TERMS AND DEFINITIONS

Anti-Aircraft Shells (AA)
Small High Explosive Shells (HE) shells ranging up to 100mm in diameter.

Air Raid Precautions (ARP)
An organisation in the United Kingdom set up in 1937 dedicated to the protection of civilians from the danger of air raids. It included the Raid Wardens' Service that was to report on bombing incidents.

Battlefield Area Clearance (BAC)
The systematic clearance of munitions from military property or old battle sites e.g., ranges, airfields etc.

Borehole Search
The placing of boreholes in a set pattern, then using a magnetometer to take readings at specific depths along each borehole. When used with a geophysical survey system this will give a magnetic signature of the area. The depth of the borehole and the pattern will depend upon the type of Unexploded Bombs (UXB) and the geology of the ground.

Doodle Bug (See Pilotless Aircraft)

Explosive Ordnance (EO)
All munitions containing explosives, nuclear fission/fusion materials and or biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket, and Small Arms Ammunition (SAA); all mines, torpedoes, and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices (IED); and all similar or related items or components explosive in nature.

Explosive Ordnance Clearance (EOC)
See BAC.

Explosive Ordnance Disposal (EOD)
The detection, identification, field evaluation, render safe, recovery and disposal of **UXO**.

Geophysical Survey
The survey of an area using a Magnetometer and geophysical gathering device, after interpretation, this will produce a geophysical map and an object list for any metallic anomalies.

High Explosive (HE)
High explosives burn/detonate at rates of up to 9,000 m/per second.

Incendiary Bomb (IB)
Incendiary bombs ranged from 1kg in size to 500kg the larger sizes were sometimes called Oil Bombs. Fills range from thermite mixtures, phosphorus to kerosene.

Intrusive Survey
The use of a cone penetrometer (MagCone) or drilled boreholes (MagDrill) to take magnetometer test in a set pattern (see borehole search), or to prove pile positions.

Land Service Ammunition (LSA)

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LSA is defined as “All items containing explosives or pyrotechnic compounds which are placed, thrown, or projected so as to cause damage to men and equipment during land warfare.

Long Range Rocket (LRR)
The long-range rocket sometimes codenamed Big Ben is the V2 rocket designed to deliver an approximate payload of 1000 kg.

Oil Bomb (OB)
A bomb containing a flammable liquid, normally the KC 250 Flam or the C 500 flam.

Pilot less Aircraft (PAC)
A flying bomb (Fly) or doodlebug is the V1 rocket, or predecessors designed to deliver an explosive payload of approximately 500kg - 800kg.

Parachute Mine (PM)
Air dropped mine may have been used as a blast effect bomb maximum explosive content 1600lb always fitted with anti-handling and anti-stripping equipment.

Unexploded Bomb (UXB)
Any air dropped bomb that has failed to operate.

Unexploded Ordnance (UXO)
Explosive ordnance that has been primed, fused, armed, or otherwise prepared for use or used. It may have been fired, dropped, launched, or projected yet remains unexploded either through malfunction or design or for any other cause.

Vengeance Weapons (V)
V1 see Pilotless Aircraft.
V2 see Long Range Rocket.

WWI
World War 1 (1914 – 1918)

WWII
World War 2 (1939 – 1945)

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EXECUTIVE SUMMARY

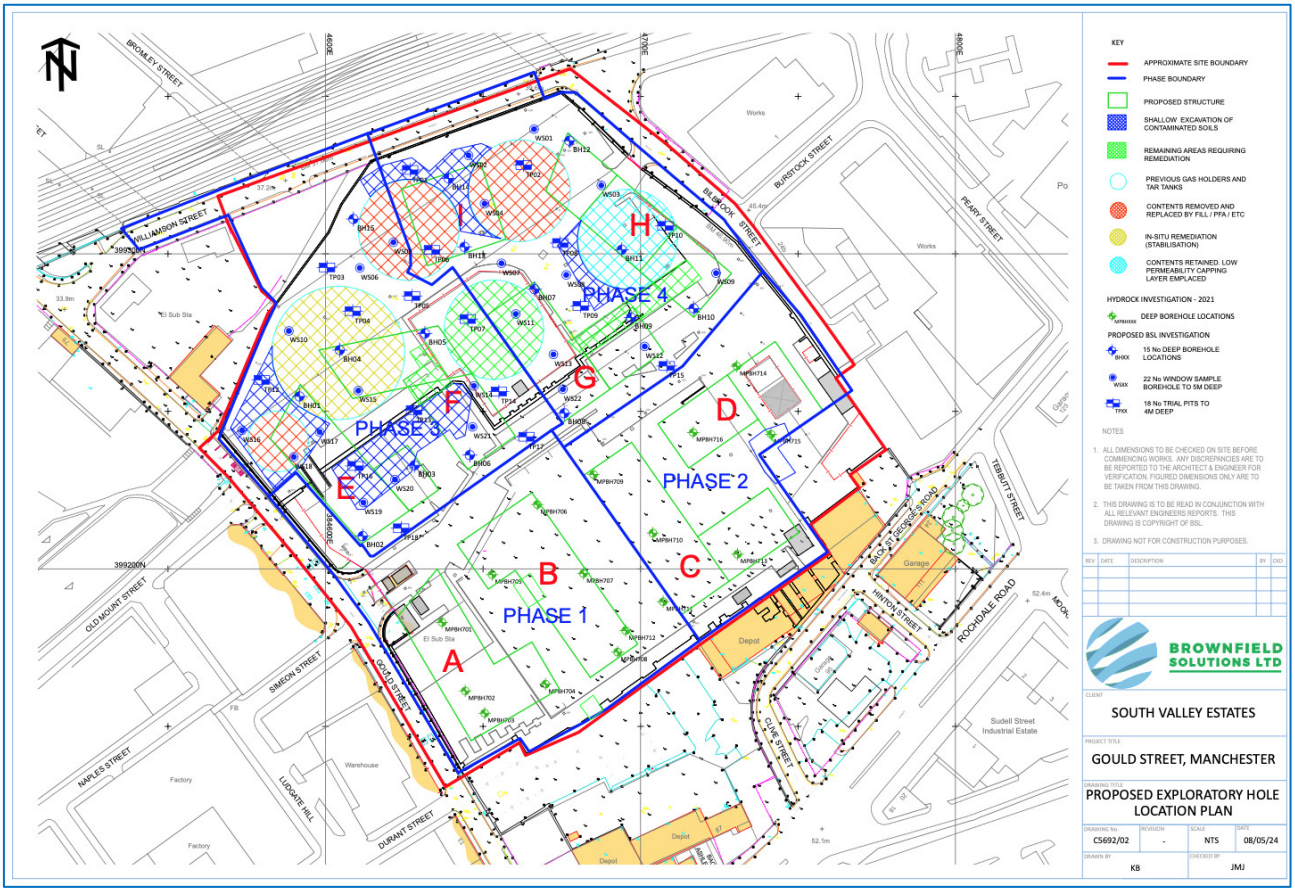
INSTRUCTION

EOD Contracts Ltd, have been commissioned by Brownfield Solutions to undertake a Provisional Desktop Study (PDTS) for potential historic Unexploded Ordnance (UXO) contamination for the future works at Gould Street, Manchester, M4 4BH, hereafter referred to as the Site.

SCOPE OF WORK

The scope of this EO Risk Assessment/Desk Study is to assess the likelihood of buried EO/UXO within the environs of The Site (See Figure 1.1), in view of further development. A further aim was to evaluate the implication from UXO contamination during any future intrusive land use.

Figure 1.1: Clients Supplied Site Diagram, This DTS will be covering the area bordered in RED.

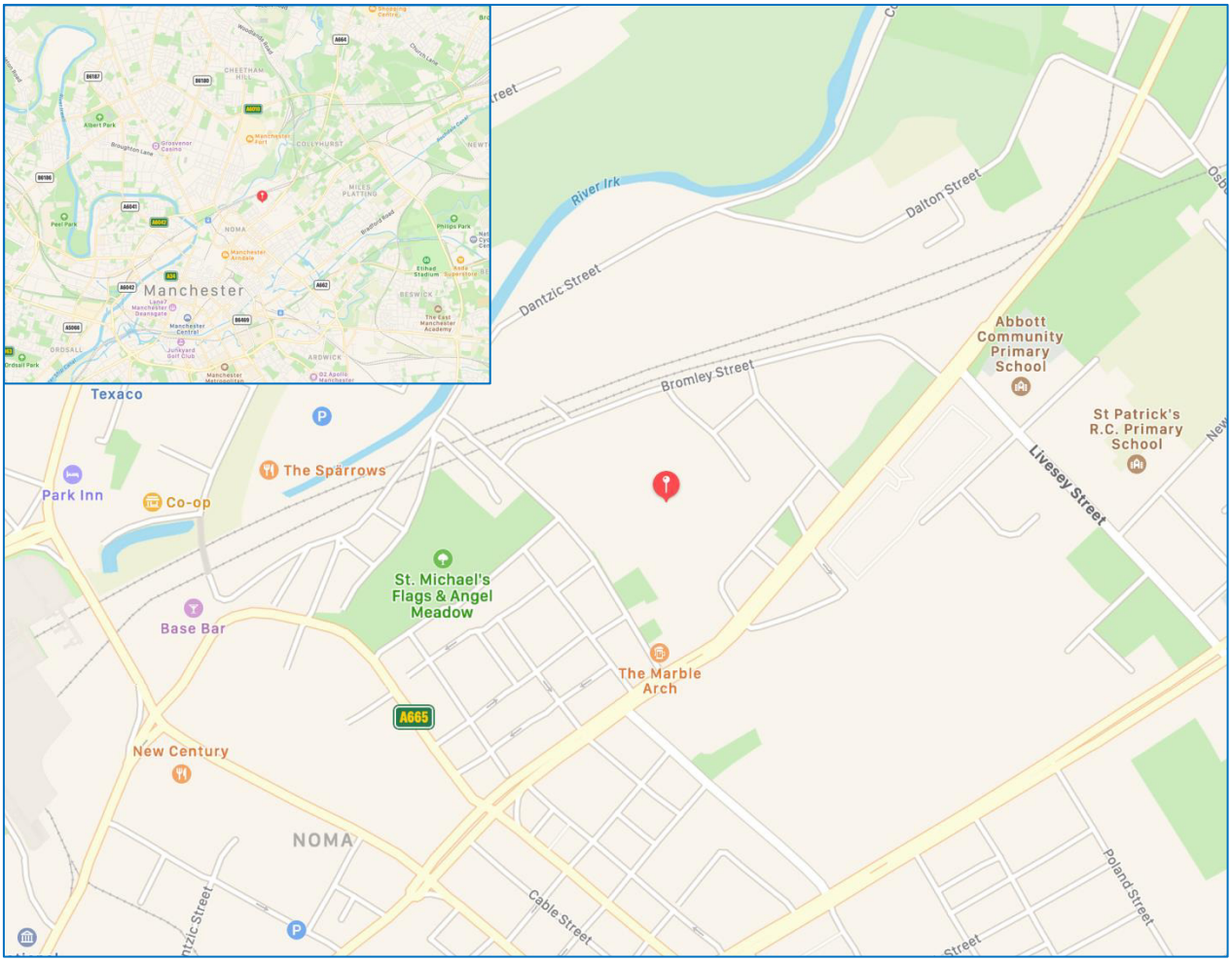


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LOCATION

Site Location (red flag). An exact meeting point will be determined by the Client should the need arise.

Table 3.1 Site Location.



Title	Description
Address	Gould Street, Manchester,
Post Code	M4 4BH
Nat Grid Reference	SJ 846992 / SJ 8468599234
what3words	mirror.cars.hotel

SOURCES OF UXO CONTAMINATION

The main sources of potential UXO contamination that have been researched for the site are:

- Buried or discarded items of ordnance.
- Air delivered ordnance bombs and sub-munitions/incendiaries.

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KEY FINDINGS

Based on the information researched by EOD Contracts Ltd for the proposed scope of works being carried out within the given Site area, the following conclusions have been reached:

- The Site area is situated within Manchester, which is off historic fact was bombed on several occasions throughout WW2, the worst of which being the Christmas raids. However, despite this it is situated away from the centre of Manchester which is where the focus of the raids took place.
- The Site was subjected to bombing throughout WW2 as can be seen in Annex D.
- The Site area was fully utilised throughout WW2.
- The Site would have been considered a viable and strategic target throughout this period.
- There have been several phases of construction and remediation works that have taken place within the Site boundary post WW2. However, it cannot be guaranteed that these remediation works went to protentional bomb penetration depth.

Risk Level

The prevailing risk level has been determined to be **LOW** for some areas within the Site boundary and **MEDIUM** for others (see risk map).

Historical UXO Contamination

The indicators for UXO contamination are:

Bomb Strikes	There are no recorded incidents of the site being the subject of bombardment throughout WW1. Manchester was targeted heavily throughout WW2. The Site would have been considered a strategic target throughout this period. Known bomb strikes within the Site boundary. There have been several phases of construction and remediation works that have taken place within the Site boundary. The Site was fully utilised throughout WW2.
Bomb Damage	Difficult to ascertain.
Reconstruction	No obvious signs
Military Usage	No obvious signs.
Explosive/Munition Factory	No obvious signs

Risk Level	Therefore, so far as reasonably practicable the risk level on Site has been deemed as both a **LOW** risk and **MEDIUM** risk for some areas. See risk map.
Risk Depth	7.062 for areas deemed a **MEDIUM** risk

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PART 8: RECOMMENDATIONS

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **LOW** risk.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **MEDIUM** risk.

Communicating the risks, all stakeholders should be made aware of the UXO situation on the site and the possible impact it may have on the project works and day to day running of the district. Clients have a legal duty under the Construction Design & Management Regulations (CDM) and Health & Safety at Work legislation to provide Designers and Contractors with project specific information needed to identify hazards and risks associated with the design and construction work. The possibility that UXO may be encountered on site falls within the category of a significant risk and as such it should be addressed as early as possible in the lifecycle of the project.

Further planning: the risks posed by UXO should be brought to the attention of the Project CDM Coordinators and other individuals with a responsibility for project safety and operations at the site. The matter of UXO should be considered critical to project safety and one requiring high priority action.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

Project overview and the responsibilities of those working on site with regard to duty of care and public safety.

UXO recognition and safety procedures to be followed on discovery of a suspicious object or the alarm being sounded.

Emergency procedures to be followed in the event of an explosion. Evacuation routes, muster stations and accounting for personnel.

Work permits, works methodology and specific UXO risk mitigation methods. Post-incident inspections and returning to normal works.

Prior to any intrusive piling or drilling commencing, UXO safety testing and appropriate clearance certification into the ground to sufficient depth to provide clearance from UXO. This can be done using a progressive drilling process or (where large numbers of piles are to be placed and ground permitting)

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using a vehicle borne hydraulic system to push a magnetometer into the ground to test for the presence of UXO prior to piling.

UXO safety monitoring of all "at risk" excavations, including geotechnical or archaeological trial pits to be conducted during the project. This should be provided by a UK Home Office Authorised EOD/UXO Contractor using qualified EOD Engineer with specialist locators and detectors to scan the ground ahead of the excavation wherever possible.

9.0: SPECIFICALLY

Geotechnical investigations, percussive drilling/trial pits/window/samples, require an EOD Engineer over watch.

The removal of all buildings within the site footprint can be removed down to ground level (including basements)

New foundations with piling should be mitigated by the insertion of a magnetometer to encompass the pile position, this would be carried out using a CPT rig (magcone), the expected radius of the magcone is 1.5m therefore multiple piles could be checked.

Non-Intrusive Magnetometer surveys generally prove inconclusive on "Brownfield sites", this is due to the high ferromagnetic background, therefore this methodology is not recommended for this site and shallow excavations should be overseen by a qualified EOD Engineer.

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10: RISK MAP

Due to the Site being subjected to several known bomb strikes throughout WW2, areas of the northern half of the Site has been deemed a **MEDIUM** risk. This area has been subjected to post war excavation works however, it cannot be guaranteed to at a depth below potential bomb penetration depth.





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EOD Contracts Ltd can supply a turnkey solution to your UXO requirements. Therefore, the following mitigation strategies can be supplied for land or water-based operations:

Intrusive survey using CPT *(Cone Pressure Testing)* or borehole equipment, *supplying risk mitigation to all Borehole and Pile locations, down to a maximum bomb penetration depth determined within this document.*

Non-Intrusive Survey using multiple array system with DGPS *(Differential Global Positioning System).*

Offshore, near-shore, estuarine and freshwater water environments magnetic, side scan and bathymetric supported by state-of-the-art DGPS.

The aforementioned surveys are supported with post processing of data and intrusive investigations if required.

EOD Engineer over watch using Suitably Qualified and Experienced Personnel, normally former British Army, Navy, or RAF Bomb Disposal specialists.

Explosive Ordnance Safety Presentations.

