require review when the DoWCoP Version 3 is adopted.

Version 2 of the DoWCoP clearly sets out the principles and an outline of the requirements of a MMP. The following compliance criteria must be seen to apply to the MMP for the site:

Factor 1: Protection of human health and protection of the environment.

Factor 2: Suitability for use, without further treatment.

Factor 3: Certainty of Use.

Factor 4: Fixed Quantity of Material.

The reuse of soils at sites should be considered during the planning and development design process so that compliance with issues such as fixed quantity and certainty of use clearly relate to agreed site levels. Suitability of Use is normally evident from the remediation strategy or the design statement, which form an integral part of a MMP. However, some soils may need to be tested post-excavation to prove they are suitable for use.

Once the MMP is finalised, it must be declared by a Qualified Person (QP). The Declaration is an on-line submission as part of which the QP is required to confirm that the declaration is being made before the relevant works have commenced (i.e. it is not a retrospective application).

Once all material movements have been completed in accordance with the MMP a verification report must be produced, kept for 2 years and provided to the EA on request.

It should be noted that failure to comply with the requirements of the DoWCoP when re-using materials has potentially significant consequences for the waste holder. The risk is that the reused materials are still regarded as a waste that has been illegally deposited. From 1 April 2018, the scope of Landfill Tax has been extended to sites operating without the appropriate environmental disposal permit, and operators of illegal waste sites will now be liable for Landfill Tax. Further information is available at: https://www.gov.uk/government/publications/landfill-tax-disposals-not-made-at-landfill-sites/landfill-tax-disposals-not-made-at-landfill-sites.

If soils are excavated and reused on sites (or moved to another site) without a MMP, exemption, or appropriate Permit in place, anyone who knowingly facilitates the disposal may be 'jointly and severally liable' to any assessment of tax, fines or prosecution.

11.3.2 Materials management scenarios

The materials management scenarios present on site are discussed below.

It should be noted that more than one scenario may apply, dependent upon where the soils are proposed for reuse.

Clean, naturally occurring materials – reused on the site of origin.

Where soils are naturally occurring, uncontaminated and are reused on the site they are excavated (i.e. greenfield site with documented site history, with no Made Ground), they will fall outside the Waste Framework Directive (WFD) by means of Article 2 1(c) (i.e. they will not be a waste when reused on the site of origin).

However, there needs to be certainty of that reuse, and evidence is necessary to support this strategy, for example through information provided during the planning process. The onus is on the developer to demonstrate that the materials are not a waste and will never become a waste. As such, a Materials Re-use Strategy is recommended to show certainty. Alternatively, if the volume of material is under 1,000 tonnes, then a U1 waste exemption may be applied for from the Environment Agency if the use meets the strict re-use requirements of that exemption.

It may be noted that some 'clean naturally occurring materials' may still fail the 'suitable for use' test, for example, soils with a naturally high organic content may not be suitable for use because of their propensity to produce ground gases such as methane. Rules regarding other more unusual

circumstances such as where natural soils contain an unacceptably high mineral content are described in the DoWCoP.

11.3.2.1 Made Ground and other contaminated soils

On sites where Made Ground or contaminated soils are present, any soils excavated will be a waste as soon as they are excavated (even if they are clean, naturally occurring materials), unless they are subject to reuse in accordance with the DoWCoP. As such, for any brownfield site or a site where Made Ground is present and soils are being moved and reused, the materials could be deemed a waste, subject to either:

a Materials Management Plan (MMP), to prevent the material being classified as a waste following reuse; or

- an exemption (for limited volumes); or
- an environmental permit, dependant on its status.

Made Ground cannot be moved between sites under DoWCoP alone and would require relevant permits as part of the MMP documentation for the Hub site the material is being treated at.

12 Uncertainties and limitations

12.1 General comments

Stantec Hydrock Limited (Stantec) has prepared this report in accordance with the instructions of client. (the Client), by signed fee proposal acceptance form, dated 4 August 2025 under the terms of appointment for Stantec, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Stantec shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Stantec's appointment.

This report details the findings of work carried out in August 2025. The report has been prepared by Stantec on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Stantec has used reasonable skill, care and diligence in the design of the investigation of the site and in its interpretation of the information obtained. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred.

Groundwater data are only representative of the dates on which they were obtained and both levels and quality may vary.

Unless otherwise stated, the recommendations in this report assume that ground levels will remain as existing. If there is to be any re-profiling (e.g. to create development platforms or for flood alleviation) then the recommendations may not apply.

Information provided by third parties has been used in good faith and is taken at face value; however, Stantec cannot guarantee its accuracy or completeness.

Where the existing report(s) prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Stantec. Should this not be the case Stantec should be informed immediately as additional work may be required. Stantec is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

The work has been carried out in general accordance with recognised best practice. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Stantec.

The chemical analyses reported were scheduled for the purposes of risk assessment with respect to human health, plant life and controlled waters as discussed in the report. Whilst the results may be useful in applying the Hazardous Waste Assessment Methodology given in Environment Agency Technical Guidance WM3, they are not primarily intended for that purpose and additional analysis will

be required at the time of disposal to fully classify waste. Discussion and comment with regards to waste classification are preliminary and do not form the requirements of ‘Basic Characterisation’ as required.

Assessment and testing for the presence of coal tar has only been completed at the locations of exploratory holes undertaken for risk assessment purposes. This investigation is not designed to provide a definitive assessment of the risk from coal tar, nor the waste classification for bituminous bound pavement arisings at the site.

Unless otherwise stated, at the time of this investigation the future routes of water supply pipes had not been established. This investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling and chemical testing may be required at a later date once the routes of the supply pipes are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

Whilst the preliminary risk assessment process has identified potential risks to construction workers, consideration of occupational health and safety issues is beyond the scope of this report.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

Any site boundary line depicted on plans does not imply legal ownership of land.

13 Recommendations for further work

Following the ground investigation works undertaken to date, the following further works will be required:

- discussion and agreement with utility providers regarding the materials suitable for pipework; and
- site investigation monitoring wells (installed by NX Consulting) (where still present) should be decommissioned in line with relevant guidance where deemed appropriate by a qualified professional (for example the Environment Agency's Good Practice for Decommissioning Redundant Boreholes and Wells, 2012 or section 2.4.3.2 of NHBC NF94, 2023).

In addition, the following works may be required:

- production of a Materials Management Plan relating to reuse of soils at the site; and
- verification of the earthworks and Materials Management.

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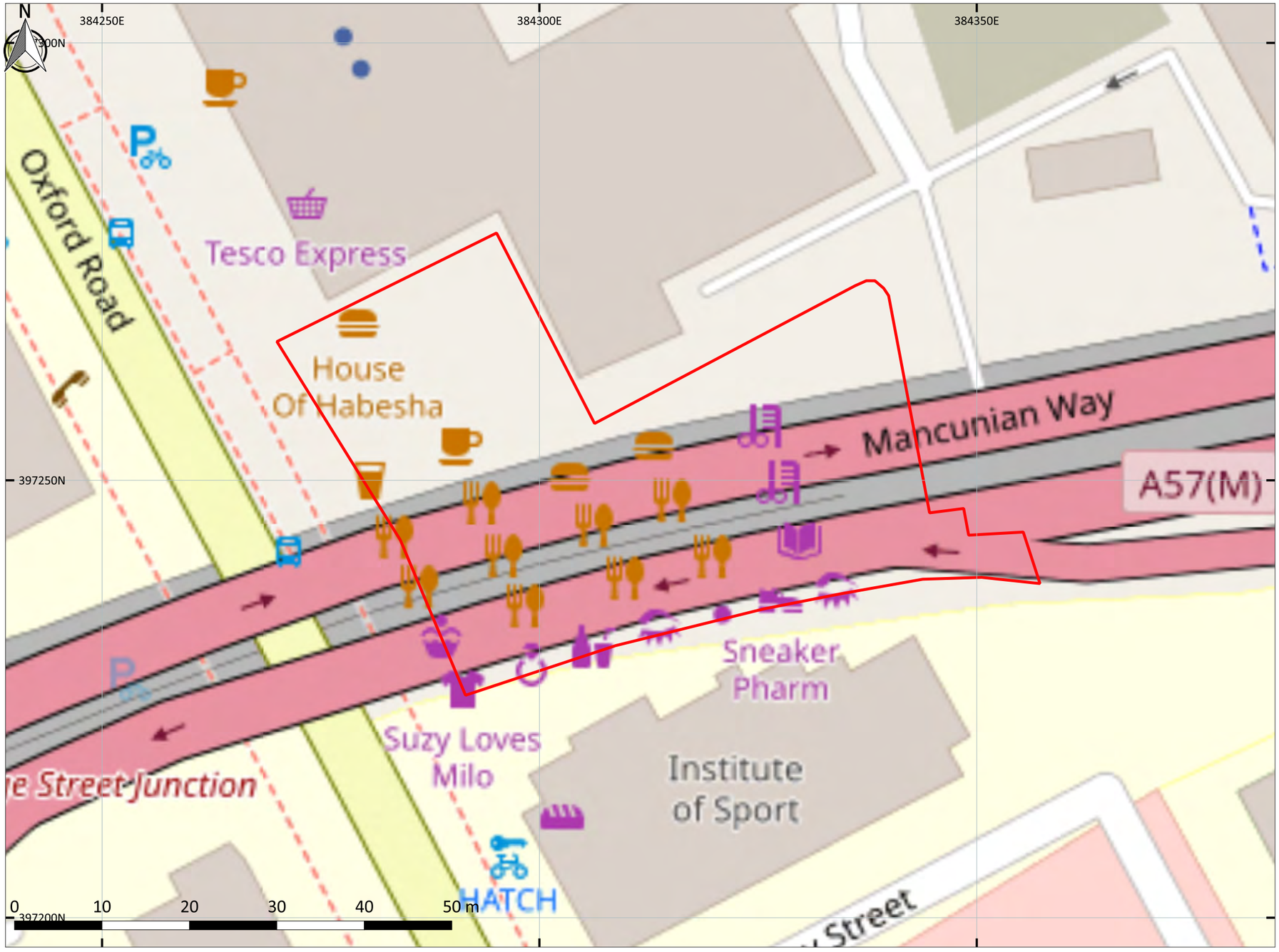
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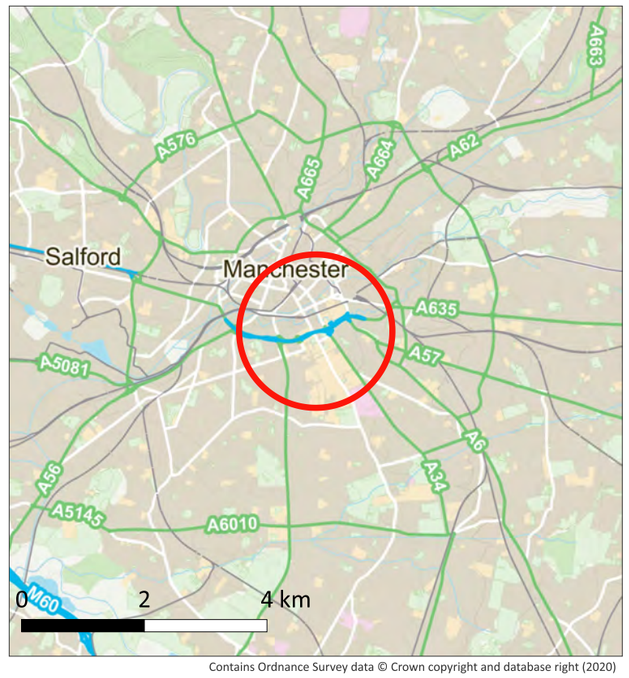
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Appendices

Appendix A Drawings







Contains Ordnance Survey data © Crown copyright and database right (2020)

KEY PLAN

Site Boundary

NOTES

1. Contains OS data © Crown copyright and database right (2022)

REVISIONS

REV.	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS
P01	ED	ED	05/04/24	First issue

Stantec

TITLE
SITE LOCATION PLAN

PROJECT NUMBER
333701845

SCALE @ A3
1:500

CLIENT
Stack (Manchester) Limited

PURPOSE OF ISSUE
SUITABLE FOR INFORMATION

STATUS
S2

PROJECT
Stack Manchester

DRAWING NO.
333701845-STN-XX-XX-DR-GE-0001

REVISION
P01

NORTH

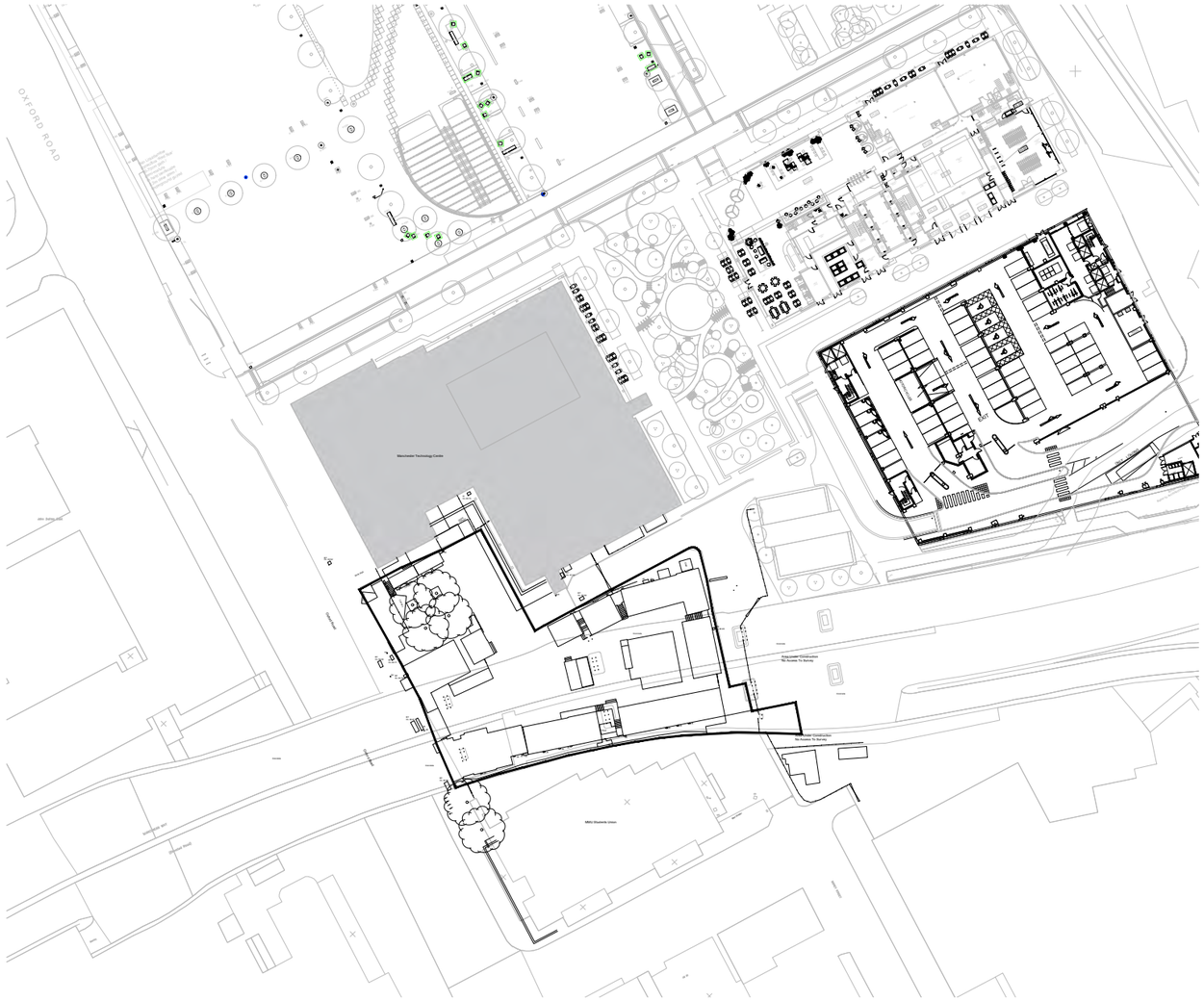
VISUAL SCALE BAR 1:1250

0 10m 20m 30m 40m 50m 60m

NOTES
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KEY

— APPLICATION SITE BOUNDARY
(0.26 HA / 0.66 ACRES)



SITE LOCATION PLAN
SCALE 1:1250 @ A3

REV	DATE	DESCRIPTION	BY	CHK
PL01	NYI	FIRST ISSUE	JW	PS

dunwoodieswift architects

CLIENT
STACK (MANCHESTER) LIMITED

PROJECT
STACK MANCHESTER

TITLE
SITE LOCATION PLAN

SCALE @ A3	STATUS
1:1250	PLANNING

	NAME	DATE
DRAWN BY	JW	14/02/2024
CHECKED BY	PS	

PROJECT No.	DRAWING No	REVISION
1162	EX-EW-000	PL01

Manchester Technology Centre

Oxford Road

CRAFT BAR
(AS EXISTING)

MMU Students Union

Area Under Construction
No Access To Survey

Area Under Const
No Access To Su

NOTES
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NORTH

VISUAL SCALE BAR 1:150
0 1.5m 3m 4.5m 6m 7.5m

KEY
- APPLICATION SITE BOUNDARY (0.26 HA / 0.66 ACRES)
- ELECTRICITY CABLE EASEMENT (SUBSTATION LEASE AGREEMENT

REV	DATE	DESCRIPTION	BY	CHK
PL01	NYI	FIRST ISSUE	JW	PS

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CLIENT
STACK (MANCHESTER) LIMITED

PROJECT
STACK MANCHESTER

TITLE
EXISTING SITE LAYOUT

SCALE @ A1	STATUS
1:150	PLANNING
NAME	DATE
DRAWN BY JW	14/02/2024
CHECKED BY PS	

PROJECT No.	DRAWING No	REVISION
1162	EW-[00]-001	PL01

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NORTH

VISUAL SCALE BAR 1:125
0 1m 2m 3m 4m 5m 6m

Area Under Construction
No Access To Survey

Area Under Construction
No Access To Survey

REV	DATE	DESCRIPTION	BY	CHK
PL04	11/06/2024	KEG STORE AREA EXTENDED; OXFORD ROAD ESCAPE CAPACITY INCREASED	JW	PS
PL03	06/06/2024	DEMISE LINE (BLUE) UPDATED TO REFLECT AFL; REFUSE STORE RE-ORGANISED TO SUIT DEMISE; APPLICATION BOUNDARY (RED LINE) UPDATED TO CAPTURE STREET SEATING	JW	PS
PL02	10/04/2024	UPDATED TO SUIT AMENDMENTS TO FIRST FLOOR GA - INCLUDING REFORMATTING OF - FIRE ESCAPES, REFUSE STORE, STAIRS & PLATFORM LIFT, AND PLANT ROOM & FEMALE WC	JW	PS
PL01	15/03/2024	ISSUED FOR PLANNING	JW	PS

PL07	28/08/2025	UPDATED LAYOUT TO SUIT AMENDED PLANNING BOUNDARY, ISSUED TO PLANNERS.	TL	PS
PL06	31/07/2025	UPDATED TO SHOW LAYOUT WITH RE-USED EXISTING CONTAINERS.	DF	PS
PL05	30/10/2024	UPDATED IN RESPONSE TO CONSULTEE COMMENTS - ADDITIONAL DETAILS TO OXFORD ROAD SHOWN; NOTE REF. BIRD NEST BOX ADDED; STAFF CYCLE STORE ADDED	JW	PS

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CLIENT
STACK (MANCHESTER) LIMITED

PROJECT
STACK MANCHESTER

TITLE
PROPOSED FLOOR PLAN
GROUND LEVEL

SCALE @ A1	1:125	STATUS	PLANNING
	NAME		DATE
DRAWN BY	JW		15/03/2024
CHECKED BY	PS		
PROJECT No.	1162	DRAWING No	P0-[20]-000
		REVISION	PL07

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NORTH

VISUAL SCALE BAR 1:125
0 1m 2m 3m 4m 5m 6m

IC
CL 36.73

Raised Flower Bed

Brick Wall

FOOD 10

FOOD 11

FOOD 9

BAR 6

STAIR 4

BRIDGE

COVERED WALKWAY

SV

BUS STOP

BUS STOP

STAFF ROOM

SECURITY OFFICE

STAIR 3

STORE 1

STORE 2

STAFF OFFICE

STAGE

STORE 3

STORE 4

CLNR'S STORE

FEMALE WASHROOM

STAIR 2

LIFT

STAIR 1

STORE 5

A/WC

STORE 4

MALE WASHROOM

FOOD 8

FOOD 7

BAR 5

STORE 6

GLASS WASH

STORE 6

REV	DATE	DESCRIPTION	BY	CHK
PL02	10/04/2024	BOH AREA TO NORTH AND SOUTH OF STAGE REFORMATTED IN RESPONSE TO FIRE STRATEGY REVIEW; FOOD 14 & ACC WC UNITS REFORMATTED TO ALLOW ADDITIONAL STORE; ADDITIONAL STORE BETWEEN BAR 6 AND FOOD 10 (FORMED OUT OF TIMBER HOARDING)	JW	PS
PL01	15/03/2024	ISSUED FOR PLANNING	JW	PS

PL06	28/08/2025	UPDATED LAYOUT TO SUIT AMENDED PLANNING BOUNDARY. ISSUED TO PLANNERS.	TL	PS
PL05	31/07/2025	UPDATED TO SHOW LAYOUT WITH RE-USED CONTAINERS.	DF	PS
PL04	24/10/2024	UPDATED IN RESPONSE TO CONSULTEE COMMENTS - ADDITIONAL DETAILS TO OXFORD ROAD SHOWN. NOTE REF. BIRD NEST BOX ADDED	JW	PS
PL03	29/07/2024	APPLICATION BOUNDARY UPDATED IN RESPONSE TO CHANGES TO LEASE BOUNDARY; FIRST FLOOR DECK REDUCED TO SUIT CHANGES TO APPLICATION BOUNDARY	JW	PS

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CLIENT
STACK (MANCHESTER) LIMITED

PROJECT
STACK MANCHESTER

TITLE
PROPOSED FLOOR PLAN
UPPER LEVEL

SCALE @ A1 1:125
STATUS PLANNING
NAME
DATE
DRAWN BY JW 15/03/2024
CHECKED BY PS
PROJECT No. 1162.1
DRAWING No P1-[20]-101
REVISION PL06

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NORTH

VISUAL SCALE BAR 1:125
0 1m 2m 3m 4m 5m 6m

IC CL 36.73
Upper Canopy
Brick Wall
STORE 1
SECURITY OFFICE
ACC WC
FOOD 7
FOOD 8
CELLAR
BAR 4
RETAIL
RETAIL
LP
BT CL 37.02
BT CL 36.56
36.84
36.87
CELLAR
PLANT
FEMALE WC
STORE 2
3640
BAR 1
FOOD 1
FOOD 6
FOOD 2
Concrete
Canopy
Decking
Stairs
Retaining wall
FOOD 5
AV BOOTH
STAGE
TP
BT CL 36.64
BT CL 36.71
QUARTER BARREL
CELLAR
FOOD 9
STAGE CHANGE
SV BT CL 36.79
LOBBIED ENTRANCE
LIFT
GLASS WASH
STORE 3
MALE WC
BAR 2
CELLAR
BAR 3
CELLAR
BT CL 36.81
COFFEE SHOP
FOOD 4
FOOD 3
36.71
36.72
36.75
36.77
36.78
36.75
36.74
36.76
LP
Concrete
BT CL 36.88
36.88
36.79
36.74
Oxford Road
Bike Shelter

Concrete

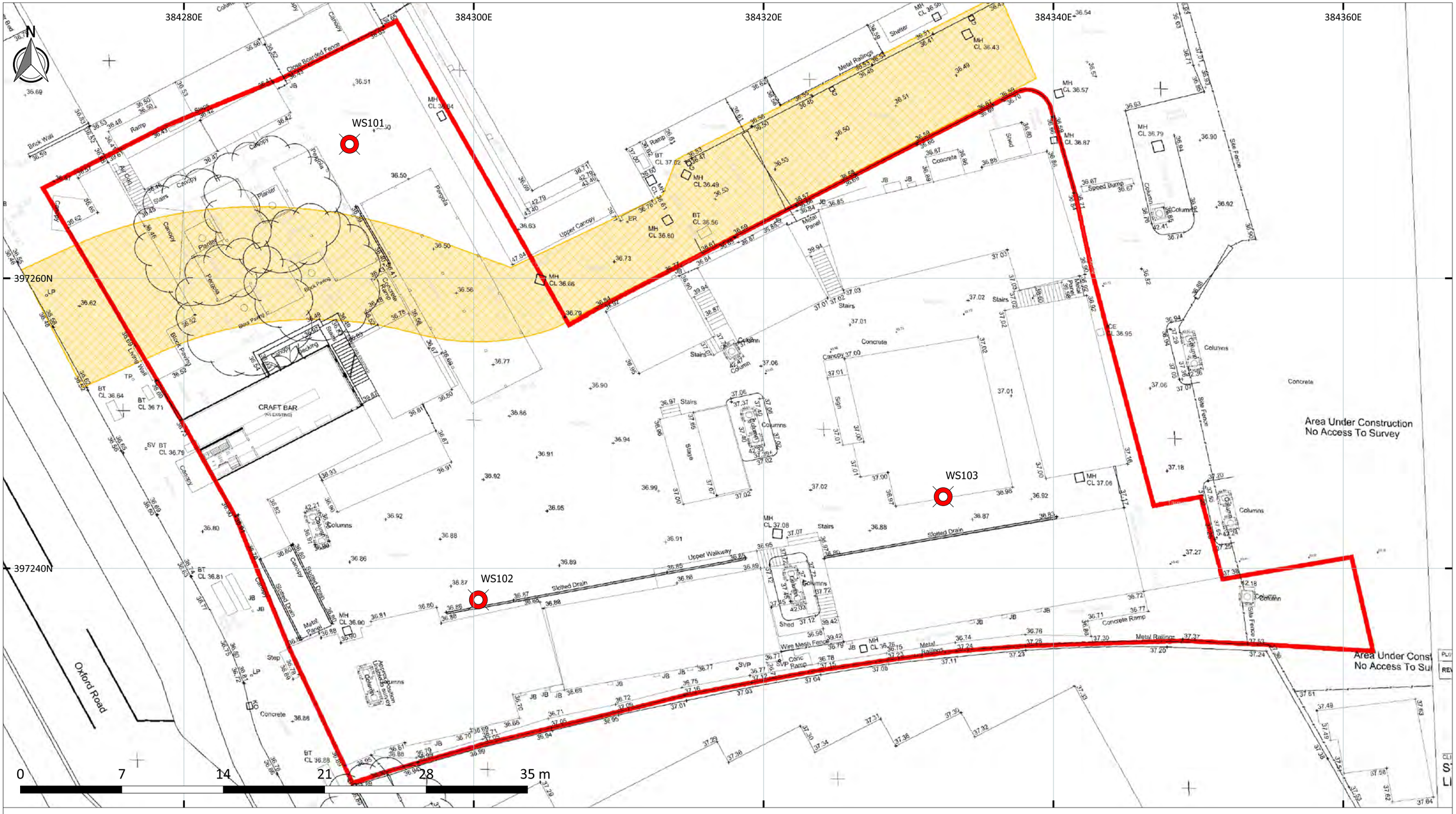
Area Under Construction
No Access To Survey

Area Under Construction
No Access To Survey

STACK MANCHESTER
TRUNK MAIN/ HV MAIN
OVERLAY SKETCH
13/05/2024

Appendix B Exploratory hole location plan, exploratory hole logs and photographs

Exploratory hole location plan



KEY PLAN

Site Boundary

WS locations

Window Sample Locations

NOTES

1. Contains OS data © Crown copyright and database right (2022)

REVISIONS

REV.	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS
P01	ED	ED	08/04/24	First issue

Stantec

TITLE
Exploratory Hole Location Plan

PROJECT NUMBER
333701845

SCALE @ A3
1:250

CLIENT
Stack (Manchester) Ltd

PURPOSE OF ISSUE
SUITABLE FOR INFORMATION

STATUS
S2

PROJECT
Stack, Manchester

DRAWING NO.
333701845-STN-XX-XX-DR-GE-0003

REVISION
P01

Exploratory hole logs

Stantec

Project: Stack, Manchester

Borehole No
WS101
Page No. 1 of 1

Method: Dynamic (Windowless) Sampler	Date(s): 29/08/2025	Logged By: MA	Drilled By: DMW Drilling
Client: Stack (Manchester) Ltd		Checked By: RS	Rig: Archway Dart
Hydrock Project No: 333701845			Scale: 1:30

Sample Run Info			Testing			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
Sample Run	Run Ø	Recovery	Depth (m)	Type	Results							
							Grey UNREINFORCED CONCRETE (MADE GROUND - HARDSTANDING)	0.14	(0.14)			
							Light grey sandy subangular to angular fine to coarse GRAVEL of mixed lithologies. (MADE GROUND)	0.45	(0.31)			
			0.50	ES			Orangish brown mottled grey gravelly slightly clayey SAND. Gravel is subangular to rounded fine to coarse of sandstone and rare brick fragments. (MADE GROUND)	0.70	(0.25)			
			0.70 - 1.20	B			Medium Dense brown gravelly SAND. Gravel is subangular to rounded fine to coarse of flint and sandstone. (GLACIAL TILL - GRANULAR)	1				
1.20 - 2.00	117mm	100%	0.80	ES					(1.20)			
			1.20	SPT	N=20 (4,5,5,4,4,7)							
			1.90	SPT	N=28 (4,8,8,7,8,5)		Stiff high strength brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine and medium sandstone mudstone and coal. (GLACIAL TILL - COHESIVE)	1.90				
2.00 - 3.00	102mm	100%						2				
			2.50	D								
			2.90	SPT	N=21 (3,3,5,5,5,6)							
3.00 - 4.00	75mm	100%						3				
			3.50	D					(3.00)			
			3.90	SPT	N=18 (4,4,4,4,5,5)							
4.00 - 4.90	65mm	100%						4				
			4.50	D								
			4.90	SPT	N=19 (5,4,5,5,5,4)			4.90				
							End of Borehole at 4.90m	5				
								6				

General Remarks:
1. Hand dug to 1.20m bgl to clear for services. 2. Borehole completed at 4.90m bgl. 3. Casing wont pass 1.90m. 4. No groundwater encountered. 5. Borehole backfilled on completion. 6. Unable to obtain coordinates due to extent of structures and buildings in vicinity.

