



Unexploded Ordnance Risk Mitigation

Explosive Ordnance Desk Top Study for:

Dutton Street, Manchester

PROJECT 23040

On behalf of

BROWNFIELD SOLUTIONS



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EXPLOSIVE ORDNANCE DESK TOP STUDY

For

Dutton Street, Manchester

Conducted by **EOD Contracts Limited**

On behalf of **Brownfield Solutions**

Document Control & Enquiries

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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)

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 Pilot Less Aircraft.

V2 see Long Range Rocket.

WWI

World War 1 (1914 – 1918)

WWII

World War 2 (1939 – 1945)

EXECUTIVE SUMMARY

INSTRUCTION

EOD Contracts Ltd, have been commissioned by Brownfield Solutions to undertake a desktop study for potential historic Unexploded Ordnance (UXO) contamination for the future works at Dutton Street, Manchester (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: Clients Supplied Site Diagram, This DTS will be covering all areas shown within the Red Boundary.



LOCATION

The site is located within Manchester. During WWII the site was located within the Air Raid Precautions reporting area Region (10) North Western Region HQ Manchester.

Table 1 Site Location

Title	Description (Centre of Site)
Address	Dutton Street, Manchester
Post Code	M31LD
Grid Reference	SJ8387499248
what3words	duke.bridge.fears

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)
- Explosive/Munition Factories
- Military Usage

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:

Bomb Strikes	Recorded bomb strikes on the site
Bomb Damage	Bomb damage was recorded over the majority of the site
Reconstruction	Reconstruction was noted circa 1970s with the site being partially redeveloped
Military Usage	No military usage was noted
Explosive/Munition Factory	The site was not used in the production of explosives or munitions

Historical UXO Contamination

The indications of UXO contamination are:

Risk Level

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

Risk Level	The risk level on site is MEDIUM and given that some UXO retains the potential to detonate if disturbed with possible severe consequences, it is concluded that it would be prudent to ensure that basic precautions are taken to ensure that the project can proceed in the safest possible manner and that any residual risk posed by UXO is as low as it is reasonably practical to achieve (ALARP).
Risk Depth	The expected bomb depth is 8m below 1939 ground level .

RECOMMENDATIONS

It is recommended that the following risk mitigation strategy is executed during all Phases of the project:

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 Principal Designers 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.

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.

Specifically

- Geotechnical investigations, percussive drilling/trial pits/window/samples, require an EOD Engineer over watch
- 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, consequently for excavations an EOD Engineer over watch should be utilised

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.

PART 1: INTRODUCTION

Instruction

EOD Contracts Ltd, have been commissioned by Brownfield Solutions to undertake a desktop study for potential historic Unexploded Ordnance (UXO) contamination for the future works at Dutton Street, Manchester (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 all areas shown within the Red Boundary.



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 Contracts Ltd will in no circumstances be held responsible for the accuracy of such information or data supplied.

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 Principle 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:
 - EOD Contracts Ltd company records
 - Ministry of Defence records
 - Central and Local Government Records
 - Public Records Office (Kew)
 - Historic Maps and Air Photography
 - 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 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.

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
- Luftwaffe Over Manchester Peter Smith
- Our Blitz Red Skies Over Manchester
- Manchester at War
- Blitz Britain: Manchester and Salford

PART 3: SITE DESCRIPTION AND DETAILS

Location

The site is located within Manchester. During WWII the site was located within the Air Raid Precautions reporting area Region (10) North Western Region HQ Manchester.

Table 3.1 Site Location

Title	Description (Centre of Site)
Address	Dutton Street, Manchester
Post Code	M31LD
Grid Reference	SJ8387499248
what3words	duke.bridge.fears

Description and Current Usage

The site boundaries are; to the north is Julia Street, to the east is Dutton Road, to the south is Trinity Way and to the west is a college building. At present the site is mostly open ground utilised as a car park, with treed areas.