Bibliography

The significant published documents referred to during this study are listed below:

- HO 193 series from National Archives
- HO 198 series from National Archives
- The Blitz Then and Now Volumes 1 to 3
- AA Command Colin Dobinson
- German Air Raids on Britain 1914-1918
- English Heritage
- Bombing Britain Database
- https://luna.manchester.ac.uk/luna/servlet/view/search?q==%22GB127.MISC%2F1192%2F1%22
- https://www.ashremediation.co.uk/portfolio/gould-street-gasworks-2/
- https://www.manchestereveningnews.co.uk/news/greater-manchester-news/manchester-blitz-bomb-sites-map-10465447
- https://www.derelictmanchester.com/p/derelict-viaduct-near-gouldback-georges.html#gsc.tab=0
- https://www.manchestereveningnews.co.uk/news/greater-manchester-news/gould-street-gasworks-site-could-18757500
- https://manchesterhistory.net/manchester/gone/gouldgasworks.html
- https://aboutmanchester.co.uk/work-has-begun-on-site-of-former-gasworks-on-rochdale-road/
- https://www.placenorthwest.co.uk/mcr-ready-to-move-on-1200-home-manchester-resi/
- https://mcrproperty.com/2021/06/04/manchesters-400million-gasworks-new-town-scheme-gets-green-light-for-1200-homes/
- https://www.manchestereveningnews.co.uk/news/greater-manchester-news/what-happen-east-manchesters-iconic-14011886

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PART 1: INTRODUCTION

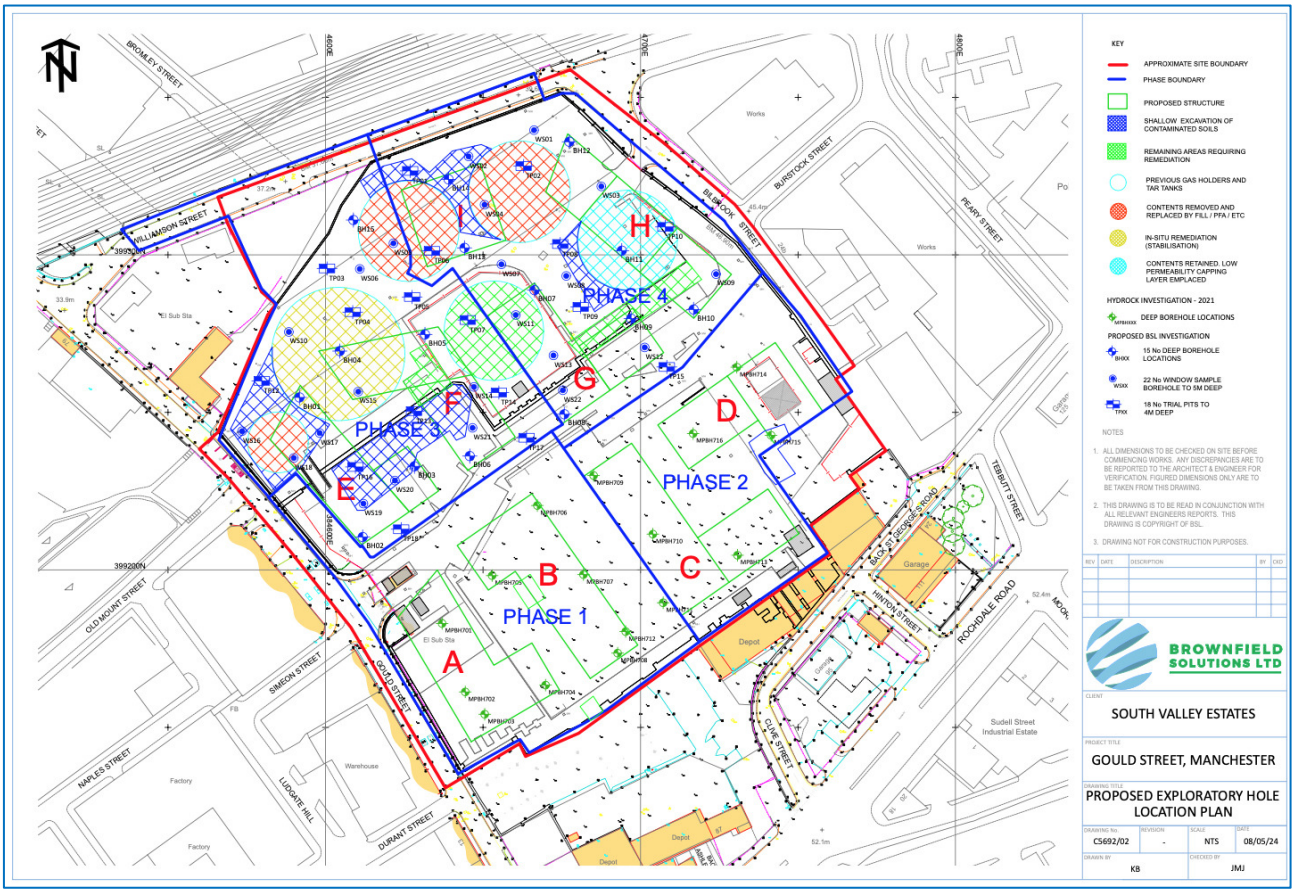
Instruction

EOD Contracts Ltd, have been commissioned by Brownfield Solutions to undertake a Provisional Desktop Study (PDTS) for potential historic Unexploded Ordnance (UXO) contamination for the future works at Gould Street, Manchester, M4 4BH, hereafter referred to as the Site.

Scope of Work

The scope of this EO Risk Assessment/Desk Study is to assess the likelihood of buried EO/UXO within the environs of The Site (See Figure 1.1), in view of further development. A further aim was to evaluate the implication from UXO contamination during any future intrusive land use.

Figure 1.1: Clients Supplied Site Diagram, This DTS will be covering the area bordered in RED.



Restrictions

It must be emphasized that a desk study can only indicate the potential for UXO to be present on the site. This study was written with the site conditions prevailing at the time of the study and no liability can be accepted for any change in the condition of the area.

Please note that our appraisal relies on the accuracy of the information contained in the documents consulted and that EOD Contacts Ltd will in no circumstances be held responsible for the accuracy of such information or data supplied.

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Sensitive Documentation

Information may be classified, restricted, or deemed to be confidential in nature to EOD Contracts Limited, where such material has been gained a summary of the documentation has been approved.

Objective

The objective of this document is to define the UXO contamination routes as defined in Unexploded ordnance (UXO) A guide for the construction industry (C681) dated July 2009 and offer remediation methodologies if required.

CIRIA Framework

The CIRIA report is intended to provide good practice guidance (code of practice) on how to identify whether a site is likely to be at significant risk of UXO encounter and, if so, to set-out a process that will allow this risk to be managed. To be effective this process must start early in the life of the project (usually before intrusive works commence) and have involved Clients, Advisors and Principal Contractors. Therefore, the ground contractor should be provided with a systematic appraisal of the UXO risk when they become involved. The CIRIA report recommends the following stages be undertaken as part of the risk management process:

- Phase 1 Preliminary Risk Assessment
- **Phase 2 Detailed Risk Assessment (Completed and updated in this document)**
- Phase 3 Risk Mitigation (The act of ameliorating the risk, the clearance methodology)
- Phase 4 The UXO Risk Management and Implementation Plan

PART 2: SOURCES OF INFORMATION

Research of the site's history, with regard to military usage, bombing raids and bomb impacts has been undertaken to establish the following:

- Frequency and intensity of enemy bombing raids for the site and immediate vicinity up to 500m.
- Bomb impacts and associated damage on the Site and in the immediate vicinity.
- The potential for UXO to remain on the Site and in the vicinity.
- Records of UXO removal activities for the Site and immediate vicinity.
- The main sources of information consulted include:
    a. EOD Contracts Ltd company records
    b. Ministry of Defence records
    c. Central and Local Government Records
    d. Public Records Office (Kew)
    e. Historic Maps and Air Photography
    f. Open-Source information (Internet)

Ministry of Defence (MOD) Records

33 Engineer Regiment (Explosive Ordnance Disposal) Royal Engineers is the unit responsible for maintaining the records concerning conventional Bomb incidents, reports, clearances and related UXO

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matters. These records are known to be incomplete and are no longer supplied. Based on in-house information released by the MOD previously, it is considered unlikely that any information released will have any significant impact on the findings of this study.

Attack Record Keeping

In general, the quality and accuracy of bombing and shelling records prior to 1942 varied greatly from one region to another. Records relating to the limited air attacks on the United Kingdom are considered to be sufficiently accurate in urban areas to provide a reasonable level of confidence in determining the likelihood that an area was or was not bombed during this period. Wartime records, maps etc held within the civil archives are considerably more comprehensive than those still in existence within the MOD, where it is acknowledged that large numbers of records have been disposed of since 1945. Records from some areas, particularly rural districts or near large bodies of water should still be regarded as an incomplete picture of the extent and effect of the bombing campaign.

Attack Record Accuracy

While an Air Raid was in progress it was inevitable that mistakes would be made in the transcription of rushed verbal reports into the written records. Discrepancies did occur between the total of bombs dropped against detonations witnessed. In some cases, records were made several hours after the event and mistakes were inevitable. Some reports were drafted before the full extent of the raid had been determined which has led to significant omissions in the records. Reports of raids on rural areas were often witnessed and submitted by untrained individuals and passed through third parties before being recorded. Suspect UXBs occasionally went unreported by local farmers and freeholders who saw the event as insignificant or were reluctant to report their findings for fear of valuable land or crops being destroyed by the authorities in their attempts to find the UXB. It should also be noted that bomb strikes in water were notoriously difficult to spot, particularly if the bomb had failed to detonate. As a result, bomb record accuracy in areas containing large bodies of water or marshland is considered to be questionable.

Errors and Omissions

The accuracy of bombing records has been shown to vary greatly; this may have been a result of the individual record keeper's expertise. Additionally, in some cases, errors occurred as a result of poor or incomplete transcription and copying. Some "errors and omissions" were intentional, designed to serve as dis-information to confuse German intelligence. So long after the event, official verification of such incidents has often proven to be impossible to obtain. At present, UXBs are found on construction sites and other locations where there had been no documentary evidence to suggest their presence. These events, although infrequent, do serve as confirmation that records cannot be considered definitive.

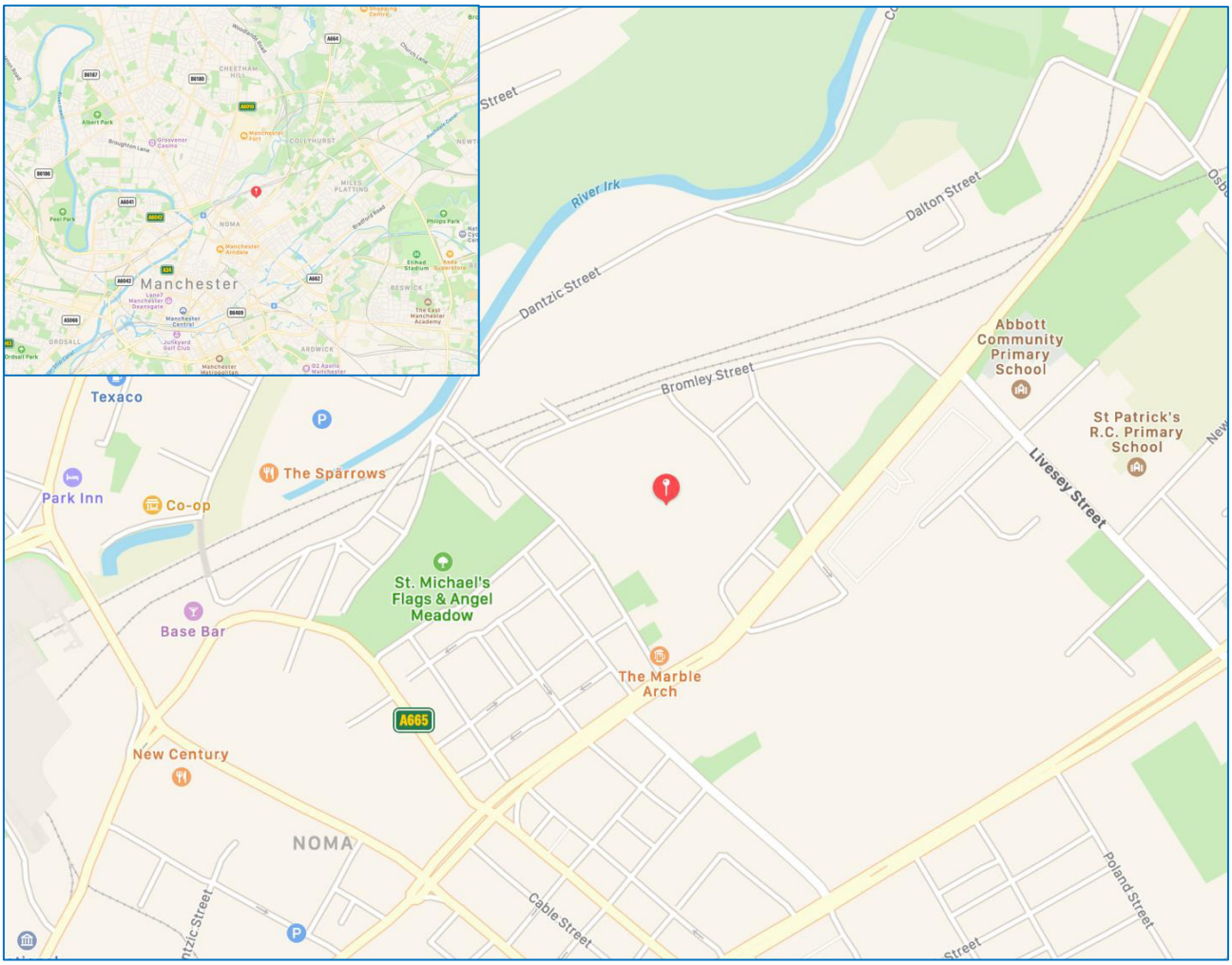
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PART 3: SITE DESCRIPTION AND DETAILS

Location

The Location (red flag). An exact meeting point will be determined by the Client should the need arise.

Table 3.1 Site Location.



Title	Description (Centre of Site)
Address	Gould Street, Manchester,
Post Code	M4 4BH
Nat Grid Reference	SJ 846992 / SJ 8468599234
what3words	mirror.cars.hotel

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Description and Current Usage

PHOTO 3.1: The Site at present is still fully utilised. However, its only use is as a "off street" carpark. All former buildings have been demolished to ground level.



Geology

BGS (British Geological Survey) indicates the following geology.

Wilmslow Sandstone Formation - Sandstone. Sedimentary bedrock formed between 252.2 and 247.1 million years ago during the Triassic period.

Future Works

At the time of writing this report it is understood that the site will be subjected to some form of redevelopment (the exact scope of works is not known at this time). The supplied requirement is usually for, geotechnical investigations, possibly percussive drilling/trial pits/window/samples.

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PART 4: HISTORICAL REVIEW

Historical Mapping

The historical maps in Annex B have been reviewed and a brief synopsis is in Table 4.1:

Table 4.1 Historical Map Synopsis

Date	Scale	Description/Remarks
1922 - 1933	1:2,500	The Site pre-WW2 lies within a well-established built-up area and is both residential and Industrial in nature. Within the Site boundary lies "Rochdale Road Gas Works" which includes three gas holders as well as four large sheds with rail lines used for loading/offloading. There are also several smaller ancillary buildings whose exact usage cannot be determined but can be assumed to form part of the infrastructure required for the Gas Holders.
1948 - 1949	1:1,250	For the most part the Site remains unchanged except for the southeast corner where one of the sheds has been removed and replaced with a conveyor.
1968 - 1990	1:1,250	There has been post war development that has taken place within the Site boundary. The three gas holders remain unchanged. However, the three sheds/conveyor and rail lines have been removed and replaced with one large building which occupies the entire southern half of the Site area.
1992	1:1,250	Further development has taken place within the Site boundary. The Site is now titled as a "depot". It appears that the entire Site has undergone change, this includes both the large building that occupied the Southern half of the Site and the removal of the three Gas Holders.
2024	1:10,000	Further changes have taken place within the Site boundary. All former buildings have been reduced to ground level. The Site at present is being utilised as an "off road" carpark.

Post War Construction/Works

There have been several stages of post WW2 construction as previously stated. Additionally, there has also been post war remediation works carried out in order to clear contaminated ground, particularly in and around the former gas holders.

SOURCE: https://www.ashremediation.co.uk/portfolio/gould-street-gasworks-2/

WWI

Although many people associate wartime bombing with The Blitz during World War II, the first airborne terror campaign in Britain took place during the First World War. Air raids in World War One caused significant damage and took many lives. German raids on Britain, for example, caused 1,413 deaths and 3,409 injuries.

Site Specific Bombing Information

There is no evidence to suggest that the Site was targeted throughout this period.

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WWII

Bombing started as early as October 1939, by the end of the WWII the Luftwaffe had dropped approximately 50,000 tonnes of high explosive bombs and 110,000 tonnes of incendiary bombs, this caused over 40,000 UXBs, killed 43,000 people and over 250,000 homes were destroyed.