Logged in general accordance with BS5930:2015

Stantec	Project: Stack, Manchester	Borehole No WS102 Page No. 1 of 1

Method: Dynamic (Windowless) Sampler	Date(s): 29/08/2025	Logged By: MA	Drilled By: DMW Drilling
Client: Stack (Manchester) Ltd		Checked By: RS	Rig: Archway Dart
Hydrock Project No: 333701845			Scale: 1:30

Sample Run Info			Testing			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
Sample Run	Run Ø	Recovery	Depth (m)	Type	Results							
			0.30	ES			Black ASPHALT HARDSTANDING (MADE GROUND - HARDSTANDING)	0.06	(0.06)			
							Grey sandy subangular to angular fine to coarse GRAVEL of mixed lithologies. (MADE GROUND)	0.20	(0.14)			
			0.50 - 1.20	B			Loose black slightly gravelly SAND with high cobble content. Gravel is angular to subangular fine to coarse if brick and concrete with rare timber. Cobbles are subangular of brick. (MADE GROUND)					
			0.80	ES								
1.20 - 2.00	117mm	20%	1.20	SPT	N=4 (2,2,2,1,1,0)		*... Between 1.20m and 3.00m bgl: Suspected forced cobble of brick during drilling resulting in limited recovery from drilling runs.*					
			1.20 - 1.65	SPTLS								
			1.50	D			*... At 1.50m to 1.60m bgl: Soft dark grey slightly sandy silty CLAY.*		(2.80)			
2.00 - 3.00	102mm	10%	2.00	SPT	N=9 (2,2,2,3,3,1)							
			2.00 - 2.45	SPTLS								
							End of Borehole at 3.00m	3.00				

General Remarks:
1. Hand dug to 1.20m bgl to clear for services. 2. Borehole terminated at 3.00m bgl, due to hole collapse to 2.00m, limited recovery and potential cobble forced.
3. No groundwater encountered. 4. Borehole backfilled on completion. 5. Unable to obtain coordinates due to extent of structures and buildings in vicinity.

Logged in general accordance with BS5930:2015

Stantec	Project: Stack, Manchester	Borehole No WS103 Page No. 1 of 1

Method: Dynamic (Windowless) Sampler	Date(s): 29/08/2025	Logged By: MA	Drilled By: DMW Drilling
Client: Stack (Manchester) Ltd		Checked By: RS	Rig: Hand Dug
Hydrock Project No: 333701845			Scale: 1:30

Sample Run Info			Testing			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
Sample Run	Run Ø	Recovery	Depth (m)	Type	Results							
			0.30	ES			Black ASPHALT HARDSTANDING (MADE GROUND - HARDSTANDING)	0.06	(0.06)			
								0.10	(0.04)			
							Grey sandy subangular to angular fine to coarse GRAVEL of mixed lithologies. (MADE GROUND)	0.15	(0.05)			
							Black ASPHALT HARDSTANDING (MADE GROUND - HARDSTANDING)		(0.35)			
							Black slightly gravelly SAND with high cobble content. Gravel is angular to subangular fine to coarse of brick and concrete with rare timber. Cobbles are subangular brick. (MADE GROUND)	0.50				
							End of Borehole at 0.50m					

General Remarks:
1. Hand dug to 0.50m bgl, terminated due to compact Made Ground and possible relict brick wall. 2. No groundwater encountered. 3. Backfilled on completion.
4. Unable to obtain coordinates due to extent of structures and buildings in vicinity.

Logged in general accordance with BS5930:2015

Appendix C Geotechnical test results and geotechnical plots

Geotechnical laboratory test results

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,cl 5.2 and 6

4041

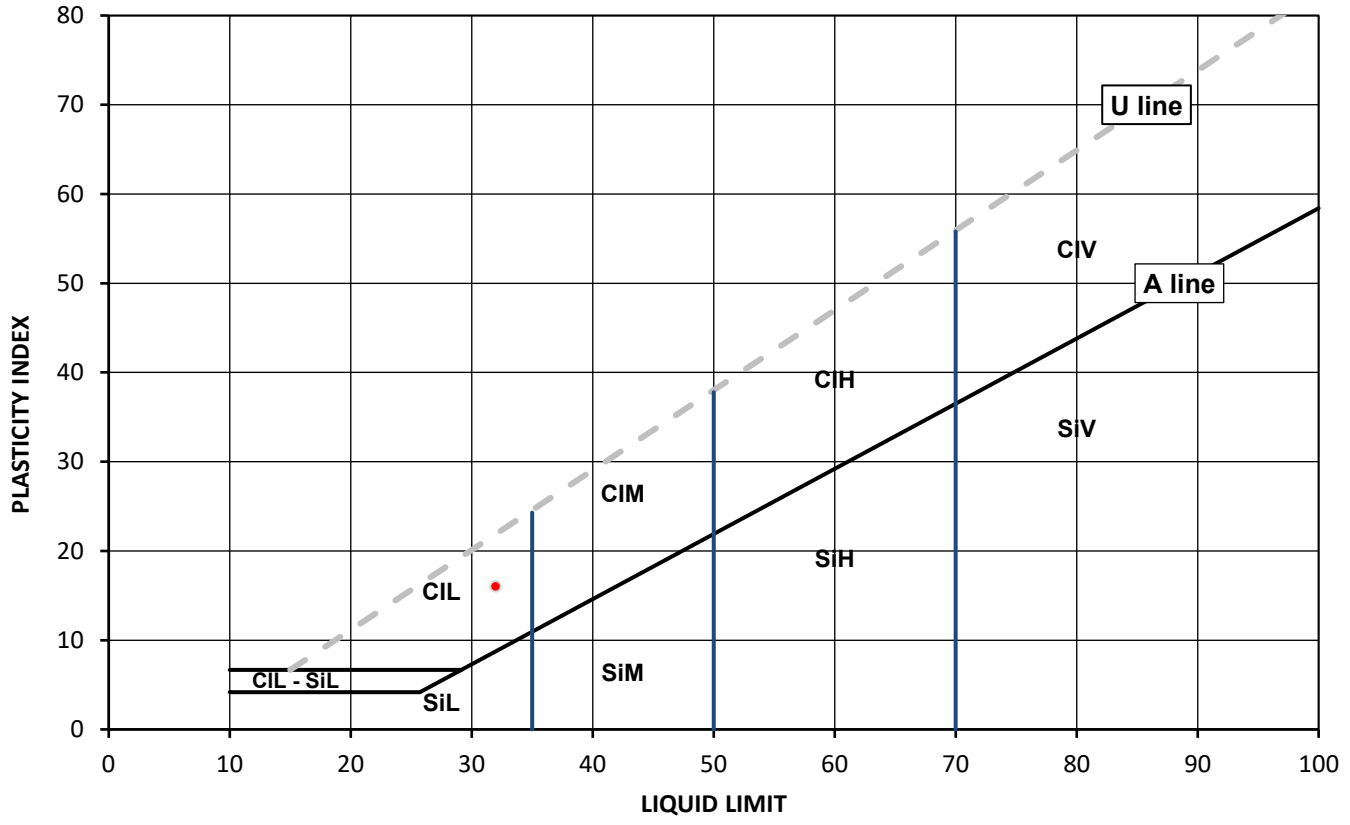
Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	19/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679032	Depth Top [m]:	2.50
Hole No.:	WS101	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown gravelly very sandy CLAY		
Sample Preparation:	Tested after >0.425mm removed by hand; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
13.6	32	16	16	-0.13	1.13	61



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN ISO 17892-1:2014+A1:2022, BS 1377-2:2022; # Non accredited

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

Date Reported: 03/10/2025

GF 337.16

i2 Analytical Ltd, Unit 8, Harrowden Road, Brackmills Industrial Estate, Northampton, NN4 7EB

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,cl 5.2 and 6

4041

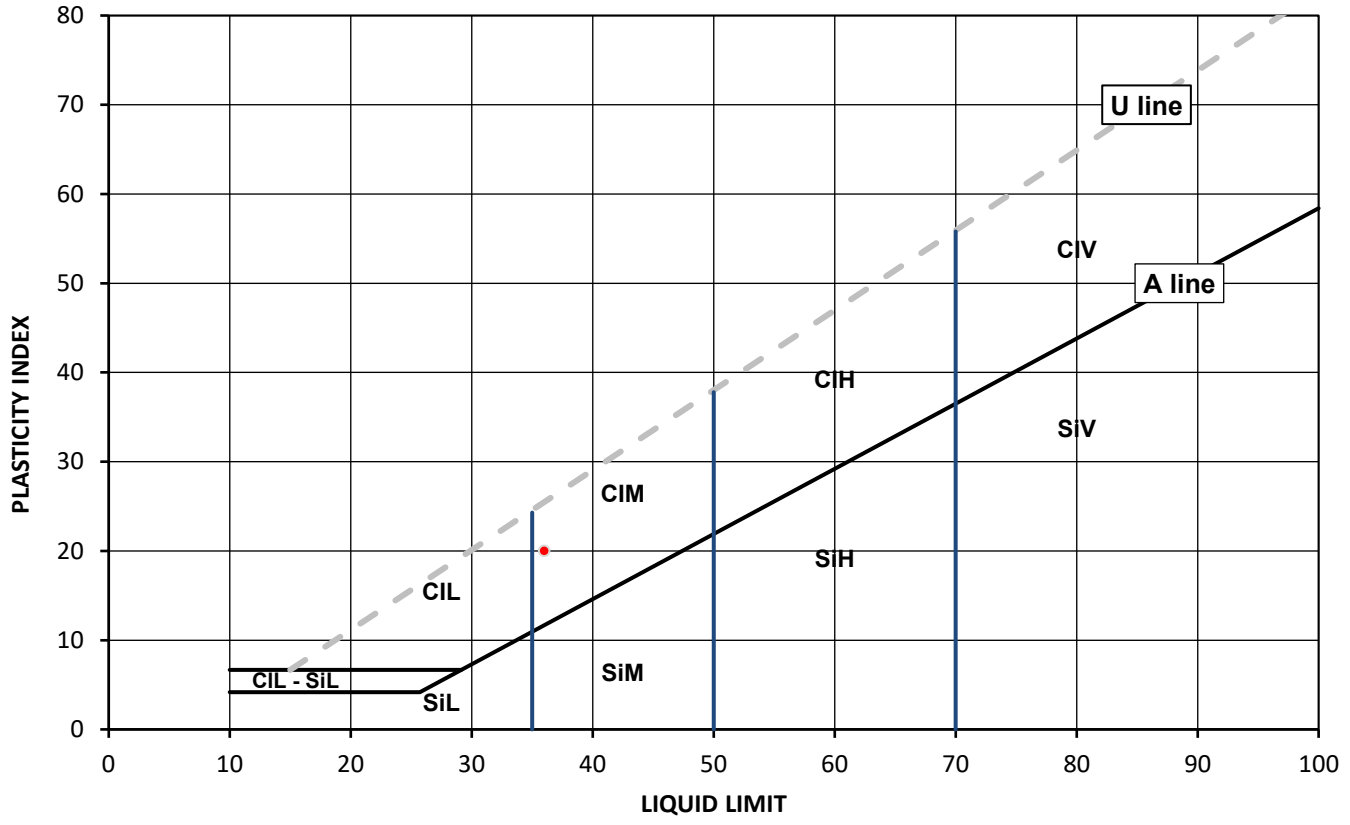
Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	19/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679033	Depth Top [m]:	3.50
Hole No.:	WS101	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown slightly gravelly sandy CLAY		
Sample Preparation:	Tested after washing to remove >0.425mm; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
11.9	36	16	20	-0.20	1.20	90



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN ISO 17892-1:2014+A1:2022, BS 1377-2:2022; # Non accredited

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

Date Reported: 03/10/2025

GF 337.16

i2 Analytical Ltd, Unit 8, Harrowden Road, Brackmills Industrial Estate, Northampton, NN4 7EB

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,cl 5.2 and 6

4041

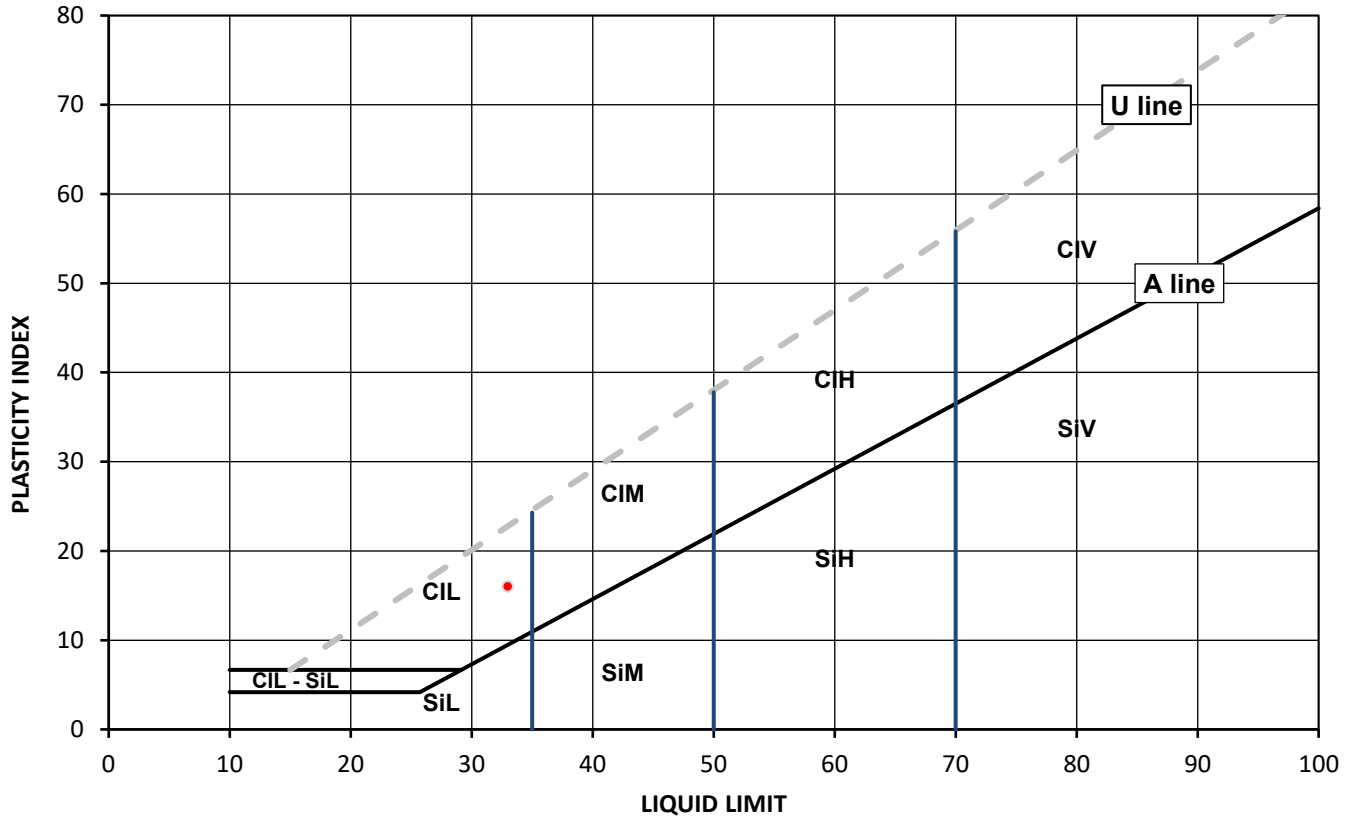
Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	19/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679034	Depth Top [m]:	4.50
Hole No.:	WS101	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >0.425mm; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
15.4	33	17	16	-0.13	1.13	93



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN ISO 17892-1:2014+A1:2022, BS 1377-2:2022; # Non accredited

Remarks:

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Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

Date Reported: 03/10/2025

GF 337.16

i2 Analytical Ltd, Unit 8, Harrowden Road, Brackmills Industrial Estate, Northampton, NN4 7EB

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,cl 5.2 and 6

4041

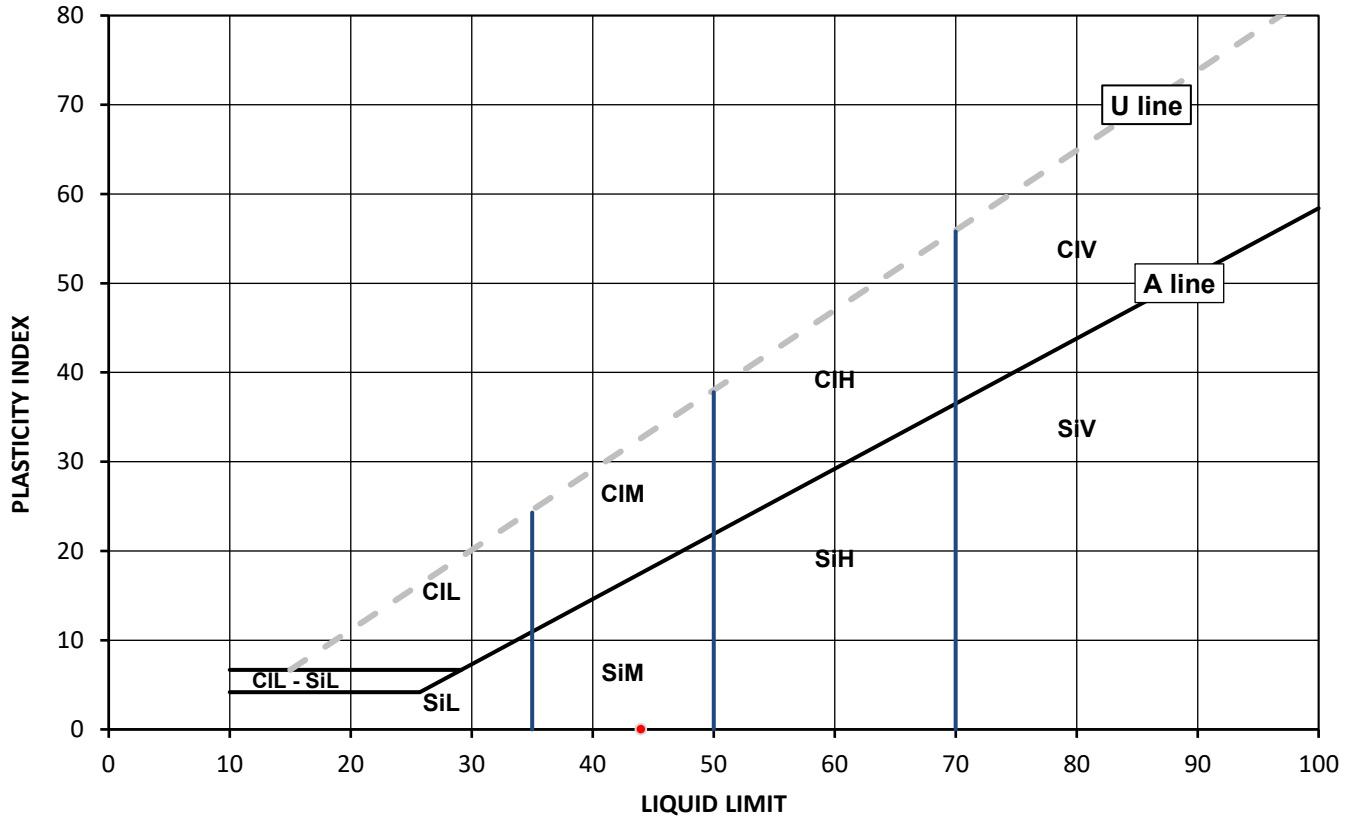
Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	19/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679036	Depth Top [m]:	1.50
Hole No.:	WS102	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Dark brown slightly gravelly sandy SILT		
Sample Preparation:	Tested after washing to remove >0.425mm; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
28.0	44	NP	NP	N/A	N/A	82



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN ISO 17892-1:2014+A1:2022, BS 1377-2:2022; # Non accredited

Remarks: NP - non plastic.

Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

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 Date Reported: 03/10/2025 **GF 337.16**

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

BS EN ISO 17892-12:2018+A2:2022 cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022, cl 5.2 and 6. W by BS EN ISO 17892-1:2014+A1:2022.

Normec i2 Analytical

4041

Client: Hydrock Consultants Ltd

Client Address: 4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY

Contact: Rob Crookes

Site Address: Stack, Manchester

Client Reference: 333701845
Job Number: 25-048976-1
Date Sampled: 29/08/2025
Date Received: 02/09/2025
Date Tested: 19/09/2025
Sampled By: Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	W	Liquid & Plastic Limit							Density		
		Reference	Depth Top m	Depth Base m	Type			%	% Passing 425um %	WL* %	Correlation Factor	Wp %	Ip %	Cone type	Sample Preparation	bulk Mg/m3	dry Mg/m3	PD Mg/m3
679032	WS101	Not Given	2.50	Not Given	D	Brown gravelly very sandy CLAY	Atterberg 4 Point	13.6	61	32	-	16	16	80g/30 deg	R / I			
679033	WS101	Not Given	3.50	Not Given	D	Brown slightly gravelly sandy CLAY	Atterberg 4 Point	11.9	90	36	-	16	20	80g/30 deg	WR / I			
679034	WS101	Not Given	4.50	Not Given	D	Brown slightly gravelly very sandy CLAY	Atterberg 4 Point	15.4	93	33	-	17	16	80g/30 deg	WR / I			
679036	WS102	Not Given	1.50	Not Given	D	Dark brown slightly gravelly sandy SILT	Atterberg 4 Point	28.0	82	44	-	NP	NP	80g/30 deg	WR / I			

Note: # Non accredited; NP - Non plastic; N - Tested in natural condition, R - Tested after >0,425mm removed by hand, WR - Tested after washing to remove >425mm; I - The water content in the sample was increased , D - The water content in the sample was decreased; * - One point liquid limit corrected as per the report Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Comments:

Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

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Date Reported: 03/10/2025 **GF 362.17**

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS EN ISO 17892-1:2014+A1:2022, BS 1377-2: 2022, clause 4.1

4041

Client: Hydrock Consultants Ltd

Client Address: 4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY

Contact: Rob Crookes

Site Address: Stack, Manchester

Client Reference: 333701845
Job Number: 25-048976-1
Date Sampled: 29/08/2025
Date Received: 02/09/2025
Date Tested: 19/09/2025
Sampled By: Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC											
		Reference	Depth Top m	Depth Base m	Type			%											
679032	WS101	Not Given	2.50	Not Given	D	Brown gravelly very sandy CLAY		13.6											
679033	WS101	Not Given	3.50	Not Given	D	Brown slightly gravelly sandy CLAY		11.9											
679034	WS101	Not Given	4.50	Not Given	D	Brown slightly gravelly very sandy CLAY		15.4											
679036	WS102	Not Given	1.50	Not Given	D	Dark brown slightly gravelly sandy SILT		28.0											

Comments:

Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

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Date Reported: 03/10/2025

GF 126.20

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS EN ISO 17892-4:2016, BS 1377-2:2022 cl. 10

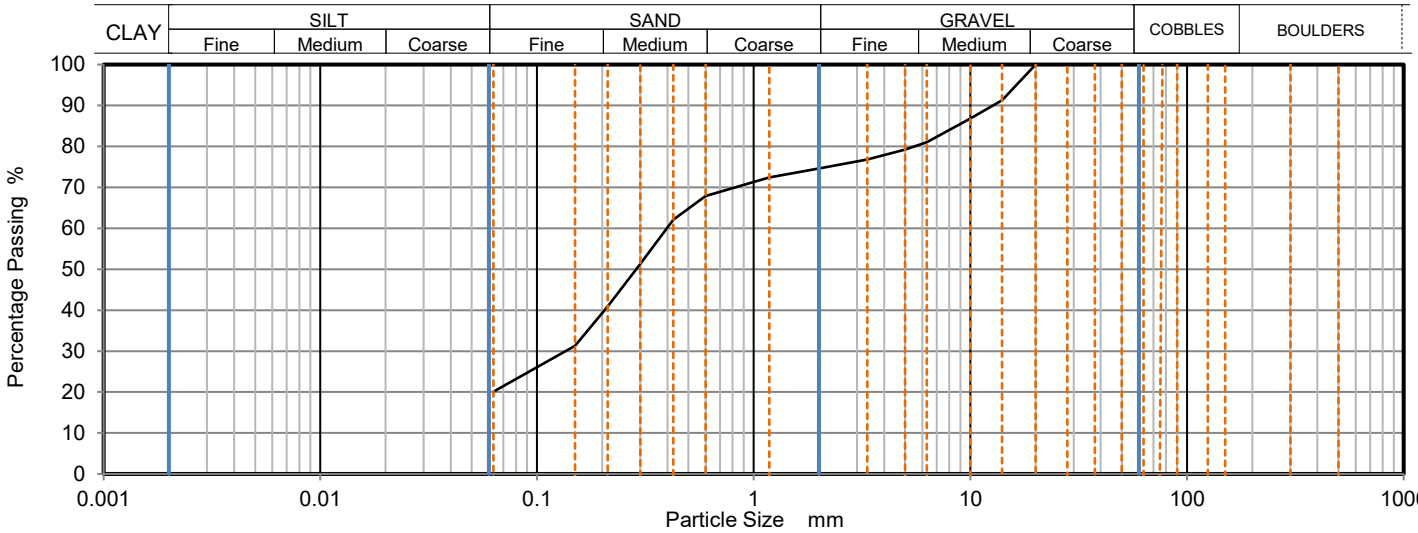
4041

Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	22/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679031	Depth Top [m]:	0.70
Hole No.:	WS101	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown very gravelly very clayey SAND		
Sample Preparation:	Sample was quartered, oven dried at 107.4 °C and broken down by hand.		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	91		
10	87		
6.3	81		
5	79		
3.35	77		
2	75		
1.18	72		
0.6	68		
0.425	62		
0.3	51		
0.212	41		
0.15	31		
0.063	20		

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	55
Fines <0.063 mm	20

Grading Analysis		
D100	mm	20
D60	mm	0.397
D30	mm	0.136
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with ISO 17892 -4, by sieving on as received or wet sample

Remarks:

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Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

Date Reported: 03/10/2025

GF 366.13

i2 Analytical Ltd, Unit 8, Harrowden Road, Brackmills Industrial Estate, Northampton, NN4 7EB

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS EN ISO 17892-4:2016, BS 1377-2:2022 cl. 10

4041

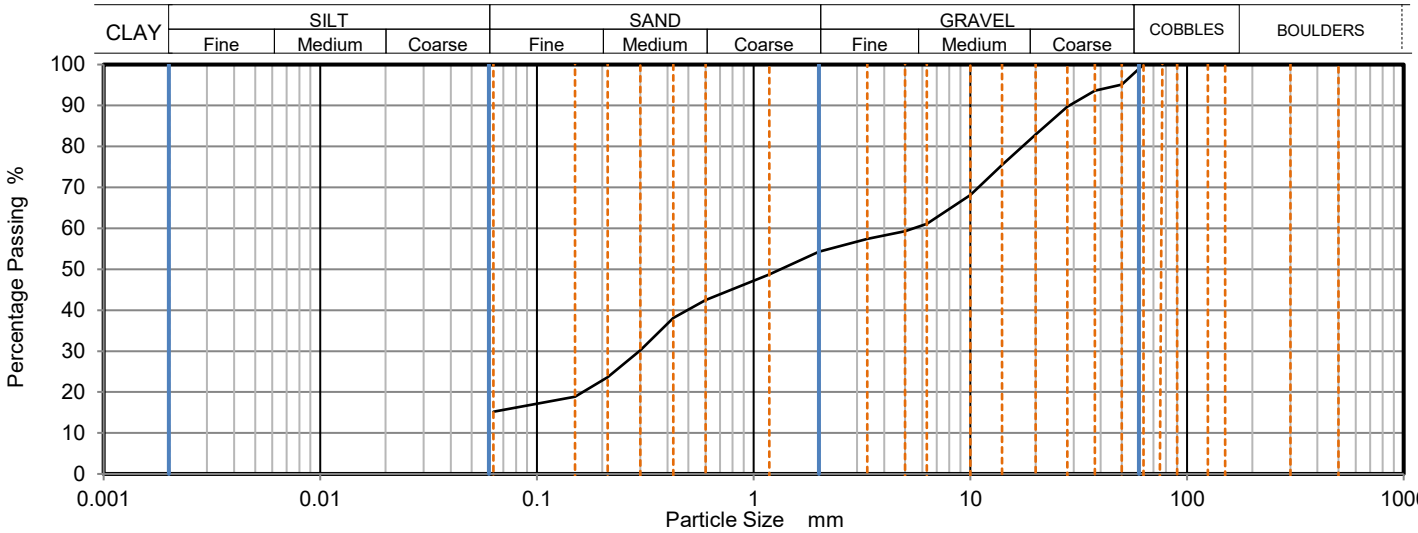
Normec i2 Analytical

Client:	Hydrock Consultants Ltd	Client Reference:	333701845
Client Address:	4 Lakeside, Festival Park, Stoke on Trent, ST1 5RY	Job Number:	25-048976-1
		Date Sampled:	29/08/2025
		Date Received:	02/09/2025
Contact:	Rob Crookes	Date Tested:	22/09/2025
Site Address:	Stack, Manchester	Sampled By:	Client - MA

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	679035	Depth Top [m]:	0.50
Hole No.:	WS102	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Dark brown very sandy clayey GRAVEL with fragments of bricks		
Sample Preparation:	Sample was whole tested, oven dried at 107.4 °C and broken down by hand.		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	94		
28	90		
20	83		
14	76		
10	68		
6.3	61		
5	59		
3.35	57		
2	54		
1.18	49		
0.6	43		
0.425	38		
0.3	30		
0.212	24		
0.15	19		
0.063	15		

Sample Proportions	% dry mass
Very coarse	0
Gravel	46
Sand	39
Fines <0.063 mm	15

Grading Analysis		
D100	mm	63
D60	mm	5.49
D30	mm	0.296
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with ISO 17892 -4, by sieving on as received or wet sample

Remarks:

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Signed: [redacted]

Katarzyna Koziel
Geotechnical Reporting Team Leader
for and on behalf of i2 Analytical Ltd

Date Reported: 03/10/2025

GF 366.13

i2 Analytical Ltd, Unit 8, Harrowden Road, Brackmills Industrial Estate, Northampton, NN4 7EB

SD1 Datasheet

Client	Location or material to which this assessment applies
Stack (Manchester) Limited	MADE GROUND
Project	
Stack, Manchester	
Job number	
333701845	

Concrete in aggressive ground

After BRE Special Digest 1:2005 + 2017 3e

Soil data

	(Adjusted) water soluble sulfate (mg/l)	Total potential sulfate (%)	Water soluble magnesium (mg/l)
Number of tests	2	2	2
No. tests in 20% data set	0	0	
No. tests with suspected pyrite		0	
Maximum value	2540	0.5	32
Mean of highest two values	1289	0	18
Mean of highest 20%			
Characteristic Value	**2540**	**0.5**	**32**
			Mg not required
	[no pyrite]	**[pyrite suspected]**	
DS Class	**DS-3**	**DS-2**	

If pyrite suspected, DS Class limited to **DS-2**

Is pyrite assumed to be present? No **Adopted DS Class =** **DS-3**

Water data

	(Adjusted) soluble sulfate (mg/l)	Soluble magnesium (mg/l)
Characteristic Value	0	0
(Maximum Level)		**Mg not required**
DS Class		

pH data

	Soil	Water
Number of tests	2	0
No. tests in 20% data set	0	
Lowest pH	7.5	
Mean of lowest 20%		
Characteristic value	**7.5**	
Design value	**7.5**	
Number of soil pH results less than 5.5	0	

DS Class design value

Based on higher of soil and water data **DS-3**

ACEC Class design value

Brownfield

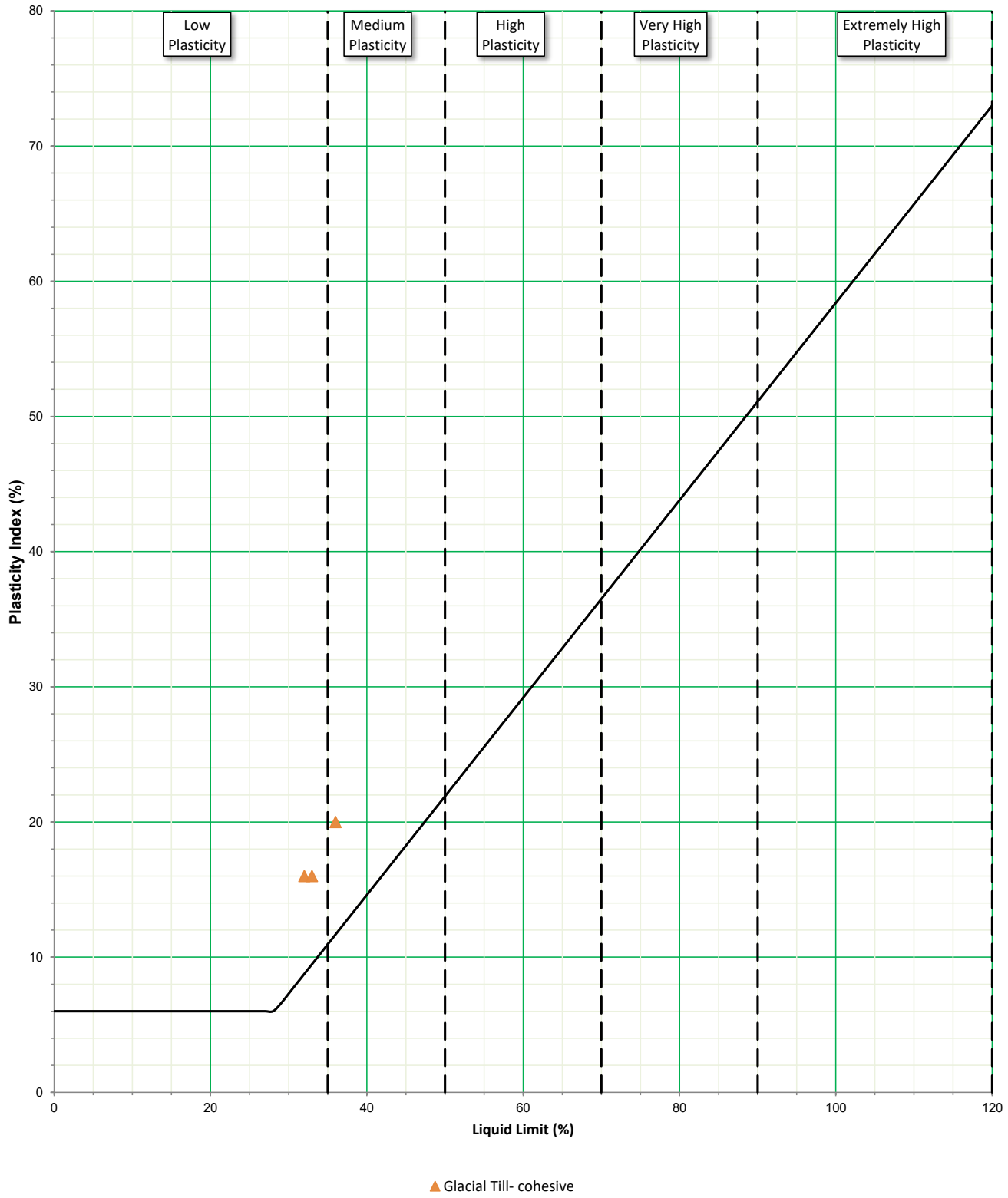
Mobile groundwater **AC-3**

Geotechnical plots

Stantec

PLASTICITY CLASSIFICATION CHART

Site:	Client:	Contract No.	333701845
Stack, Manchester	Stack (Manchester) Ltd	All Data	



Template Version	2	Template Date	03/06/2025

Appendix D Contamination test results

Contamination test results

Hydrock Consultants Ltd
4 Lakeside
Festival Park
Stoke on Trent
ST1 5RY

t: 01782 261919

[redacted]

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

t: 01923 225404
f: 01923 237404
e: info-i2analytical@normecgroup.com

Analytical Report Number : 25-047258

Replaces Analytical Report Number: 25-047258, issue no. 1
Additional analysis undertaken.
Asbestos Quantification added to samples 669810, 669811 and 669812 as per client's request.