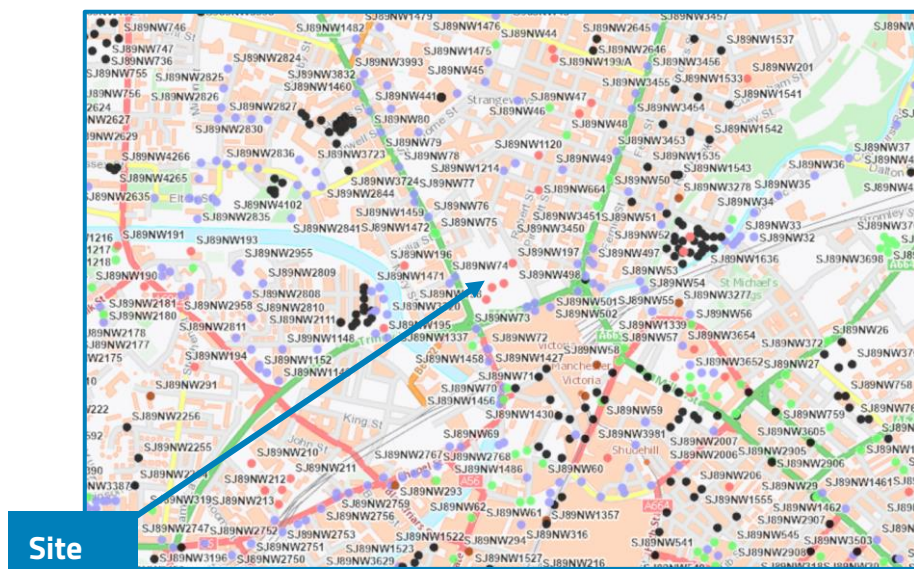
Geology

BGS (British Geological Survey) nearest borehole see Figure 3.1 indicates the following geology:

Table 3.2 Geology

Geological Unit Description	Anticipated Thickness (m)	Anticipated Depth (m bgl)
MADE GROUND	0.75	0.75
Clay and Gravel	1.2	1.95
Clay	40	41.95

Figure 3.1 Borehole Location (www.bgs.co.uk)



Future Works

At the time of writing this report it is understood that the site will be redeveloped (the exact scope of works is not known at this time). Therefore, it is assumed that the following intrusive construction works will be carried out:

- Geotechnical investigations, percussive drilling/trial pits/window/samples
- Foundations with possible piling
- Services trenching
- Open Excavations

PART 4: HISTORICAL REVIEW

Historical Mapping and Aerial Photography

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

Table 4.1 Aerial Photograph and Historical Map Synopsis

Date	Scale	Description/Remarks
1938	1:10,560	The site is mostly built upon, there appears to be engineering works
1953	NA	AERIAL PHOTOGRAPH. The aerial photograph shows massive damage across the site, buildings are missing throughout.
1956	1:10,000	The site is mostly devoid of buildings a building remains in the north and west
1972-1979	1:10,000	Shows buildings having been constructed on the site
2022	1:10,000	Shows present configuration of buildings and usage,

Post WWII Construction

Post WWII circa 1972 shows some construction of buildings. The depth of these works is unknown.

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

The map shown in Annex C indicates the Site was not the subject of bombardment throughout WWI.

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.

The Manchester and Salford Blitz:

- Air raids began in August 1940
- The heaviest raids occurred on the nights of 22/23 and 23/24 December 1940, killing an estimated 684 people and injuring 2,364. 1,400,000 people were made homeless
- On the night of 22/23 December 1940, 270 aircraft dropped 272 tons of high explosive and 1,032 incendiary bombs

- On the night of 23/24 1940, 171 aircraft dropped another 195 tons of high explosive and 893 incendiaries.

Site Specific Bombing Information

Record of air raids on and in the vicinity of the site have been scrutinized, the Manchester bomb damage and impact map is attached in Annex D, this has been reviewed and the following have been assessed as relevant:

- 2 Large Incendiary bombs on the site
- Multiple Bomb Damage across the site

Anti-Aircraft Artillery

The nearest recorded location of heavy anti-aircraft gun (HAA) position is over 1.4km from the site.

Bomb Damage

Multiple buildings across the site have been annotated as badly damaged,

Explosive or Munition Factories

No explosive or munition factories were noted, the site was used by engineering works.

Military Usage

No military usage was recorded for the site.