Manchester (the Site) Throughout WW2

Manchester and its surrounding area were a major centre of industry during the Second World War. Many large firms were concentrated in the Trafford Park area, making it an important target for the Luftwaffe. Major producers included the aircraft manufacturers A V Roe that produced Manchester and Lancaster Bombers; Ford also employed 17,000 workers making aero engines in a huge new factory complex. During the raids on 22nd – 24th December 1940, the Metropolitan-Vickers works in Mosley Road was just one of the areas factories that was badly damaged. In a later raid 1n 1941 Manchester United's Stadium was hit by a bomb and remained out of action till 1949.

Manchester was attacked on the night of 22nd – 23rd December and again the following night of 23rd – 24th December 1940 (the Christmas raids). On the first night of the raids over 272 tons of HE Bombs was dropped, followed the next night by a further 195 tons. In cooperation to this the Luftwaffe also dropped around 2000 Incendiary bomblets across the city.

Additionally, to these raids, Manchester also suffered smaller attacks, including one in June 1941 when the Blitz was thought to be over. The city had three major raids over the Blitz period (a major raid being defined when over 100 tons of HE Bombs have been dropped) in total, more than 578 tons of explosives were aimed at the city making it the 11th most heavily raided city in Britain.

During the Christmas Raids over 600 fires were started by Incendiary bombs, unfortunately the majority of these were allowed to burn causing further damage. This was due to the cities 3,500 full and part time fire fighters had not returned from Liverpool where they had been sent several days before to help fight fires caused by previous raids. In some cases, the Army was utilised to demolish surrounding buildings to stop the fire from spreading further. Some of the fires continued to burn throughout the day on the 23rd December, providing a beacon for the German Luftwaffe upon its return that night.

So far as the city's infrastructure was concerned, following the Christmas raids both of Manchester's railway stations had been hit, as were the major bus stations. Deansgate and Oxford Road were blocked by debris from damaged buildings; bomb craters and UXBs meant that whole sections of the city had to be cordoned off. Water supplies were also affected, and electricity was rationed.

As can be seen within the Bomb Map in Annex D there does appear to have been at least four bomb strikes within the Site boundary itself, including strikes on the Gas holders themselves.

Abandoned Bombs/UXO

EOD Contracts records could find no evidence of any abandoned Bombs in or around the subject Site.

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Anti-Aircraft Artillery

There is no recorded evidence of the site being utilised for this purpose.

Explosive or Munition Factories

No explosive or munition factories were noted.

Military Usage

No records that indicate that the site has served any military purpose other than as a supply depot, as previously highlighted.

Prior Clearance Operations

EOD Contracts could find no evidence to suggest that there have been any prior UXO clearance operations in or around the site footprint.

PART 5: SOURCES OF UXO CONTAMINATION

The main sources of UXO contamination that have been researched for the site are:

Air delivered ordnance bombs and sub-munitions/incendiaries.

- Anti-Aircraft Ammunition (AA)
- Air delivered ordnance bombs and sub-munitions/incendiaries.

General

UXO contamination pathways from:

- Air delivered ordnance bombs between 100m and 200m.
- The nearest Anti-Aircraft Weapons (AA) is over 3km.
- No recorded use as an Explosive or Munition Factory
- Has had no Military Usage

UXOs are essentially dangerous; therefore, further information on UXO and Safety is detailed in Annex D.

Bomb Penetration Depths

The weapon penetration depths have been assessed as part of the tables in Annex D.

Factors Affecting Penetration

The penetration of sub-surface bombs will be affected by the following:

- Height of release
- Weight, shape, and design of bomb
- Aerodynamic qualities
- Angle of flight and impact
- Nature of impact surface
- Nature of sub soil

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The expected bomb depths for the site assuming the following criteria:

- 15,000 feet, the vast majority of bombs were dropped from height to avoid AA fire and balloons.
- General Purpose Bombs of 50kg to 1000kg
- Near Vertical impact 80 to 90 degrees
- Surface geotechnical conditions are made ground.
- Subsurface geotechnical conditions are generally clays.

Therefore, the expected depths for Air dropped UXBs on site are indicated in RED in the following table:

TABLE 5.1: Bomb Penetration Depths

	Bomb Weights			
Sub-Soil Type	50kg	250kg	500kg	1000kg
Soft Rock	2.442	5.016	6.006	7.062
Gravel	2.442	5.016	6.006	7.062
Sand	2.442	5.016	6.006	7.062
Chalk	3.7	7.6	9.1	10.7
Shingle	3.7	7.6	9.1	10.7
Dry Clay	3.7	7.6	9.1	10.7
Wet Sand	5.55	11.4	13.65	16.05
Wet Clay	5.55	11.4	13.65	16.05
Average Offset (m)	0.8-1.6	1.6-3.7	3-4.5	3.4-5.3

PART 6: RISK ASSESSMENT

Risk Assessment

Assessing both the likelihood of occurrence and the consequences of the encounter has derived the overall risk for the site from unexploded ordnance. Review of the Site's history and geographic location can provide an overall likelihood of encounter factor, which is used in the subsequent determination of a risk level when a Figure can be determined for the consequence.

Likelihood of Encounter

Given the study findings and other criteria (see Annex E Tables) it is considered that there is a **LOW**/ **MEDIUM** risk of encountering UXO within the Site footprint. This finding is based on assessment of all of the available information and taking account of the following factors:

- The Site area is situated within Manchester, which is off historic fact was bombed on several occasions throughout WW2, the worst of which being the Christmas raids. However, despite this it is situated away from the centre of Manchester which is where the focus of the raids took place.
- The Site was subjected to bombing throughout WW2 as can be seen in Annex D.
- The Site area was fully utilised throughout WW2.
- The Site would have been considered a viable and strategic target throughout this period.

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- There have been several phases of construction and remediation works that have taken place within the Site boundary post WW2. However, it cannot be guaranteed that these remediation works went to protentional bomb penetration depth.
- Encounters of UXO are not uncommon, recent UXO finds are in Annex E.

Consequence of Encounter

The consequence (see Annex D) of an uncontrolled encounter with UXO, given its lethal design and its unpredictable nature could be catastrophic and warrants a high severity factor. With regards to the consequences, the following factors were considered:

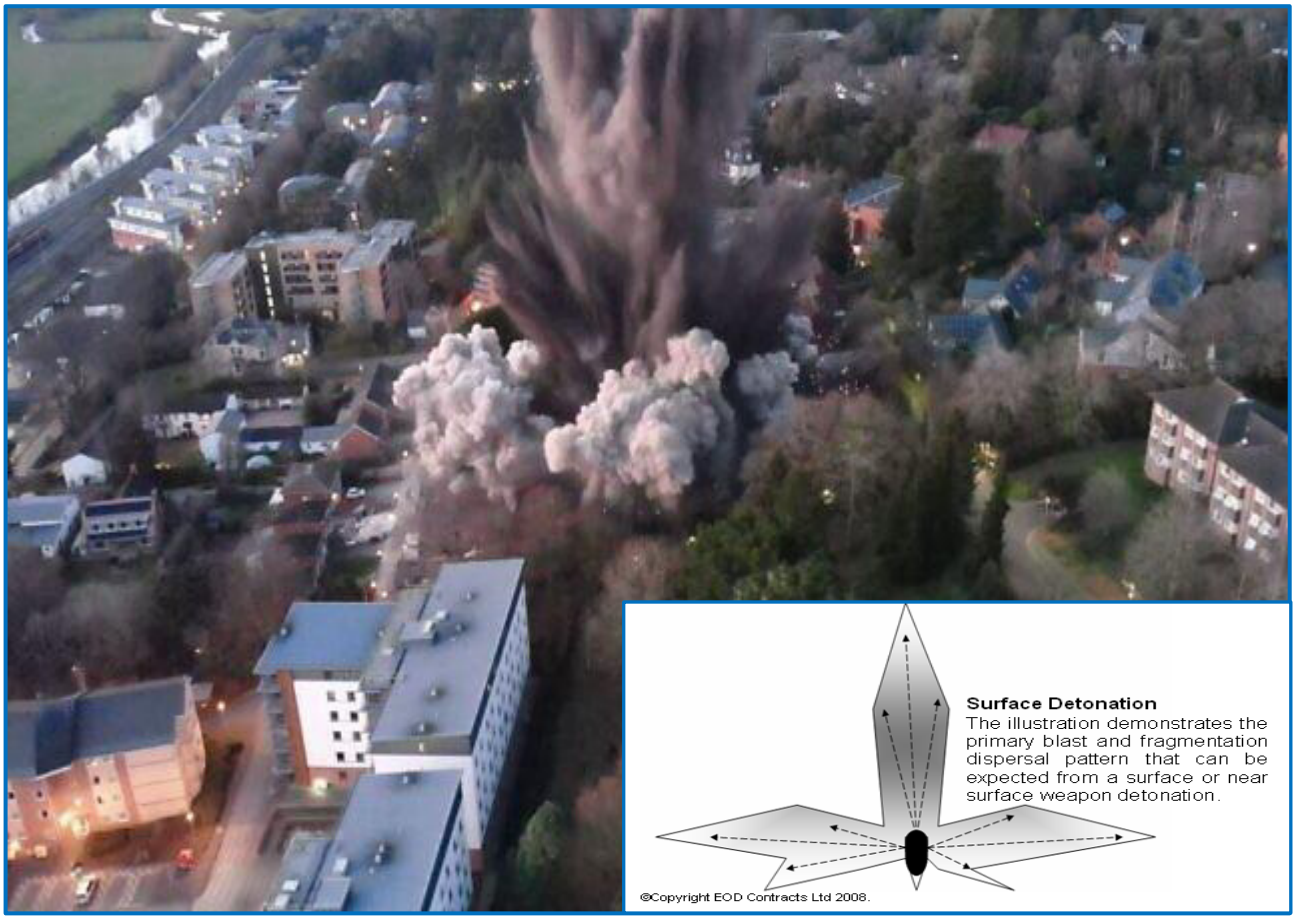
The project works may make use of a number of common ground investigation and construction techniques in its methodology during the project. Any intrusive groundwork has the potential to encounter UXO.
Intrusive earthwork, piling driving and dynamic ground compaction are by nature, aggressive, significant force (kN) is often required to achieve the desired results. As a precaution it is prudent to assume that any external stimulus, no matter how slight, may result in an unstable weapon detonating.

Records of encounters with UXO, particularly where plant machinery has been involved have resulted in detonations of the items with varying degrees of consequence; ranging from slight injuries sustained to piling contractors when a bomb detonated at 6.0m bgl to fatal injuries sustained to a construction worker while conducting near surface machine works on a motorway.

Detonation on land; the effects of a detonation at depth will be more localised and less destructive than one occurring on the surface. Figure 6.1 shows an illustration of the primary blast and fragmentation dispersal from explosive ordnance when it detonates on the surface. The weapon's design, and other key factors such as the ratio of explosive charge weight to total weapon weight (CWR) and the Net Explosive Quantity (NEQ) will determine the size and effects of a blast. The effects will also be enhanced or reduced by a number of factors including, the presence of other energetic materials in close proximity to the blast or if the weapon is buried or exposed on the surface. As a guide Annex E Table 1 gives an indication of the likely blast radius for common types of UXO.

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Figure 6.1: Primary Blast & Fragmentation on Land



In addition to the dangers of explosion, many common chemicals used in the manufacture of explosive ordnance fillings are in sufficient quantity, and level of exposure, toxic or poisonous. Although it is unlikely that such chemicals would be encountered in significant quantity to represent a significant risk to personnel, leakage or venting could pose a risk to the local marine environment. In addition to heavy metals, copper, lead, zinc etc used in the weapon body and fuze, hydrocarbon propellants such as Kerosene may also be present.

Risk Level

The prevailing risk level has been determined to be **LOW** within the Southern half of the Site area and a **MEDIUM** risk in the northern half. (See Risk Map)

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PART 7: CONCLUSIONS

Based on the information researched by EOD Contracts Ltd for the proposed scope of works being carried out within the given site area, the following conclusions have been reached:

Historical UXO Contamination

The indicators for UXO contamination are:

Bomb Strikes	There are no recorded incidents of the site being the subject of bombardment throughout WW1. Manchester was targeted heavily throughout WW2. The Site would have been considered a strategic target throughout this period. Known bomb strikes within the Site boundary. There have been several phases of construction and remediation works that have taken place within the Site boundary. The Site was fully utilised throughout WW2.
Bomb Damage	Difficult to ascertain.
Reconstruction	No obvious signs
Military Usage	No obvious signs.
Explosive/Munition Factory	No obvious signs

Risk Level

The overall risk has been determined to apply to all ground works within the site footprint.

Risk Level	Therefore, so far as reasonably practicable the risk level on Site has been deemed as both a **LOW** risk and **MEDIUM** risk for some areas. See risk map.
Risk Depth	7.062 for areas deemed a **MEDIUM** risk

PART 8: RECOMMENDATIONS

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **LOW** risk.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

It is recommended that the following risk mitigation strategy be executed during phases of the project indicated previously as a **MEDIUM** risk.

Communicating the risks, all stakeholders should be made aware of the UXO situation on the site and the possible impact it may have on the project works and day to day running of the district. Clients have a legal

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duty under the Construction Design & Management Regulations (CDM) and Health & Safety at Work legislation to provide Designers and Contractors with project specific information needed to identify hazards and risks associated with the design and construction work. The possibility that UXO may be encountered on site falls within the category of a significant risk and as such it should be addressed as early as possible in the lifecycle of the project.

Further planning: the risks posed by UXO should be brought to the attention of the Project CDM Coordinators and other individuals with a responsibility for project safety and operations at the site. The matter of UXO should be considered critical to project safety and one requiring high priority action.

UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. A competent person as part of the project safety induction course should provide the awareness training. It should be reinforced with specific safety briefings and toolbox talks to individuals involved in conducting intrusive earthworks.

Project overview and the responsibilities of those working on site with regard to duty of care and public safety.

UXO recognition and safety procedures to be followed on discovery of a suspicious object or the alarm being sounded.

Emergency procedures to be followed in the event of an explosion. Evacuation routes, muster stations and accounting for personnel.

Work permits, works methodology and specific UXO risk mitigation methods. Post-incident inspections and returning to normal works.

Prior to any intrusive piling or drilling commencing, UXO safety testing and appropriate clearance certification into the ground to sufficient depth to provide clearance from UXO. This can be done using a progressive drilling process or (where large numbers of piles are to be placed and ground permitting) using a vehicle borne hydraulic system to push a magnetometer into the ground to test for the presence of UXO prior to piling.

UXO safety monitoring of all “at risk” excavations, including geotechnical or archaeological trial pits to be conducted during the project. This should be provided by a UK Home Office Authorised EOD/UXO Contractor using qualified EOD Engineer with specialist locators and detectors to scan the ground ahead of the excavation wherever possible.

9.0: SPECIFICALLY

Geotechnical investigations, percussive drilling/trial pits/window/samples, require an EOD Engineer over watch.

The removal of all buildings within the site footprint can be removed down to ground level (including basements)

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New foundations with piling should be mitigated by the insertion of a magnetometer to encompass the pile position, this would be carried out using a CPT rig (magcone), the expected radius of the magcone is 1.5m therefore multiple piles could be checked.

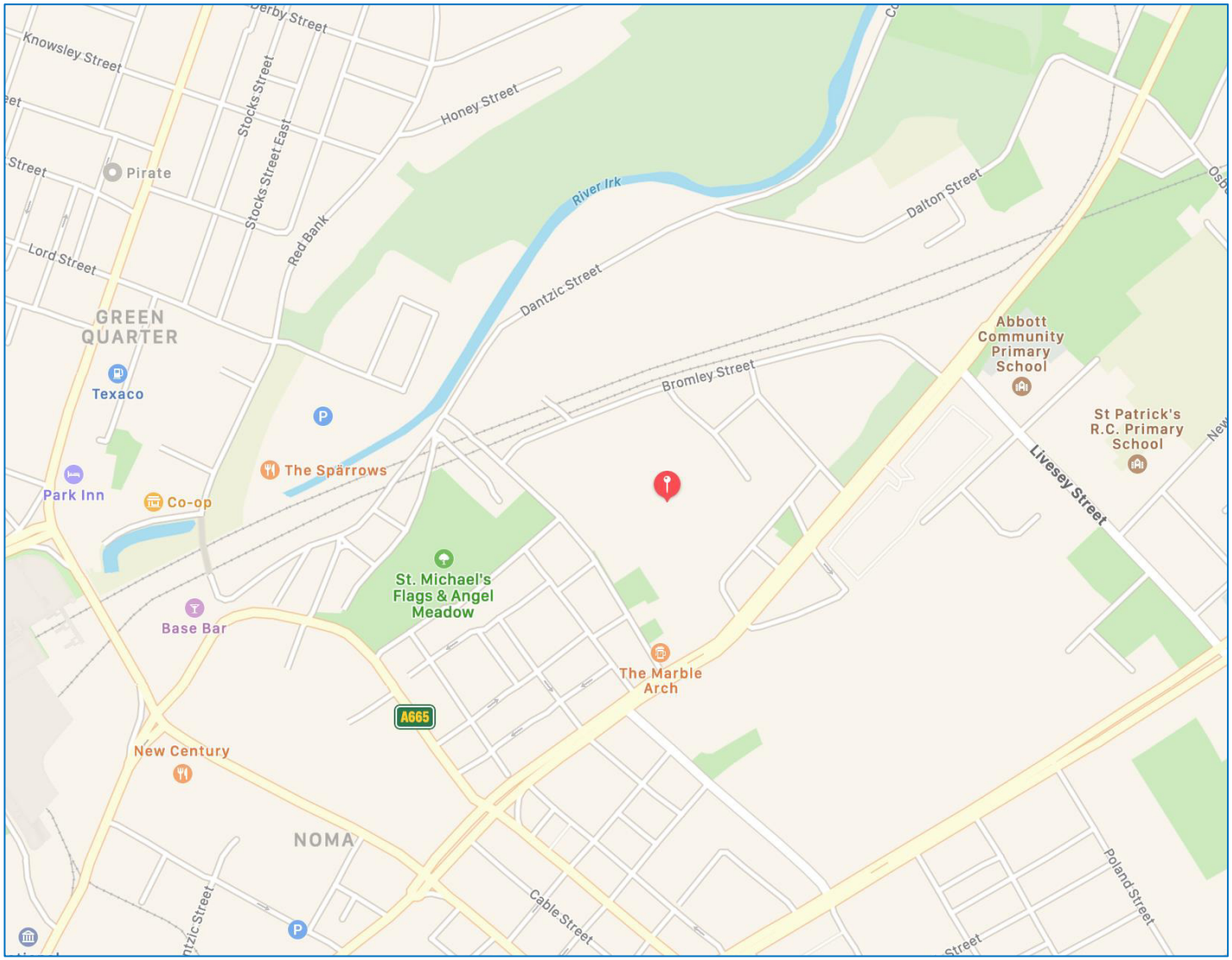
Non-Intrusive Magnetometer surveys generally prove inconclusive on "Brownfield sites", this is due to the high ferromagnetic background, therefore this methodology is not recommended for this site and shallow excavations should be overseen by a qualified EOD Engineer.