Project / Site name:	Stack, Manchester	**Samples received on:**	02/09/2025
Your job number:	333701845	**Samples instructed on/ Analysis started on:**	04/09/2025
Your order number:	EPL048001	**Analysis completed by:**	23/09/2025
Report Issue Number:	2	**Report issued on:**	23/09/2025
Samples Analysed:	4 soil samples		

Signed: [redacted]

Adan Cazas Garcia
Key Account Manager
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
air	- once the analysis is complete

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

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-047258
Project / Site name: Stack, Manchester
Your Order No: EPL048001

Lab Sample Number				669809	669810	669811	669812
Sample Reference				WS101	WS102	WS102	WS103
Sample Number				ES1	ES1	ES2	ES1
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.50	0.30	0.80	0.30
Date Sampled				29/08/2025	29/08/2025	29/08/2025	29/08/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	37.9	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.7	8.5	11	11
Total mass of sample received	kg	0.1	NONE	1.1	1.1	1.1	1.1

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Detected	Detected	Detected
Asbestos Analyst ID	N/A	N/A	N/A	MUA	MUA	MUA	MUA
Analysis completed	N/A	N/A	N/A	10/09/2025	10/09/2025	10/09/2025	10/09/2025
Actinolite detected	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected
Amosite detected	Type	N/A	ISO 17025	-	Not-detected	Detected	Not-detected
Anthophyllite detected	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected
Chrysotile detected	Type	N/A	ISO 17025	-	Detected	Not-detected	Detected
Crocidolite detected	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Detected
Tremolite detected	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected

Asbestos % by hand picking/weighing	%	0.001	ISO 17025	-	< 0.001	< 0.001	0.035

Asbestos Containing Material Types Detected (ACM)	Type	N/A	ISO 17025	-	Loose Fibres	Loose Fibres	Loose Fibrous Debris

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.9	7.5	7.2	7.8
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO_4	mg/kg	50	MCERTS	290	3200	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	0.029	0.324	-	-
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	78	3100	4000	700
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0388	1.54	1.99	0.35
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	38.8	1540	1990	350
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	12	77	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	6.1	39	-	-
Total Sulphur	mg/kg	50	MCERTS	96	1500	-	-
Total Sulphur	%	0.005	MCERTS	0.01	0.153	-	-
Ammoniacal Nitrogen as NH_4^+	mg/kg	0.5	MCERTS	< 0.5	< 0.5	-	-
Ammonium as NH_4^+ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	< 0.05	-	-
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0019	0.01	0.011	0.01
Water Soluble Nitrate (2:1) as NO_3	mg/kg	2	NONE	< 2.0	92	-	-
Water Soluble Nitrate (2:1) as NO_3 (leachate equivalent)	mg/l	5	NONE	< 5.0	46	-	-

Total Phenols

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

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-047258
Project / Site name: Stack, Manchester
Your Order No: EPL048001

Lab Sample Number				669809	669810	669811	669812
Sample Reference				WS101	WS102	WS102	WS103
Sample Number				ES1	ES1	ES2	ES1
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.50	0.30	0.80	0.30
Date Sampled				29/08/2025	29/08/2025	29/08/2025	29/08/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status				
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.24	0.13	0.08
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.09	0.1	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.26	0.53	0.11
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.24	0.28	0.12
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	2.5	4.3	1
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.44	0.89	0.26
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	3.5	6.8	1.7
Pyrene	mg/kg	0.05	MCERTS	< 0.05	3.3	6	1.7
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.6	2.9	0.83
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.7	3.2	0.96
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	1.7	3.8	0.89
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.93	1.3	0.51
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.6	3.1	0.85
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.76	1.6	0.44
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.19	< 0.05	0.11
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	1	1.9	0.55
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	20.1	36.8	10.1
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.8	22	30	14
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.56	0.97	1.1	0.94
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	1.6	2.3	1.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.9	1.3	0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	17	24	23	18
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	24	23	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14	74	150	84
Lead (aqua regia extractable)	mg/kg	1	MCERTS	11	770	660	260
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.3	0.7	0.4
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	23	27	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21	31	36	27
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	29	220	340	110
Magnesium (leachate equivalent)	mg/l	2.5	NONE	3.5	32	-	-
Magnesium (water soluble)	mg/kg	5	NONE	6.9	64	-	-

Analytical Report Number: 25-047258
Project / Site name: Stack, Manchester
Your Order No: EPL048001

Lab Sample Number				669809	669810	669811	669812
Sample Reference				WS101	WS102	WS102	WS103
Sample Number				ES1	ES1	ES2	ES1
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.50	0.30	0.80	0.30
Date Sampled				29/08/2025	29/08/2025	29/08/2025	29/08/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status				
Petroleum Hydrocarbons							
TPHCWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	2.2	3.9	2.9
TPHCWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	10	< 8.0
TPHCWG - Aliphatic >EC16 - EC35 EH_CU_1D_AL	mg/kg	10	MCERTS	< 10	24	50	23
TPHCWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	24	40	23
TPHCWG - Aliphatic >EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	< 8.4	11	16	< 8.4
TPHCWG - Aliphatic >EC5 - EC35 EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	27	54	25
TPHCWG - Aliphatic >EC5 - EC44 EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	37	69	25
TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	3	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	7.7	4.3	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	17	30	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	40	82	16
TPHCWG - Aromatic >EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	< 8.4	9.7	26	< 8.4
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	< 10	68	120	16
TPHCWG - Aromatic >EC5 - EC44 EH_CU+HS_1D_AR	mg/kg	10	NONE	< 10	77	140	16
TPH Total >EC5 - EC44 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	< 10	110	210	42
VOCs							
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0

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

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number:	25-047258
Project / Site name:	Stack, Manchester
Your Order No:	EPL048001

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

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

Quantitative Analysis

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

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

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

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample	Analysis completed	Analyst ID
669810	WS102	0.30-	229	Loose Fibres	Chrysotile	< 0.001	< 0.001	23/09/2025	MBI
669811	WS102	0.80-	221	Loose Fibres	Amosite	< 0.001	< 0.001	23/09/2025	JWU
669812	WS103	0.30-	181	Loose Fibrous Debris	Chrysotile & Crocidolite	0.035	0.035	23/09/2025	JWU

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

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Analytical Report Number : 25-047258
Project / Site name: Stack, Manchester

* 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 ***
669809	WS101	ES1	0.5	Light brown clay and sand with gravel
669810	WS102	ES1	0.3	Brown loam and sand with stones
669811	WS102	ES2	0.8	Brown loam and sand with gravel
669812	WS103	ES1	0.3	Brown loam and sand with gravel and brick

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Analytical Report Number : 25-047258
Project / Site name: Stack, Manchester

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI 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
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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES	In-house method based on TRL 447	L038B	D	NONE
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	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
Speciated 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
TPH Chromatogram in soil	TPH Chromatogram in soil	In-house method	L064B	D	NONE
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID in soil	Determination of total petroleum hydrocarbons in soil by GC-FID with carbon banding aliphatic and aromatic	In-house method	L076B	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil (Summed Bands)	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic (Summed Bands).	Calculation	L076B/L088-PL	D/W	NONE
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Chromium III in soil	In-house method by calculation from total Cr and Cr VI	In-house method by calculation	L080-PL/L130B	W	NONE

Analytical Report Number : 25-047258
Project / Site name: Stack, Manchester

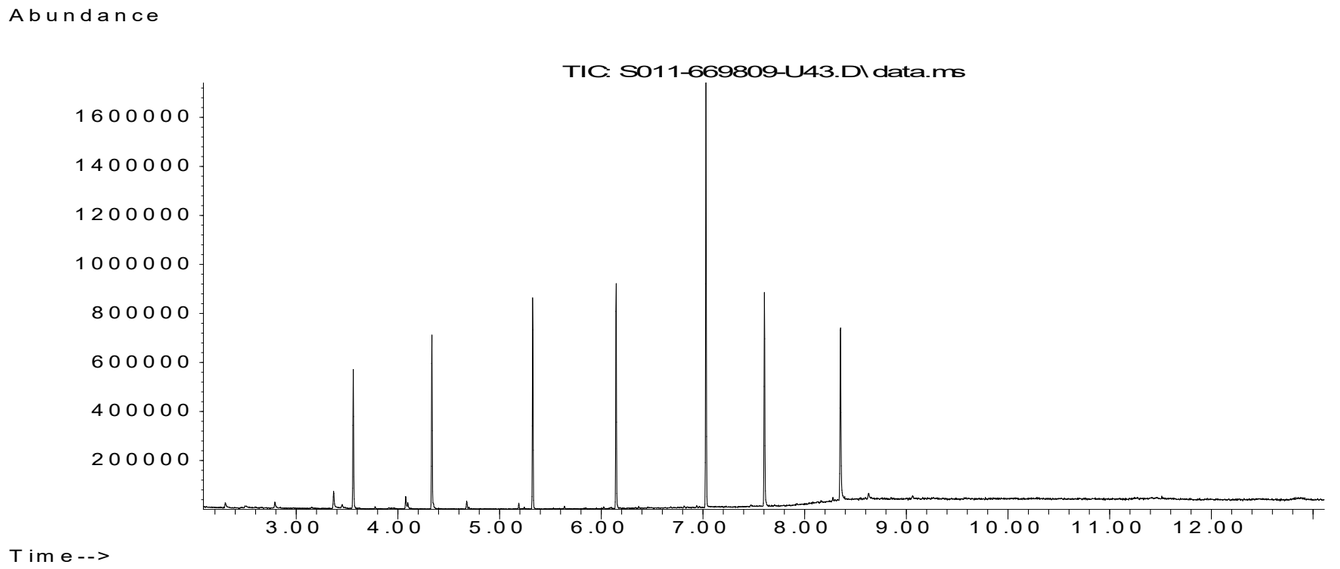
Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

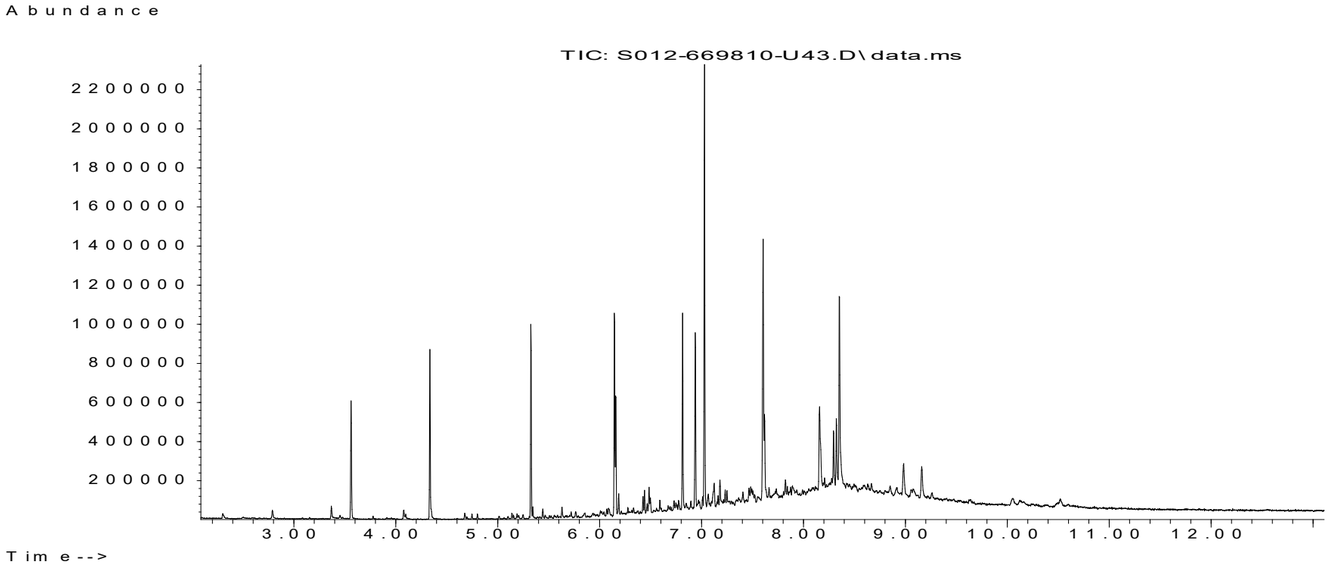
Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
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-PL	W	MCERTS
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser	In-house method	L082B	D	MCERTS
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by HS-GC/MS in soil	Determination of total petroleum hydrocarbons in soil by HS-GC/MS with carbon banding aliphatic and aromatic	In-house method	L088-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate	In-house method	L009B	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references	HSE Report No: 83/1996, HSG 248 (2021), HSG 264 (2012) & SCA Blue Book (draft)	A006B	D	ISO 17025

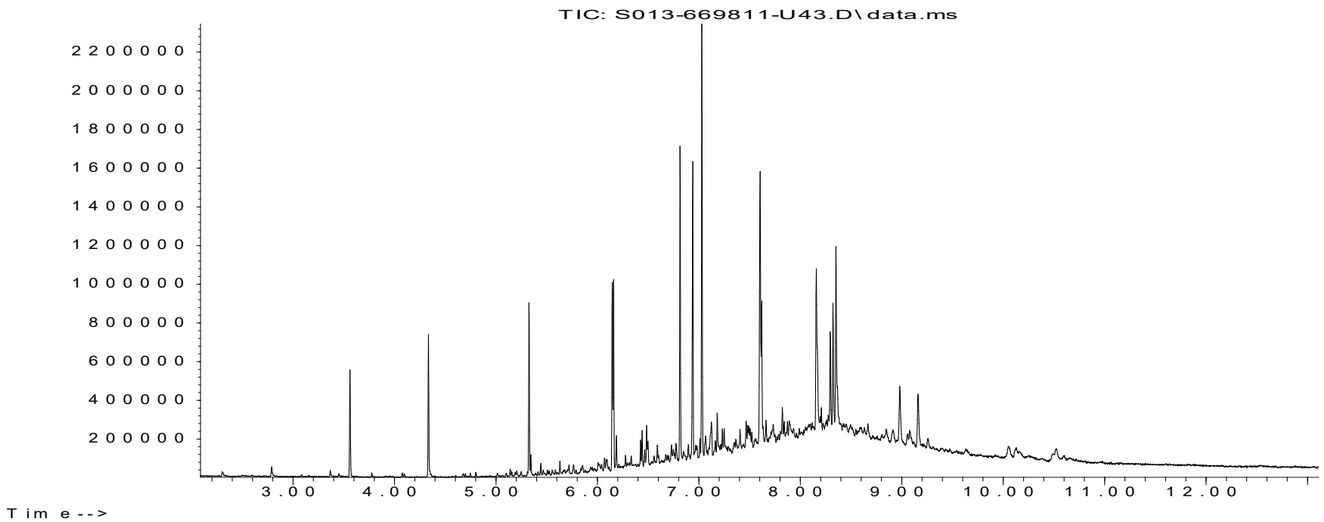
For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

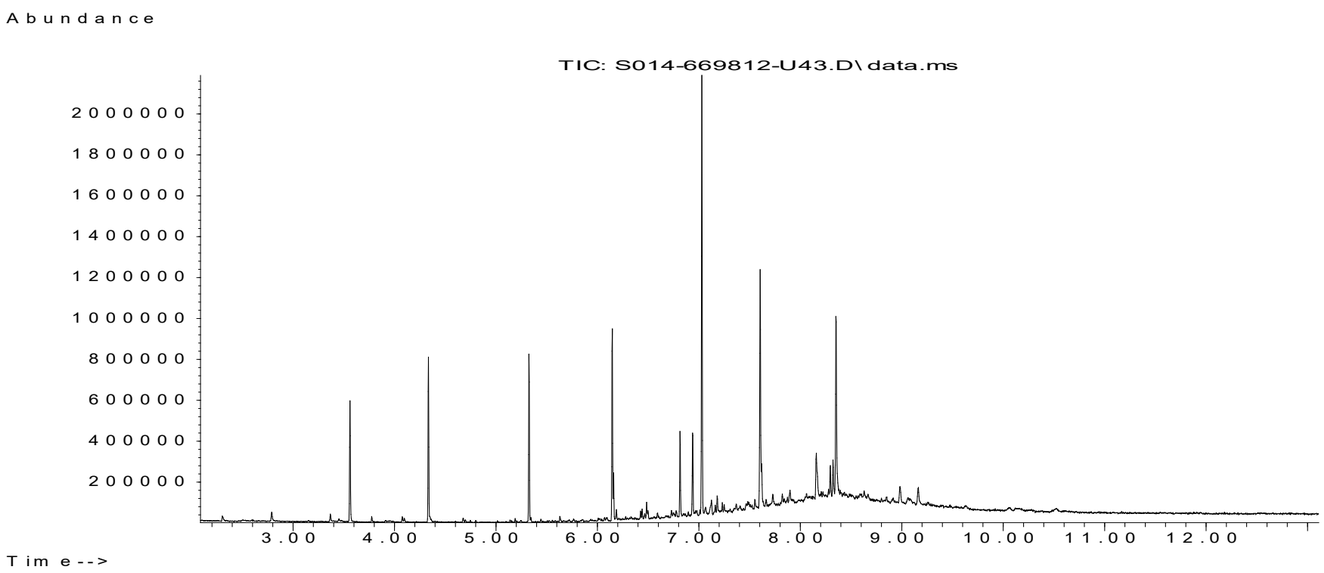
Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

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TIC: S011-669809-U43.D\data.ms
Abundance
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1400000
1200000
1000000
800000
600000
400000
200000
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
Time-->


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10000000
8000000
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4000000
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4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
Time-->


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6.00
7.00
8.00
9.00
10.00
11.00
12.00
Time-->

GAC derivation

Background

Initially, the Stantec GAC were derived following the publishing of soil guideline values (SGV), toxicological (TOX) reports and associated publications by the Environment Agency (EA) in 2009 referenced under Science Report SC050021 (EA, 2009a, b, c, d). The Stantec GAC have then been periodically updated following publication of new information on toxicological, physico-chemical, land use or receptor parameters, namely:

- LQM/CIEH, 2009. LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment, second edition. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D.
- CL:AIRE, 2010. 'The EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment'. Environmental Industries Commission, The Association of Geotechnical and Geoenvironmental Specialists and Contaminated Land: Applications in Real Environment.
- CL:AIRE, 2014. 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.
- LQM/CIEH, 2015. 'The LQM/CIEH S4ULs for Human Health Risk Assessment'. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F.
- CL:AIRE, 2021-2024. 'C4SL Phase 2 Technical Reports'.
- CL:AIRE, 2022. C4SL Phase 2 Technical Report for 1,2-dichloroethane.
- CL:AIRE, 2024. C4SL Phase 2 Technical Reports for cis-1,2-dichloroethene, trans-1,2-dichloroethene, naphthalene, PFAS and inorganic mercury.

Land use scenarios

Stantec has derived generic assessment criteria (GAC) for human health based on the six exposure scenarios defined in CL:AIRE (2014) using generic default assumptions from published guidance. GAC for each exposure scenario have been derived for three soil organic matter (SOM) contents, 1%, 2.5% and 6%.

All GAC have been rounded to two significant figures.

Exposure parameters

The exposure parameters used for the Stantec GAC are the default parameters stated in SR3, unless updated in CL:AIRE (2014) where the CL:AIRE (2014) values have been adopted.

Approach to consumption rates

Stantec have adopted the 90th percentile consumption rates from Table 3.4 of CL:AIRE (2014) for all produce types. This is noted to be more conservative than the "top two" approach taken in the derivation of C4SLs.

Approach to plant uptake for GAC omitted in CL:AIRE (2010)

Plant uptake factors were not identified in CL:AIRE (2010) for antimony, barium and molybdenum. Stantec has sourced the required parameter values from ORNL (1984) in order to derive GAC that are inclusive of the homegrown produce exposure pathway.

Chemical and toxicity parameters

The chemical and toxicity parameters have been adopted based on the following documents:

- IRIS, 2016. 'Toxicological Review of Trimethylbenzenes'. Integrated Risk Information System, National Centre for Environmental Assessment, office of Research and Development, U.S. Environmental Protection Agency.
- LQM/CIEH, 2015.
- ORNL, 1984. 'ORNL-5786. A Review and Analysis of Parameters for Assessing Transport of Environmentally released Radionuclides through Agriculture'. Oak Ridge National Laboratory.
- CL:AIRE, 2010.
- RIVM, 2001. RIVM Report 711701 025 'HCV Re-evaluation of human-toxicological maximum-permissible risk levels'. National Institute of Public Health and the Environment.
- LQM/CIEH, 2009.
- EA, 2009a.

Approach to Cyanide GAC

The Stantec GAC for free cyanide have been derived based on ingestion of a bolus of contaminated soil. The GAC are derived for acute exposure of a child (0-6 years old) for all land uses except commercial, where the GAC are derived for acute exposure of an adult (16-65 years old). For the purpose of GQRA, the child value may be adopted for all land use scenarios.

For complex cyanide, the GAC have been derived based on chronic exposure, using the default exposure scenarios but excluding the consumption of homegrown produce, soil attached to homegrown produce, indoor vapour and outdoor vapour pathways. The chronic health criteria value (HCV) for complex cyanide is based on the EA (2009a) HCV for free cyanide and the ratio of toxicity between free and complex cyanide proposed by RIVM (2001).

Approach to Phenol GAC

In accordance with the EA Science Report SC050021 / Phenol SGV, a $GAC_{ing/inh}$ has been derived for ingested and inhaled phenol using the CLEA model, with a GAC_{derm} derived for dermal contact using Equation 5.7 within SR3. The lower of the $GAC_{ing/inh}$ and GAC_{derm} has been adopted as the final GAC.

Approach to PCB GAC

GAC for assessing the non-dioxin-like risk from PCBs have been based on the "Dutch 7". As the TDI used by the authors of the Dutch guidance is for the sum of the 7 individual congeners, the TDI has been divided by 7 to create a TDI for each congener. The non-dioxin-like risk from PCBs is therefore assessed using a Hazard Index approach as for total petroleum hydrocarbons (TPH).

Sub-surface soil to indoor air correction factors

Reflecting the approach taken by the Environment Agency in the development of revised SGV in 2009 for BTEX, a sub-surface soil to indoor air correction factor of 10 has been applied for petroleum hydrocarbons in order to account for over-prediction of vapour intrusion into building using the Johnson and Ettinger approach.

The correction factor of 10 has been applied to the following petroleum hydrocarbons (it makes negligible difference to less volatile TPH and PAH compounds):

- TPHCWG fractions, namely aliphatic EC>5-44 and aromatic EC>6-44;
- PAHs (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene), benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h,)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene, pyrene);
- BTEX;
- Isopropylbenzene;
- Propylbenzene;
- 1,2,4- and 1,3,5-trimethylbenzene; and
- Styrene.

Approach to saturation limits

The CLEA model includes a traffic light colour system to highlight when saturated soil conditions have potentially been exceeded for the vapour pathways during calculation of assessment criteria. The colours represent:

Green: the assessment criteria do not exceed the saturated soil concentration.

Amber: the assessment criteria exceed the saturated soil concentration but the contribution of the indoor and outdoor vapour pathway to total exposure is less than 10% and will not significantly affect the assessment criteria.

Red: the assessment criteria exceed the saturated soil concentration and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10% and will significantly affect the assessment criteria.

Stantec has not applied any further calculations or assessment in relation to saturation limits during GAC derivation, with the CLEA-modelled GAC being presented as the GAC. Consideration of saturation limits is undertaken during the data assessment stage.