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)
- Explosive or Munition Factories
- Military Usage

General

UXO contamination pathways from:

- 2 x Air delivered ordnance bombs on the site
- The nearest Anti-Aircraft Weapons(AA) is over 1.4km
- 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 F.

Bomb Penetration Depths

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 as per Paragraph 3

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

TABLE 5.1: Bomb Penetration Depths

Sub Soil Type	Bomb Weights			
	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

* Empirical data taken from 1,000 bombs dropped during WWII, strata and depth from operational excavations.

Bombs on penetration of the surface do not follow a straight-line trajectory they can and do curve; this is called a "J" curve where the bomb's path bends back towards the surface. This gives what is known as the Offset, which may place a bomb under a structure and at a shallow depth.

Further information on bomb depths and J Curves is in Annex F.

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 G Tables) it is considered that there is a **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:

- It is a matter of historic record that the area was subjected to enemy attack. For the most part, the records provide relatively accurate numbers of strikes however are limited in their precise locations.
- The area has been slightly developed since WW2.

Encounters of UXO are not uncommon, further recent UXO finds are in Annex H.

Consequence of Encounter

The consequence see Annex F 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.

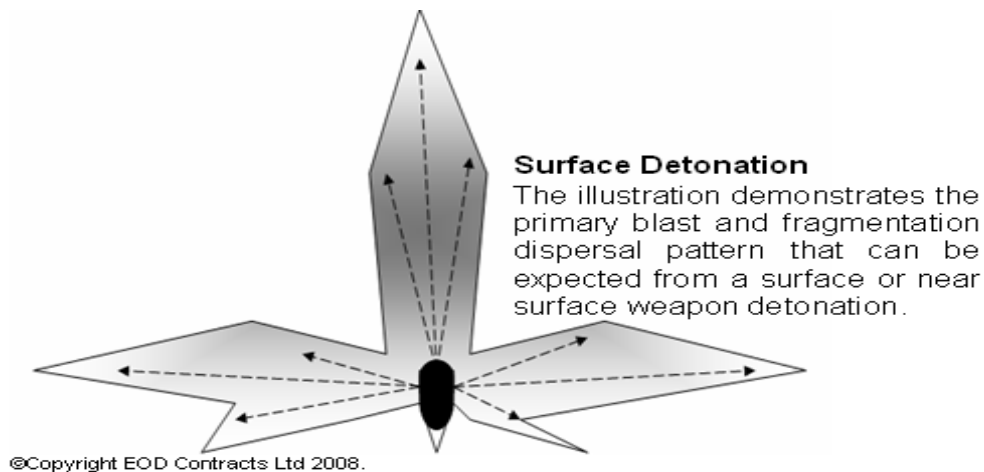
Intrusive earthwork, piling driving and dynamic ground compaction are by nature, aggressive, significant force (kN) is often required to achieve the desired results. As a precaution it is prudent to assume that any external stimulus, no matter how slight, may result in an unstable weapon detonating.

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.

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 overall risk has been determined to apply to all of the ground within the site footprint. The prevailing risk level has been determined to be **MEDIUM**. The risk from UXO is considered to exist to a maximum depth of 8 metres below the 1939 ground levels.

Encounter Consequences

It is acknowledged that when viewed from a “likelihood versus consequence” scenario; the consequences of an explosion may have the potential to include:

- Multiple casualties or fatalities.
- Extensive damage to high value private and public assets and property.
- Significant delays to the construction project.

Those at Risk

The risk is considered to have the potential to pose a direct and indirect threat to a wide range of individuals and facilities. While the impact on fixed assets can be estimated based on the asset’s proximity to the seat of the explosion. The impact to transient assets and people will, for the most part, be the result of both; proximity to the explosion and the time at which the event occurs. The overall impact therefore has the potential to range from little more than a minor localised event to a level, which may be considered to be a more widespread major incident involving some or all of the following:

- Construction and other specialist personnel carrying out the work.
- General public in open spaces, at their places of work and transient population on foot or road users in proximity to the construction work.
- Public services including transport, water, gas and electricity supplies.
- Public facilities, including buildings, vehicles, other high value assets and equipment.
- Private business property including construction equipment.
- Private residential property in proximity to the work.