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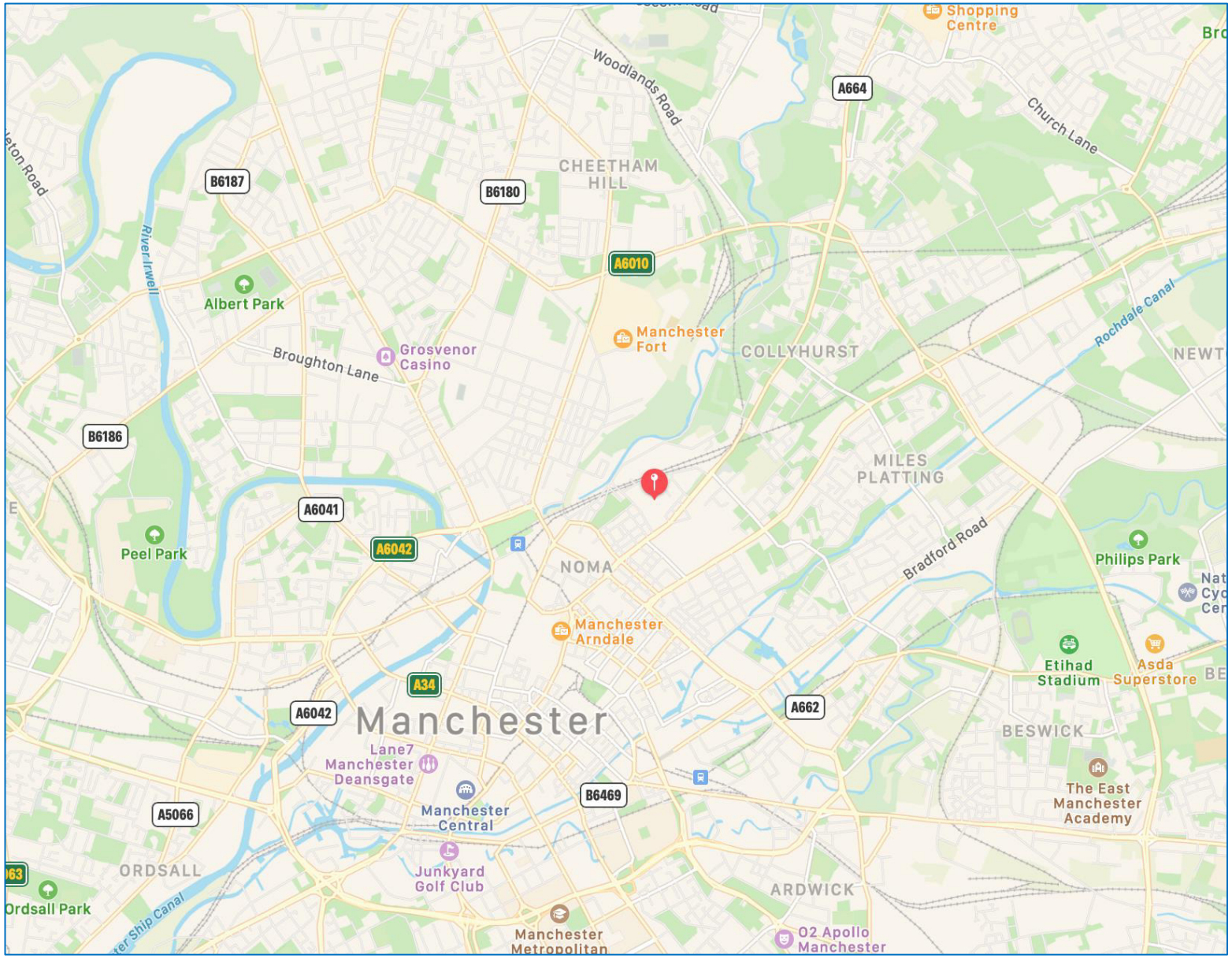
Annex A

SITE LOCATION

The Site Location (red flag). An exact meeting point will be determined by the Client should the need arise.



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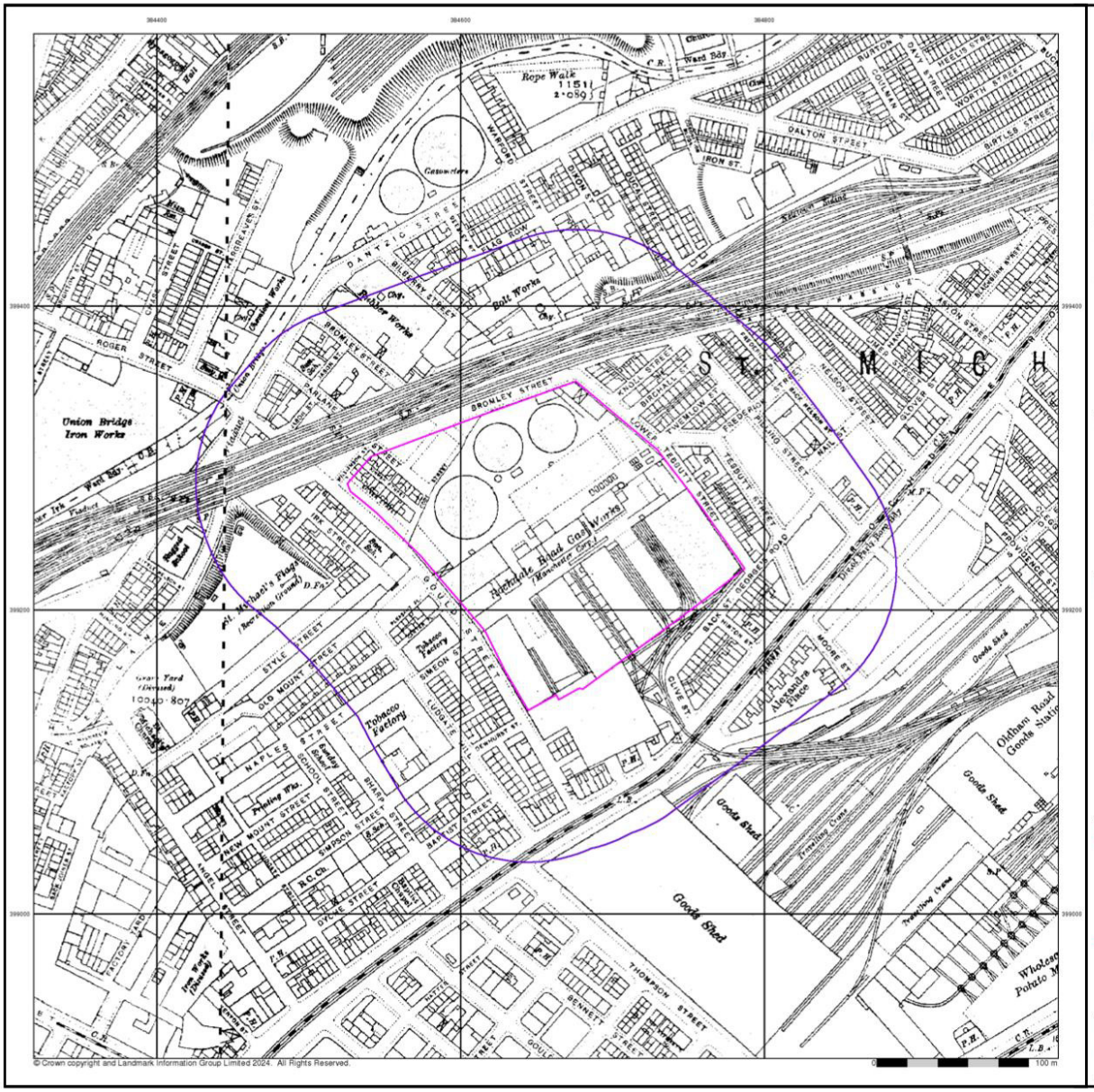
Annex B

HISTORIC MAPS

Index of Historical Maps

Page No.	Date	Scale	Description/Remarks
B-2	1922 - 1933	1:2,500	The Site pre-WW2 lies within a well-established built-up area and is both residential and Industrial in nature. Within the Site boundary lies "Rochdale Road Gas Works" which includes three gas holders as well as four large sheds with rail lines used for loading/offloading. There are also several smaller ancillary buildings whose exact usage cannot be determined but can be assumed to form part of the infrastructure required for the Gas Holders.
B-3	1948 - 1949	1:1,250	For the most part the Site remains unchanged except for the southeast corner where one of the sheds has been removed and replaced with a conveyor.
B-4	1968 - 1990	1:1,250	There has been post war development that has taken place within the Site boundary. The three gas holders remain unchanged. However, the three sheds/conveyor and rail lines have been removed and replaced with one large building which occupies the entire southern half of the Site area.
B-5	1992	1:1,250	Further development has taken place within the Site boundary. The Site is now titled as a "depot". It appears that the entire Site has undergone change, this includes both the large building that occupied the Southern half of the Site and the removal of the three Gas Holders.
B-6	2024	1:10,000	Further changes have taken place within the Site boundary. All former buildings have been reduced to ground level. The Site at present is being utilised as an "off road" carpark.

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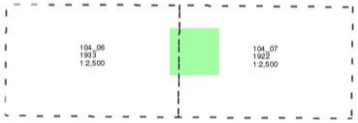
Lancashire And Furness

Published 1922 - 1933

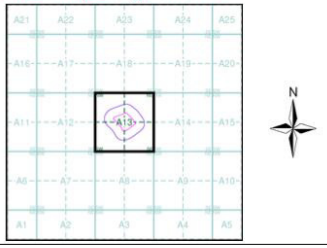
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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National Grid Reference:	384660, 399250
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Site Area (Ha):	3.05
Search Buffer (m):	100

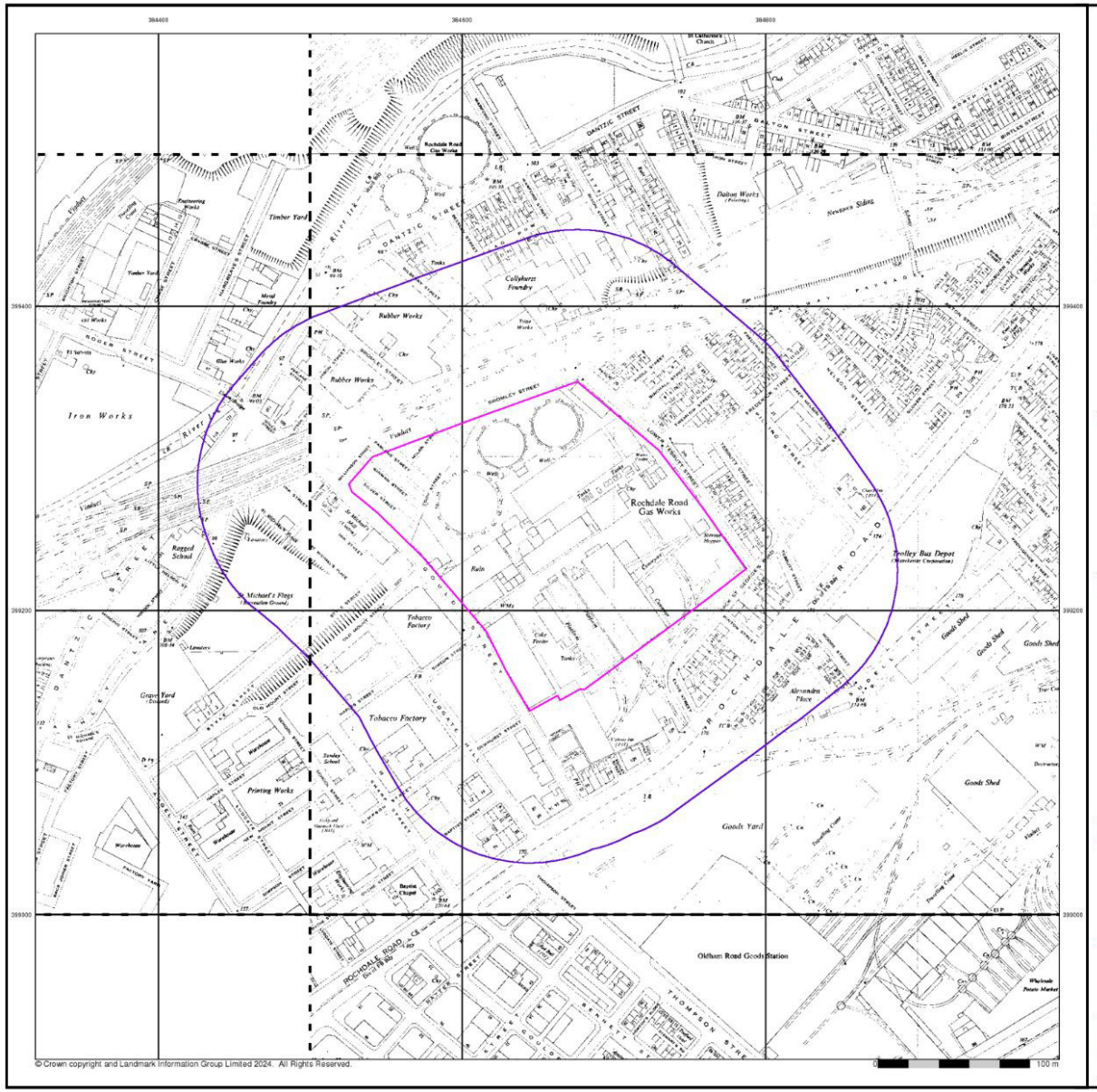
Site Details

Gould Street, Manchester, M4 4BH

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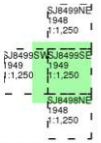
Ordnance Survey Plan

Published 1948 - 1949

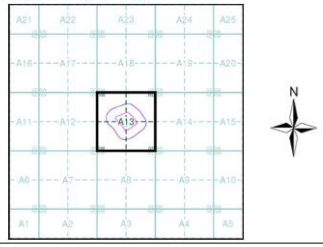
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