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Human health GAC screening results

Assessment of Chemicals of Potential Concern to Human Health

Risk parameter:	Default - Human Health - commercial (1%SOM)
Client:	Stack (Manchester) Ltd
Site:	Stack, Manchester
Job no.:	3E+08
Lab. report no(s).:	25-047258-2

Data Filters

Zone	All
Strata	All
Depth Min (m bgl)	0.3
Depth Max (m bgl)	0.8
Dataset mean SOM%	1.42
Scenario SOM%	1

All values in mg/kg unless otherwise stated

CAS No / P Code	Chemical of Potential Concern	Units	LoD	No. Samples	Min. Value	Max. Value	Mean	Median	Standard Deviation	No. Samples >= GAC & > LoD	Soil Saturation Limit @1% SOM	GAC	GAC Source	Date	29/0/2025	29/0/2025	29/0/2025	29/0/2025
														Zone	1	1	1	1
														Location	WS101	WS102	WS102	WS103
														Depth (m bgl)	0.5	0.3	0.8	0.3
														Strata	MG	MG	MG	MG
	Asbestos																	
P1020	Asbestos Identified	text	Y/N	4	-	-	-	-	No. of detects:	3	-	-	-		N	Y	Y	Y
P1889	Asbestos Screen Name	text	Y/N	3	-	-	-	-	-		-	-	-			Loose Fibres	Loose Fibres	Loose Fibrous Debris
12172-67-7	Actinolite detected	text	Y/N	3	-	-	-	-	-		-	-	-			N	N	N
12172-73-5	Amosite detected	text	Y/N	3	-	-	-	-	-		-	-	-			N	Y	N
17068-78-9	Anthophyllite detected	text	Y/N	3	-	-	-	-	-		-	-	-			N	N	N
12001-29-5	Chrysotile detected	text	Y/N	3	-	-	-	-	-		-	-	-			Y	N	Y
12001-28-4	Crocidolite detected	text	Y/N	3	-	-	-	-	-		-	-	-			N	N	Y
14567-73-8	Tremolite detected	text	Y/N	3	-	-	-	-	-		-	-	-			N	N	N
P1885	Asbestos Quant. (Stage 2)	%	0.001	3	0.001	0.035	0.012	0.001	No. > LOD:	1	-	-	-			<0.001	<0.001	0.035
	Hydrock Default Suite - FOC / SOM / pH										-							
P1085	FOC (dimensionless)	-	0.001	4	0.002	0.011	0.008	0.010	0.00		-	-	-		0.0019	0.01	0.011	0.01
-	SOM (calculated)	%	0.1724	4	0.33	1.90	1.42	1.72	0.73		-	-	-		0.32756	1.724	1.8964	1.724
P1334	pH (su)	pH Units	0.1	4	7.20	7.90	7.60	7.65	0.32		-	-	-		7.9	7.5	7.2	7.8
	Hydrock Default Suite - Metals & PAH																	
7440-38-2	Arsenic	mg/kg	1	4	4.80	30.00	17.70	18.00	10.80	0	NR	640	C4SL - CL:AIRE 2014		22	30	14	4.8
7440-41-7	Beryllium	mg/kg	0.06	4	0.56	1.10	0.89	0.96	0.23	0	NR	12	Hydrock Derived		0.97	1.1	0.94	0.56
7440-42-8	Boron	mg/kg	0.2	4	0.40	2.30	1.38	1.40	0.79	0	NR	240000	Hydrock Derived		1.6	2.3	1.2	0.4
7440-43-9	Cadmium	mg/kg	0.2	4	0.20	1.30	0.65	0.55	0.54	0	NR	410	C4SL - CL:AIRE 2014		0.9	1.3	0.2	<0.2
16065-83-1	Chromium (III)	mg/kg	1	4	17.00	24.00	20.50	20.50	3.51	0	NR	8400	Hydrock Derived		24	23	18	17
18540-29-9	Chromium (VI)	mg/kg	1.8	4	1.80	1.80	1.80	1.80	0.00	0	NR	49	C4SL - CL:AIRE 2014		<1.8	<1.8	<1.8	<1.8
7440-47-3	Chromium (Total)	mg/kg	1	4	17.00	24.00	20.50	20.50	3.51			-			24	23	18	17
7440-50-8	Copper	mg/kg	1	4	14.00	150.00	80.50	79.00	55.70	0	NR	68000	Hydrock Derived		74	150	84	14
7439-92-1	Lead	mg/kg	1	4	11.00	770.00	425.25	460.00	352.55	0	NR	2300	C4SL - CL:AIRE 2014		770	660	260	11
7439-97-6	Mercury, inorganic	mg/kg	0.3	4	0.30	0.70	0.43	0.35	0.19	0	NR	5100	Hydrock Derived		0.3	0.7	0.4	<0.3
7440-02-0	Nickel	mg/kg	1	4	16.00	27.00	21.75	22.00	4.57	0	NR	980	Hydrock Derived		23	27	21	16
7782-49-2	Selenium	mg/kg	1	4	1.00	1.00	1.00	1.00	0.00	0	NR	12000	Hydrock Derived		<1	<1	<1	<1
7440-62-2	Vanadium	mg/kg	1	4	21.00	36.00	28.75	29.00	6.34	0	NR	9000	Hydrock Derived		31	36	27	21
7440-66-6	Zinc	mg/kg	1	4	29.00	340.00	174.75	165.00	135.14	0	NR	730000	Hydrock Derived		220	340	110	29
P1095	Cyanide (free)	mg/kg	1	4	1.00	1.00	1.00	1.00	0.00	0	NR	24	Acute Risk - SoBRA 2020		<1	<1	<1	<1
P1186	Total Phenols (Monohydric)	mg/kg	1	4	1.00	1.00	1.00	1.00	0.00	0	24237	440	Hydrock Derived		<1	<1	<1	<1
83-32-9	Acenaphthene	mg/kg	0.05	4	0.05	0.53	0.24	0.19	0.21	0	57	110000	Hydrock Derived		0.26	0.53	0.11	<0.05
208-96-8	Acenaphthylene	mg/kg	0.05	4	0.05	0.10	0.07	0.07	0.03	0	86	110000	Hydrock Derived		0.09	0.1	<0.05	<0.05
120-12-7	Anthracene	mg/kg	0.05	4	0.05	0.89	0.41	0.35	0.36	0	1.17	540000	Hydrock Derived		0.44	0.89	0.26	<0.05
56-55-3	Benz(a)anthracene	mg/kg	0.05	4	0.05	2.90	1.35	1.22	1.21	0	1.71	170	Hydrock Derived		1.6	2.9	0.83	<0.05
50-32-8	Benzo(a)pyrene	mg/kg	0.05	4	0.05	3.10	1.40	1.23	1.30	0	0.91	77	C4SL - CL:AIRE 2014		1.6	3.1	0.85	<0.05
205-99-2	Benzo(b)fluoranthene	mg/kg	0.05	4	0.05	3.80	1.61	1.30	1.61	0	1.22	44	Hydrock Derived		1.7	3.8	0.89	<0.05
191-24-2	Benzo(ghi)perylene	mg/kg	0.05	4	0.05	1.90	0.88	0.78	0.79	0	0.02	3900	Hydrock Derived		1	1.9	0.55	<0.05
207-08-9	Benzo(k)fluoranthene	mg/kg	0.05	4	0.05	1.30	0.70	0.72	0.54	0	0.69	1200	Hydrock Derived		0.93	1.3	0.51	<0.05
218-01-9	Chrysene	mg/kg	0.05	4	0.05	3.20	1.48	1.33	1.33	0	0.44	350	Hydrock Derived		1.7	3.2	0.96	<0.05
53-70-3	Dibenz(ah)anthracene	mg/kg	0.05	4	0.05	0.19	0.10	0.08	0.07	0	0.004	3.5	Hydrock Derived		0.19	<0.05	0.11	<0.05
206-44-0	Fluoranthene	mg/kg	0.05	4	0.05	6.80	3.01	2.60	2.89	0	19	23000	Hydrock Derived		3.5	6.8	1.7	<0.05
86-73-7	Fluorene	mg/kg	0.05	4	0.05	0.28	0.17	0.18	0.11	0	31	71000	Hydrock Derived		0.24	0.28	0.12	<0.05
193-39-5	Indeno(123cd)pyrene	mg/kg	0.05	4	0.05	1.60	0.71	0.60	0.66	0	0.06	500	Hydrock Derived		0.76	1.6	0.44	<0.05
91-20-3	Naphthalene	mg/kg	0.05	4	0.05	0.24	0.13	0.11	0.08	0	76	1600	C4SL - CL:AIRE 2024		0.24	0.13	0.08	<0.05
85-01-8	Phenanthrene	mg/kg	0.05	4	0.05	4.30	1.96	1.75	1.86	0	36	23000	Hydrock Derived		2.5	4.3	1	<0.05
129-00-0	Pyrene	mg/kg	0.05	4	0.05	6.00	2.76	2.50	2.53	0	2.2	54000	Hydrock Derived		3.3	6	1.7	<0.05
P1310	PAH 16 Total	mg/kg	0.8	4	0.80	36.80	16.95	15.10	15.40			-			20.1	36.8	10.1	<0.8
	TPH fractions																	
P1407	TPH ali EC05-EC06	mg/kg	0.001	4	0.01	0.01	0.01	0.01	0.000	0	304	3200	Hydrock Derived		<0.01	<0.01	<0.01	<0.01
P1408	TPH ali >EC06-EC08	mg/kg	0.001	4	0.01	0.01	0.01	0.01	0.000	0	144	7800	Hydrock Derived		<0.01	<0.01	<0.01	<0.01
P1409	TPH ali >EC08-EC10	mg/kg	0.001	4	0.01	0.01	0.01	0.01	0.000	0	78	2000	Hydrock Derived		<0.01	<0.01	<0.01	<0.01
P1410	TPH ali >EC10-EC12	mg/kg	1	4	1.00	1.00	1.00	1.00	0.00	0	48	9700	Hydrock Derived		<1	<1	<1	<1
P1411	TPH ali >EC12-EC16	mg/kg	2	4	2.00	3.90	2.75	2.55	0.86	0	24	59000	Hydrock Derived		2.2	3.9	2.9	<2
-	TPH ali >EC16-EC21	mg/kg	8	4	8.00	10.00	8.50	8.00	1.00			-			<8	10	<8	<8
-	TPH ali >EC21-EC35	mg/kg	8	4	8.00	40.00	23.75	23.50	13.07			-			24	40	23	<8
P1938	TPH ali >EC16-EC35	mg/kg	10	4	10.00	50.00	26.75	23.50	16.76	0	8	1600000	Hydrock Derived		24	50	23	<10
P1415	TPH ali >EC35-EC44	mg/kg	8.4	4	8.40	16.00	10.95	9.70	3.58	0	8	1600000	Hydrock Derived		11	16	<8.4	<8.4
-	TPH ali >EC5-EC35	mg/kg	10	4	10.00	54.00	29.00	26.00	18.31			-			27	54	25	<10
-	TPH ali >EC5-EC44	mg/kg	10	4	10.00	69.00	35.25	31.00	25.06			-			37	69	25	<10
P1441	TPH aro EC05-EC07	mg/kg	0.001	4	0.01	0.01	0.01	0.01	0.00	0	1218	26000	Hydrock Derived		<0.01	<0.01	<0.01	<0.01
P1355	TPH aro >EC07-EC08	mg/kg	0.001	4	0.01	0.01	0.01	0.01	0.00	0	869	56000	Hydrock Derived		<0.01	<0.01	<0.01	<0.01
P1356	TPH aro >EC08-EC10	mg/kg	0.001	4	0.02	0.02	0.02	0.02	0.00	0	613	3500	Hydrock Derived		<0.02	<0.02	<0.02	<0.02
P1357	TPH aro >EC10-EC12	mg/kg	1	4	1.00	3.00	1.50	1.00	1.00	0	364	16000	Hydrock Derived		3	<1	<1	<1
P1358	TPH aro >EC12-EC16	mg/kg	2	4	2.00	7.70	4.00	3.15	2.69	0	169	36000	Hydrock Derived		7.7	4.3	<2	<2
P1359	TPH aro >EC16-EC21	mg/kg	10	4	10.00	30.00	16.75	13.50	9.43	0	54	28000	Hydrock Derived		17	30	<10	<10
P1360	TPH aro >EC21-EC35	mg/kg	10	4	10.00	82.00	37.00	28.00	32.68	0	5	28000	Hydrock Derived		40	82	16	<10
P1362	TPH aro >EC35-EC44	mg/kg	8.4	4	8.40	26.00	13.13	9.05	8.61	0	5	28000	Hydrock Derived		9.7	26	<8.4	<8.4
-	TPH aro >EC5-EC35	mg/kg	10	4	10.00	120.00	53.50	42.00	51.42			-			68	120	16	<10
-	TPH aro >EC5-EC44	mg/kg	10	4	10.00	140.00	60.75	46.50	60.89			-			77	140	16	<10
	VOCs - BTEX & MTBE																	
71-43-2	Benzene	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00	0	1218	27	C4SL - CL:AIRE 2014		<0.005	<0.005	<0.005	<0.005
108-88-3	Toluene	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00	0	869	56000	Hydrock Derived		<0.005	<0.005	<0.005	<0.005
100-41-4	Ethylbenzene	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00	0	518	5700	Hydrock Derived		<0.005	<0.005	<0.005	<0.005
95-47-6	Xylene, o-	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00	0	478	6600	Hydrock Derived		<0.005	<0.005	<0.005	<0.005
-	Xylene, p- (or combined m & p)	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00			-			<0.008	<0.008	<0.008	<0.008
1634-04-4	MTBE	mg/kg	1	4	0.01	0.01	0.01	0.01	0.00	0	20358	7500	Hydrock Derived		<0.005	<0.005	<0.005	<0.005
	TPH Additivity Check						**HAZARD QUOTIENTS FOR EACH FRACTION**											
													Aliphatics >EC5-EC6		0.000003125	0.000003125	0.000003125	0.000003125
													Aliphatics >EC6-EC8		1.28205E-06	1.28205E-06	1.28205E-06	1.28205E-06
							Considered additive						Aliphatics >EC8-EC10		0.000005	0.000005	0.000005	0.000005
							Considered additive						Aliphatics >EC10-EC12		0.000103093	0.000103093	0.000103093	0.000103093
							Considered additive						Aliphatics >EC12-EC16		3.72881E-05	6.61017E-05	4.91525E-05	3.38983E-05
													Aliphatics >EC16-EC35		0.000015	0.00003125	0.000014375	0.00000625
													Aliphatics >EC35-EC44		0.000006875	0.00001	0.00000525	0.00000525
													Aromatics EC5-EC7		3.84615E-07	3.84615E-07	3.84615E-07	3.84615E-07
													Aromatics >EC7-EC8		1.78571E-07	1.78571E-07	1.78571E-07	1.78571E-07
							Considered additive						Aromatics >EC8-EC10		5.71429E-06	5.71429E-06	5.71429E-06	5.71429E-06
							Considered additive						Aromatics >EC10-EC12		0.0001875	0.0000625	0.0000625	0.0000625
							Considered additive						Aromatics >EC12-EC16		0.000213889	0.000119444	5.55556E-05	5.55556E-05
													Aromatics >EC16-EC21		0.000607143	0.001071429	0.000357143	0.000357143
													Aromatics >EC21-EC35		0.001428571	0.002928571	0.000571429	0.000357143
													Aromatics >EC35-EC44		0.000346429	0.000928571	0.0003	0.0003
							Hazard Index HI or HQ greater than 1 highlighted with orange shading						**Hazard Index for ali>C8-C16**		**0.000145381**	**0.000174194**	**0.000157245**	**0.000141991**
													Hazard Index for aro>C8-C16		**0.000407103**	**0.000187659**	**0.00012377**	**0.00012377**
													Hazard Index for aro>C16-C35		**0.002035714**	**0.004**	**0.000928571**	**0.000714286**

Legend:

MG	Made Ground	
<0.02		Value below the laboratory reporting limit and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate.
0.02		Value greater than, or equal to, the generic assessment criterion (GAC).
64.00		Value exceed saturation limit and substance is liquid or solid at ambient temperature
***<10**		Value excluded from statistical analysis
Y		Text result
-		Represents a determinand that was not tested.
+		represents a data point that is not included in the current filter settings

Template Version:

1.17: 23/07/25

Appendix E Waste classification

HazWasteOnline™ assessment

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

IMIWQ-NJXP1-SS2E3

Report is invalid if pages are removed.

Job name

333701845 Stack Manchester

Description/Comments

Lab report 25-047258
Sample IDs WS101 0.5m , WS102 0.30m, WS102 0.80m, WS103 0.30m

Project

333701845 Stack Manchester

Site

Stack Manchester, Oxford Road, Manchester

Classified by

Name:
Emma Dixon
Date:
25 Sep 2025 09:43 GMT
Telephone:
01912 302993

Company:
Stantec UK Ltd
2 Esh Plaza, Sir Bobby Robson Way, Great Park,
Newcastle upon Tyne
NE13 9BA

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification: **CERTIFIED**

Course	Date
Hazardous Waste Classification	04 Apr 2024

Next 3 year Refresher due by Apr 2027

Purpose of classification

2 - Material Characterisation

Address of the waste

Stack Manchester, Oxford Road, Manchester **Post Code** M1 7ED

SIC for the process giving rise to the waste

41201 Construction of commercial buildings

Description of industry/producer giving rise to the waste

Reduced level excavation and reengineering of Made Ground

Description of the specific process, sub-process and/or activity that created the waste

Excavation arisings to be disposed offsite.

Description of the waste

Made Ground: Orangish brown gravelly clayey SAND with rare brick fragments or black gravelly ashy SAND with cobbles of brick and gravel of brick, concrete and timber

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS101-ES1-29082025-0.50		Non Hazardous		3
2	WS102-ES1-29082025-0.30		Non Hazardous		6
3	WS102-ES2-29082025-0.80		Non Hazardous		9
4	WS103-ES1-29082025-0.30		Non Hazardous		12

Related documents

#	Name	Description
1	25-047258_HWOL.hwol	i2 Analytical .hwol file used to populate the Job
2	Hydrock Standard plus Cresol (ammended Lead)	waste stream template used to create this Job

Report

Created by: Emma Dixon

Created date: 25 Sep 2025 09:43 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	15
Appendix B: Rationale for selection of metal species	16
Appendix C: Version	17

Classification of sample: WS101-ES1-29082025-0.50

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS101-ES1-29082025-0.50
Moisture content:
7.7%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 7.7% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		acenaphthene		201-469-6	83-32-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
2		acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
3		anthracene		204-371-1	120-12-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
4		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		4.8	mg/kg	1.32	5.85	mg/kg	0.000585 %	✓	
5		benzene	601-020-00-8	200-753-7	71-43-2		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
6		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
7		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
8		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
9		benzo[ghi]perylene		205-883-8	191-24-2		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
10		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
11		beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.56	mg/kg	2.775	1.435	mg/kg	0.000143 %	✓	
12		boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		0.4	mg/kg	13.43	4.958	mg/kg	0.000496 %	✓	
13		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
14		chromium in Cr(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		17	mg/kg	1.462	22.933	mg/kg	0.00229 %	✓	
15		chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		<LOD
16		chrysene	601-048-00-0	205-923-4	218-01-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
17		copper { dicopper oxide; copper (I) oxide }				14	mg/kg	1.126	14.549	mg/kg	0.00145 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
18		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
		006-007-00-5											
19		dibenz[a,h]anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-041-00-2	200-181-8	53-70-3									
20		ethylbenzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		601-023-00-4	202-849-4	100-41-4									
21		fluoranthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-912-4	206-44-0									
22		fluorene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			201-695-5	86-73-7									
23		indeno[123-cd]pyrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-893-2	193-39-5									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	11	mg/kg		10.153	mg/kg	0.00102 %	✓	
		082-001-00-6											
25		mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
26		naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-052-00-2	202-049-5	91-20-3									
27		nickel { nickel dihydroxide }				16	mg/kg	1.579	23.326	mg/kg	0.00233 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
28		pH				7.9	pH		7.9	pH	7.9 pH		
				PH									
29		phenanthrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			201-581-5	85-01-8									
30		pyrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			204-927-3	129-00-0									
31		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
		034-002-00-8											
32		toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		601-021-00-3	203-625-9	108-88-3									
33		TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
				TPH									
34		xylene				<0.013	mg/kg		<0.013	mg/kg	<0.0000013 %		<LOD
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
35		zinc { zinc oxide }				29	mg/kg	1.245	33.317	mg/kg	0.00333 %	✓	
		030-013-00-7	215-222-5	1314-13-2									
36		monohydric phenols				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
				P1186									
37		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		603-181-00-X	216-653-1	1634-04-4									
38		vanadium { divanadium pentaoxide; vanadium pentoxide }				21	mg/kg	1.785	34.602	mg/kg	0.00346 %	✓	
		023-001-00-8	215-239-8	1314-62-1									
39		magnesium { magnesium phosphide; trimagnesium diphosphide }				6.9	mg/kg	1.85	11.779	mg/kg	0.00118 %	✓	
		015-005-00-3	235-023-7	12057-74-8									
										Total:	0.0163 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
	This determinand is defined in the EU CLP Table 3
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS102-ES1-29082025-0.30

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS102-ES1-29082025-0.30
Moisture content:
8.5%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 8.5% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	acenaphthene		201-469-6	83-32-9		0.26 mg/kg		0.238 mg/kg	0.0000238 %	✓	
2	acenaphthylene		205-917-1	208-96-8		0.09 mg/kg		0.0823 mg/kg	0.00000823 %	✓	
3	anthracene		204-371-1	120-12-7		0.44 mg/kg		0.403 mg/kg	0.0000403 %	✓	
4	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		22 mg/kg	1.32	26.578 mg/kg	0.00266 %	✓	
5	benzene	601-020-00-8	200-753-7	71-43-2		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<**LOD**
6	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		1.6 mg/kg		1.464 mg/kg	0.000146 %	✓	
7	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		1.6 mg/kg		1.464 mg/kg	0.000146 %	✓	
8	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		1.7 mg/kg		1.555 mg/kg	0.000156 %	✓	
9	benzo[ghi]perylene		205-883-8	191-24-2		1 mg/kg		0.915 mg/kg	0.0000915 %	✓	
10	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.93 mg/kg		0.851 mg/kg	0.0000851 %	✓	
11	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.97 mg/kg	2.775	2.463 mg/kg	0.000246 %	✓	
12	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		1.6 mg/kg	13.43	19.662 mg/kg	0.00197 %	✓	
13	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.9 mg/kg	1.285	1.058 mg/kg	0.0000824 %	✓	
14	chromium in Cr(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		24 mg/kg	1.462	32.096 mg/kg	0.00321 %	✓	
15	chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8 mg/kg	1.923	<3.462 mg/kg	<0.000346 %		<**LOD**
16	chrysene	601-048-00-0	205-923-4	218-01-9		1.7 mg/kg		1.555 mg/kg	0.000156 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
17		copper { dicopper oxide; copper (I) oxide }				74	mg/kg	1.126	76.234	mg/kg	0.00762 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
18		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<**LOD**
		006-007-00-5											
19		dibenz[a,h]anthracene				0.19	mg/kg		0.174	mg/kg	0.0000174 %	✓	
		601-041-00-2	200-181-8	53-70-3									
20		ethylbenzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
		601-023-00-4	202-849-4	100-41-4									
21		fluoranthene				3.5	mg/kg		3.203	mg/kg	0.00032 %	✓	
			205-912-4	206-44-0									
22		fluorene				0.24	mg/kg		0.22	mg/kg	0.000022 %	✓	
			201-695-5	86-73-7									
23		indeno[123-cd]pyrene				0.76	mg/kg		0.695	mg/kg	0.0000695 %	✓	
			205-893-2	193-39-5									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	770	mg/kg		704.55	mg/kg	0.0705 %	✓	
		082-001-00-6											
25		mercury { mercury dichloride }				0.3	mg/kg	1.353	0.372	mg/kg	0.0000372 %	✓	
		080-010-00-X	231-299-8	7487-94-7									
26		naphthalene				0.24	mg/kg		0.22	mg/kg	0.000022 %	✓	
		601-052-00-2	202-049-5	91-20-3									
27		nickel { nickel dihydroxide }				23	mg/kg	1.579	33.241	mg/kg	0.00332 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
28		pH				7.5	pH		7.5	pH	7.5 pH		
				PH									
29		phenanthrene				2.5	mg/kg		2.288	mg/kg	0.000229 %	✓	
			201-581-5	85-01-8									
30		pyrene				3.3	mg/kg		3.02	mg/kg	0.000302 %	✓	
			204-927-3	129-00-0									
31		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<**LOD**
		034-002-00-8											
32		toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
		601-021-00-3	203-625-9	108-88-3									
33		TPH (C6 to C40) petroleum group				114	mg/kg		104.31	mg/kg	0.0104 %	✓	
				TPH									
34		xylene				<0.013	mg/kg		<0.013	mg/kg	<0.0000013 %		<**LOD**
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
35		zinc { zinc oxide }				220	mg/kg	1.245	250.561	mg/kg	0.0251 %	✓	
		030-013-00-7	215-222-5	1314-13-2									
36		monohydric phenols				<1	mg/kg		<1	mg/kg	<0.0001 %		<**LOD**
				P1186									
37		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
		603-181-00-X	216-653-1	1634-04-4									
38		vanadium { divanadium pentaoxide; vanadium pentoxide }				31	mg/kg	1.785	50.637	mg/kg	0.00506 %	✓	
		023-001-00-8	215-239-8	1314-62-1									
39		magnesium { magnesium phosphide; trimagnesium diphosphide }				64	mg/kg	1.85	108.311	mg/kg	0.0108 %	✓	
		015-005-00-3	235-023-7	12057-74-8									
										Total:	0.143 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
	This determinand is defined in the EU CLP Table 3
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No flammability risk considered due to nature of material (soil)

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0104%)

Classification of sample: WS102-ES2-29082025-0.80

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS102-ES2-29082025-0.80
Moisture content:
11%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 11% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		acenaphthene		201-469-6	83-32-9		0.53	mg/kg		0.472	mg/kg	0.0000472 %	✓	
2		acenaphthylene		205-917-1	208-96-8		0.1	mg/kg		0.089	mg/kg	0.0000089 %	✓	
3		anthracene		204-371-1	120-12-7		0.89	mg/kg		0.792	mg/kg	0.0000792 %	✓	
4		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		30	mg/kg	1.32	35.253	mg/kg	0.00353 %	✓	
5		benzene	601-020-00-8	200-753-7	71-43-2		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
6		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		2.9	mg/kg		2.581	mg/kg	0.000258 %	✓	
7		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		3.1	mg/kg		2.759	mg/kg	0.000276 %	✓	
8		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		3.8	mg/kg		3.382	mg/kg	0.000338 %	✓	
9		benzo[ghi]perylene		205-883-8	191-24-2		1.9	mg/kg		1.691	mg/kg	0.000169 %	✓	
10		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		1.3	mg/kg		1.157	mg/kg	0.000116 %	✓	
11		beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		1.1	mg/kg	2.775	2.717	mg/kg	0.000272 %	✓	
12		boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		2.3	mg/kg	13.43	27.491	mg/kg	0.00275 %	✓	
13		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	1.3	mg/kg	1.285	1.487	mg/kg	0.000116 %	✓	
14		chromium in Cr(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		23	mg/kg	1.462	29.918	mg/kg	0.00299 %	✓	
15		chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		<**LOD**
16		chrysene	601-048-00-0	205-923-4	218-01-9		3.2	mg/kg		2.848	mg/kg	0.000285 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
17		copper { dicopper oxide; copper (I) oxide }				150	mg/kg	1.126	150.306	mg/kg	0.015 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
18		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
		006-007-00-5											
19		dibenz[a,h]anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-041-00-2	200-181-8	53-70-3									
20		ethylbenzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		601-023-00-4	202-849-4	100-41-4									
21		fluoranthene				6.8	mg/kg		6.052	mg/kg	0.000605 %	✓	
			205-912-4	206-44-0									
22		fluorene				0.28	mg/kg		0.249	mg/kg	0.0000249 %	✓	
			201-695-5	86-73-7									
23		indeno[123-cd]pyrene				1.6	mg/kg		1.424	mg/kg	0.000142 %	✓	
			205-893-2	193-39-5									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	660	mg/kg		587.4	mg/kg	0.0587 %	✓	
		082-001-00-6											
25		mercury { mercury dichloride }				0.7	mg/kg	1.353	0.843	mg/kg	0.0000843 %	✓	
		080-010-00-X	231-299-8	7487-94-7									
26		naphthalene				0.13	mg/kg		0.116	mg/kg	0.0000116 %	✓	
		601-052-00-2	202-049-5	91-20-3									
27		nickel { nickel dihydroxide }				27	mg/kg	1.579	37.955	mg/kg	0.0038 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
28		pH				7.2	pH		7.2	pH	7.2 pH		
				PH									
29		phenanthrene				4.3	mg/kg		3.827	mg/kg	0.000383 %	✓	
			201-581-5	85-01-8									
30		pyrene				6	mg/kg		5.34	mg/kg	0.000534 %	✓	
			204-927-3	129-00-0									
31		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
		034-002-00-8											
32		toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		601-021-00-3	203-625-9	108-88-3									
33		TPH (C6 to C40) petroleum group				209	mg/kg		186.01	mg/kg	0.0186 %	✓	
				TPH									
34		xylene				<0.013	mg/kg		<0.013	mg/kg	<0.0000013 %		<LOD
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
35		zinc { zinc oxide }				340	mg/kg	1.245	376.65	mg/kg	0.0377 %	✓	
		030-013-00-7	215-222-5	1314-13-2									
36		monohydric phenols				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
				P1186									
37		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
		603-181-00-X	216-653-1	1634-04-4									
38		vanadium { divanadium pentaoxide; vanadium pentoxide }				36	mg/kg	1.785	57.197	mg/kg	0.00572 %	✓	
		023-001-00-8	215-239-8	1314-62-1									
										Total:	0.153 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No flammability risk considered due to nature of material (soil)

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0186%)

Classification of sample: WS103-ES1-29082025-0.30

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS103-ES1-29082025-0.30
Moisture content:
11%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 11% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		acenaphthene		201-469-6	83-32-9		0.11	mg/kg		0.0979	mg/kg	0.00000979 %	✓	
2		acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
3		anthracene		204-371-1	120-12-7		0.26	mg/kg		0.231	mg/kg	0.0000231 %	✓	
4		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		14	mg/kg	1.32	16.451	mg/kg	0.00165 %	✓	
5		benzene	601-020-00-8	200-753-7	71-43-2		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
6		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.83	mg/kg		0.739	mg/kg	0.0000739 %	✓	
7		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.85	mg/kg		0.757	mg/kg	0.0000757 %	✓	
8		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.89	mg/kg		0.792	mg/kg	0.0000792 %	✓	
9		benzo[ghi]perylene		205-883-8	191-24-2		0.55	mg/kg		0.49	mg/kg	0.000049 %	✓	
10		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.51	mg/kg		0.454	mg/kg	0.0000454 %	✓	
11		beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.94	mg/kg	2.775	2.322	mg/kg	0.000232 %	✓	
12		boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		1.2	mg/kg	13.43	14.343	mg/kg	0.00143 %	✓	
13		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.2	mg/kg	1.285	0.229	mg/kg	0.0000178 %	✓	
14		chromium in Cr(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		18	mg/kg	1.462	23.414	mg/kg	0.00234 %	✓	
15		chromium in Cr(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		<**LOD**
16		chrysene	601-048-00-0	205-923-4	218-01-9		0.96	mg/kg		0.854	mg/kg	0.0000854 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
17		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		84	mg/kg	1.126	84.171	mg/kg	0.00842 %	✓	
18		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<**LOD**
19		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.11	mg/kg		0.0979	mg/kg	0.00000979 %	✓	
20		ethylbenzene	601-023-00-4	202-849-4	100-41-4		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
21		fluoranthene		205-912-4	206-44-0		1.7	mg/kg		1.513	mg/kg	0.000151 %	✓	
22		fluorene		201-695-5	86-73-7		0.12	mg/kg		0.107	mg/kg	0.0000107 %	✓	
23		indeno[123-cd]pyrene		205-893-2	193-39-5		0.44	mg/kg		0.392	mg/kg	0.0000392 %	✓	
24		lead { lead compounds with the exception of those specified elsewhere in this Annex }	082-001-00-6			1	260	mg/kg		231.4	mg/kg	0.0231 %	✓	
25		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.4	mg/kg	1.353	0.482	mg/kg	0.0000482 %	✓	
26		naphthalene	601-052-00-2	202-049-5	91-20-3		0.08	mg/kg		0.0712	mg/kg	0.00000712 %	✓	
27		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		21	mg/kg	1.579	29.521	mg/kg	0.00295 %	✓	
28		pH			PH		7.8	pH		7.8	pH	7.8 pH		
29		phenanthrene		201-581-5	85-01-8		1	mg/kg		0.89	mg/kg	0.000089 %	✓	
30		pyrene		204-927-3	129-00-0		1.7	mg/kg		1.513	mg/kg	0.000151 %	✓	
31		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<**LOD**
32		toluene	601-021-00-3	203-625-9	108-88-3		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
33		TPH (C6 to C40) petroleum group			TPH		41	mg/kg		36.49	mg/kg	0.00365 %	✓	
34		xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.013	mg/kg		<0.013	mg/kg	<0.0000013 %		<**LOD**
35		zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		110	mg/kg	1.245	121.857	mg/kg	0.0122 %	✓	
36		monohydric phenols			P1186		<1	mg/kg		<1	mg/kg	<0.0001 %		<**LOD**
37		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<**LOD**
38		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		27	mg/kg	1.785	42.898	mg/kg	0.00429 %	✓	
											Total:	0.0613 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No flammability risk considered due to nature of material (soil)

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.00365%)

Appendix A: Classifier defined and non GB MCL determinands

acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06 Aug 2015
Hazard Statements: EUH014 , Acute Tox. 2; H330 , Acute Tox. 2; H300 , Skin Corr. 1A; H314 , Skin Corr. 1B; H314

chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

GB MCL index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

ethylbenzene (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

lead compounds with the exception of those specified elsewhere in this Annex

GB MCL index number: 082-001-00-6
Description/Comments: Least-worst case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following MCL protocols, considers many simple lead compounds to be Carcinogenic category 2
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html. Review date 29/09/2015

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Unknown Oil

Hazard statements taken from WM3 1st Edition 2015
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

monohydric phenols (CAS Number: P1186)

Description/Comments: Combined hazards statements from harmonised entries in CLP for phenol, cresols and xylenols (604-001-00-2, 604-004-00-9, 604-006-00-X)
Data source: CLP combined data
Data source date: 26 Mar 2019
Hazard Statements: Muta. 2; H341 , Acute Tox. 3; H331 , Acute Tox. 3; H311 , Acute Tox. 3; H301 , STOT RE 2; H373 , Skin Corr. 1B; H314 , Skin Corr. 1B; H314 >= 3 % , Skin Irrit. 2; H315 1 <= conc. < 3 % , Eye Irrit. 2; H319 1 <= conc. < 3 % , Aquatic Chronic 2; H411

magnesium phosphide; trimagnesium diphosphide (EC Number: 235-023-7, CAS Number: 12057-74-8)

EU CLP index number: 015-005-00-3
Description/Comments:
Data source: Commission Regulation (EU) No 944/2013 - 5th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP5)
)
Hazard Statements: Water-react. 1; H260 , Acute Tox. 2; H300 , Acute Tox. 3; H311 , Acute Tox. 1; H330 , Aquatic Acute 1; H400 (M=100) , EUH029 , EUH032 , Water-react. 1; H260 >= 0.3 % , EUH032 >= 0.3 % , EUH029 >= 0.3 %
Reason for additional Hazards Statement(s):
14 Dec 2015 - Water-react. 1; H260 >= 0.3 % hazard statement sourced from: WM3, Table C3.2
14 Dec 2015 - EUH032 >= 0.3 % hazard statement sourced from: WM3, Table C12.2
14 Dec 2015 - EUH029 >= 0.3 % hazard statement sourced from: WM3, Table C12.2

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

beryllium {beryllium oxide}

Worst case species based on hazard statements

boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in Cr(III) compounds {chromium(III) oxide (worst case)}

Worst case species based on hazard statements

chromium in Cr(VI) compounds {chromium(VI) oxide}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Worst case species

lead {lead compounds with the exception of those specified elsewhere in this Annex}

Worst case species based on hazard statements

mercury {mercury dichloride}

Worst case species based on hazard statements

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements

zinc {zinc oxide}

Worst case species based on hazard statements

vanadium {divanadium pentaoxide; vanadium pentoxide}

Worst case species based on hazard statements.

magnesium {magnesium phosphide; trimagnesium diphosphide}

Worst case species based on hazard statements.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2025.248.6764.12269 (06 Sep 2025)
HazWasteOnline Database: 2025.266.6789.12301 (23 Sep 2025)

This classification utilises the following guidance and legislation:
WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
14th ATP - Regulation (EU) 2020/217 of 4 October 2019
15th ATP - Regulation (EU) 2020/1182 of 19 May 2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
GB MCL List - version 1.1 of 09 June 2021
GB MCL List v2.0 - version 2.0 of 20th October 2023
GB MCL List v3.0 - version 3.0 of 11th January 2024
GB MCL List v4.0 - version 4.0 of 2nd March 2024
GB MCL List v5.0 - version 5.0 of 26th June 2024
GB MCL List v6.0 - version 6.0 of 15th February 2025

Appendix F Preliminary Geotechnical Risk Register

Potential geotechnical hazards have been assessed in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HD 41/15 and CD 622. The following pages set out the identified geotechnical risks and hazards which are associated with the proposed development and establish the approach which is to be taken to manage the risks including the geotechnical input and analysis.