At Risk Activities

Based on our understanding of the scope of the most common construction projects, it is considered that a wide range of intrusive processes may be required to complete the project. Any intrusive groundworks have the potential to encounter UXO and each activity therefore has a degree of risk attached to it. The severity or level of the risk is derived as a consequence of activity’s; location, methodology and volume or quantity of risk material to be worked, at risk activities are considered to include:

- Site preparation and levelling.
- Intrusive geotechnical and archaeological investigations including drilling and pitting.
- Foundation construction, trenching and other excavations.
- Intrusive construction works, which may include piling.

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	Recorded bomb strikes on the site
Bomb Damage	Bomb damage was recorded over the majority of the site
Reconstruction	Reconstruction was noted circa 1970s with the site being partially redeveloped
Military Usage	No military usage was noted
Explosive/Munition Factory	The site was not used in the production of explosives or munitions

Risk Level

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

Risk Level	The risk level on site is MEDIUM and given that some UXO retains the potential to detonate if disturbed with possible severe consequences, it is concluded that it would be prudent to ensure that basic precautions are taken to ensure that the project can proceed in the safest possible manner and that any residual risk posed by UXO is as low as it is reasonably practical to achieve (ALARP).
Risk Depth	The expected bomb depth is 8m below 1939 ground level .

PART 8: RECOMMENDATIONS

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 Principal Designers 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.

Safety Training; UXO safety awareness training should be given at all levels of site personnel and selected individuals on the project staff with relevant responsibilities. The training should be provided by a competent person as part of the project safety induction course. It should be reinforced with specific safety briefings and tool box talks to individuals involved in conducting intrusive earthworks. The training should cover the following topics to a level commensurate with the audience's responsibilities and duties:

- 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

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.

Specifically

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

- 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, consequently for excavations an EOD Engineer over watch should be utilised