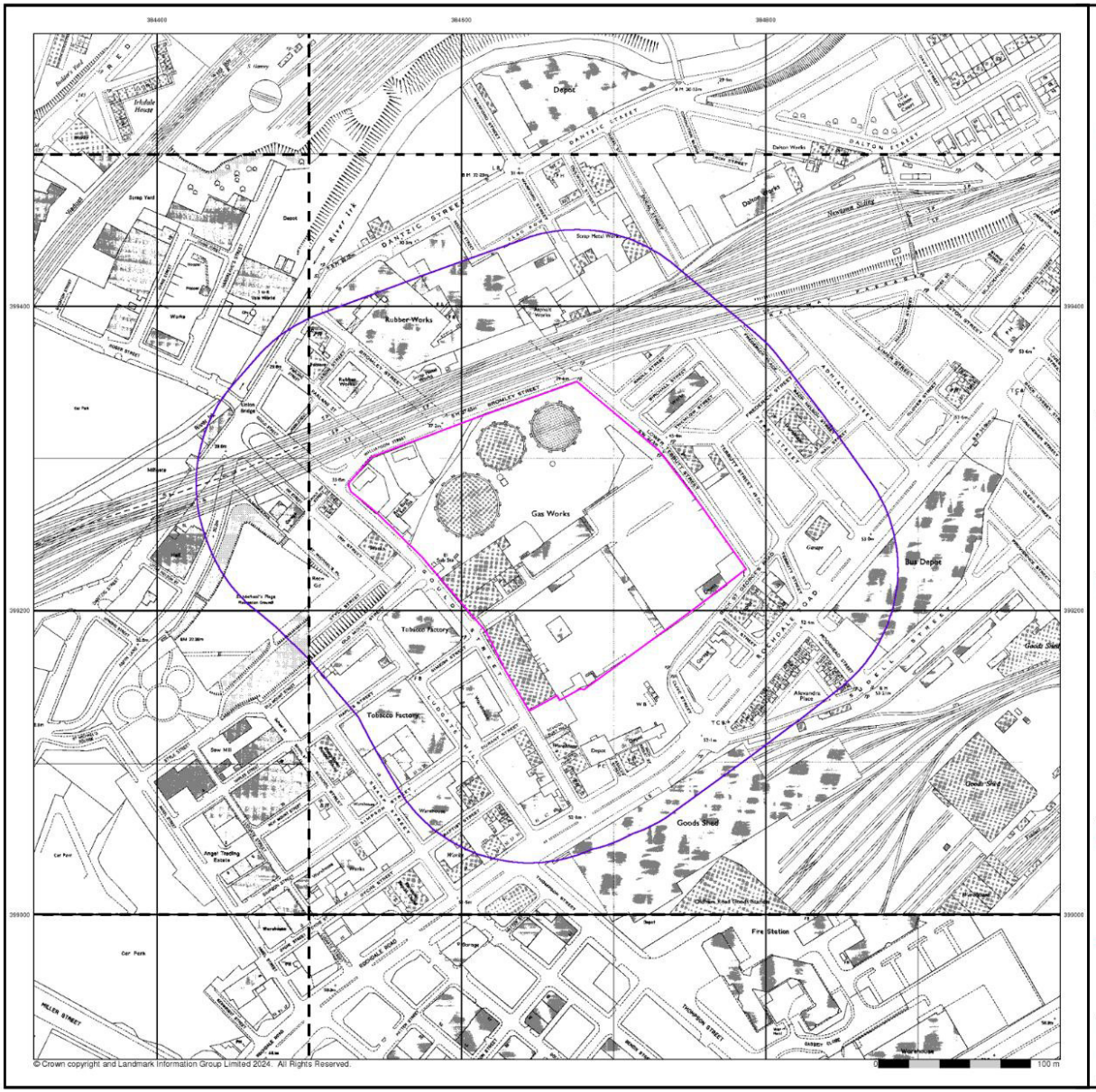
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National Grid Reference:	384660, 399250
Slice:	A
Site Area (Ha):	3.05
Search Buffer (m):	100

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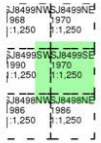
Ordnance Survey Plan

Published 1968 - 1990

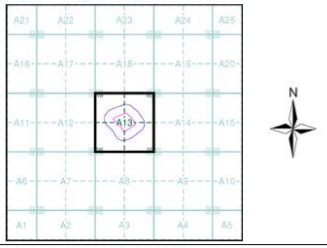
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

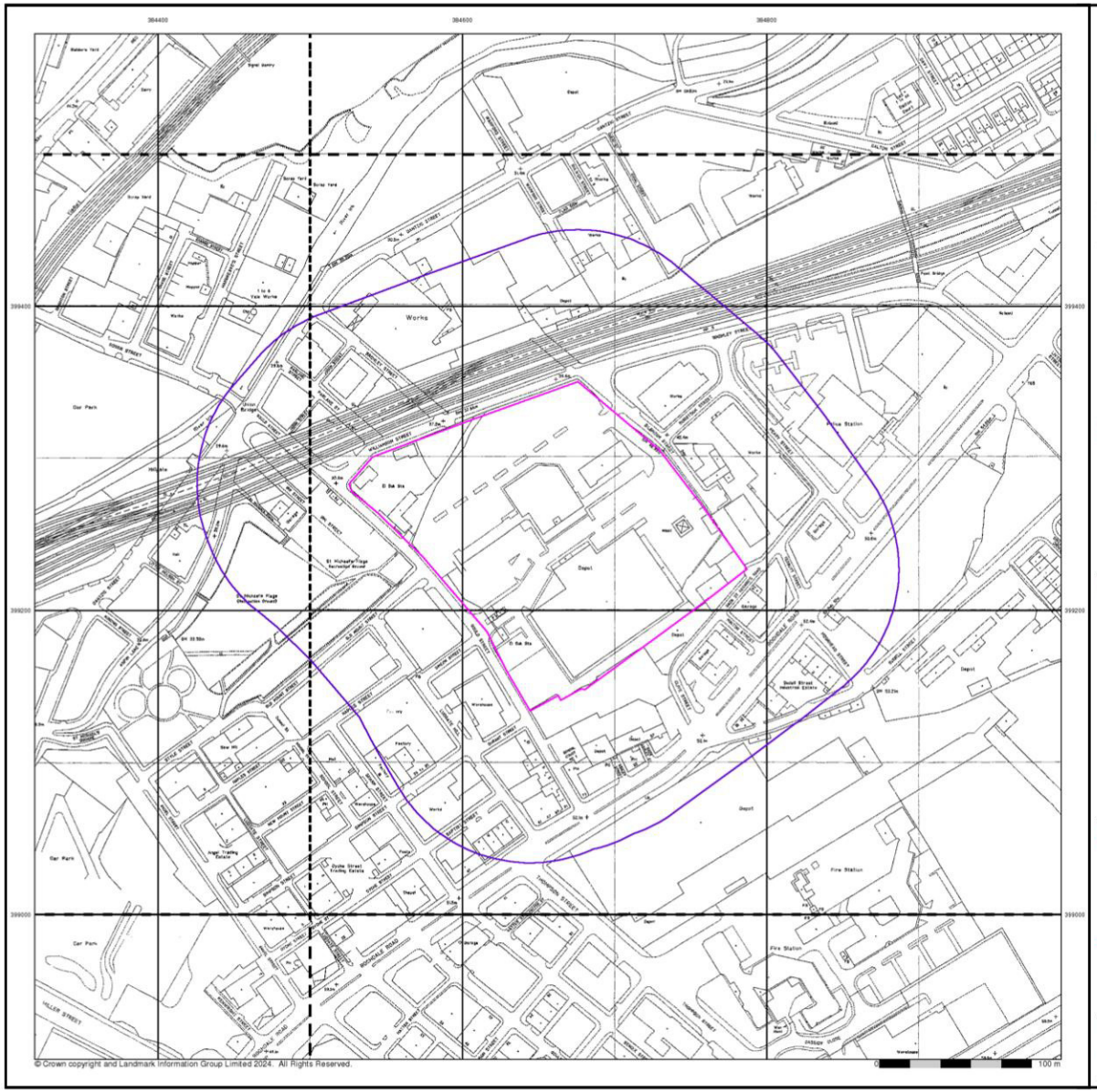
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National Grid Reference:	384660, 399250
Slice:	A
Site Area (Ha):	3.05
Search Buffer (m):	100

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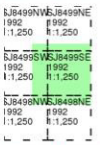
Large-Scale National Grid Data

Published 1992

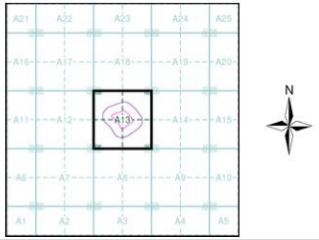
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	349249836_1_1
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National Grid Reference:	384660, 399250
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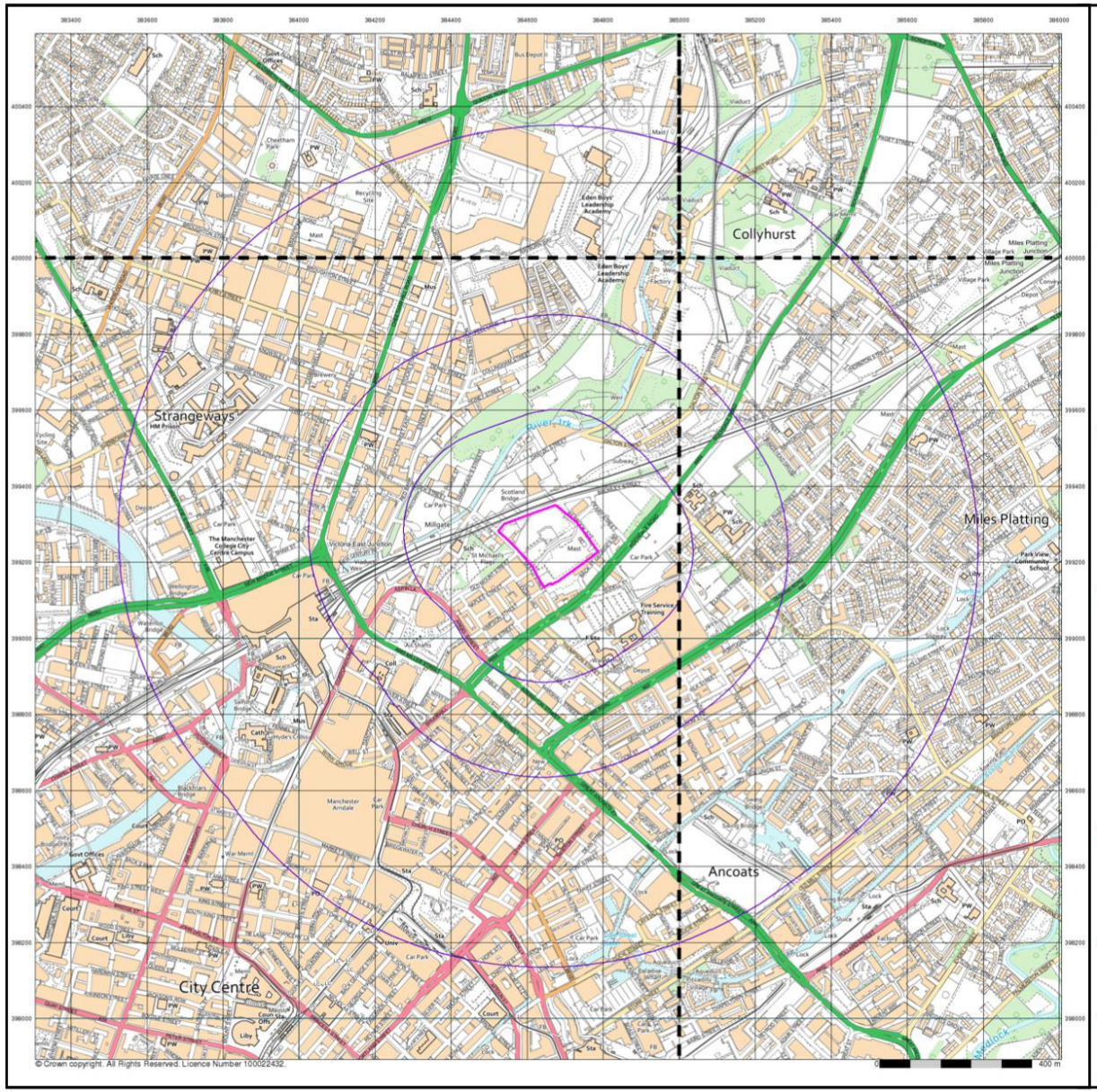
Site Details

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VectorMap Local

Published 2024

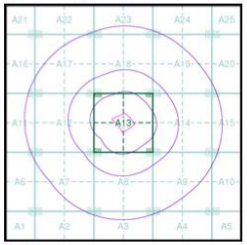
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

SD80SW 2024 Variable	SD80SE 2024 Variable
SJ89NW 2024 Variable	SJ89NE 2024 Variable

Historical Map - Slice A



Order Details

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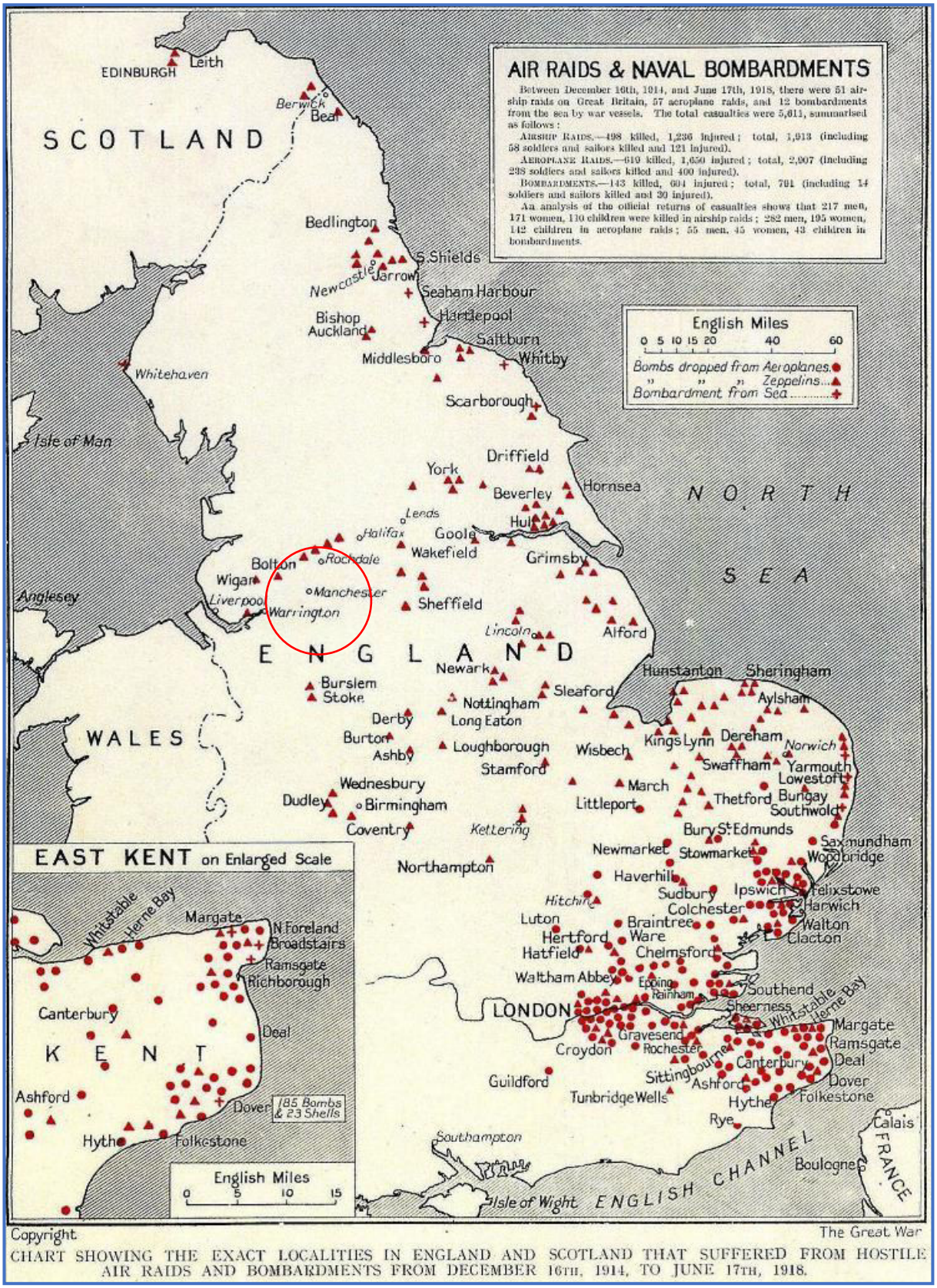
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Annex C

BOMB RAIDS WWI



Copyright The Great War

CHART SHOWING THE EXACT LOCALITIES IN ENGLAND AND SCOTLAND THAT SUFFERED FROM HOSTILE AIR RAIDS AND BOMBARDMENTS FROM DECEMBER 16TH, 1914, TO JUNE 17TH, 1918.

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Annex D

BOMB IMPACT MAPS

PHOTO D-1(accumulation map): Extracted Manchester Archives. The Site (approximate, red arrow) – This map highlights both bomb strikes as well as bomb damage. As can be seen there are at least four bomb strikes within the Site boundary.



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Annex E



Source:	Kent Online
Date:	15th November 2023
Description:	**Dig uncovers V2 Nazi rocket in Halstow Marshes, Hoo – 78 years after it was fired at London from German occupied Holland.** Remains of a Nazi V2 rocket fired at Britain during the Second World War have been unearthed in a Kent field. The 12.5-tonne German missile was launched towards London from The Hague in occupied Holland 78 years ago but fell short of its target instead landing in the Halstow Marshes on Medway's Hoo Peninsula. The force also noted: "The Warwickshire Police goalkeeper won't be happy. it was blown up in the six-yard box of the pitch." Researchers have pinpointed the exact date and time of its explosion as February 17, 1945, at 2pm. Hitler used the missiles – the world's first ballistic missiles – as part of his terror weapons programme in an effort to force Britain into surrender. Around 100 of these "Vengeance Weapons" were fired towards Britain each week between 1944 and 1945, in the hopes of causing maximum destruction of the V2's weight, 8.5 tonnes was made up of fuel, three tonnes comprised the missile's body, and one tonne made up the weapon's warhead. The find is the second V2 rocket found in Kent in the past few years, with the team at Research Resource Archaeology previously digging up a missile at St Mary's Platt near Sevenoaks back in 2021.