Geotechnical Hazard Identification – Following Ground Investigation

The preliminary Geotechnical Risk Register following Ground Investigation is set out in Table J.2.

The probability and impact of a hazard have been judged on a qualitative scale as set out in Table J.1. The degree of risk (R) is determined by combining tan assessment of the probability (P) of the hazard occurring with an assessment of the impact (I) of the hazard and associated mitigation it will require if it occurs (R = P x I).

Table J.1: Qualitative assessment of hazards and risks

P = probability		**I = impact**		**R = risk rating (P x I)**	
1	Very unlikely	1	Very low	1-4	None/negligible
2	Unlikely	2	Low	5-9	Minor
3	Plausible	3	Medium	10-14	Moderate
4	Likely	4	High	15-19	Substantial
5	Very likely	5	Very high	20-25	Severe

Table J.2: Preliminary geotechnical risk register

Hazard	Comments	Who is at risk	Consequence	Risk before mitigation			Actions required
				P	I	R	
Uncontrolled Made Ground (variable strength and compressibility).	There is Made Ground due to historical construction activity at the site. The Made Ground is up to 3.0m thick in the east due to the historical development and possible backfilled basements.	Container Foundations	Bearing capacity failure, settlement (total and differential).	3	4	12	Design foundations to found below Made Ground or on Made Ground which has been improved.
		Pavements.	Settlement (total and differential) of roads and pavements.	2	3	9	Design pavements using suitable geotechnical parameters and increase the sub-base and use geo-grids as appropriate.
		Services.	Settlement (differential), causing damage to services.	2	2	4	Ground levels are remaining at approximately current levels. Settlements are not anticipated to be significant.
		Construction staff, vehicles and plant operators.	Trafficking of the site in temporary conditions. Overturning of plant during construction.	2	2	4	Where soft spots encountered, over-excavation and replacement with suitable fill. Outline design of working platform to include geo-grid. Site inspection and watching brief by Contractor to review working platform frequently and regularly.
Sulphates present in the soils.	The Made Ground contains elevated sulphates.	Attack of buried concrete.	Damage to concrete and reduction in strength.	3	4	12	Classify concrete in accordance with BRE SD1 and design concrete accordingly.
Obstructions.	Obstructions have been proven by the investigation and there is a potential for additional obstructions to be present especially where backfilled basements are expected and heterogeneous Made Ground is present.	Construction staff, vehicles and plant operators.	Risk of collapse of excavation as obstructions are pulled out.	3	2	6	Allow for a breaker to be present during construction and remove obstructions where encountered during construction.
		Pavements	Hard spots in externals and pavements.	3	2	6	

Hazard	Comments	Who is at risk	Consequence	Risk before mitigation			Actions required
Variable lateral and vertical changes in ground conditions	The Made Ground soils vary laterally and vertically, both in composition and strength.	Container Foundations	Bearing capacity failure, settlement (total and differential).	3	4	12	Design foundations to found below Made Ground or on Made Ground which has been improved.
		Pavements.	Settlement (total and differential) of roads and pavements.	2	3	9	Design pavements using suitable geotechnical parameters and increase the sub-base and use geo-grids as appropriate.
		Services.	Settlement (differential), causing damage to services.	2	2	4	Ground levels are remaining at approximately current levels. Settlements are not anticipated to be significant.
		Construction staff, vehicles and plant operators.	Trafficking of the site in temporary conditions. Overturning of plant during construction.	2	2	4	Where soft spots encountered, over-excavation and replacement with suitable fill. Outline design of working platform to include geo-grid. Site inspection and watching brief by Contractor to review working platform frequently and regularly.
Existing below ground structures to remain (columns and foundations associated with the Mancunian Way).	The foundations supporting the Mancunian Way are present in the south and encroach into part of the development.	Adjacent road.	Foundation bearing capacity failure, settlement (differential).	3	4	12	Undertake geotechnical design to ensure the proposed structures do not place additional load on the existing structures / not result in settlement of the existing foundations. Design to be undertaken in accordance with EC7. Contractor to appoint competent Temporary Works Designer to design temporary works, in accordance with BS 5975:2008+A1:2011. Temporary Works Design to include recommendations for inspection of excavations. No person entry to unsupported excavations.

Hazard	Comments	Who is at risk	Consequence	Risk before mitigation			Actions required
Loose Made Ground, leading to difficulty with excavation and collapse of side walls.	The ground investigation has indicated that there is a potential for loose soils associated with the Made Ground.	Construction staff, vehicles and plant operators.	Risk of collapse of excavation.	3	4	12	Contractor to appoint competent Temporary Works Designer to design temporary works, in accordance with BS 5975:2008+A1:2011. Temporary Works Design to include recommendations for inspection of excavations. No person entry to unsupported excavations.
Earthworks – Settlement (due to Deep Made Ground).	Made Ground is present up to 3.0m bgl in the east and is heterogenous in its characteristics.	Roads and Pavements/ foundations	Settlement (total and differential), pavements/ foundations.	3	3	9	Undertake ground improvement (rolling dynamic compaction / dynamic compaction / over-excavation and replacement) to reduce settlements. Design pavements using suitable geotechnical parameters and increase the sub-base and use geo-grids as appropriate. Undertake suitable validation testing to confirm in area of deep Made Ground that it it's suitable to support foundations. Deeper foundation solutions may be required if the Made is found to be unsuitable to support foundations.
Unforeseen ground conditions - risk associated with limited data.	Ground investigation has been undertaken. However, additional information will be obtained during construction. Ground conditions are only defined at exploratory hole locations.	All aspects of the development		3	4	12	Designers to be contacted if conditions encountered are different to those identified during investigation. Regular inspections of excavations and earthworks for evidence of stability. Adequate investigation required to characterise the site and understand the potential risks.

Whilst the probability and impact of the hazard occurring can be reduced to a minimum by geotechnical design, the impact cannot be reduced below very low. The risk register will need to be up-dated, as necessary, to reflect design, additional information, data and experience as it is gained through the construction process.

Impacts of the design with regard to health and Safety considerations will need to be included by the designer at design stage.

Appendix G UXO Risk Assessment



Preliminary
Unexploded Ordnance (UXO)
Risk Assessment

Project Name	Oxford Road, Manchester
Client	Hydrock
Site Address	Oxford Road, Manchester, M1 7ED
Report Reference	PA19760-00
Date	3rd April 2024
Author	HJ
Quality Assurance	AT

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Assessment Objective

This preliminary unexploded ordnance (UXO) risk assessment is a qualitative screening exercise to assess the likely potential of encountering UXO at the Oxford Road, Manchester site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

Background

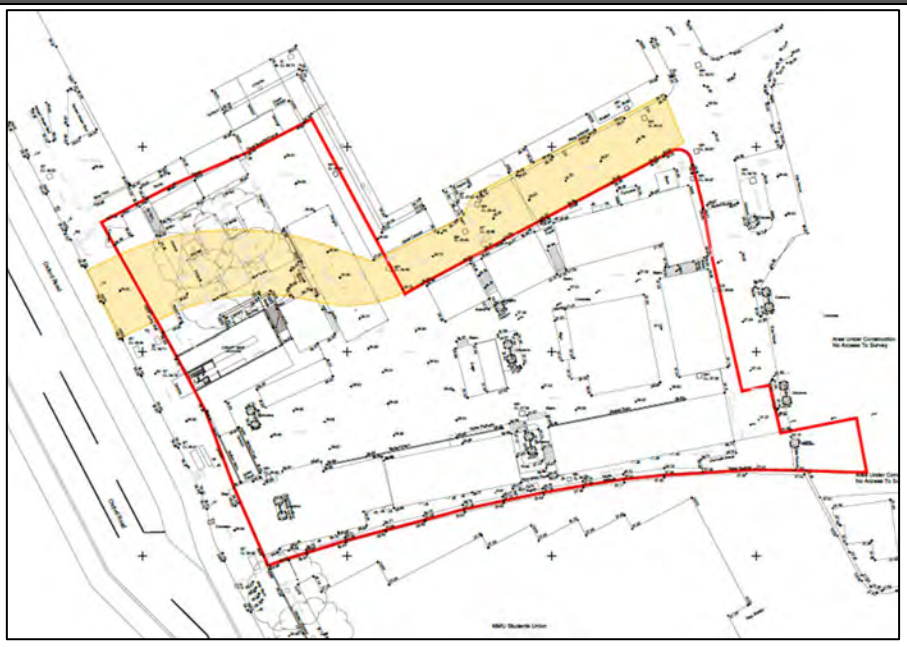
This assessment uses the sources of information available in-house to 1st Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1st Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1st Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.

Site Boundary



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Risk Assessment Considerations	
Site location and description/current use	The site is located within a densely urban area within the city of Manchester. According to recent aerial imagery, the site is currently occupied by an area of undeveloped land and a small portion of Mancunian Way. To the east and west of the site is the continuation of Mancunian Way. North of the site is a large structure, labelled the Manchester Technology Centre and south of the site is a large commercial structure. The site is approximately centred on the OS grid reference: **SJ 84301 97247.**
Are there any indicators of current/historical military activity on/close to the site?	No former military use can be identified within in-house records. No features such as WWII defensive positions, encampments or firing ranges are recorded to have been located at or in the immediate vicinity of the site. In addition, no information of ordnance being stored, produced, or disposed of within the proposed site boundary could be found. The closest recorded Heavy Anti-Aircraft (HAA) battery was situated approximately 3km north-west. The conditions in which unexploded anti-aircraft ordnance may have fallen unrecorded within the proposed site are analogous to that of German aerial delivered ordnance - see below for further information.
What was the pre- and post-WWII history of the site?	Pre-WWII OS mapping shows that the site was occupied by a number of residential structures and their associated gardens with a portion of a school occupying the eastern boundary of the site. Bordering the north, east and west of the site were Gray Street, York Street and Oxford Road, respectively. To the south of the site were further residential structures and their gardens as well as more of the school building which crosses over the southern boundary of the site. Post-WWII OS mapping indicates that the west of the site remained occupied by residential structures and the east of the site was occupied by undeveloped land and a portion of a textile machinery works. The area to the north and west of the site remained the same. Several structures to the west of the site are shown on this mapping to have been cleared and the south of the site was bordered by further residential properties and the continuation of the textile machine works.
Was the area subject to bombing during WWII?	During WWII, the site was situated within the County Borough of Manchester, which sustained an overall low density of bombing according to Home Office statistics, with an average of 27.1 items of ordnance recorded per 1,000 acres. This included 712 HE (high explosive) bombs, 18 parachute mines, 7 oil bombs and 1 V-1 pilotless aircraft. A Bomb Map of Manchester indicates bombing incidents within proximity to the site, the closest of which are a fire bomb plotted approximately 50m west of the site and a high explosive bomb plotted approximately 60m east of the site.
Is there any evidence of bomb damage on/close to the site?	Manchester Bomb mapping indicates that structures in the north and east of the site were damaged during the war. High-resolution WWII-era aerial photography will need to be analysed in order to fully assess the wartime conditions of the site.
To what degree would the site have been subject to access?	Once damage had been caused to some of the structures on site and the structures within close proximity to the site, the remaining structures on site are not believed to have been subject to much frequent access and observation.
To what degree has the site been developed post-WWII?	There has been significant development on site post-WWII, including the removal of the residential and commercial structures and the construction of Mancunian Way, which currently occupies the southern portion of the site.

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What is the nature and extent of the intrusive works proposed?	The scope of works across the site were not available at the time of writing.

Summary and Conclusions

During WWII, the site was situated within the County Borough of Manchester, which sustained an overall low density of bombing, with an average of 27.1 items of ordnance recorded per 1,000 acres.

The closest recorded bombing incidents to the site are a fire bomb, plotted approximately 50m west of the site and a high explosive bomb, plotted approximately 60m east of the site. Damage is recorded to some of the structures on site and to several structures immediately north of the site and structures to the east of the site.

After damage had been caused to the structures on site and within close proximity to the site, it is believed that the frequency of access to the site is believed to have significantly decreased, increasing the likelihood that any evidence of UXO could have been missed and gone unreported.

Recommendations

Given the findings of this preliminary report, it is recommended that **further research** be undertaken in the form of a **Detailed UXO Risk Assessment**. Additional information is required to confirm the exact wartime history of the site of proposed works. This would involve the analysis of additional bombing information such as local bomb mapping, written incident records and high-resolution WWII-era aerial photography.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1st Line Defence.

This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

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Front cover image credit: London County Council Bomb Damage Mapping (London Metropolitan Archives)



Detailed
Unexploded Ordnance (UXO)
Risk Assessment

Project Name	Land off Oxford Road, Manchester
Client	Hydrock Consultants Limited
Site Address	Oxford Road, Manchester, M1 7LD
Report Reference	DA19760-00
Date	17/04/2024
Author	JBM
Quality Assurance	PB
Final Check	ERG

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Executive Summary

Site Location and Description

The site is located in central Manchester. Recent aerial and ground-level photography indicates that the site comprises hard-standing car parking and access areas, partially underneath the Mancunian Way, which was until recently occupied by a temporary pop-up shopping centre. It is bordered by Oxford Road to the west, and the elevated A57(M) Ring Road runs over the southern half of the site.

The site is approximately centred on the OS grid reference: **SJ 84301 97247**.

Proposed Works

The proposed development comprises a street food market comprised of several shipping container units around the site peripheries, with a central seating area. It is understood that no permanent buildings are proposed for the site, with all structures comprising shipping container units, and that the entire site will be surfaced by hardstanding. Works at this stage are believed to comprise five window sampler boreholes excavated to 5m bgl.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by the Chester Formation - sedimentary bedrock comprising sandstone formed between 250 and 247.1 million years ago during the Triassic period. Superficial deposits comprise Till, Devensian – diamicton formed between 116 and 11.8 thousand years ago during the Quaternary period.

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report – in this instance, the depth of the boreholes. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is an overall **Medium Risk** from German and anti-aircraft unexploded ordnance in the eastern section the site of proposed works, and an overall **Low Risk** in the western section. There is an assessed **Negligible Risk** from Allied unexploded ordnance.

The Risk from German Air-Delivered UXO

- During WWII, the site was located within the County Borough of Manchester, which sustained an overall low density of bombing according to official Home Office bombing statistics, with an average of 27.1 items of ordnance recorded per 1,000 acres.
- In Manchester bomb and damage mapping, a high explosive (HE) bomb is plotted approximately 40m east of the site boundary; a 'fire bomb' is plotted approximately 20m west of the site boundary, with a second immediately west of this bomb. Further incidents are recorded in the site's wider surrounds, including at the southern end of All Saints Church, approximately 130m south-west of the site boundary, although it should be noted that this resource is not comprehensive, covering the years up to 1941 only.
- In the aforementioned bomb and damage mapping, multiple structures in the northern and eastern areas of the site are recorded as partially damaged structures, with two buildings approximately 35m east recorded as 35m demolished. Manchester Bomb Damage Cards record multiple structures within and adjacent to the site boundary as being *so badly damaged that [they are] not worth repairing*, with other buildings nearby as *seriously damaged*.
- In WWII-era and post-WWII aerial photography of the site, a large clearance occupies the eastern section of the site, with more clearance immediately adjacent to the north and east. Damage to the western section of the site appears to be relatively minor, however.
- At the start of WWII, the site existed within a highly urbanised area of Manchester and comprised residential and commercial properties, providing ground conditions favourable to the detection of UXO, and presumed regular/frequent access. However, following the multiple bombing incidents in the local area, the resulting ruins and rubble in the areas affected

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(notably the eastern section of the site) would likely have created conditions unconducive to the detection of UXO, the entry hole of which could be as small as 20cm.

- In summary, the risk of UXO contamination is not considered homogenous across the whole site. Available historical records, maps and photography indicate that the western half of the site survived the war broadly intact, with no serious damage, clearance, bomb strikes or areas of 'ruin' present. It is thought likely that levels of access and checks would have remained high in this area, and ground conditions are likely to have been such that evidence of UXB entry holes should have been relatively easy to observe and report. This half of the site is considered to be at a **Low Risk** of UXO contamination (see Risk Map, **Annex O**). A large area of damage/clearance resulting from bombing raids was noted/recorded in the eastern section of the site. Within this area, it is much less likely that evidence of UXO would have been easily observed – UXB entry holes can be readily obscured by debris and rubble, and the area is not likely to have been accessed/checked (this was one of the most common reasons for UXBs going unnoticed during the war). This section of the site has been assessed as **Medium Risk** A buffer zone has been added around the damaged areas to account for the possibility of J-Curve.

The Risk from Allied UXO

- No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA.
- The closest WWII-era HAA battery was located approximately 2.95km north-west of the site boundary, in the vicinity of Lower Broughton. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

Post-WWII Redevelopment

- Comparison of historical and recent aerial imagery indicates that several of the structures which stood on site during WWII were cleared during WWII, with the remainder cleared later in the 20th century. The Mancunian Way overpass, and the areas of hard-standing underneath and immediately adjacent to it, are post-WWII developments.
- The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Land off Oxford Road, Manchester site:

Activity	Recommended Risk Mitigation Measure
All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.
Open Excavations (trial pits, service pits, bulk excavations, strip foundations etc.) **(Medium Risk Areas Only)**	• UXO Specialist On-site Support
Boreholes and Piled Foundations **(Medium Risk Areas Only)**	• Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

Note – proactive on-site UXO support/survey should not be necessary for any works taking place at the location of and down to the depths of significantly worked post-war made ground/post-war fill.

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UXO Risk Map and Recommended Risk Mitigation Measures



For indicative purposes – not to scale.
Please note that this assessed risk map may not take into account all post-war redevelopment/excavations on site.

Risk Zone	Activity	Recommended Risk Mitigation Measure
Low	All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.
Medium	Open Excavations (trial pits, service pits, bulk excavations, strip foundations etc.)	• UXO Specialist On-site Support
	Boreholes and Piled Foundations	• Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

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Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded

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Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Land off Oxford Road, Manchester
Client: Hydrock Consultants Limited

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Hydrock Consultants Limited to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at the Land off Oxford Road, Manchester site.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

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2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the Oxford Road site. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and the Manchester Central Library.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Hydrock Consultants Limited
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

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3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

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4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII air bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

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5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams' judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

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6. The Site

6.1. Site Location

The site is located in central Manchester. It is bordered by Oxford Road to the west, and the elevated A57(M) Ring Road runs over the southern half of the site.

The site is approximately centred on the OS grid reference: **SJ 84301 97247**.

Site location maps are presented in **Annex A**.

6.2. Site Description

Recent aerial and ground-level photography indicates that the site comprises hard-standing car parking and access areas, partially underneath the Mancunian Way, which was until recently occupied by a temporary pop-up shopping centre.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

The proposed development comprises a street food market comprised of several shipping container units around the site peripheries, with a central seating area. It is understood that no permanent buildings are proposed for the site, with all structures comprising shipping container units, and that the entire site will be surfaced by hardstanding. Works at this stage are believed to comprise five window sampler boreholes excavated to 5m bgl.

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8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site to be underlain by the Chester Formation - sedimentary bedrock comprising sandstone formed between 250 and 247.1 million years ago during the Triassic period. Superficial deposits comprise Till, Devensian – diamicton formed between 116 and 11.8 thousand years ago during the Quaternary period.

8.2. Site-Specific Geology

Borehole data has been provided by Hydrock Consultants Limited. See below for a brief example description of the geology encountered.

Example Borehole	
Depth (m)	Description
0-0.05m	MADE GROUND: TARMACADAM.
0.05m – 0.3m	MADE GROUND: Brown fine to coarse silty sand with some fine to coarse sub rounded to angular gravel of brick, tarmacadam, ash, clinker, cement, concrete, slate and other mixed lithology.
0.3m – 1m	Possible Made Ground: Firm to stiff light brown sandy clay with some fine to coarse sub rounded to rounded gravel of mixed lithology.
1m – 3.5m	Medium dense brown fine to coarse silty clayey SAND & GRAVEL. Gravel is fine to coarse, sub rounded to rounded of mixed lithology.
3.5m – 5.45m	Stiff brown CLAY with some fine to coarse sub rounded to rounded gravel of mixed lithology.

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9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D**. See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	Scale	Description
1932	1:2,500	In this pre-WWII OS mapping, the site is indicated to comprise various properties and structures including a *School*, part of *Fairfield Street*, and part of *York Street*. It is bound to the north by *Gray Street*, to the east by *St Augustine's R.C. Church* and a *School*, as well as properties adjacent to *Stafford Street*, to the south by further properties and structures, and to the west by *Oxford Road*.

Post-WWII		
Date	Scale	Description
1948-1950	1:2,500	In this post-WWII OS mapping, the site is indicated to comprise residential and commercial properties including a *Bank* and a *Textile Machinery Works*, part of *Fairfield Street* and *York Street*, and areas of clearance. The site is adjacent to further clearance areas to the east, with more visible to the north.

9.3. Pre-WWII Photography of the Site

Pre-WWII aerial photography has been obtained from the Aerofilms collection available from Britain From Above. This imagery provides a view of the site in 1937 (see **Annex E**). See below for a description:

Pre-WWII Aerial Photography	
Date/Title	Description
1937	In this pre-WWII aerial photography, the site is indicated to comprise various buildings and structures. The site exists within a highly developed area, with commercial properties, terraced properties and churches visible in the site's surrounds.

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10. Introduction to German Air Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German air delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Air Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German air delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Appendices i-iii**.

Generic Types of WWII German Air Delivered Ordnance		
Type	**Frequency**	**Likelihood of Detection**
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see **Annex F**). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present–day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

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10.3. Failure Rate of German Air Delivered Ordnance

It has been estimated that 10% of WWII German air delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex G**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Principle

J-curve is the term used to describe the characteristic curve commonly followed by an air delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex F**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

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10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters should be used:

- WWII geology – Chester Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report – in this instance, the depth of the boreholes. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the flying bomb or pilotless aircraft, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in Manchester were generally too far to be considered for V-weapon strikes by the Luftwaffe, although a small number were launched from aircraft off the east coast of England. The risk from V-weapons is therefore considered negligible and will not be further addressed in this report.

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11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI bomb plot map of London/ a WWI map of air raids and naval bombardments across the UK was consulted, see **Annex H**. This source shows that no incidents were recorded in the vicinity of Manchester.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the County Borough of Manchester

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the County Borough of Manchester, which sustained an overall low density of bombing, as represented by bomb density data figures and maps, see Section 11.3**.** Much of the bombing targeted Manchester's substantial industrial facilities, which in the site's local area included the Gaythorn Gas Works, designated as a strategic target in Luftwaffe target mapping which is presented in **Annex I**, approximately 420m south-west of the site boundary.

Records of bombing incidents in the civilian areas of the district were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

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11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German air delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the County Borough of Manchester between 1940 and 1945.

Record of German Ordnance Dropped on the County Borough of Manchester		
Area Acreage		27,255
Weapons	High Explosive bombs (all types)	712
	Parachute mines	18
	Oil bombs	7
	Phosphorus bombs	0
	Fire pots	0
	Pilotless aircraft (V-1)	1
	Long range rocket bombs (V-2)	0
Total		738
Number of Items per 1,000 acres		27.1
Source: Home Office Statistics This table does not include UXO found during or after WWII.		

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Manchester City Architects Department Bomb Plot and Damage Map

During WWII, the City Architects Department of Manchester Council produced a bomb plot and damage map, which was acquired from the University of Manchester Library. This map shows the buildings in Manchester that were recorded to have been struck by bombing, the types of bombs, and the damage sustained by the building, though as the map only records incidents up to 1941 it is not necessarily comprehensive. The site area was checked on the map and the bomb incidents and damage caused on and in the immediate vicinity of the site are discussed below and presented in **Annex J**.

Manchester City Architects Department Bomb Plot and Damage Map	
Date Range	Comments
1940-1941	A HE bomb is plotted approximately 40m east of the site boundary, falling on 23/12/40. A 'fire bomb' is plotted approximately 20m west of the site boundary, with a second adjacent to this bomb, both falling on 22-24/12/40. Further incidents are recorded in the site's wider surrounds, including the southern end of All Saints Church, approximately 130m south-west of the site boundary. Multiple buildings on site are recorded to have been *partially damaged*. Two buildings approximately 35m east of the site boundary are recorded as *demolished*.

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11.5. Manchester Bomb Damage Cards

Bomb damage cards, compiled by the City Architects Department of Manchester Council and recording the damage caused to properties in Manchester by bombing, were obtained from Manchester Central Library. These include details of the damage caused, and damage classified with an alphabetic system, with *'A'* being the most severe. A transcript of the associated cards of bomb damage incidents in the site area is presented in the table below. Only those recorded incidents on or in close proximity to the site have been highlighted. Imagery of this record is presented in **Annex K**.

Manchester Bomb Damage Cards			
Date	Damage Classification	Record Transcription	Comments
22nd/23rd December 1940	D	Blast, HE. 91 + 93 Oxford Road, lock-up shop. Slight damage to asphalt from incendiary bombs, inside wall slightly damaged.	Row of properties partially within and immediately adjacent to the site's southern boundary. Corresponds to the purple/red area immediately south of the site boundary in **Annex L**.
	E	Blast, HE. 95 Oxford Road, lock-up shop. Plate glass windows broken.	
	D	Blast, HE. 97 Oxford Road, lock-up showroom. Plate glass windows and roof light damage.	
	C	Blast, HE. 99 Oxford Road, lock-up shop. Slight roof damage, interior walls cracked. Slight damage to outside walls.	
	C	Blast, HE. All Saints Church, Oxford Road. Vestry destroyed. Floors damaged by direct hit	Approximately 110m south-west of the site boundary. All Saints Church is highlighted in red at the bottom of the map in **Annex L**.
	C	HE. Clarendon Hotel, 1 Clarendon Street. Roof: Dislodged slates. Walls: Badly bulged rear elevation. Broken and loose brickwork of south elevation of store room. Bulged south elevation.	Approximately 30m west of the site boundary. The Clarendon Hotel is highlighted in red to the west of the site boundary in **Annex L**.
20th October 1941	Nos. 2-8 Sidney Street: Category D damage. Nos. 8-22 Sidney Street: Category B damage.		The western end of Sidney Street is immediately adjacent to the south-eastern corner of the site boundary.
9th April 1942 (date inspected)	**Nos. 66-76, No. 91 York Street: Category B damage.**		**The eastern edge of the site includes part of York Street. Corresponds to the blue area partially within, and immediately to the north of, the site boundary in Annex L.**
	Nos. 1-15, No. 10 Cooke Street: Category B damage.		The western end of Cooke Street is approximately m north of the site boundary.
	Nos. 5, 9-25, 31, 10-22 Stafford Street: Category B damage.		The western end of Stafford Street is immediately adjacent to the site boundary, to the east. Corresponds approximately to the blue area immediately to the east of the site boundary in **Annex L**.

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11.6. Manchester Emergency Committee Log Book of Bombing Incidents, 22nd-24th December 1940

Graham Pythian's 'Blitz Britain: Manchester and Salford', which chronicles the wartime history of these areas, includes a transcript of the Manchester Emergency Committee's Log Book of Bombing Incidents for the 'Christmas Blitz' of 22nd to 24th December 1940. References to incidents in proximity to the site are described in the table below.

Manchester Emergency Committee Log Book of Bombing Incidents, 22nd-24th December 1940		
Date Range	Transcript	Comments
22nd December 1940	49: Gray Street & Oxford Road. Incendiary bomb at 8.55pm, 22nd. Extinguished by wardens. Incident closed. No damage.	The junction of Gray Street and Oxford Road is immediately adjacent to the north-west corner of the site.
	73: Sidney Street, Chorlton-on-Medlock Post Office. Incendiary bomb at 8.55pm, 22nd. Post office damaged by fire. Fire extinguished by fire brigade and incident closed.	The C-on-M post office was approximately 100m east of the site boundary.
	83: Taylor Street, off Oxford Road. Incendiary bomb at 8.55pm, 22nd. Extinguished and incident closed at once.	Approximately 150m north-west of the site boundary.
23rd December 1940	Grosvenor Street & Brook Street. Incendiary bomb at 2.05am, 23rd. Fell on gutter of shop 62 Brook Street. Extinguished and incident closed at 9.30am.	Approximately 195m south-east of the site boundary.

11.7. Manchester Air Raid Damage Files, 1942

Air Raid Damage Files were obtained from the National Archives, recording bombing incidents resulting in damage across Manchester in 1942. This record set was checked for references to incidents in the immediate vicinity of the site, but no such incidents could be identified.

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11.8. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England), and the Aerofilms Collection available from Britain from Above. This photography provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (see **Annex M**).

WWII-Era Aerial Photography	
Date/Title	Description
30th May 1944	In this WWII-era aerial photography of relatively low quality, the site is indicated to comprise an area of development and part of an adjacent road, within an urbanised area. Various areas of clearance and suspected bomb damage are visible immediately adjacent to the site, and in its wider surrounds, which are highlighted in **Annex M2**.
7th May 1946	In this post-WWII aerial photography, in which the site area is only partially covered, the site is indicated to comprise areas of development including terraced properties in the north and two larger buildings to the south, as well as areas of clearance to the east. Areas of clearance in the local area are highlighted in **Annex M4**.
14th April 1949	In this post-WWII oblique aerial photography, the site is indicated to comprise an area of development including buildings of various sizes and shapes; areas of clearance; and an adjacent road. Areas of clearance and suspected bomb damage in the local area are highlighted in **Annex M6**. In the foreground to the left, the remains of the All Saints Church is visible. Ground-level photography of the bomb-damaged church, taken in 1949, is presented in **Annex M7**.

11.9. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.10. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) no longer processes commercial requests for information. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, Hydrock Consultants Limited will be advised.

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11.11. Evaluation of German Air Delivered UXO Records

German Air Delivered UXO Records Summary	
Factors	**Conclusion**
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.*	During WWII the site was located within the County Borough of Manchester, which sustained an overall low density of bombing according to official Home Office bombing statistics, with an average of 27.1 items of ordnance recorded per 1,000 acres. In Manchester bomb and damage mapping, a HE bomb is plotted approximately 40m east of the site boundary; a 'fire bomb' is plotted approximately 20m west of the site boundary, with a second immediately west of this bomb. Further incidents are recorded in the site's wider surrounds, including at the southern end of All Saints Church, approximately 130m south-west of the site boundary, although it should be noted that this resource is not comprehensive, covering the years up to 1941 only.
Damage *If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	In the aforementioned bomb and damage mapping, multiple structures in the northern and eastern areas of the site are recorded as *partially damaged structures*, with two buildings approximately 35m east recorded as 35m *demolished*. Manchester Bomb Damage Cards record multiple structures within and adjacent to the site boundary as being *so badly damaged that [they are] not worth repairing*, with other buildings nearby as *seriously damaged*. In WWII-era and post-WWII aerial photography of the site, a large clearance area occupies the eastern section of the site, with more clearance immediately adjacent to the north and east. Damage to the western section of the site appears to be relatively minor, however.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	During WWII, the site existed within a highly urbanised area of Manchester and comprised residential and commercial properties, providing ground conditions favourable to the detection of UXO. However, following the multiple bombing incidents in the local area resulting in severe damage to several of the buildings on site and many more nearby, the resulting ruins and rubble would have created conditions unconducive to the detection of UXO, the entry hole of which could be as small as 20cm.
Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post- raid checks for evidence of UXO.*	The site's location was also likely to have provided a good level of access at the outbreak of WWII, although local access is likely to have declined significantly as a result of the nearby bombing incidents, followed by periods of evacuation and clearance of debris, reducing the likelihood of any evidence of UXO being observed and recorded.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.

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Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

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12. Introduction to Allied Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.3. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	Description			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LAA Ammunition	Gun type	Calibre	Shell Weight	Shell Dimensions
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	Rockets were commonly designed to destroy heavily armoured military vehicles (anti-tank weapon). The device contains an explosive head (warhead) that can be accelerated using internal propellants to an intended target. Anti-aircraft rocket batteries were also utilised as part of air defence measures.			

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding air delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Air Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Appendix iv**.

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13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Allied UXO Records Summary	
Sources of Allied UXO Contamination	Conclusion
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 2.95km north-west of the site, in the vicinity of Lower Broughton. Despite this distance the maximum effective range of an AA projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are generally analogous to those regarding German air delivered ordnance.
Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	No evidence of training or firing ranges could be found within the site or surrounding area.

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Defensive Minefields *Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields *Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.*	The site was not situated within the perimeters or vicinity of a military airfield.

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14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German air delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, pre-WWII aerial photography of the site, Luftwaffe reconnaissance imagery, Manchester bomb plot and damage mapping, Manchester bomb damage cards, the Manchester Emergency Committee Log Book of Bombing Incidents, 22nd-24th December 1940, Manchester Air Raid Damage Files, and WWII-era and post-WWII aerial photography of the site The record set is of generally reasonable quality, with a relatively limited range of sources available for consultation, although the quantity and date range of aerial photography available was beneficial.
German Air-Delivered Ordnance	• During WWII, the site was located within the County Borough of Manchester, which sustained an overall low density of bombing according to official Home Office bombing statistics, with an average of 27.1 items of ordnance recorded per 1,000 acres. • In Manchester bomb and damage mapping, a high explosive (HE) bomb is plotted approximately 40m east of the site boundary; a 'fire bomb' is plotted approximately 20m west of the site boundary, with a second immediately west of this bomb. Further incidents are recorded in the site's wider surrounds, including at the southern end of All Saints Church, approximately 130m south-west of the site boundary, although it should be noted that this resource is not comprehensive, covering the years up to 1941 only. • In the aforementioned bomb and damage mapping, multiple structures in the northern and eastern areas of the site are recorded as partially damaged structures, with two buildings approximately 35m east recorded as 35m demolished. Manchester Bomb Damage Cards record multiple structures within and adjacent to the site boundary as being *so badly damaged that [they are] not worth repairing*, with other buildings nearby as *seriously damaged*. • In WWII-era and post-WWII aerial photography of the site, a large clearance occupies the eastern section of the site, with more clearance immediately adjacent to the north and east. Damage to the western section of the site appears to be relatively minor, however. • At the start of WWII, the site existed within a highly urbanised area of Manchester and comprised residential and commercial properties, providing ground conditions favourable to the detection of UXO, and presumed regular/frequent access. However, following the multiple bombing incidents in the local area, the resulting ruins and rubble in the areas affected (notably the eastern section of the site) would likely have created conditions unconducive to the detection of UXO, the entry hole of which could be as small as 20cm. • In summary, the risk of UXO contamination is not considered homogenous across the whole site. Available historical records, maps and photography indicate that the western half of the site survived the war broadly intact, with no serious damage, clearance, bomb strikes or areas of 'ruin' present. It is thought likely that levels of access and checks would have remained high in this area, and ground conditions are likely to have been such that evidence of UXB entry holes should have been relatively easy to observe and report. This half of the site is considered to be at a **Low Risk** of UXO contamination (see Risk Map, **Annex O**). A large area of damage/clearance resulting from bombing raids was noted/recorded in the eastern section of the site. Within this area, it is much less likely that evidence of UXO would have been easily observed – UXB entry holes can be readily obscured by debris and rubble, and the area is not likely to have been accessed/checked (this was one of the most common reasons for UXBs going unnoticed during the war). This section of the site has been assessed as **Medium Risk**. A buffer zone has been added around the damaged areas to account for the possibility of J-Curve.

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Allied Ordnance	• No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. • The closest WWII-era HAA battery was located approximately 2.95km north-west of the site boundary, in the vicinity of Lower Broughton. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

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15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

Comparison of historical and recent aerial imagery indicates that several of the structures which stood on site during WWII were cleared during WWII, with the remainder cleared later in the 20th century. The Mancunian Way overpass, and the areas of hard-standing underneath and immediately adjacent to it, are post-WWII developments.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed works would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Air Delivered Ordnance

Since an air delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

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17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Air Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

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18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production.

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

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19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall **Medium Risk** from German and anti-aircraft unexploded ordnance in the eastern section of the site of proposed works, and an overall **Low Risk** in the western section. There is an assessed **Negligible Risk** from Allied unexploded ordnance.

Eastern Section of Site:

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs			✓	
German 1kg Incendiary Bombs			✓	
Anti-Aircraft Artillery Projectiles			✓	
Allied Land Service and Small Arms Ammunition	✓			

Western Section of Site:

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Land Service and Small Arms Ammunition	✓			

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20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at the Oxford Road site:

Recommended Risk Mitigation Measures	
Activity	**Recommended Risk Mitigation Measure**
All Works	• **UXO Risk Management Plan** It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. • **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.
Open Excavations (trial pits, service pits, bulk excavations, strip foundations etc.) **(Medium Risk Area Only)**	• **Unexploded Ordnance (UXO) Specialist Presence on Site to support open excavations** When on site the role of the UXO Specialist would include: • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Boreholes and Piled Foundations **(Medium Risk Area Only)**	• **Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth:** 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **17th April 2024**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

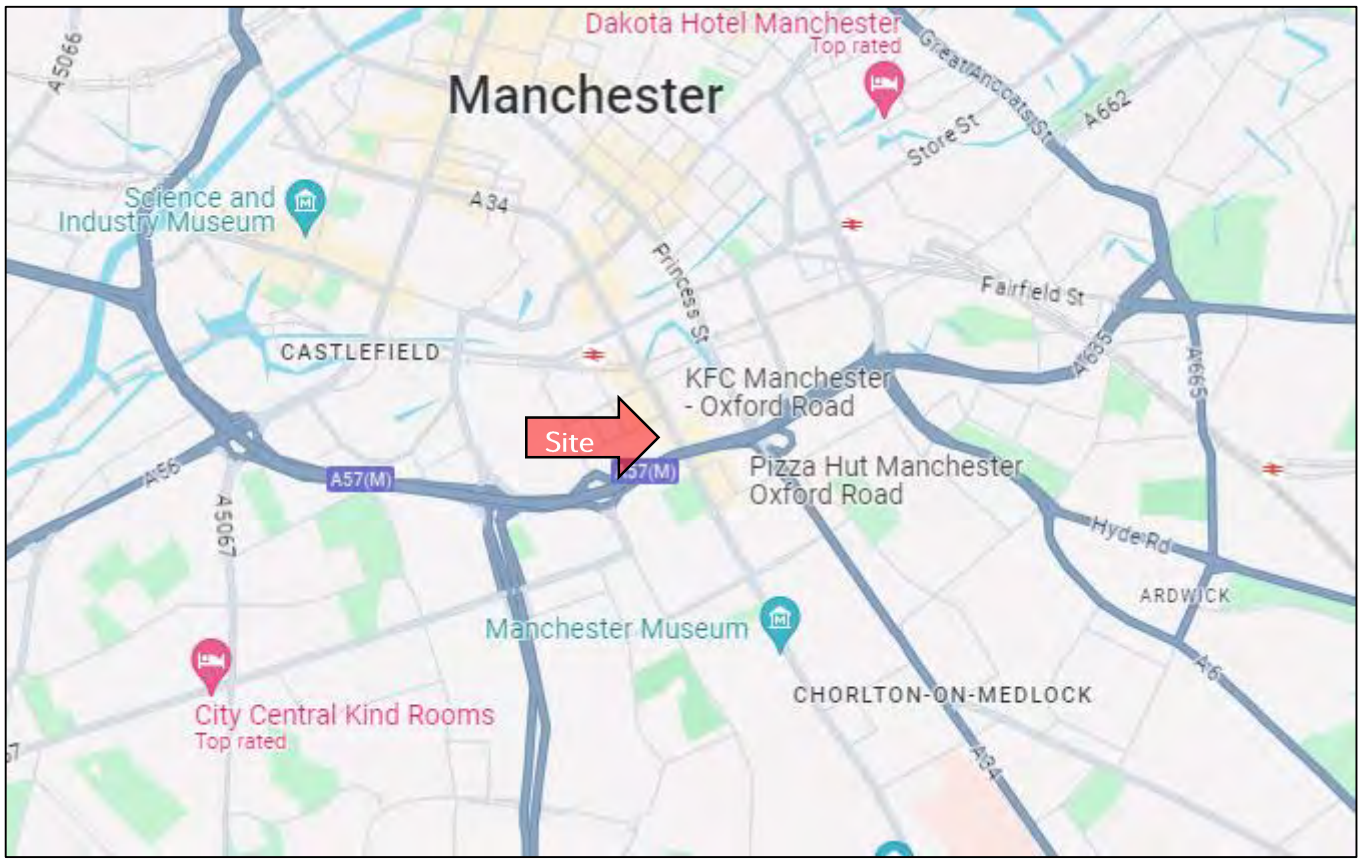
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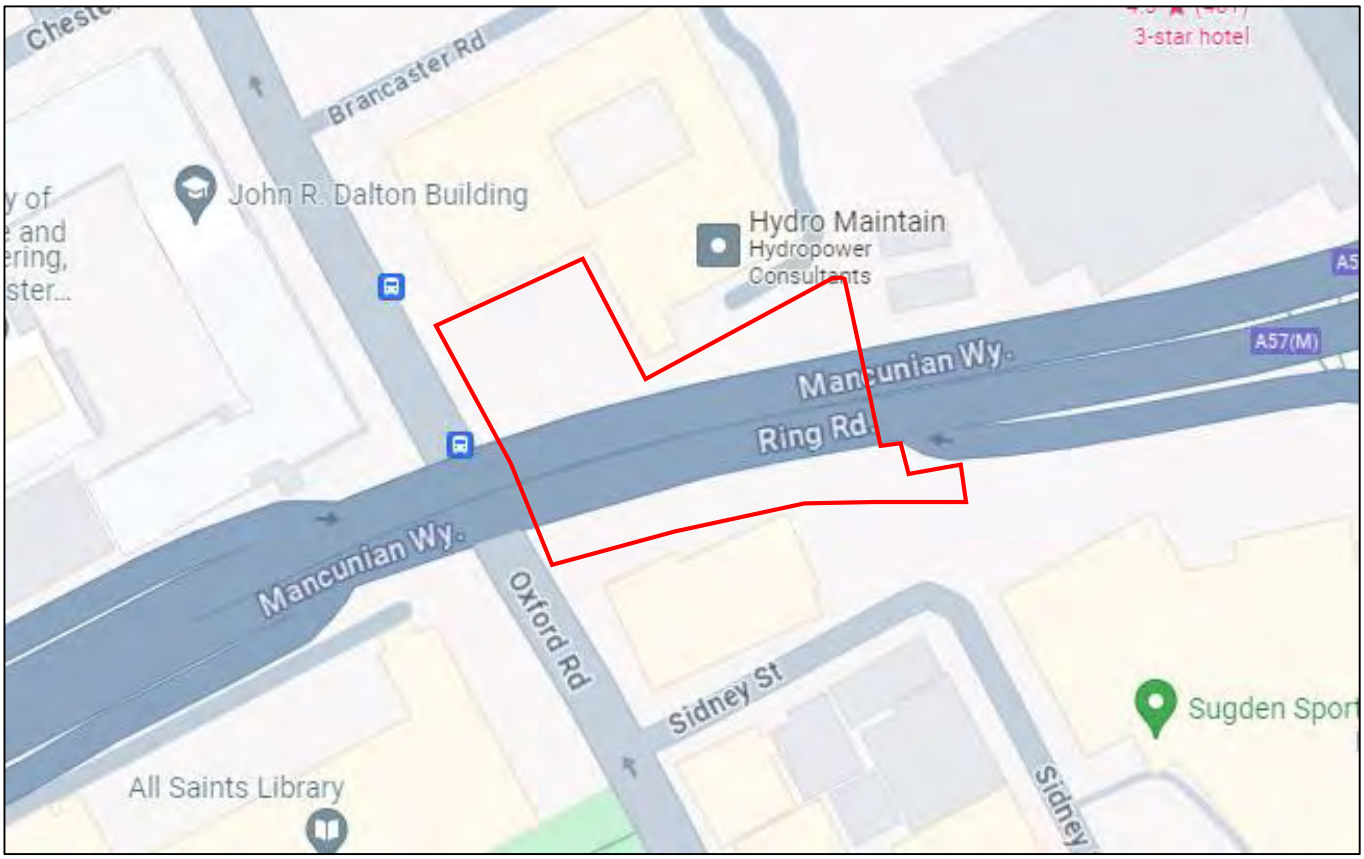
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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Google Maps

Approximate site boundary

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Recent Aerial Photography

Annex: B



Approximate site boundary

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Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Google Earth

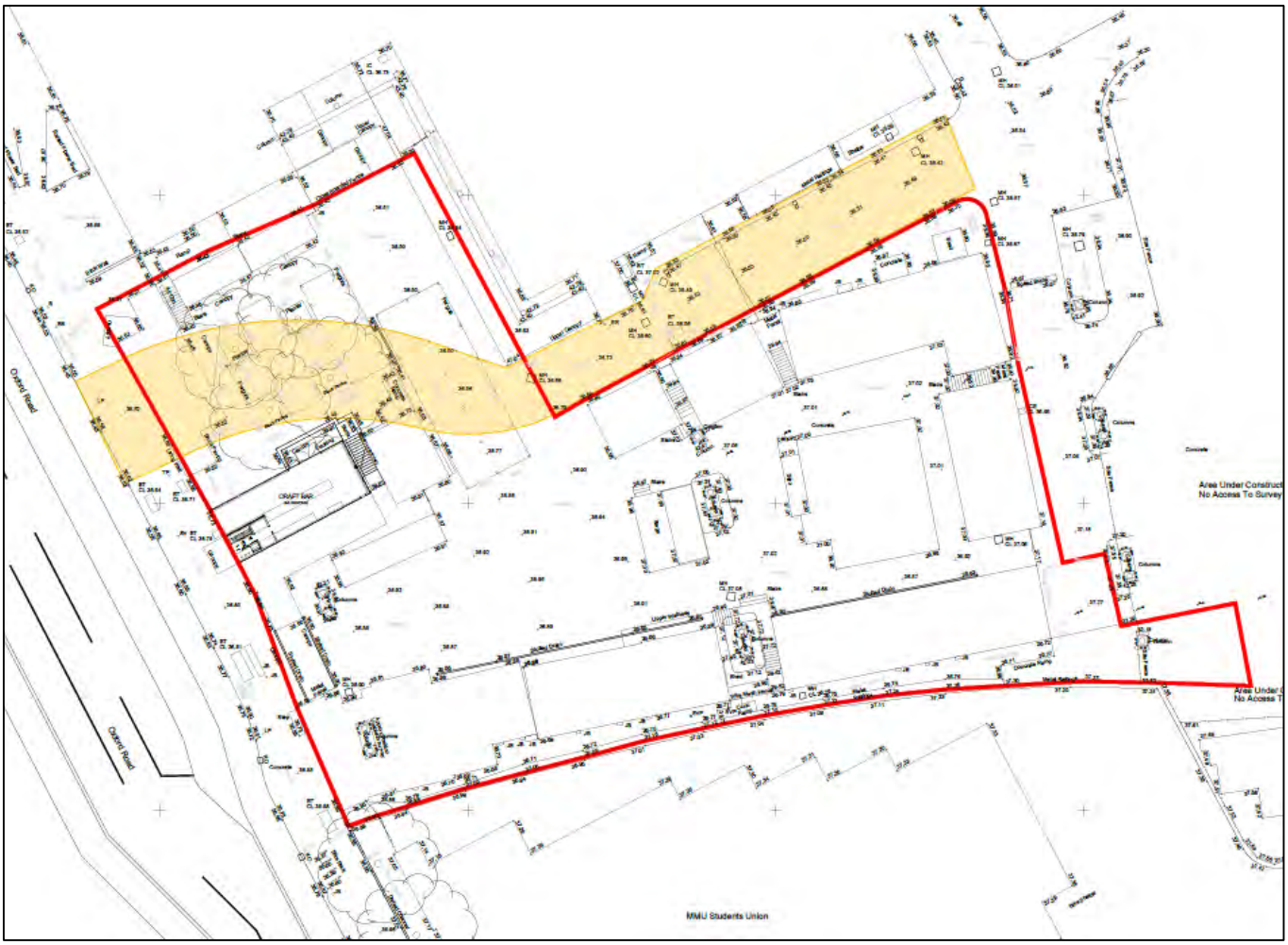
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Client Provided Site Plan

Annex: C



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Tel: +44 (0)1992 245 020

Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Hydrock Consultants Limited

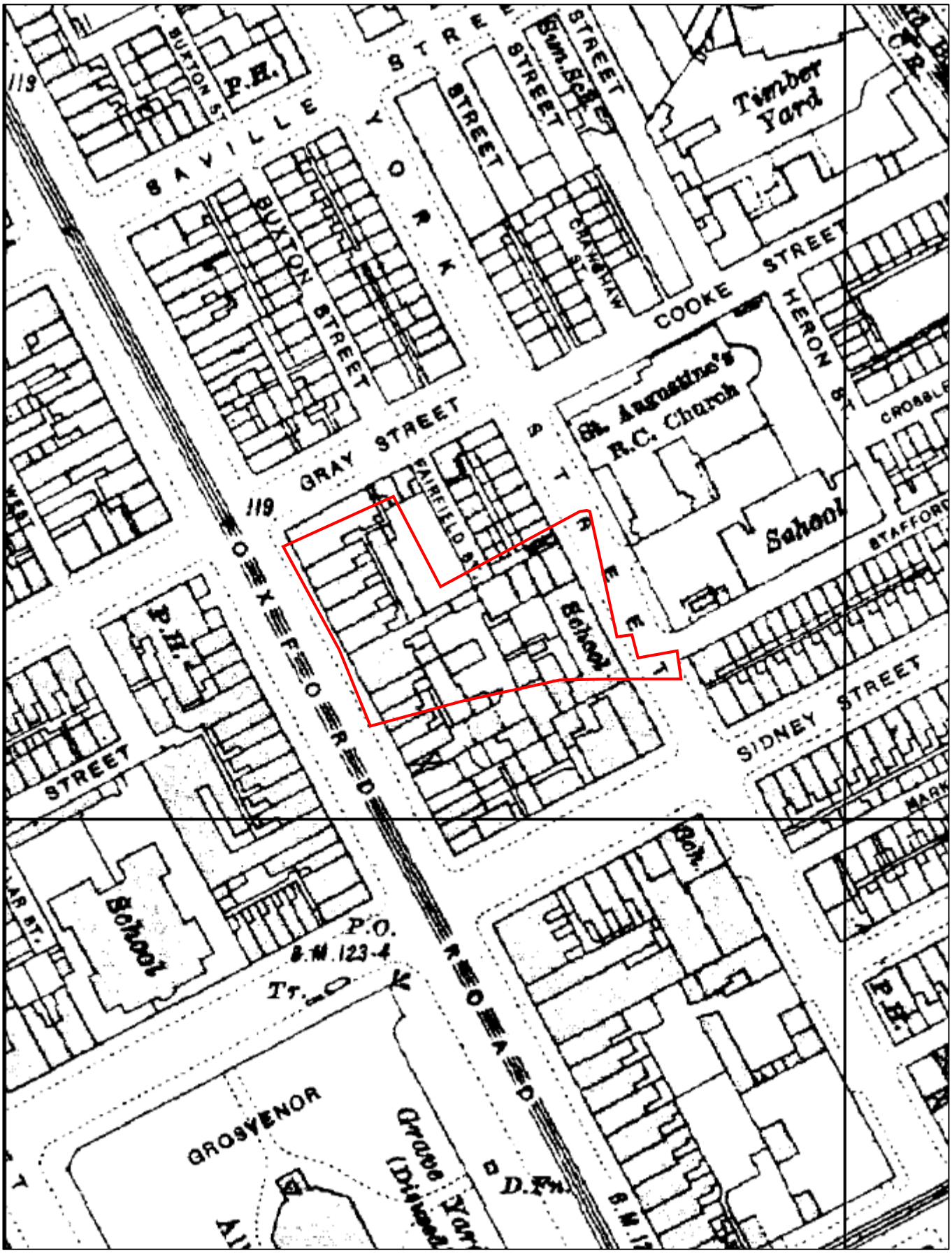
Approximate site boundary

N

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Pre-WWII Historical Map, 1932

Annex: D1



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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Landmark Maps

Approximate site boundary

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Post-WWII Historical Map, 1948-1950

Annex: D2



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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Landmark Maps

Approximate site boundary

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Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

Ref: DA19760-00

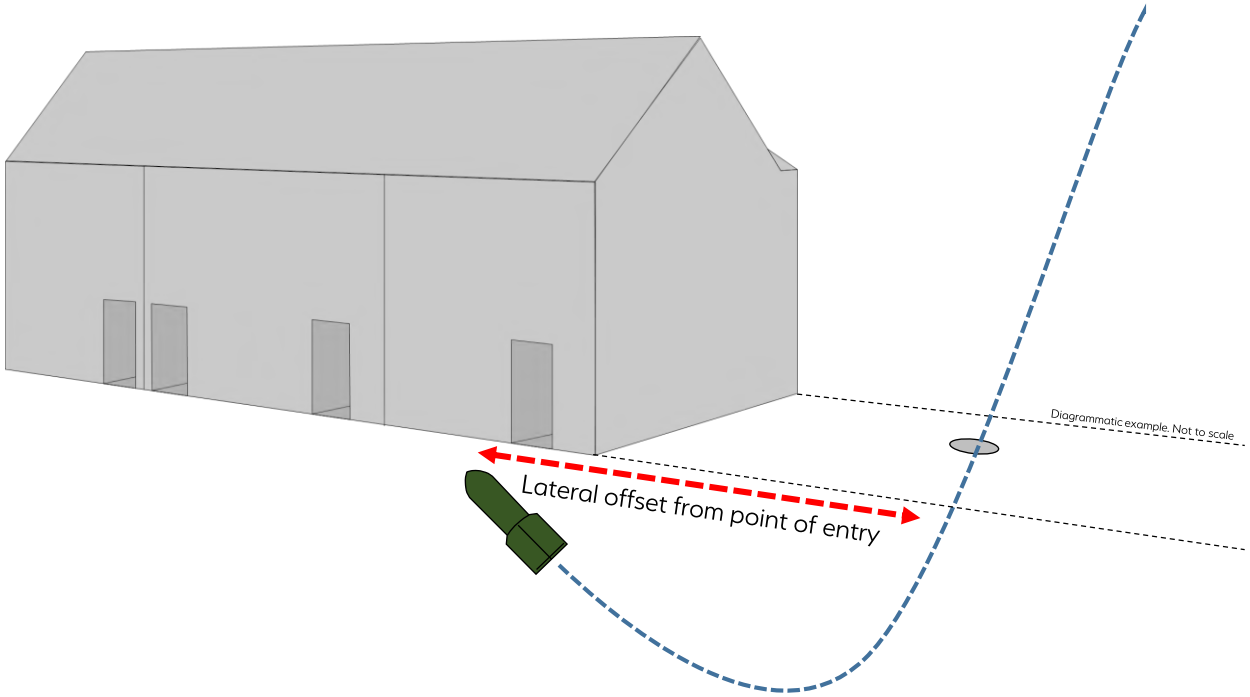
Source: Vision of Britain

Approximate site boundary

N

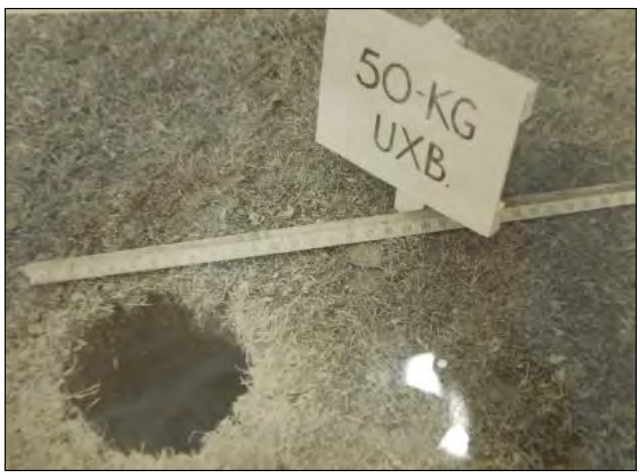
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Example of UXO Entry Hole / The 'J-curve' Effect Principle









Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

The photograph **above** shows a 250kg unexploded bomb found in Bermondsey in 2015, pointing upwards, demonstrating 'J-curve'.

One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Various sources

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BBC NEWS

WW2 bomb found near London City Airport blown up



An unexploded World War Two bomb found near London City Airport has been detonated.

The 500kg device was discovered at the King George V Dock on Sunday during planned work at the airport.

It was closed and all flights were cancelled on Monday after an exclusion zone was put in place.

The detonation, which took take place off Shoeburyness, Essex, was postponed on Tuesday because of high winds and dangerous conditions for divers.

The 1.5m-long German bomb - which was found in a bed of silt, 15m underwater - was carefully removed from the Thames and placed in a secure location a mile away from the coast of Essex.

500kg German HE Bomb, February 2018

BBC NEWS



Exeter WW2 bomb is detonated after homes evacuated

More than 2,600 households and 12 university halls of residence were cleared before the 2,200lb (1,000kg) device **was destroyed** on Saturday.

Police said the blast left a crater about the size of a double-decker bus.

Police have reported large pieces of metal debris hitting buildings and said some properties in the 100m (330ft) exclusion zone had sustained "structural damage".



1000kg German HE bomb, February 2021

BBC NEWS



Great Yarmouth: Huge blast after unplanned WW2 bomb detonation

A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.

Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT.

People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away.

There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said.

Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe.

250kg German HE Bomb, February 2023

BBC NEWS



Plymouth unexploded WW2 bomb: Thousands of people displaced

A 500kg (1,102lb) German World War Two bomb that forced the evacuation of thousands of people in Plymouth has been detonated at sea.

The unexploded device was **found in a garden** on St Michael Avenue on Tuesday, sparking four days of disruption.

On Friday police closed roads and rail and bus services were stopped as the bomb was transported 1.4 miles (2.3km) through the city's streets.

The device was taken by boat beyond the breakwater and detonated at 21:51 GMT.





500kg German HE Bomb, February 2024

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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: BBC News

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BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

BBC NEWS

World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006

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LIVE BBC NEWS CHANNEL

Last Updated: Tuesday, 3 April 2007, 12:42 GMT 13:42 UK

E-mail this to a friend Printable version

Unexploded shell in city is safe

A cordon has been removed from an area of Manchester city centre after workmen found an unexploded mortar shell at a building site.