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Source:	BBC
Date:	10th February 2023
Description:	**Army bomb disposal experts have carried out a controlled explosion after World War Two ordnance was found in the River Leam in Leamington Spa.** Warwickshire Police closed part of Willes Road around the Mill Gardens Park during Sunday's operation. A group called the Peaky Dippers, that trawls the river with magnets to hunt for metal, said on social media that it made the find. The roads and the park reopened by 19:00 GMT. A member of the Peaky Dippers group claimed on Facebook: "There wasn't just one bomb found, there [were] numerous WW1 and WW2 guns, grenades and artillery tips..." Warwickshire Police confirmed magnet fishers made the find and said the 18-pound British shell was taken back to its Leek Wootton headquarters for safe disposal. It said the 80-year-old shell "was clearly very well made" and still had the power to "produce one almighty boom and shake the ground after decades under water". The force also noted: "The Warwickshire Police goalkeeper won't be happy... it was blown up in the six-yard box of the pitch."

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Source:	BBC
Date:	10th February 2023
Description:	**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. The cordons, at 200m (656ft) and 400m (1,312ft) from the bomb, were lifted on Friday evening. Most roads have been reopened and residents have been allowed to return to their homes.

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Source:	BBC
Date:	24 July 2021
Description:	A live World War Two bomb unearthed by builders on a housing development has been destroyed in a controlled explosion. The 500lb (227kg) device was found on the new-build estate in Goole, East Yorkshire, on Thursday. Eight homes were evacuated and the M62 was shut between junctions 35 and 37 as a safety precaution. Humberside Police said the device was successfully detonated at 16:22 BST on Saturday. All residents have been able to return to their homes and local business are no longer being asked to remain closed. The force also said a no-fly zone and the closures of the M62 and other roads nearby had since been lifted. John Sharpe, site manager of the Beal Homes development, said he received a call from workers just after midday on Thursday. "They didn't know what they'd dug up at first and a guy went down into the hole because we thought it was a metal pipe. "As he uncovered it he realised it was a bomb and got out pretty quickly," he said.

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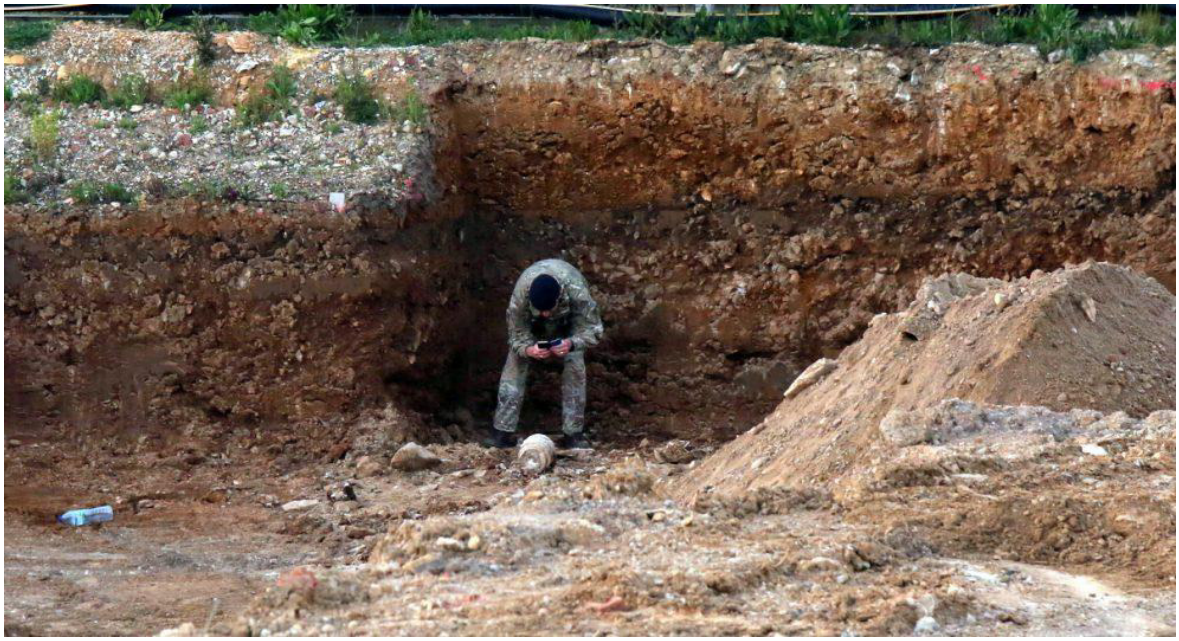






Source:	The Sun
Date:	27 February 2021
Description:	A WORLD War II bomb which sparked a mass evacuation in Exeter has been detonated by army experts leaving a crater the "size of a double decker bus." The noise from the huge blast - which sent debris flying more than 250 metres - could be heard five miles away with some residents claiming the aftershock rattled their windows. Personnel from the Army's Royal Logistics Corps took over from Royal Navy bomb disposal experts this morning. They used 400 tonnes of sand to create an enclosing "box" before it was "made safe" at around 6.10pm. He added: "Around 400-tonnes of sand was transported to the site of the device, which is at a building site on private land, and walls were erected... to mitigate the impact of the detonation. "Trenches were also dug to prevent ground shock. Despite these mitigation measures, the impact of the blast has been significant and debris has been thrown at least 250-metres away. "The crater is around the size of a double decker bus.

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Source:	UKNIP
Date:	04 May 2020
Description:	Officers from Kent Police are working with Army Bomb Disposal officers after the discovery of two unexploded WW2 bombs were located in Kings Hill, Kent. Police were called just after 4:30pm Monday afternoon to Warwick Way after the discovery of an unexploded ordnance. The Army Bomb disposal service were called in to action to attend the scene to evaluate the discovery and make it safe. Shortly after a second ordnance was found in the adjacent road Gibson Drive. Officers have placed a cordon on the area whist the Army investigate and decide if a controlled explosion is needed.

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Source:	The Bolton News
Date:	10 February 2020
Description:	A worker who found an unexploded bomb in a back garden has spoken about the discovery. Aram Mahmoud found the item while putting fence posts in for a house on Bradford Road, and said he recognised the explosive instantly due to growing up in Iraq. Mr Mahmoud said: "We were putting up concrete posts and we were digging and we found a rocket. "We called the police immediately and they came round. The bomb disposal team told Mr Mahmoud that the device was "very very dangerous". Bradford Road was closed between Green Lane and Bishops Road, and Oakleigh Avenue was also shut off with residents evacuated. Both roads have now reopened and the police have left the scene.

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Source:	Sky News
Date:	4 February 2020
Description:	London's Soho Evacuated as World War Two Bomb Discovered A large part of central London's busy Soho area was evacuated after an unexploded Second World War bomb was found at a building site. Police were called at 1.42pm on Monday to Dean Street, connecting Oxford Street to Shaftesbury Avenue, which they cordoned off after the device was discovered near the Soho Hotel. A Royal Engineers bomb disposal unit was called in and removed the half-tonne device. The Metropolitan Police's Soho team said the cordons in Oxford Street, Charing Cross Road, Shaftesbury Avenue, Lexington Street and Poland Street had been lifted shortly after 8:30pm.

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Source:	Express and Star
Date:	May 17, 2019
Description:	Second World War Bomb Detonated in Bilston. A Second World War bomb was detonated by the army in Bilston last night following a discovery by a workman. The detonation took place on what appeared to be a building site at around 8.30pm. A West Midlands Police spokesman said: "We were called to reports of an unexploded World War 2 bomb at a building site on Coseley Road, Bilston, at 3.40pm. A controlled explosion was carried out."

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Sip Grenades



Aftermath of Demolition



Source:	The Beach https://www.thebeach.co.uk/news/local-news/bomb-squad-called-after-dozens-of-second-world-war-grenades-discovered/
Date:	28th May 2019
Description:	Army bomb disposal teams have detonated 24 grenades found in a field in East Suffolk. The 'SIP grenades' - which stands for 'self-igniting phosphorus' - were discovered in the village of Sifton, which is near Yoxford, yesterday. The bombs, which were designed during the 1940s, were glass bottles filled with phosphorus and petrol. Unlike traditional Molotov cocktails, they would ignite spontaneously when the glass shattered, and the phosphorus became exposed to air. The grenades were issued to Home Guard units in the event of a German invasion as that never happened crates of them have been left buried in unregistered hiding places.

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Source:	BBC News
Date:	19th May 2019
Description:	A suspected German wartime bomb which was caught in a fishing net off the coast of the Isle of Wight has been detonated. A fishing vessel reported picking up the 7ft-long sea mine, which was "most likely an old German wartime sea mine", about a mile from the Needles at around 8am on Saturday, the Maritime, and Coastguard Agency (MCA) said. Bomb disposal experts from the Royal Navy's Portsmouth base were called in to detonate the device, while warnings were issued to ships and public in the area. Divers placed the mine back on the seabed and blew up the bomb – found to contain 2,000lb of explosives – at 10.51am on Sunday, the Ministry of Defence said.

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Annex F

Risk Assessment Tables

Table 1: Summary of Potential Contamination Sources

Source	Applicable	Not Applicable
Enemy Attack & Counter Measures		
Bombing WW1		☒
Manned Aircraft Bombing WW2	☒	
Unmanned V1 & V2 Rocket Attack		☒
Shelling		☒
Anti-Shipping Mines & Depth Charges		☒
Anti-Aircraft Shells & Rockets		☒
Beach Mines & Coastal Defences.		☒
Airfield/Key Point Defensive Mines/Charges		☒
Abandoned Unexploded Bomb (A/UXB)		☒
Migration of UXO		
UXO Migration in Rubble & Infill		☒
UXO Migration by Tide & River Current		☒
UXO Migration by Marine Dredging		☒
Shipwrecks		☒
Dispersal by Explosion, Fire & Accident		☒
Aeroplane Crash		☒
Private Collections		☒
MOD Facilities		
Bombing Range		☒
Artillery, Mortar & Tank Range		☒
Grenade Range		☒
Small Arms Firing Range		☒
Weapon Research & Development Facilities		☒
Ammunition Burial Grounds		☒
Docks & Harbour Facilities		☒
Offshore Ammunition Dumping Grounds		☒
Ammunition Storage & Manufacture Sites		☒
Airfields & Air Stations (Close Proximity)		☒
Bombing Decoy Site		☒
Army Barracks & Camps		☒
MOD Training / Concentration Areas		☒
Home Guard & SOE Weapon Caches		☒

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Table 2: Airdropped Weapon Strike Indicators (UK)

Item	Increasing Potential level ⇨			
Site Location	Rural	Small Town	**Brown Field Large Towns**	Cities
Site Description and Use	Greenfield or Agricultural Land	**Near Strategic Target**	Adjacent to Strategic Target	Strategic Target
Site History	No history of Attack	**Near area of Attack**	Immediate Area Attacked	Direct Attack
Strategic Target: Military Installation, Industrial or Munitions Manufacturer, Power Station, Gas or Water Works, Port, Dock, Railway Yard, Decoy Site.				

Table 3: Weapon Strike Records (UK)

Source	Availability			
Archive	None	Non-specific	**Specific**	Extensive
In-house	None	Non-specific	**Specific**	Extensive
Anecdotal	None	Non-specific	**Specific**	Confirmed

Table 4: Anti-Aircraft Weapon Strike Indicators (UK)

Item	Increasing Potential level ⇨			
Site Location	Rural	Town	**City**	Military Site
Fixed Battery Location	None	General Area	**Nearby**	Onsite
Mobile Battery	Rural	Town	**City**	Military Site
Military Site: Airfield, Port, Radar, Barracks, Depots, Arsenal or Similar.				

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Table 5: Abandoned Bomb Records (UK)

Item	Increasing Potential level ⇨		
In-house	**None**	Yes	On-site
Other	**None**	Yes	On-site

Table 6: Bomb Strike Density Assessment

Bombs & Mines	Placed at less than 100 - 149 per 100 hectares.

Table 7: Opportunity to have detected Bomb or Shell Strikes (UK)

Increasing Potential level
No KNOWN recorded bombs or damage
Good ARP cover
Significant development
No significant ground cover
Light bombing or damage
Moderate ARP cover
Moderate development
Frequent public access
Little ground cover
Significant bombing or damage (Surrounding Area)
Poor ARP cover
Minimal development limited to shallow excavations (within some areas of the Site)
Infrequent public access
Moderate ground cover
Heavy bombing or damage (surrounding area)
No ARP cover
Development limited to site clearance
Controlled private access
Heavy ground cover, vegetation, ploughing or body of water

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Table 8: Post Contamination Development Indicators (UK)

	Increasing Potential level
Nature of Post Contamination Development	100% excavations of the entire site to below contamination depth.
	Significant development
	Moderate development
	Minimal development (within some areas of the Site)
	No development

Table 9: Construction Activities Encounter Indicators

	Increasing Potential level
Activities	**Borehole Drilling**
	Dynamic Sampling
	Shallow Trial Pit
	Services Trenching
	Bored (CFA) Piling
	Sheet Piling
	Shallow Excavations over extended area
	Deep Excavations over a limited area
	High Density Piles
	Deep Excavations over extended area
	Bulk Excavations

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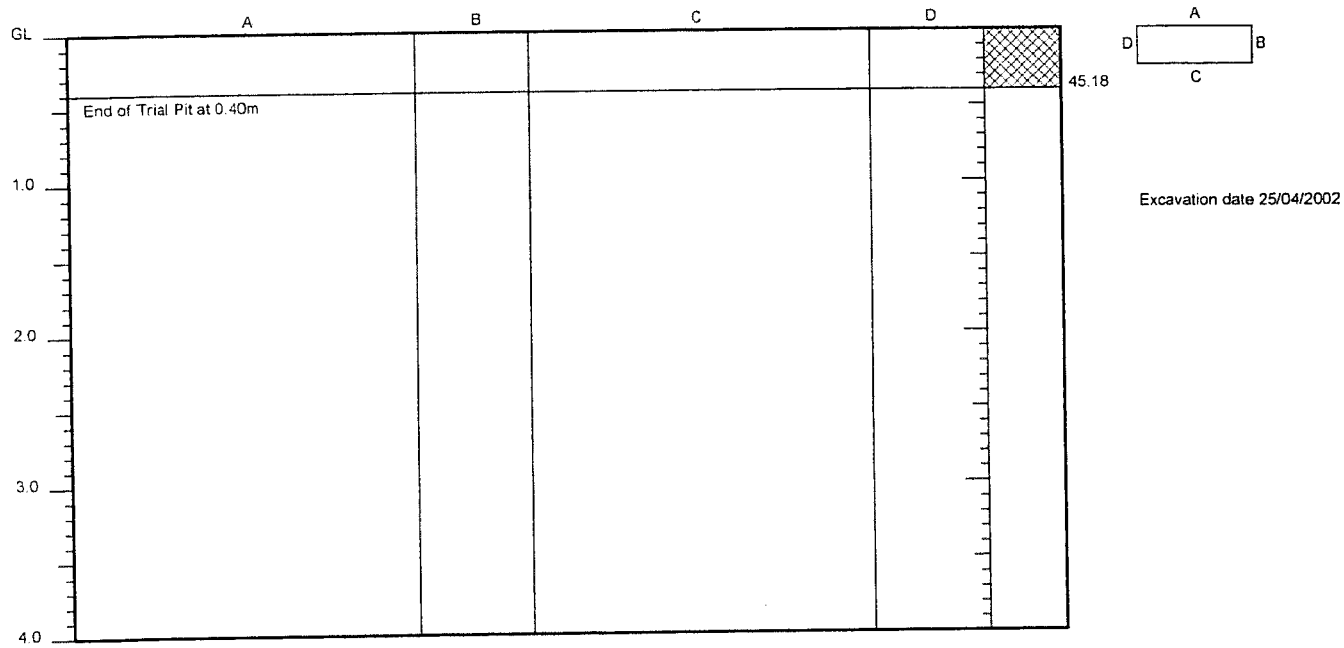
APPENDIX D

Exploratory Hole Logs

Trial Pit Log

Exploration Associates

Logged by PM Checked by	**Equipment and Methods** Trial Pit/Trench from 0.00m to 0.40m.	**Ground Level** +45.58 m OD **National Grid Coordinates** E 384762.65 N 399236.82



Excavation date 25/04/2002

Samples and Tests

Depth (m)	Type & No.	Records
0.20	D1	
0.40	D2	

Strata

Depth (m)	No.	Description
0.00-0.40	1	MADE GROUND. Loose chippings over slightly clayey sandy ash and clinker fragments. Occasional red brick, slag and concrete fragments. Rare green staining mainly in slag fragments. Rare timber and roots