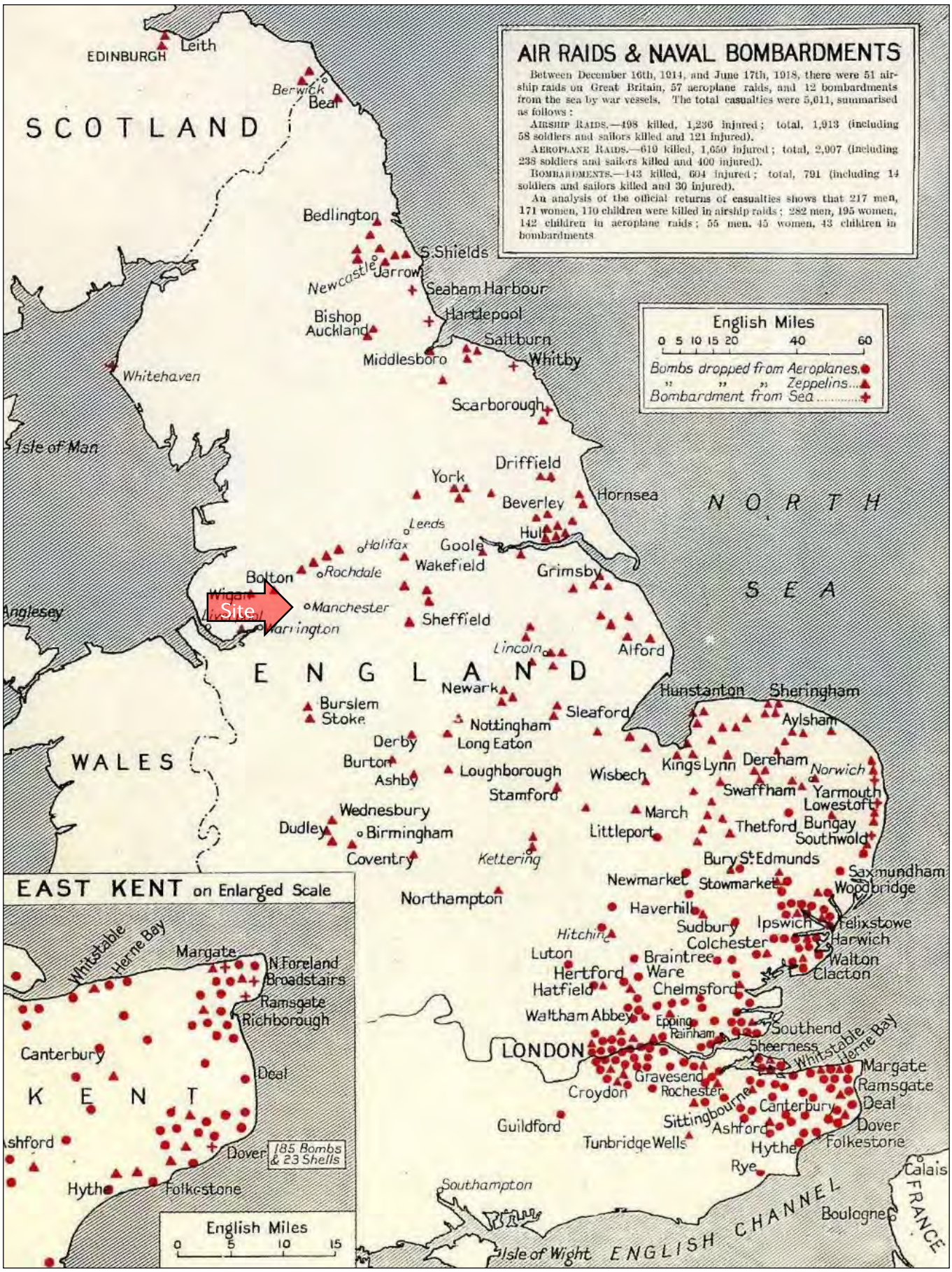
Police were alerted to the device on Tuesday morning

The army bomb disposal team were called to the site on Cambridge Street, off Oxford Road, mid-morning and declared the shell safe at lunchtime.

People moved out of nearby buildings were allowed to return and surrounding roads re-opened.

The empty shell is thought to date back to World War I or World War II.

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Ref: DA19760-00

Source: J. Morris, German Air Raids on Britain

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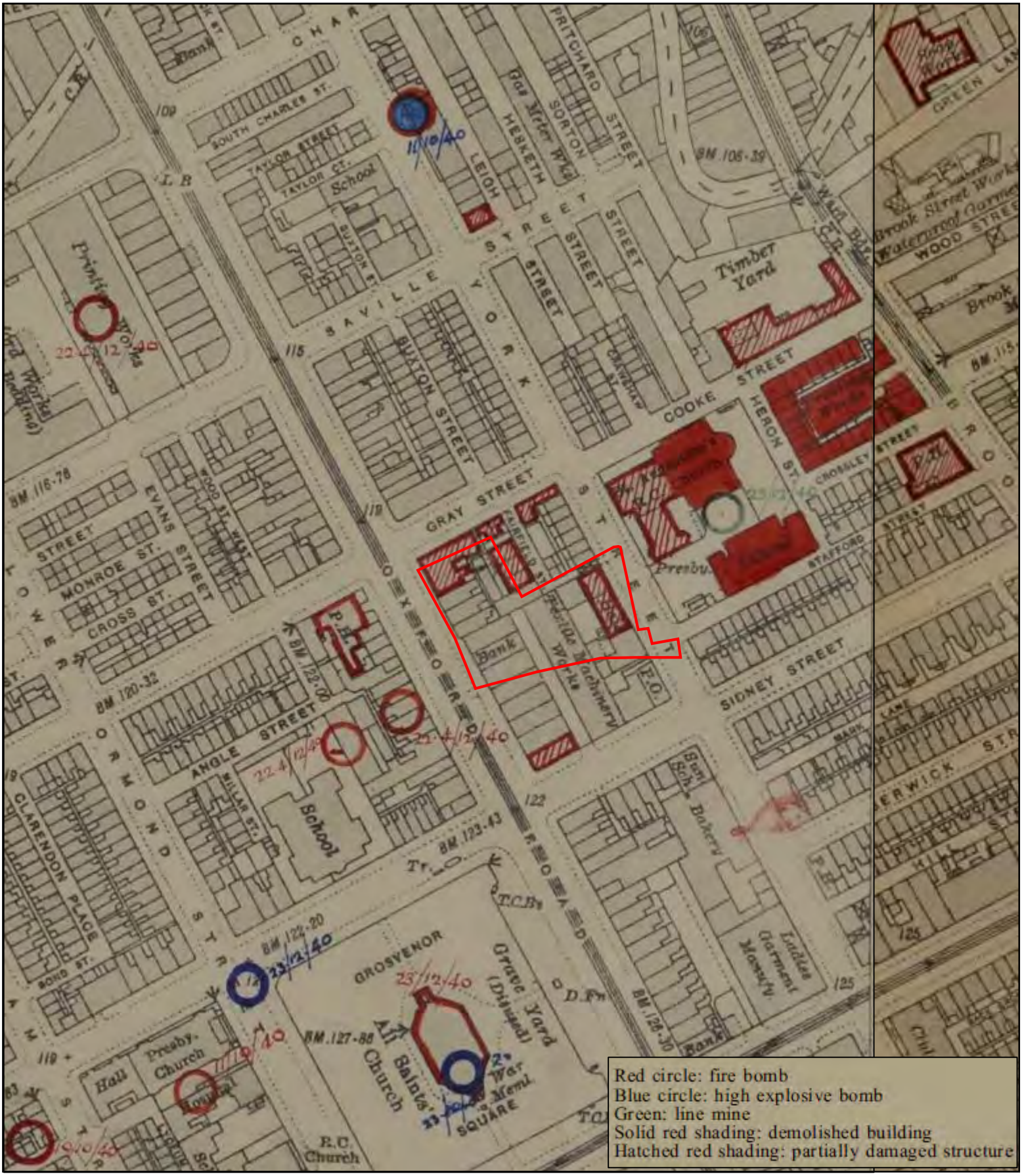
Bristol – Gaythorn Gas Works

The site is approximately 420m south-east of Gaythorn Gas Works.

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Manchester City Architects Department Bomb Plot and Damage Map

Annex: J



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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: The National Archives, Kew

Approximate site boundary

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CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT,
RETURN OF WAR DAMAGE TO PROPERTY

PART 3 | SHEET No. 227

LOCATION	DIST.	DATE	22/12/40.
Oxford Rd. C-on-M.		TYPE BOMB	Bkt HE.
		GRID No.	

IF ESSENTIAL BLDG. STATE TYPE:

* DESCRIPTION OF PROPERTY	FULL ADDRESS AND LOCALITY
Lock-up shop.	Bissey & Hailes Ltd. Scientific instrument makers 91 & 93 Oxford Rd. C-on-M.

INDICATION OF EXTENT OF DAMAGE

ROOF	WALLS	FLOORS	* GENERALLY
Slight damage to asphalt from incendiary bombs.	Inside wall slightly damaged.	—	Plate glass windows, roof lights & windows shattered. Stock gear damaged. Doors blown in

DAMAGE TO CONTENTS	INDICATION OF DANGEROUS STATE IF ANY
Slight	

* TYPE OF DAMAGE	DATE	TIME	INSPECTOR
D	18.2.41	11.30 a.m.	S. [illegible]

91 + 93 Oxford Road, lock-up shop. Slight damage to asphalt from incendiary bombs, inside wall slightly damaged.

CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT,
RETURN OF WAR DAMAGE TO PROPERTY

PART DV 24.2.41 | SHEET No.

LOCATION	DIST.	DATE	22/12/40.
Oxford Rd. C-on-M.		TYPE BOMB	Bkt. HE.
		GRID No.	

IF ESSENTIAL BLDG. STATE TYPE:

* DESCRIPTION OF PROPERTY	FULL ADDRESS AND LOCALITY
Lock up shop.	Dakin Shoe Co. Ltd. 95 Oxford Rd. C-on-M.

INDICATION OF EXTENT OF DAMAGE

ROOF	WALLS	FLOORS	* GENERALLY
—	—	—	Plate glass & sheet windows broken.

DAMAGE TO CONTENTS	INDICATION OF DANGEROUS STATE IF ANY
—	—

TYPE OF DAMAGE	DATE	TIME	INSPECTOR
E.	18.2.41.	11.45 a.m.	S. [illegible]

95 Oxford Road, lock-up shop. Plate glass windows broken.

1ST LINE DEFENCE

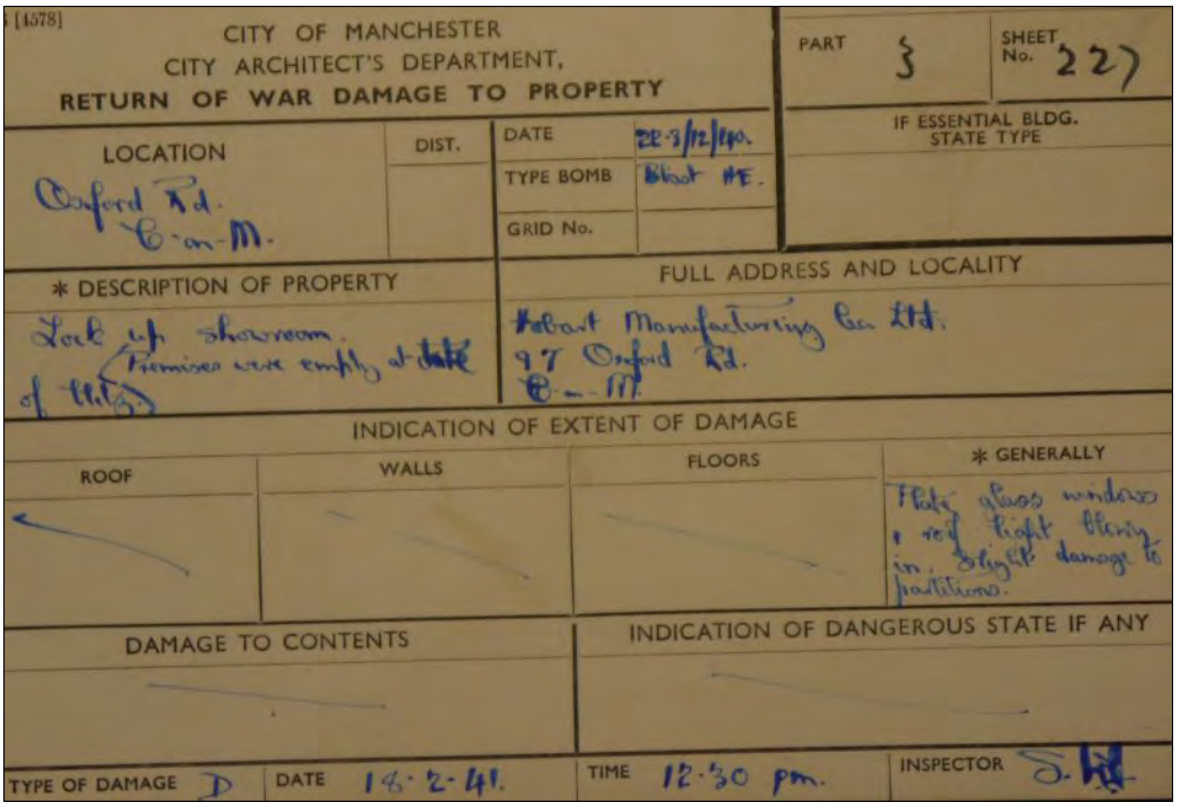
Unit 3, Maple Park,
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Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

Ref: DA19760-00 Source: Manchester Central Library

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[1578]

CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT,
RETURN OF WAR DAMAGE TO PROPERTY

PART 3 SHEET No. 227

LOCATION: Oxford Rd. C-on-M. | DIST. | DATE 22-3/12/40. | TYPE BOMB Blast HE. | GRID No. | IF ESSENTIAL BLDG. STATE TYPE

* DESCRIPTION OF PROPERTY: Lock up showroom. (Premises were empty at date of blitz)

FULL ADDRESS AND LOCALITY: Abbot Manufacturing Co Ltd. 97 Oxford Rd. C-on-M.

INDICATION OF EXTENT OF DAMAGE

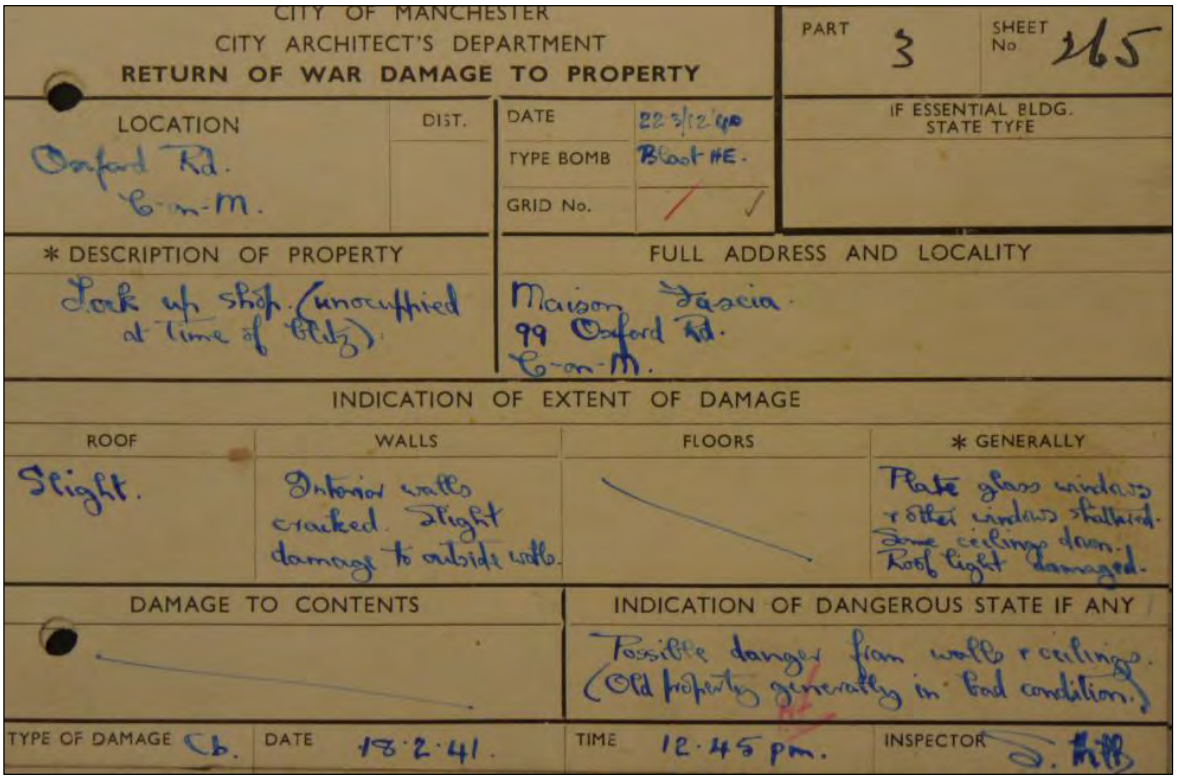
ROOF	WALLS	FLOORS	* GENERALLY
←	~	~	Plate glass windows + roof light blown in. Slight damage to partitions.

DAMAGE TO CONTENTS: ~

INDICATION OF DANGEROUS STATE IF ANY: ~

TYPE OF DAMAGE D | DATE 14-2-41. | TIME 12-30 pm. | INSPECTOR S. Hill

97 Oxford Road, lock-up showroom. Plate glass windows and roof light damage.



CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT
RETURN OF WAR DAMAGE TO PROPERTY

PART 3 SHEET No 165

LOCATION: Oxford Rd. C-on-M. | DIST. | DATE 22/3/12/40 | TYPE BOMB Blast HE. | GRID No. / ✓ | IF ESSENTIAL BLDG. STATE TYPE

* DESCRIPTION OF PROPERTY: Lock up shop. (unoccupied at time of Blitz).

FULL ADDRESS AND LOCALITY: Maison Fascia. 99 Oxford Rd. C-on-M.

INDICATION OF EXTENT OF DAMAGE

ROOF	WALLS	FLOORS	* GENERALLY
Slight.	Interior walls cracked. Slight damage to outside walls.	~	Plate glass windows + other windows shattered. Some ceilings down. Roof light damaged.

DAMAGE TO CONTENTS: ~

INDICATION OF DANGEROUS STATE IF ANY: Possible danger from walls + ceilings. (Old property generally in bad condition.)

TYPE OF DAMAGE Cb. | DATE 18-2-41. | TIME 12-45 pm. | INSPECTOR S. Hill

99 Oxford Road, lock-up shop. Slight roof damage, interior walls cracked. Slight damage to outside walls.

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CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT
RETURN OF WAR DAMAGE TO PROPERTY

PART 3 SHEET No. 140

LOCATION: Oxford Road C. on M.
DIST.
DATE: 22/23.12.40
TYPE BOMB: H.E. on church
GRID No.: ✓
IF ESSENTIAL BLDG. STATE TYPE

* DESCRIPTION OF PROPERTY: Church. C. of E.

FULL ADDRESS AND LOCALITY: All Saints Church. Oxford Road Con M

INDICATION OF EXTENT OF DAMAGE

ROOF	WALLS	FLOORS	* GENERALLY
Dislodged slates	Vestry destroyed Heavy stone coping + stone parapet wall over chancel leaning + loose	by direct hit	Window frames broken + frames damaged Door damaged by blast

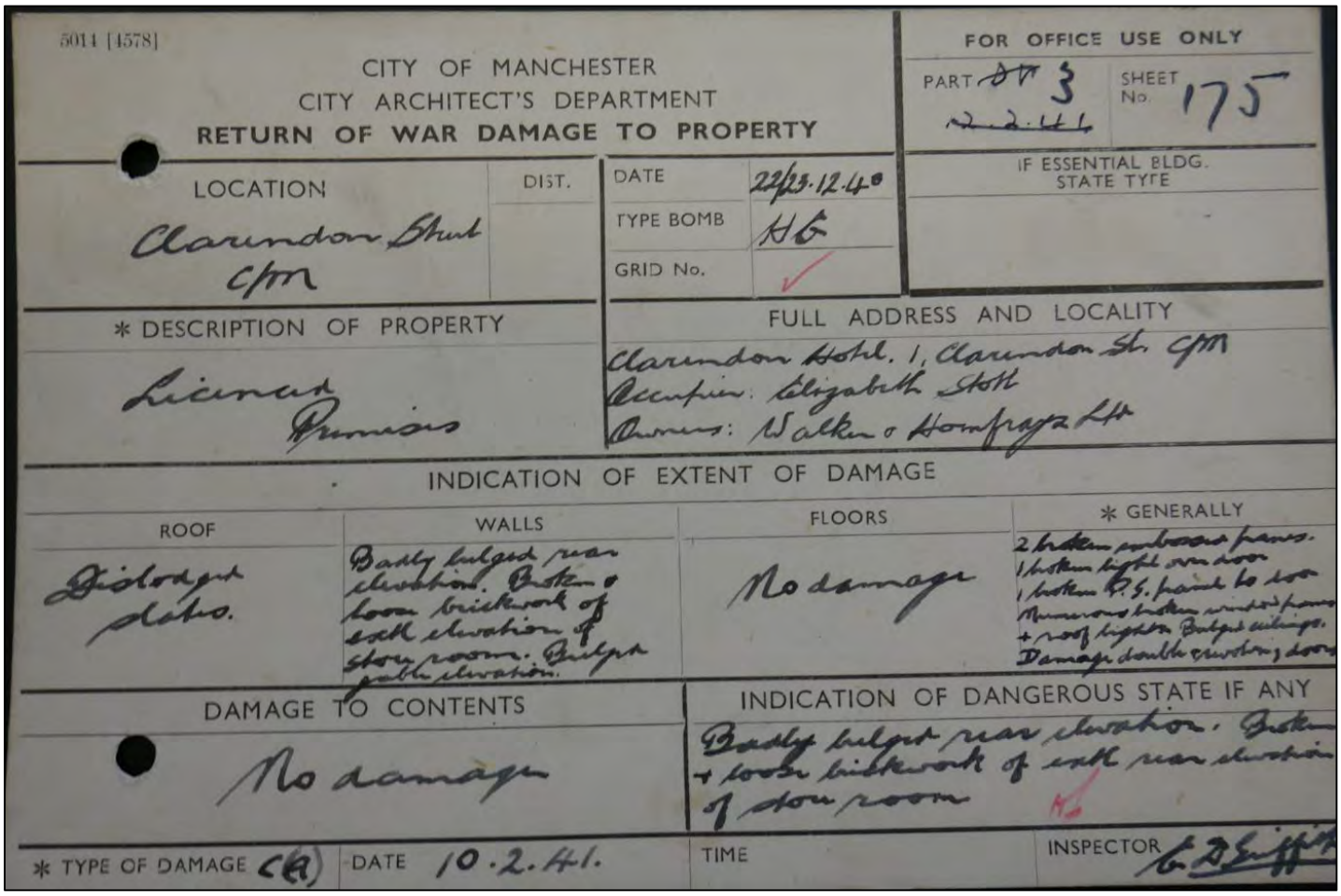
DAMAGE TO CONTENTS: Premises locked. (No examination made)

INDICATION OF DANGEROUS STATE IF ANY: Heavy stone coping + stone parapet wall over chancel leaning + loose. (Church yard gates locked). KL

* TYPE OF DAMAGE (B) DATE 7.2.41. TIME INSPECTOR

All Saints Church, Oxford Road. Vestry destroyed. Floors damaged by direct hit

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5011 [4578]

CITY OF MANCHESTER
CITY ARCHITECT'S DEPARTMENT
RETURN OF WAR DAMAGE TO PROPERTY

FOR OFFICE USE ONLY
PART DT 3 2.2.41
SHEET No. 175

LOCATION: Clarendon Street C/M
DIST.:
DATE: 22/23.12.40
TYPE BOMB: HG
GRID No.: ✓
IF ESSENTIAL BLDG. STATE TYPE:

* DESCRIPTION OF PROPERTY: Licensed Premises

FULL ADDRESS AND LOCALITY: Clarendon Hotel. 1, Clarendon St. C/M
Occupier: Elizabeth Stott
Owners: Walker & Homfray's Ltd

INDICATION OF EXTENT OF DAMAGE

ROOF	WALLS	FLOORS	* GENERALLY
Dislodged slates.	Badly bulged rear elevation. Broken & loose brickwork of east elevation of store room. Bulged gable elevation.	No damage	2 broken partition frames. 1 broken light over door 1 broken P.S. frame to door Numerous broken window panes & roof lights. Bulged ceilings. Damage to double revolving door

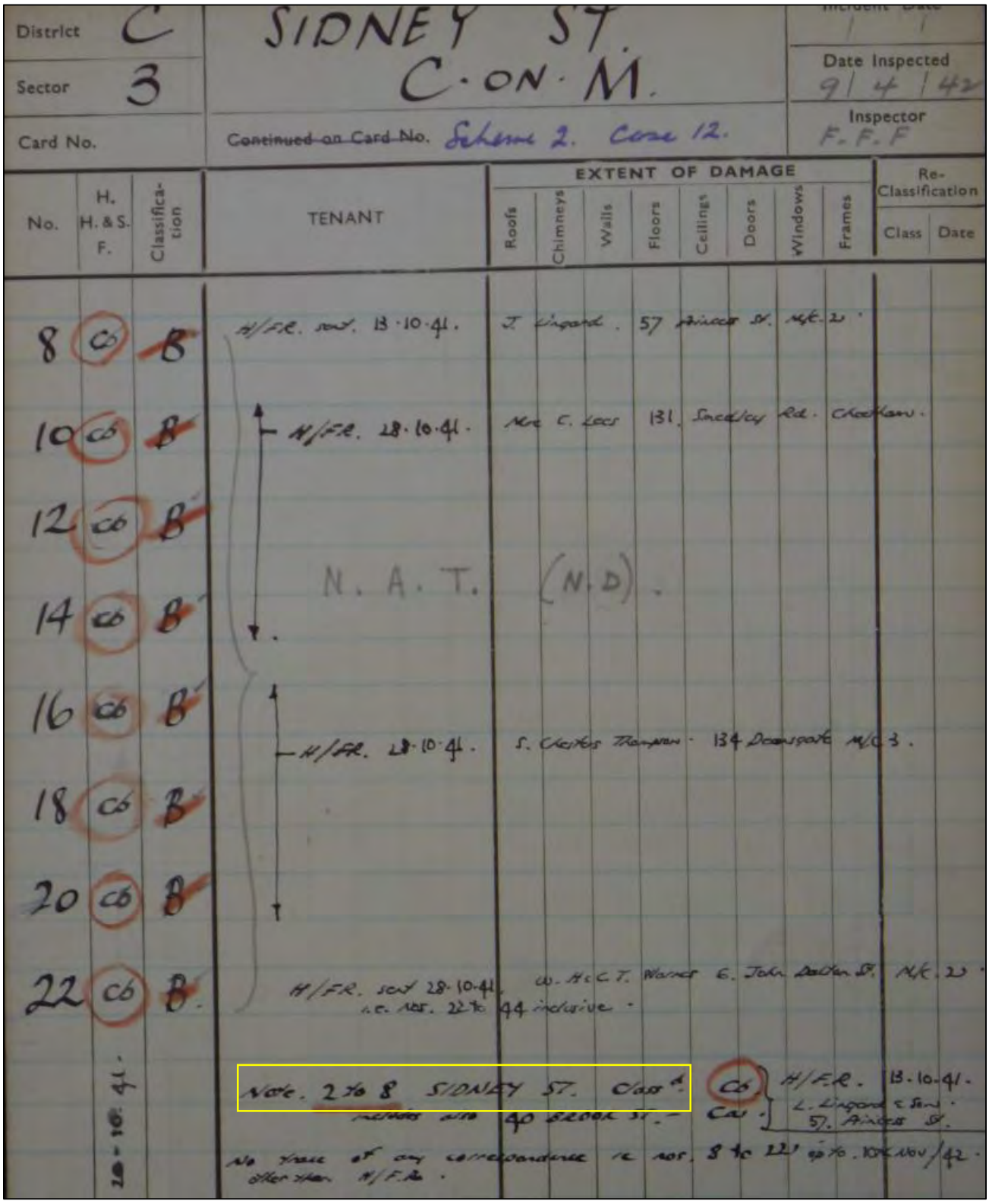
DAMAGE TO CONTENTS: No damage

INDICATION OF DANGEROUS STATE IF ANY: Badly bulged rear elevation. Broken & loose brickwork of east rear elevation of store room

* TYPE OF DAMAGE: C(a) | DATE: 10.2.41. | TIME: | INSPECTOR: G.D. Griffith

Clarendon Hotel, 1 Clarendon Street.
Roof: Dislodged slates.
Walls: Badly bulged rear elevation. Broken and loose brickwork of south elevation of store room. Bulged south elevation.

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(8) EXTENT OF DAMAGE

(a) Buildings

Do you consider the damaged property

(A) totally destroyed

or (B) so badly damaged that it is not worth repairing

or (C) seriously damaged but worth repairing

or (D) slightly damaged

Nos. 2-8 Sidney Street: Category D damage.
Nos. 8-22 Sidney Street: Category B damage.

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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Manchester Central Library

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District C

Sector 3.

Card No.

YORK ST. Con M.

Continued on Card No.

Incident Date / /

Date Inspected 9/4/42

Inspector F.F.F

No.	H. H.&S. F.	Classification	TENANT	EXTENT OF DAMAGE: Roofs	Chimneys	Walls	Floors	Ceilings	Doors	Windows	Frames	Re-Classification: Class	Date
66		B											
68		B											
70		B	D.										
72		B	S. C.										
74		B											
75		B											
76		B											
			D.										
91		B	S.C.										

(8) EXTENT OF DAMAGE

(a) Buildings

Do you consider the damaged property

(A) totally destroyed

or (B) so badly damaged that it is not worth repairing

or (C) seriously damaged but worth repairing

or (D) slightly damaged

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District C

Sector 3.

Card No.

COOKE ST
C·ON·M.

Continued on Card No.

Incident Date / /

Date Inspected 9/4/42

Inspector F.F.F.

No.	H. H. & S. F.	Classification	TENANT	EXTENT OF DAMAGE: Roofs	Chimneys	Walls	Floors	Ceilings	Doors	Windows	Frames	Re-Classification: Class	Date
1		B'											
3		B'											
5		B'											
7		B'	D. S.C. except for a few bricks										
9		B'											
11		B'											
13		B'											
15		A										B 3/7/42	
10		B'											

(8) EXTENT OF DAMAGE

(a) Buildings

Do you consider the damaged property

(A) totally destroyed

or (B) so badly damaged that it is not worth repairing

or (C) seriously damaged but worth repairing

or (D) slightly damaged

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Ref: DA19760-00

Source: Manchester Central Library

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District C. STAFFORD ST.

Sector 3. C·ON·M.

Card No. Continued on Card No.

Date Inspected 9/4/42

Inspector F.F.F

No.	H. H. & S. F.	Classification	TENANT	EXTENT OF DAMAGE: Roofs	Chimneys	Walls	Floors	Ceilings	Doors	Windows	Frames	Re-Classification: Class	Date
5		B											
9		B											
11		B											
13		B	D										
15		B	S.C.										
17		B											
19		B											
21		B											
23		B											
25		B											
31		B											
10		B	S.C.										