Groundwater
None Encountered

Remarks
Trial pit terminated at 0.40m on red brick foundation

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Trial Pit THA1

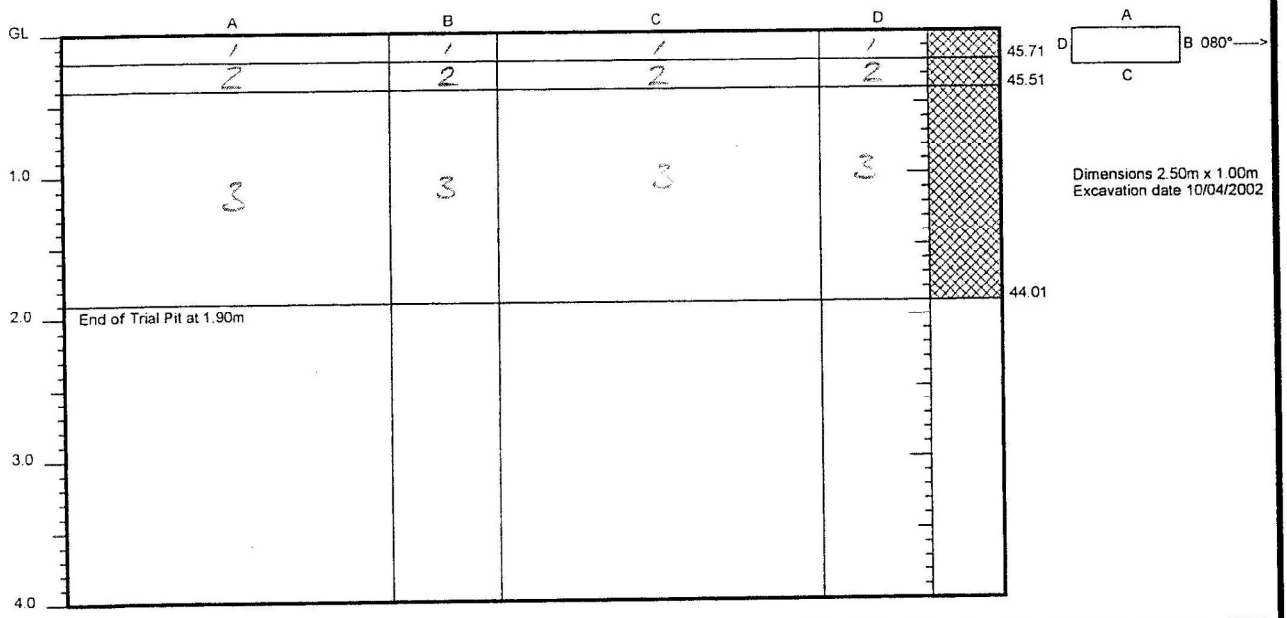
Sheet 1 of 1

11/07/2002 13:43:17 ESGLog v2.11

Trial Pit Log

Exploration Associates

Logged by CRH Checked by	**Equipment and Methods** Trial Pit/Trench from 0.00m to 1.90m.	**Ground Level** +45.91 m OD **National Grid Coordinates** E 384756.08 N 399239.37



Samples and Tests

Depth (m)	Type & No.	Records
0.40-0.50	D1	PID = 34ppm
0.90-1.20	D2	PID = 6ppm

Strata

Depth (m)	No.	Description
0.00-0.20	1	MADE GROUND: Two layers of asphalt
0.20-0.40	2	MADE GROUND: Sandy clayey gravel, orange brown and moist
0.40-1.90	3	MADE GROUND: Sandy gravel of ash and brick rubble to whole brick. Some curved bricks. Vertical 30mm diameter pipe noted At 1.90m bgl: concrete

Groundwater
No. Struck Behaviour

Remarks
Stability : stable, Shoring : no

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Trial Pit TP11

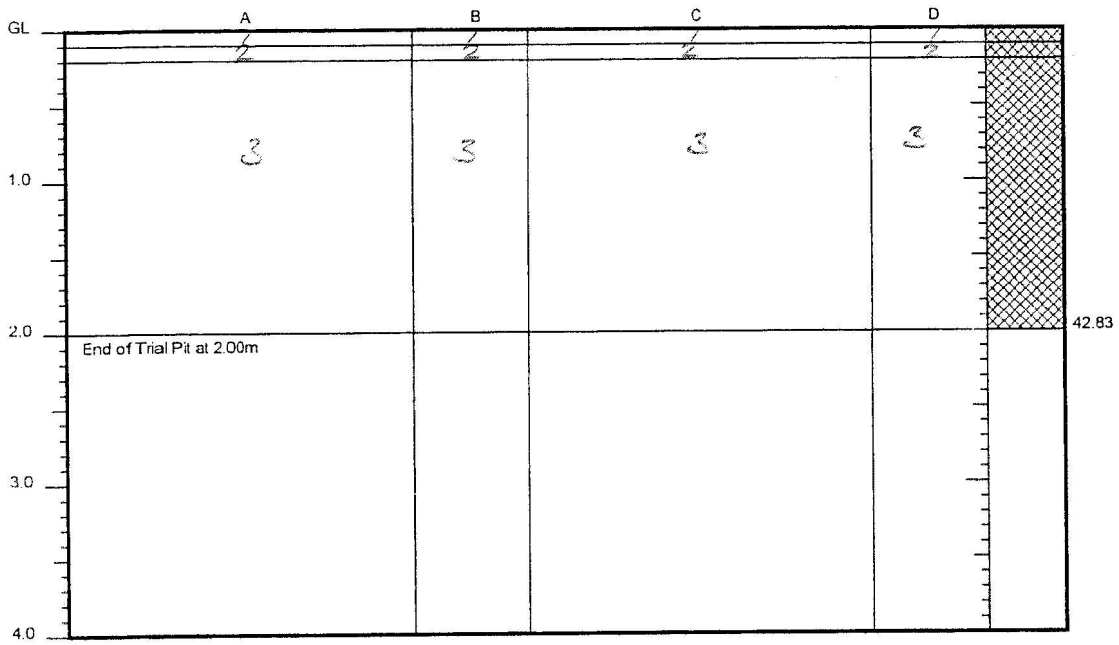
Sheet 1 of 1

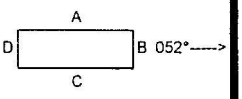
30/08/2002 13:02:31 ESGLog v2.11

Trial Pit Log

Exploration Associates

Logged by CRH Checked by	Equipment and Methods Trial Pit/Trench from 0.00m to 2.00m.	Ground Level +44.83 m OD National Grid Coordinates E 384609.29 N 399206.71





Dimensions 2.00m x 1.00m
Excavation date 19/04/2002

Samples and Tests

Depth (m)	Type & No.	Records
0.30-0.40	D1	PID= 0ppm
0.95-1.00	D2	PID= 0ppm
1.70-1.80	D3	PID= 0ppm

Strata

Depth (m)	No.	Description
0.00-0.10	1	MADE GROUND: Tarmac
0.10-0.20	2	MADE GROUND: Clayey gravel grey brown (hardcore)
0.20-2.00	3	MADE GROUND: Clayey gravel, light brown, brick and concrete rubble, minor ash At 0.95m: some ash/dust with large sandstone block, pieces of linoleum, tiles, large sandstone plinth and fire bell

Groundwater
No. Struck Behaviour

Remarks
Stability : spalling from 0.80m, Shoring : no

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project	GOULD STREET
Project no.	122303
Carried out for	Lattice Peoperty Holdings

Trial Pit
TP39
Sheet 1 of 1

30/08/2002 13:04:22 ESGLog v2.11

Inspection Pit Log

Exploration Associates

Drilled by	Equipment and Methods	Ground Level +46.07 m OD
Logged by SMJ	Inspection Pit from 0.00m to 1.10m.	National Grid E 384754.96
Checked by CRH		Coordinates N 399258.89

Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
0.50 - 0.60	D1	PID = 53.2 ppm.	03/04/2002	
			03/04/2002	

Strata

Description	Depth,Level (Thickness)	Legend
MADE GROUND: Tarmac	0.10 +45.97	a
MADE GROUND: (Rough base course tarmac)	0.30 +45.77	
MADE GROUND: (Buff brown fine to coarse angular to subangular gravel of limestone / sandstone and sand)	0.50 +45.57	
MADE GROUND: (Dark grey slightly clayey sand and gravel with ash and cobbles of bricks)	0.70 +45.37	
MADE GROUND: (Buff coarse sand)	0.80 +45.27	
MADE GROUND: (Bituman coated steel. Intermediate pressure gas mark running 345 degrees)	(0.30pen)	
EXPLORATORY HOLE ENDS AT 1.10 m	1.10 +44.97	

Groundwater
No Groundwater encountered.

Remarks
Hole backfill : 0.00m to 1.10m Arisings (a).

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project GOULD STREET
Project no. 122303
Carried out for Lattice Peoperty Holdings

Inspection Pit
HDP3
Sheet 1 of 1

30/08/2002 13:01:43 ESGLog v2.11

Entec UK

Borehole	**BH507**
Sheet	1 of 2
Project:	**Gould Street Remediation**
Client:	**National Grid**
Project No:	**05760**
Ground Level	m AOD
Contractor :	
Diameter:	
Method :	**Cable Percussion**
Rig Type:	
Co-Ordinates:	E N
Date Drilled:	-

Depth mbgl	Borehole Log: Strata Description	Legend	(Thick-ness)	mAOD	Water Strikes	Sample: Type	Sample: Data	Monitoring Well
0	MADE GROUND: Tarmac.		(0.10)					
	MADE GROUND: Dark brown/black/red sandy GRAVEL of concrete, brick and spent coke/coal.							
1								
			(3.20)					
2								
3					▼			
	Firm to stiff brown sandy CLAY.							
4								
5								
6			(5.60)		▼			
7					▽			
8	... with sand lenses from 8.4m bgl.							
9	Firm to stiff slightly sandy slightly gravelly brown CLAY. Gravel is coarse sized grey siltstone, occasional cobble.							
10								

General Remarks: **Groundwater strikes:**
3.3mbgl rising to 3.25mbgl after 20 minutes.
7.3mbgl rising to 5.9mbgl after 20 minutes.

Logged By: **LUSHM**	All Dimensions in Metres	Scale: **1:50**

Entec UK

Borehole	**BH507**
Sheet	**2** of **2**
Project:	**Gould Street Remediation**
Client:	**National Grid**
Project No:	**05760**
Ground Level	m AOD
Contractor :	
Diameter:	
Method :	**Cable Percussion**
Rig Type:	
Co-Ordinates:	E N
Date Drilled:	-

Depth mbgl	Borehole Log – Strata Description	Legend	(Thick-ness)	mAOD	Water Strikes	Sample Type	Sample Data	Monitoring Well
11			(2.60)					
12	Soft grey brown very sandy SILT. Occasional fine subrounded gravel.		(0.90)					
13	Firm to stiff grey slightly sandy CLAY with occasional gravel sized sandstone lenses from 12.5m bgl.		(0.90)					
14	Red brown fine and medium SAND. (Weathered sandstone).		(1.70)					
15	Borehole completed at 15.0m bgl.							
16								
17								
18								
19								
20								

General Remarks: **Groundwater strikes:**
3.3mbgl rising to 3.25mbgl after 20 minutes.
7.3mbgl rising to 5.9mbgl after 20 minutes.

Logged By: **LUSHM**	All Dimensions in Metres	Scale: **1:50**

	Project: Gould Street	Trialpit No TP701 Page No. 1 of 1
Method: Trial Pit	Date(s): 29/11/2021	Logged By: LH / Checked By: DL
Client: Crowning Developments Limited	Co-ords: 384596.82, 399217.69	Stability: Unstable / Dimensions: 1.60m x 0.70m / Scale: 1:20
Hydrock Project No: 21353	Ground Level: 43.58m OD	Plant: JCB 3CX

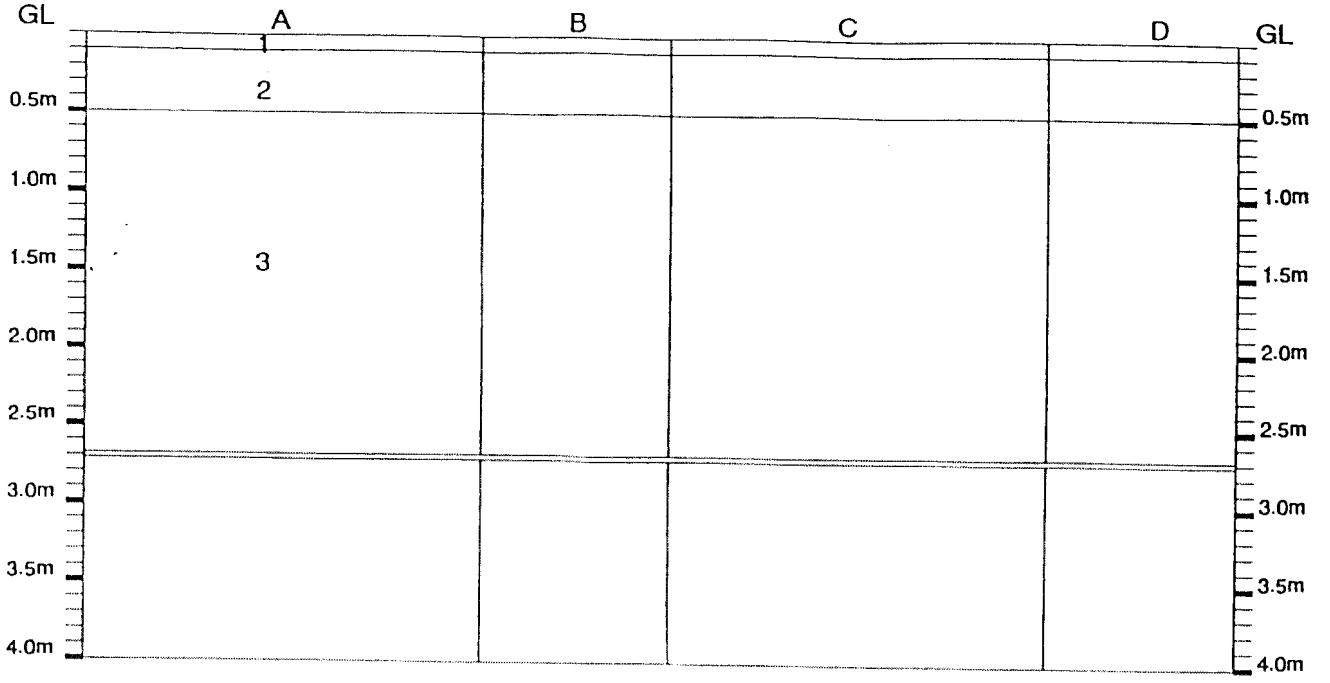
Samples / Tests			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend
Depth (m)	Type	Results						
				ASPHALT HARDSTANDING. (BITUMINOUS MATERIAL)	0.20	(0.20)	43.38	
0.20 - 0.40	B			Dark brown sandy angular to sub-angular,fine to coarse GRAVEL with high cobble content. Gravel is of brlck, coal, limestone, concrete, sandstone with rare wire and fragments of floor tile. Cobbles are subangular of brick. Boulders are sub-angular of concrete. (MADE GROUND)	1.10	(0.90)	42.48	
0.40	ES			Base of Excavation at 1.10m				

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Machine dug trial pit from 0.20m to 1.10m bgl. 3. Terminated at 1.10m bgl due to instability. 4. Backfilled with arisings on completion.

Logged in general accordance with BS5930:2015

Client. British Gas North Western.	Project. Gould Street, Manchester.	Job Ref. 12278	Trial Pit. 16
Office Liverpool / Telephone no. 051 236 6066	Date. 03/12/92	Description by. S.M.Pettitt	Ref. Drawing No. Figure 3.
Pit Dimensions (m). 2.5 x 1.0 x 2.7		Plant. JCB 3CX	Ground Level.(approx.). - - - m A.O.D.

SKETCH



Sample: Depth (m)	Sample: No.	Strata No.	Description.	Vane. Test.
		1	Tarmac	
0.5-1.0	S1	2	Base and sub- base, consisting of grey/brown, orange/brown F.M.C. gravel with much sand.	
1.5-2.0	S2	3	Brick and concrete rubble fill, with F.M.C. gravel and sand, occasional pieces of metal, wood, plastic and polythene.	

Water Observations. Pit dry	Stability. Sides collapsing due to large concrete blocks

PARKMAN CONSULTING ENGINEERS.

Window Sampler Hole Log

Exploration Associates

Drilled by JB Logged by Checked by	Equipment and Methods Window Sampler from 0.00m to 2.00m.	Ground Level +45.84 m OD National Grid Coordinates E 384741.57 N 399232.58

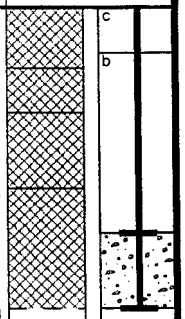
Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
1.20 - 2.00	D1		12/04/2002 12/04/2002	

Strata

Description	Depth,Level (Thickness)
MADE GROUND; Tarmac.	(0.40)
MADE GROUND; Roadstone.	0.40 +45.44 (0.30)
MADE GROUND; Compact cobbles of brick, some gravel and sand of ash and clinker.	0.70 +45.14 (0.50)
MADE GROUND; Loose dark grey brown sand and fine to medium gravel of ash and clinker, fine brick, cobbles of brick and fire brick, timber, copper wire. Strong napthalene odour stronger at base of hole.	1.20 +44.64 (0.80pen)
EXPLORATORY HOLE ENDS AT 2.00 m.	2.00 +43.84

Legend



Groundwater

No. Struck Behaviour

Remarks

Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 1.50m Bentonite (b). Surface protection : Stop Cock Cover Standpipe installed, 50mm diameter, response zone from 1.50m to 2.00m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project GOULD STREET

Project no. 122303

Carried out for Lattice Peoperty Holdings

Window Sampler
WS13
Sheet 1 of 1

30/08/2002 13:05:25 ESGLog v2.11

Hydrock	Project: Gould Street	Trialpit No TP701 Page No. 1 of 1

Method: Trial Pit	Date(s): 29/11/2021	Logged By: LH	Checked By: DL
Client: Crowning Developments Limited	Co-ords: 384596.82, 399217.69	Stability: Unstable	Dimensions: 1.60m x 0.70m; Scale: 1:20
Hydrock Project No: 21353	Ground Level: 43.58m OD	Plant: JCB 3CX	

Samples / Tests			Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend
Depth (m)	Type	Results						
				ASPHALT HARDSTANDING. (BITUMINOUS MATERIAL)	0.20	(0.20)	43.38	
0.20 - 0.40	B			Dark brown sandy angular to sub-angular,fine to coarse GRAVEL with high cobble content. Gravel is of brlck, coal, limestone, concrete, sandstone with rare wire and fragments of floor tile. Cobbles are subangular of brick. Boulders are sub-angular of concrete. (MADE GROUND)	1.10	(0.90)	42.48	
0.40	ES			Base of Excavation at 1.10m				

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Machine dug trial pit from 0.20m to 1.10m bgl. 3. Terminated at 1.10m bgl due to instability. 4. Backfilled with arisings on completion.

Logged in general accordance with BS5930:2015

Hydrock

Project: Gould Street

Borehole No
MPBH715
Page No. 1 of 3

Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
									Black ASPHALT HARDSTANDING (BITUMINOUS MATERIAL)	0.20	(0.20)	45.67		
	0.50	D							Loose black sandy ashy angular to subangular, fine to coarse GRAVEL of coal, brick, limestone and sandstone. Low cobble content of brick and sandstone. (MADE GROUND)					
	0.50 - 0.60	ES												
	1.20	SPT	N=8 (1,1,1,1,3,3)								(2.10)			
	1.20 - 1.65	D												
	1.20 - 1.70	B												
	2.00	SPT	N=22 (3,6,4,5,6,7)											
	2.00 - 2.45	D												
	2.00 - 2.50	B								2.30		43.57		
	2.50	ES							Very stiff very high strength dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of coal, sandstone, mudstone and siltstone. (GLACIAL TILL)					
	3.00 - 3.45	U	(35,100%)											
	3.50	D												
	4.00	SPT	N=15 (3,3,3,4,4,4)											
	4.00 - 4.45	D												
	4.00 - 4.50	B												
	5.00 - 5.45	U	(39,55%)											
	5.50	D												
	6.00	SPT	N=21 (3,3,4,4,5,8)											
	6.00 - 6.45	D												
	6.00 - 6.50	B									(9.70)			
	7.50 - 7.95	U	(45,77%)											
	8.00	D												
	9.00	SPT	N=40 (6,7,9,10,10,11)											
	9.00 - 9.45	D												
	9.00 - 9.50	B												

Continued on Next Sheet

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)
Dando Comacchio	03/12	1530	12.45	12.00	152		Water/Air	Dark brown Reddish orange
	07/12	1530	21.00	21.00	127			

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Hydrock	Project: Gould Street	Borehole No MPBH715 Page No. 2 of 3	
Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
	10.50	SPT	N=35 (6,7,7,8,9,11)						Very stiff very high strength dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of coal, sandstone, mudstone and siltstone. (GLACIAL TILL)					
	10.50 - 10.95	D												
	10.50 - 11.00	B												
	12.00	SPT	50/40mm (25,50)							12.00		33.87		
	12.00 - 12.45	D							Dense reddish orange gravelly slightly silty fine and medium SAND. Gravel is subangular to rounded, fine and medium of sandstone, mudstone and quartzite. (WEATHERED CHESTER FORMATION)		(1.00)			
										13.00		32.87		
									Light grey and light brown sandy subrounded fine to coarse GRAVEL of mudstone, sandstone, quartz and quartzite. (WEATHERED CHESTER FORMATION)		(3.00)			
16.00 - 17.00							30 10 111			16.00		29.87		
									Very soft light grey silty CLAY (WEATHERED CHESTER FORMATION)	16.30	(0.30)	29.57		
	16.60	ES		70	40	0			Extremely weak reddish orange medium to coarse SANDSTONE. Discontinuities; fractures are subhorizontal 10-15°, extremely closely to very closely spaced (10, 15, 20, 30), planar and undulating, smooth and rough, open with local sand smearing 2-4mm. (CHESTER FORMATION)		(0.70)			
17.00 - 18.50	16.67 - 16.70	C								17.00		28.87		
	16.87 - 16.90	C					0 0 0		No recovery: assumed highly fractured or extremely weak sandstone bedrock. (CHESTER FORMATION)					
	16.96 - 17.00	C		0	0	0								
18.50 - 20.00				0	0	0					(3.00)			
										20.00		25.87		

Continued on Next Sheet

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Hydrock	Project: Gould Street	Borehole No MPBH715 Page No. 3 of 3

Method: Dynamic/Rotary Open/Rotary Cored	Date(s): 03/12/2021 - 07/12/2021	Logged By: RS	Drilled By: DMW Drilling
Client: Crowning Developments Limited	Co-ords: 384741.41, 399242.64	Checked By: DL	Flush: Water/Air
Hydrock Project No: 21353	Ground Level: 45.87m OD		Scale: 1:50

Sample/Core Run (m) Smpl. Ø (mm) Smpl. rec. %	Samples / Tests			Mechanical Log				Water-Strikes	Stratum Description	Depth mbgl	Thickness (m)	Level m OD	Legend	Instrumentation / Backfill
	Depth (m)	Type	Results	TCR	SCR	RQD	If: Min Mean Max							
20.00 - 21.00	20.10	D		100	28	0	50		Extremely weak reddish orange medium to coarse SANDSTONE. Discontinuities; fractures are subhorizontal (5-10°), very closely spaced (40, 50) planar, rough, open with local sand smearing 2-4mm. (CHESTER FORMATION) *... Between 20.00m and 20.15m bgl: non-intact as very soft grey very sandy clay* *... Between 20.15m and 20.25m bgl: non-intact as reddish orange very gravelly medium to coarse sand.* *... Between 20.35m and 20.55m bgl: non-intact as reddish orange very gravelly medium to coarse sand.*	21.00	(1.00)	24.87		
	20.88 - 20.92	C												
	20.92 - 21.10	C												
									End of Borehole at 21.00m					

21 22 23 24 25 26 27 28 29 30

Progress and Observations

Rig	Date	Time	Borehole Depth (m)	Casing Depth (m)	Casing Diam.(mm)	Water Depth (m)	Flush Type	Returns (colour)

General Remarks:
1. Asphalt hardstanding broken out between ground level and 0.20m bgl. 2. Hand dug inspection pit from 0.20m to 1.20m bgl. 3. Cable percussive drilling from 1.20m to 12.45m bgl. 4. Rotary open holing from 12.45m to 16.00m bgl. 5. Rotary coring from 16.00m to 21.00m bgl. 6. Complete at 21.00m bgl. 7. Installed on completion with a response zone between 14.00m and 21.00m bgl.

Groundwater: No groundwater encountered

Logged in general accordance with BS5930:2015

Borehole Log

Cable Percussion with Rotary Core No.

BH802A

Sheet 1 of 3

PROJECT NO:	C5692	**CO-ORDS:**	384610E, 399214N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.62m OD
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:**	02/07/24 - 10/07/24

Hole Type: CP+RC

Scale: 1:51

Logged: PH **Checked:** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.30	B		0.10	44.52		MADE GROUND: Tarmacadam.
		0.10-0.80	D					MADE GROUND: Brown gravelly sand. Sand is fine to coarse. Gravel is sub-angular fine to coarse of brick, concrete, sandstone, coal, and slag.
			ES					
		0.10	PID	0.2PPM				
		0.20	D					
		0.20-1.20	D					
		0.30-1.20	B					
		0.50	D					
		1.20-1.65	D					
			D					
		1.20	SPT	N=46 (25 for 95mm/16,8,10,12)				
		1.50-2.20	D					
			ES					
		2.00-2.45	D					
		2.00	SPT	N=39 (7,8/9,9,9,12)				
		3.00-3.45	D					
		3.00-3.50	D					
			ES					
		3.00	SPT	N≥50 (10,12/39 for 225mm)				
		3.60	B		3.60	41.02		Firm brown slightly gravelly CLAY. Gravel is sub-rounded fine to coarse of sandstone, mudstone, and coal.
		3.70-4.00	D					
			ES					
		4.00-4.45	D					
		4.00	SPT	N=13 (2,2/3,3,3,4)				
		5.00-5.45	D					
		5.00	SPT	N=17 (3,4/4,4,4,5)				
		6.00-6.45	U					
		6.45-6.70	D					
		7.00	D					
		7.50-7.95	U					
		7.95-8.20	D		8.00	36.62		NO RECOVERY due to boulder being pushed down through clay.
		9.00-9.50	D					
		9.50	SPT	N≥50 (75 for 20mm/0 for 0mm)				*SPT refusal likely due to cobble.*

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

Cable Percussion with Rotary Core No.

BH802A

Sheet 2 of 3

PROJECT NO:	C5692	**CO-ORDS:**	384610E, 399214N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.62m OD
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:**	02/07/24 - 10/07/24

Hole Type: CP+RC

Scale: 1:51

Logged: PH **Checked:** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	TCR	SCR	RQD	Depth (m)	Level (m OD)	Legend	Stratum Description
		10.50-10.95 10.50	D SPT	N≥50 (12,13/50 for 285mm)							*SPT refusal likely due to cobble.*
		12.00-12.45 12.00	B D SPT	N=27 (4,5/5,6,7,9)				12.00	32.62		Recovery regained. Firm brown slightly gravelly CLAY. Gravel is sub-rounded fine to coarse of sandstone, mudstone, and coal.
		13.50 13.50-13.95 13.50	D D SPT	N≥50 (75 for 70mm/0 for 0mm)				13.50	31.12		Very weak disturbed reddish brown SANDSTONE, recovered as gravelly SAND. Sand is fine to coarse. Gravel is sub-angular fine to coarse of sandstone.
		14.80 15.00	D SPT	N≥50 (57 for 125mm/18 for 20mm)				15.00	29.62		NO RECOVERY assumed sandstone. *Becoming stiff from 15.00m bgl.* *15.00-16.00m bgl: Open holed.*
		16.00 - 18.00	NI 5 NI	100	90	73		16.00	28.62		Reddish brown SANDSTONE. *16.00-16.16m bgl: Non-intact recovered as sub-angular fine to coarse gravel and cobbles of sandstone.* *16.16-16.49m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *16.16-17.17m bgl: Discontinuities are very close to closely spaced, rough, and horizontal to sub-horizontal up to 45 degrees.* *16.49-16.52m bgl: Extremely weak, distinctly weathered fine to medium grained sandstone.* *16.52-17.00m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *17.00-17.17m bgl: Extremely weak, distinctly weathered fine to medium grained sandstone.* *17.17-17.21m bgl: Non-intact recovered as a reddish brown sandy gravel. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and quartz.* *17.21-18.00m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.* *17.21-18.00m bgl: Very close to closely spaced, rough and horizontal to sub-horizontal up to 10 degrees.*
		18.20 - 18.30	ES	100	98	85					*18.00-18.43m bgl: Very weak, partially weathered reddish brown fine to medium grained sandstone.*
		18.00 - 21.00	15								*18.00-21.00m bgl: Discontinuities are extremely close to closely spaced rough and horizontal to sub-horizontal (up to 15 degrees) infilled with fine to coarse sand.* *18.43-19.77m bgl: Weak, partially weathered reddish brown fine to medium grained sandstone.* *19.77-19.85m bgl: Extremely weak, partially weathered reddish brown fine to medium sandstone.* *19.85-20.05m bgl: Weak, partially weathered reddish brown fine to*

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

		Cable Percussion with Rotary Core No.	BH802A
			Sheet 3 of 3
PROJECT NO:	C5692	**CO-ORDS:** 384610E, 399214N	**Hole Type** CP+RC
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:** 44.62m OD	**Scale** 1:51
CLIENT:	MCR / INTRO DEVELOPMENTS LTD	**DATES:** 02/07/2024 - 10/07/2024	**Logged** PH / **Checked** TM

Well	Water Strike	Depth (m)	Type / FI	Coring TCR (%)	Coring SCR (%)	Coring RQD (%)	Depth (m)	Level (m OD)	Legend	Stratum Description
			5	77	75	52				*medium sandstone.* *20.02-22.05m bgl: Non-intact recovered as reddish brown slighly clayey slightly sandy gravel. Sand is fine to coarse sub-angular sandstone.* *20.05-21.00: Weak, partially weathered reddish brown fine to medium grained sandstone.*
			NR							*21.00-21.70m bgl: No recovery.*
		21.00 - 24.00	16							*21.70-21.76m bgl: Non-intact recovered as reddish brown angular fine to coarse gravel of sandstone.* *21.76-22.46m bgl: Weak, partially weathered reddish brown fine to medium gravel of sandstone.* *21.76-24.00m bgl: Discontinuities are extremely closely spaced to closely spaced, rough and horizontal to sub-horizontal up to 30 degrees.* *22.05-22.46m bgl: Weak, partially weathered reddish brown fine to medium sandstone.* *22.46-22.62m bgl: Extremely weak, partially weathered reddish brown fine to medium gravel of sandstone.* *22.62-24.00m bgl: Weak, partially weathered reddish brown fine to medium gravel of sandstone.*
							24.00	20.62		End of Borehole at 24.00m

21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Groundwater encountered at 18.10m bgl.
3. Cable percussive to 15.00m bgl with rotary follow on to 24.00m bgl.
4. Installed to 24.00m bgl: 15.00m plain and 9.00m slotted HDPE 50mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

PROJECT NO:	C5692	**CO-ORDS:**	384590E, 399236N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	42.82m OD
CLIENT:	MCR / Intro Developments Ltd	**DATES:**	03/07/24

Window Sampler No. WS818 — Sheet 1 of 1

Hole Type WS

Scale 1:30

Logged MB | **Checked** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.50 0.10 0.20	ES PID D	0.3PPM	0.10	42.72		MADE GROUND: Tarmacadam.
		0.50-0.60 0.50	ES PID	0.7PPM				MADE GROUND: Brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick. *Black staining and hydrocarbon odour noted between 0.50-0.60m bgl.*
		1.20	SPT	N=48 (10,8/12,13,11,12)				
		2.00-2.50 2.00	ES SPT	N=20 (6,5/6,5,4,5)	2.00	40.82		MADE GROUND: Dark grey silty fine to coarse sand. Sand is of PFA (Pulverised Fly Ash). *Hydrocarbon odour between 2.00-5.m bgl.*
		2.30	PID D	0.4PPM				
	▼	3.00	SPT	N=9 (2,2/2,2,2,3)				
		4.00	SPT	N=4 (1,0/1,1,1,1)				
		5.00	SPT	N=5 (1,1/1,1,1,2)				
					5.45	37.37		End of Borehole at 5.45m

1.0 2.0 3.0 4.0 5.0 6.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Hand pit to 1.20m bgl to check for buried services
3. Small groundwater seepage encountered at 3.00m bgl.
4. Window sample completed at 5.45m bgl.
5. Installed to 5.00m bgl: 2.00m plain and 3.00m slotted PVC 35mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

PROJECT NO:	C5692	**CO-ORDS:**	384612E, 399221N
PROJECT NAME:	GOULD STREET, MANCHESTER	**LEVEL:**	44.68m OD
CLIENT:	MCR / Intro Developments Ltd	**DATES:**	04/07/24

Window Sampler No. WS819

Sheet 1 of 1

Hole Type WS

Scale 1:30

Logged MB | **Checked** TM

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
		0.10-0.30 0.10 0.20	ES PID D	0.0PPM	0.10	44.58		MADE GROUND: Tarmacadam.
								MADE GROUND: Brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick.
		1.00-1.40 1.00 1.20 1.30	ES PID SPT D	0.0PPM N=25 (6,5/6,5,6,8)	1.00	43.68		MADE GROUND: Reddish brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and brick.
		1.80	SPT	N≥50 (25 for 70mm/50 for 225mm)				
					2.09	42.59		End of Borehole at 2.09m

1.0
2.0
3.0
4.0
5.0
6.0

Remarks

1. Clearance of services using GPR techniques and CAT and Genny prior to breaking ground.
2. Hand pit to 1.20m bgl to check for buried services.
3. No groundwater encountered.
4. Window sample refused at 2.09m bgl.
5. Installed to 1.50m bgl: 0.50m plain and 1.00m slotted PVC 35mm pipe.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

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