No.	H. H. & S. F.	Classification	TENANT	EXTENT OF DAMAGE: Roofs	Chimneys	Walls	Floors	Ceilings	Doors	Windows	Frames	Re-Classification: Class	Date
12		B											
14		B											
16		B											
18		B											
20		B											
22		B											

(8) EXTENT OF DAMAGE

(a) Buildings

Do you consider the damaged property

(A) totally destroyed

or (B) so badly damaged that it is not worth repairing

or (C) seriously damaged but worth repairing

or (D) slightly damaged

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Ref: DA19760-00

Source: Manchester Central Library

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Bomb Damage Cards Overlay – Pre-WWII OS mapping, 1932

Annex: L

Only includes incidents recorded in **Annex J**.

- Category B
- Category C
- Category D or lower

(8) EXTENT OF DAMAGE

(a) Buildings

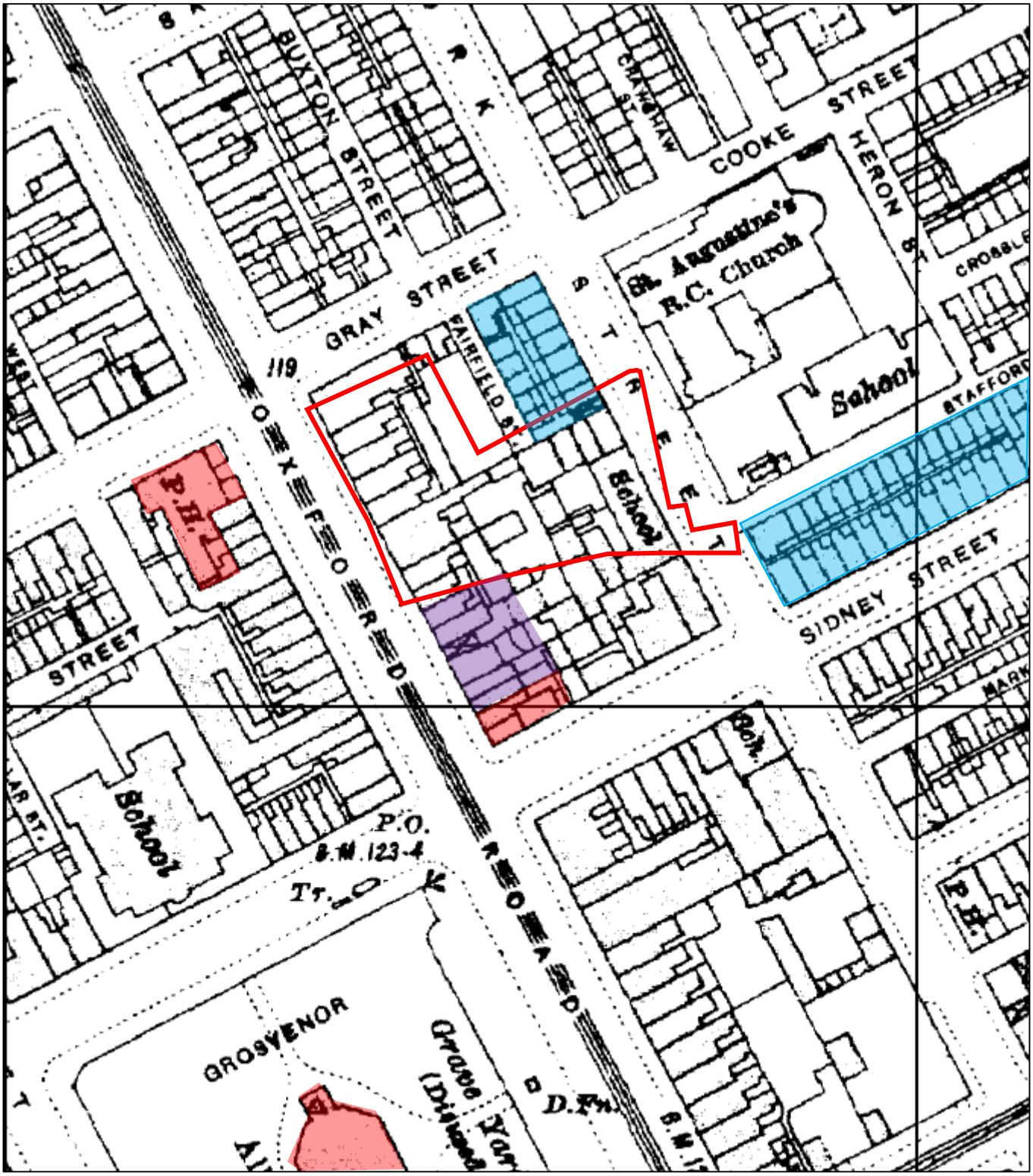
Do you consider the damaged property

(A) totally destroyed

or (B) so badly damaged that it is not worth repairing

or (C) seriously damaged but worth repairing

or (D) slightly damaged



Approximate site boundary

N

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Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: 1st Line Defence

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USAAF Aerial Photography, 30th May 1944



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Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: National Monuments Record Office (Historic England)

Approximate site boundary

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USAAF Aerial Photography, 30th May 1944 – Damage Overlay

Annex: M2



Clearance

Damage

Partially cleared/bomb-damaged area

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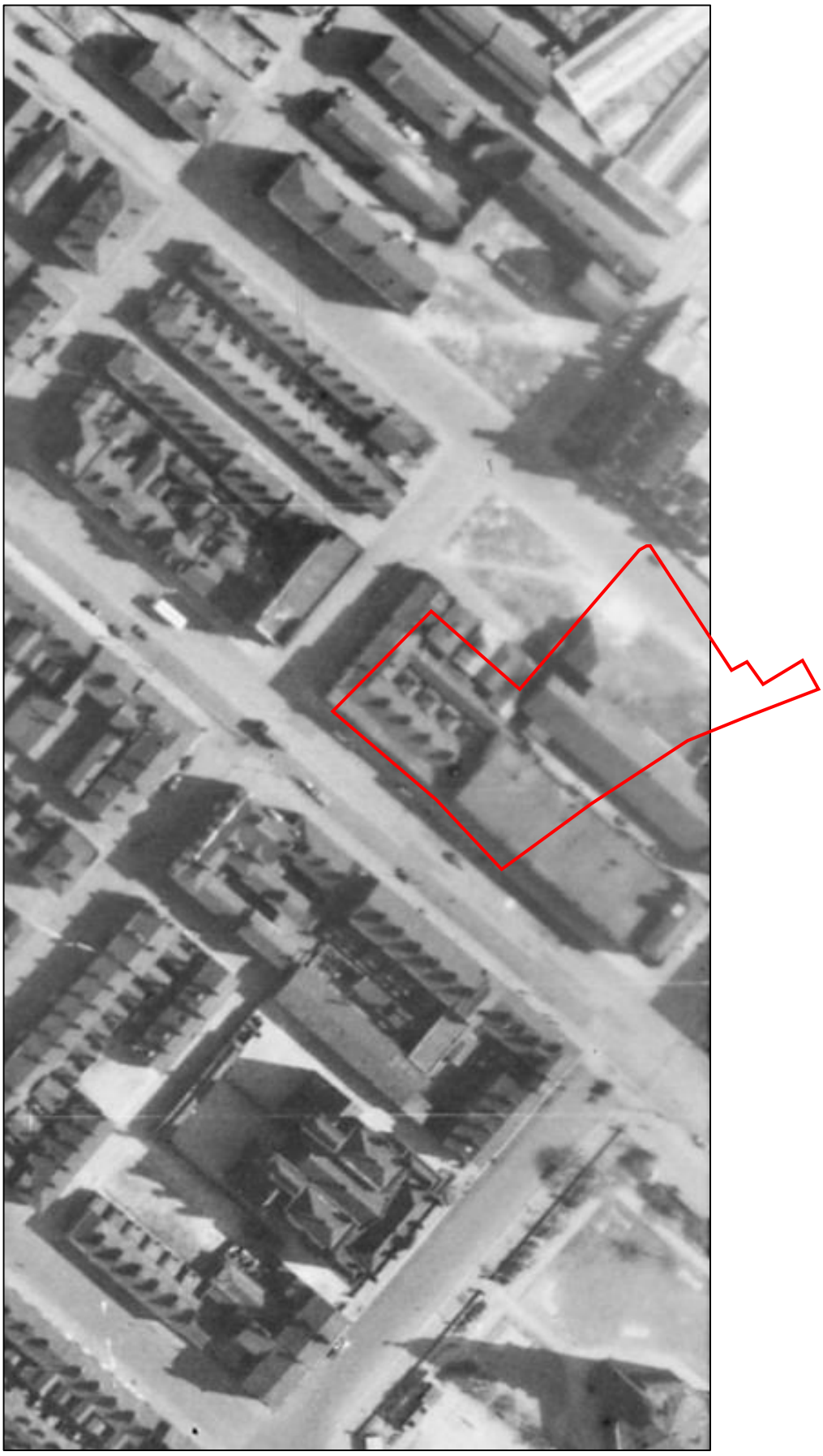
Ref: DA19760-00

Source: National Monuments Record Office (Historic England)

Approximate site boundary

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Source: National Monuments Record Office (Historic England)

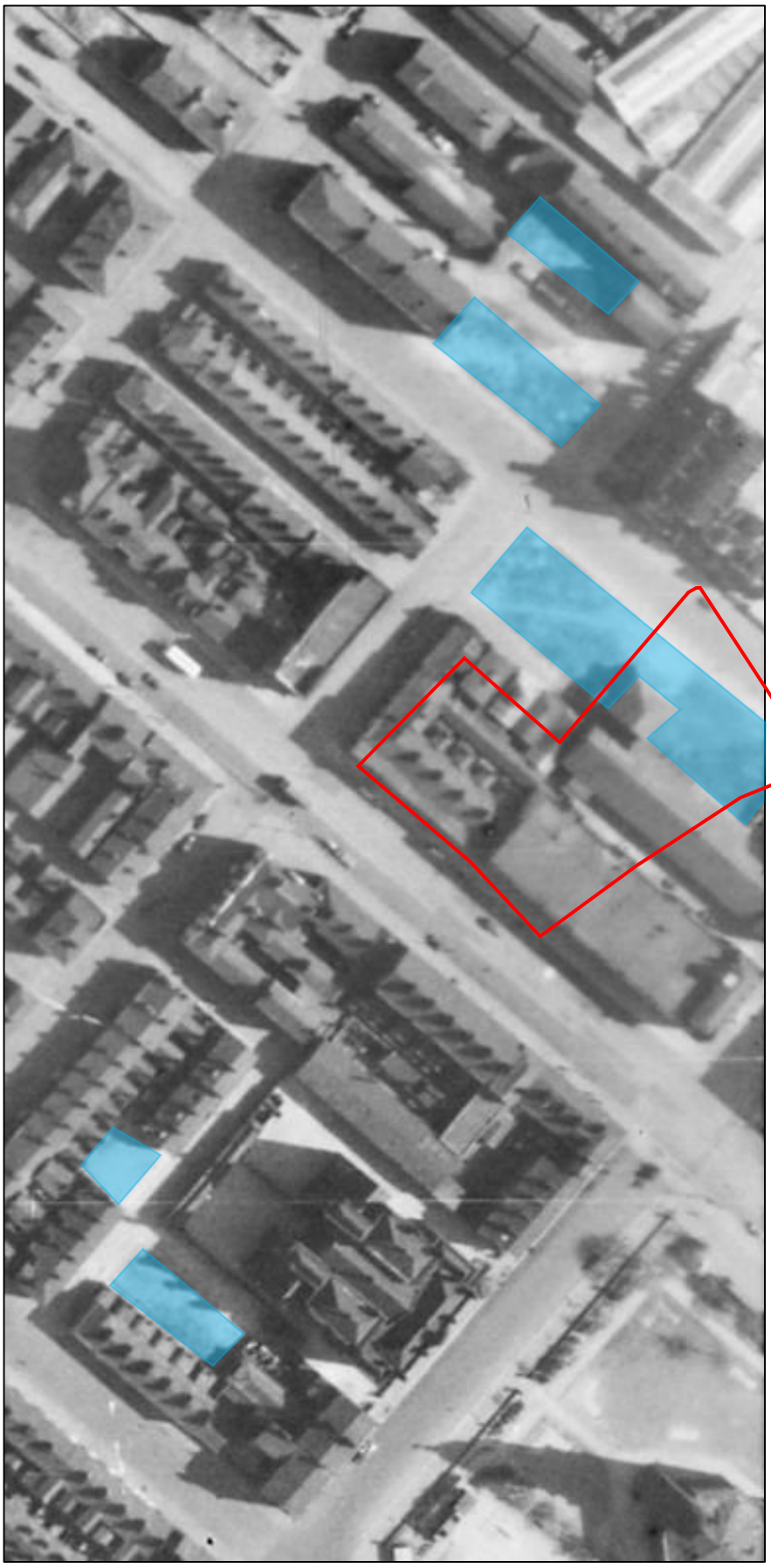
Approximate site boundary

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RAF Aerial Photography, 7th May 1946 – Damage Overlay

Annex: M4



Clearance

Approximate site boundary

N

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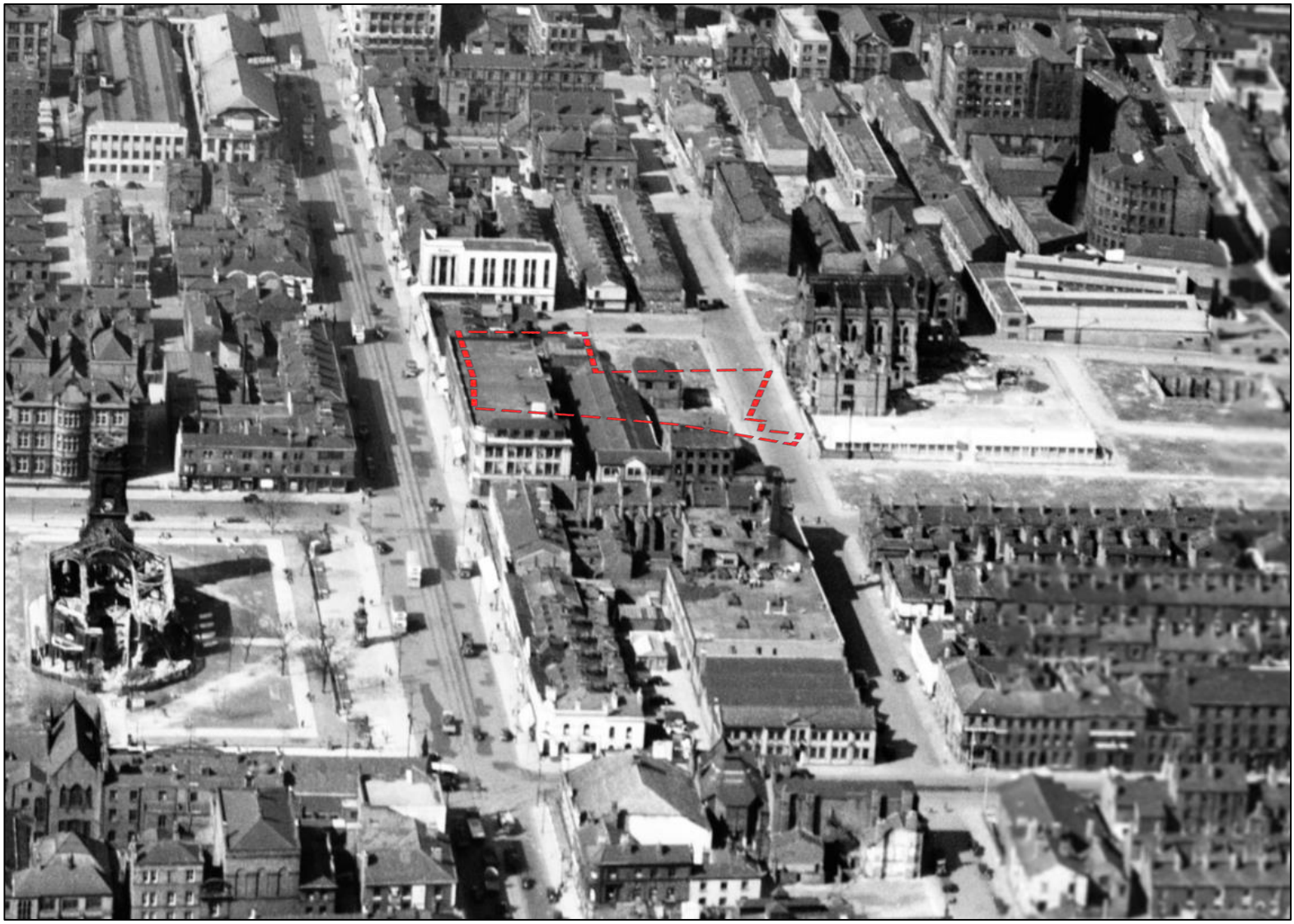
Client: Hydrock Consultants Limited

Project: Land off Oxford Road, Manchester

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Source: National Monuments Record Office (Historic England)

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Project: Land off Oxford Road, Manchester

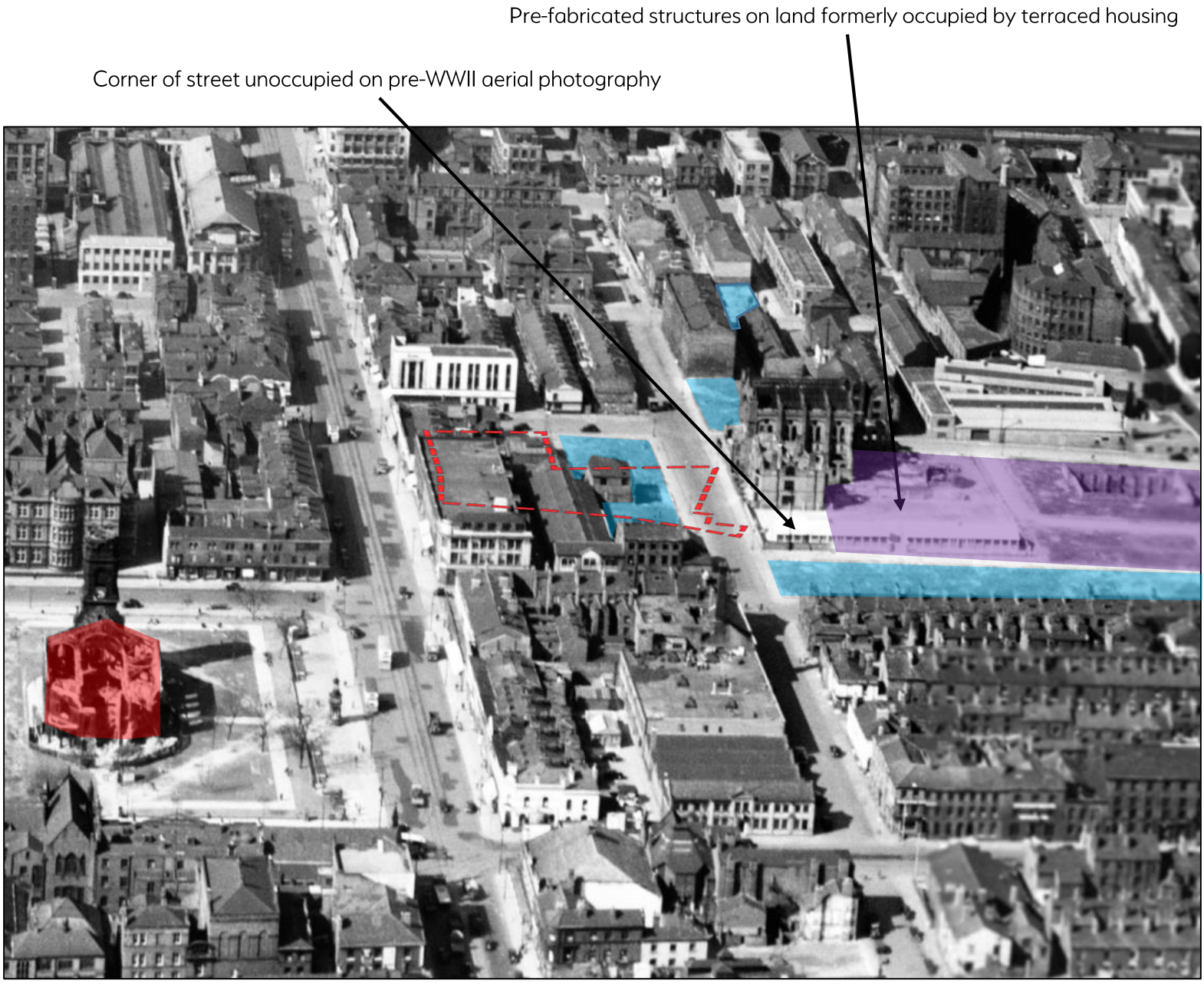
Ref: DA19760-00

Source: Vision of Britain

--- Approximate site boundary

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RAF Aerial Photography, 14th April 1949 – Damage Overlay



Clearance

Damage

Partially cleared/bomb-damaged area

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Client: Hydrock Consultants Limited

Approximate site boundary

Project: Land off Oxford Road, Manchester

Ref: DA19760-00

Source: Vision of Britain

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The bomb-damaged All Saints Church on Oxford Road, shortly before demolition, captured in the late 1940s.





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Source: Various sources

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Risk Zone	Activity	Recommended Risk Mitigation Measure
Low	All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.
Medium	Open Excavations (trial pits, service pits, bulk excavations, strip foundations etc.)	• UXO Specialist On-site Support
	Boreholes and Piled Foundations	• Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

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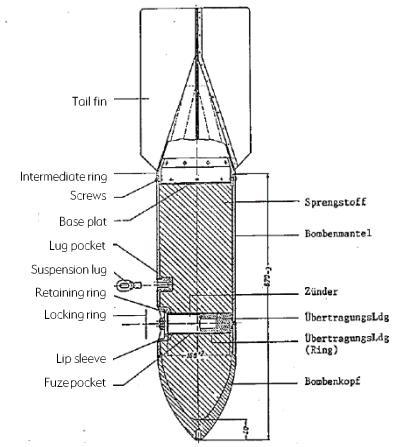
Approximate site boundary

N

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SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

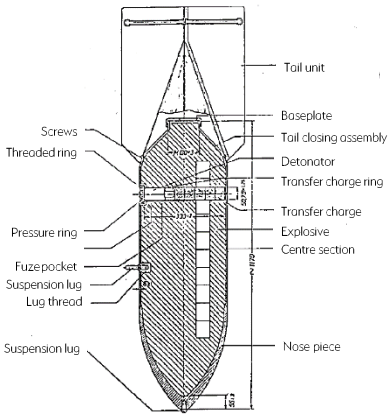






SC 250kg High Explosive Bomb

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft and was used to notable effect by the Junkers Ju-87 Stuka (*Sturzkampfflugzeug*, or dive-bomber).

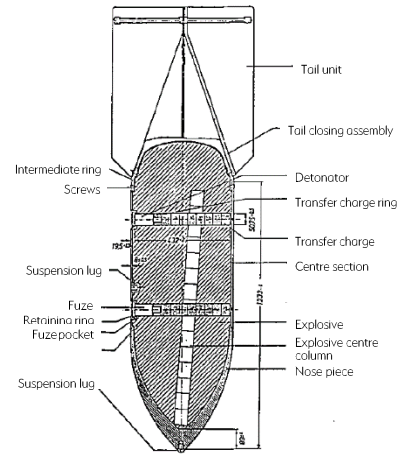




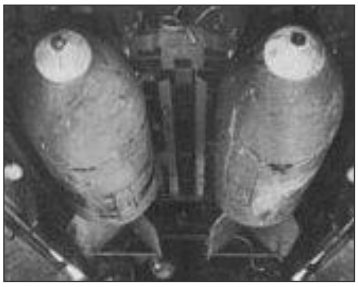


SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, Trialene. Bombs recovered with Trialen filling have cylindrical paper-wrapped pellets, 1-15/16in. in length and diameter.



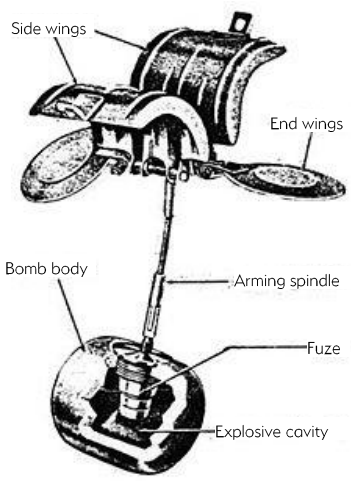




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SD2 Anti-Personnel 'Butterfly Bomb'

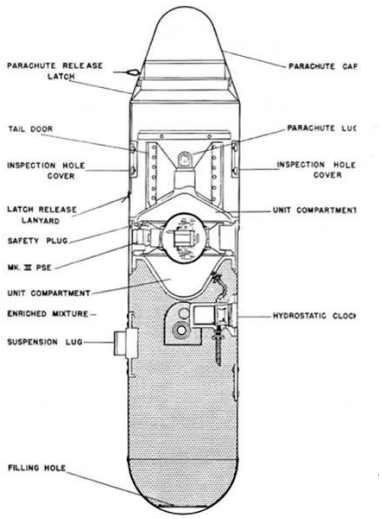
Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Quite rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open via springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane, which armed the device as it span.





Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/time delay/hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage within a 100m radius.



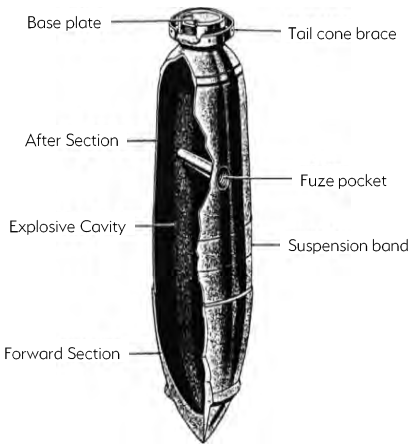






SC 1000kg High Explosive Bomb

Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC-type bombs were General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses, they are usually of three-piece welded construction.





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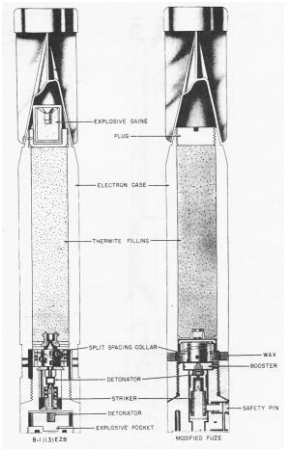
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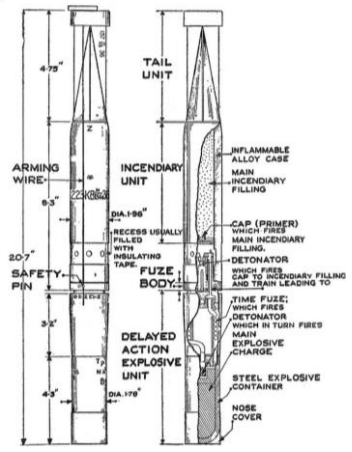
Source: Various sources

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1kg Incendiary Bomb

Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)
Explosive Weight	Approx. 680g (1.5lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters on towns and industrial complexes.
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.

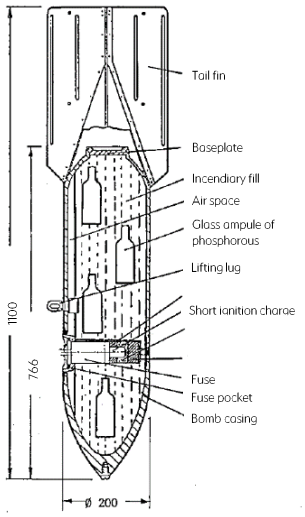


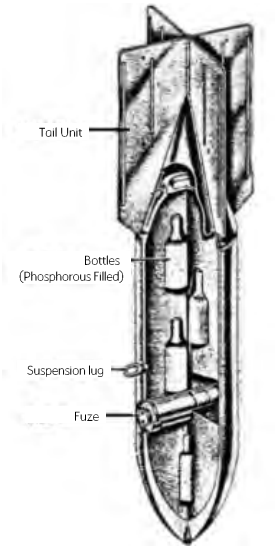




C50 A Incendiary Bomb

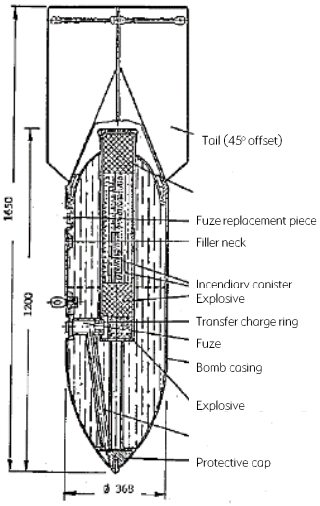
Bomb Weight	Approx. 41kg (90.4lb)
Explosive Weight	Approx. 0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against any targets where an incendiary effect is required.
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture.





Flam C-250 Oil Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, Trialene. Bombs recovered with Trialen filling have cylindrical paper-wrapped pellets, 1-15/16in. in length and diameter.





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Source: Various sources

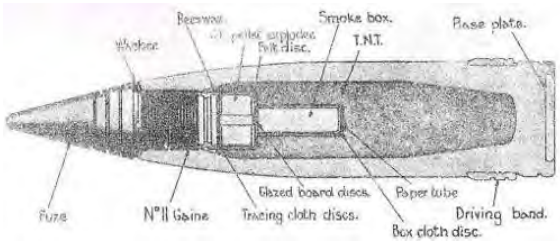
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3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army and were commonly used on the Home Front.
Ceiling	30,000ft to 59,000ft





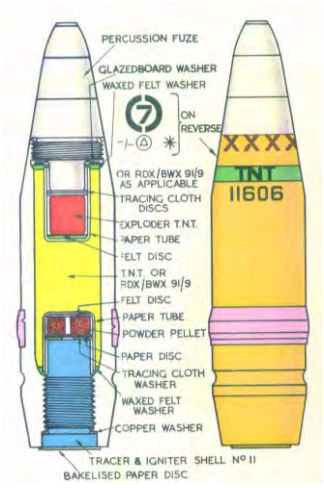


40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft.







3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor.



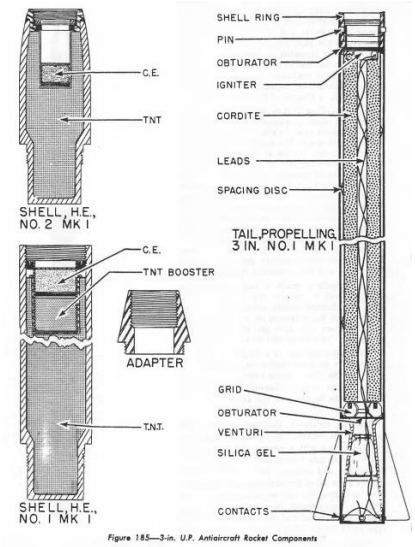


Figure 185.—3-in. U.P. Antiaircraft Rocket Components

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