SITE LOCATION



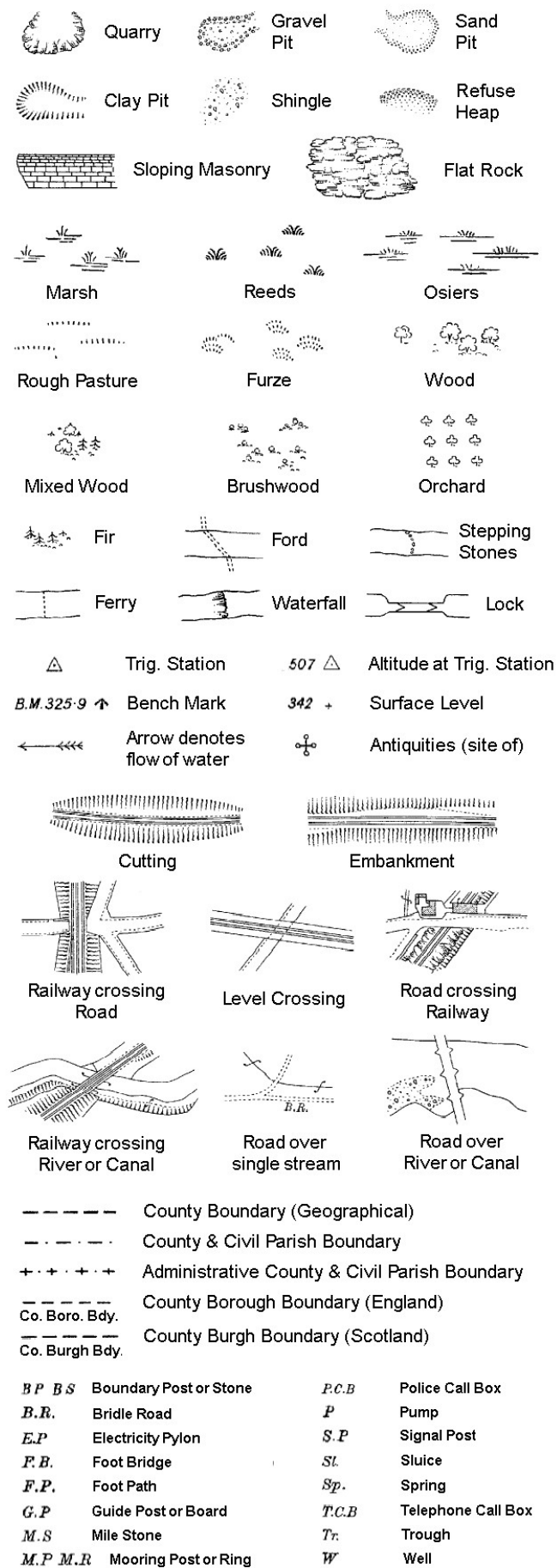
HISTORIC AERIAL PHOTOGRAPHS AND MAPS

Index of Historical Maps

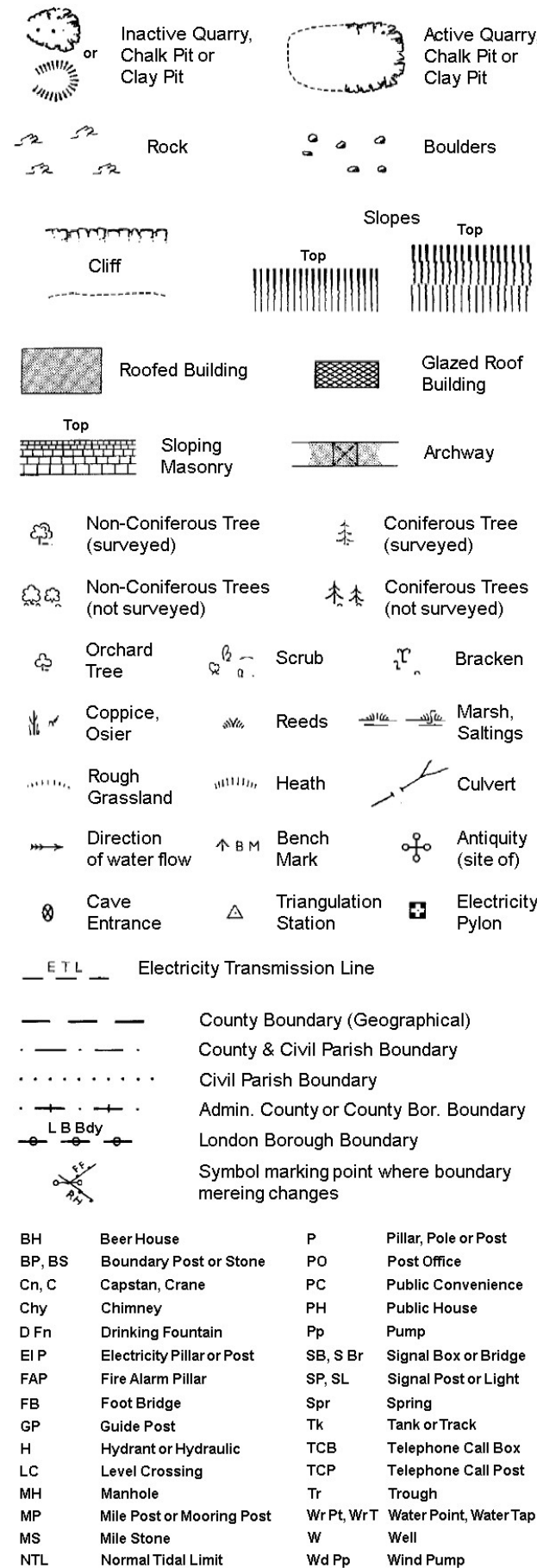
Page No.	Date	Scale	Description/Remarks
B-2	NA	1:10,000 and 1:10,560	Historical Mapping Legends
B-3	1938	1:10,560	The site is mostly built upon, there appears to be engineering works
B-4	1953	NA	AERIAL PHOTOGRAPH. The aerial photograph shows massive damage across the site, buildings are missing throughout.
B-5	1956	1:10,000	The site is mostly devoid of buildings a building remains in the north and west
B-6	1972-1979	1:10,000	Shows buildings having been constructed on the site
B-7	2022	1:10,000	Shows present configuration of buildings and usage,

Historical Mapping Legends

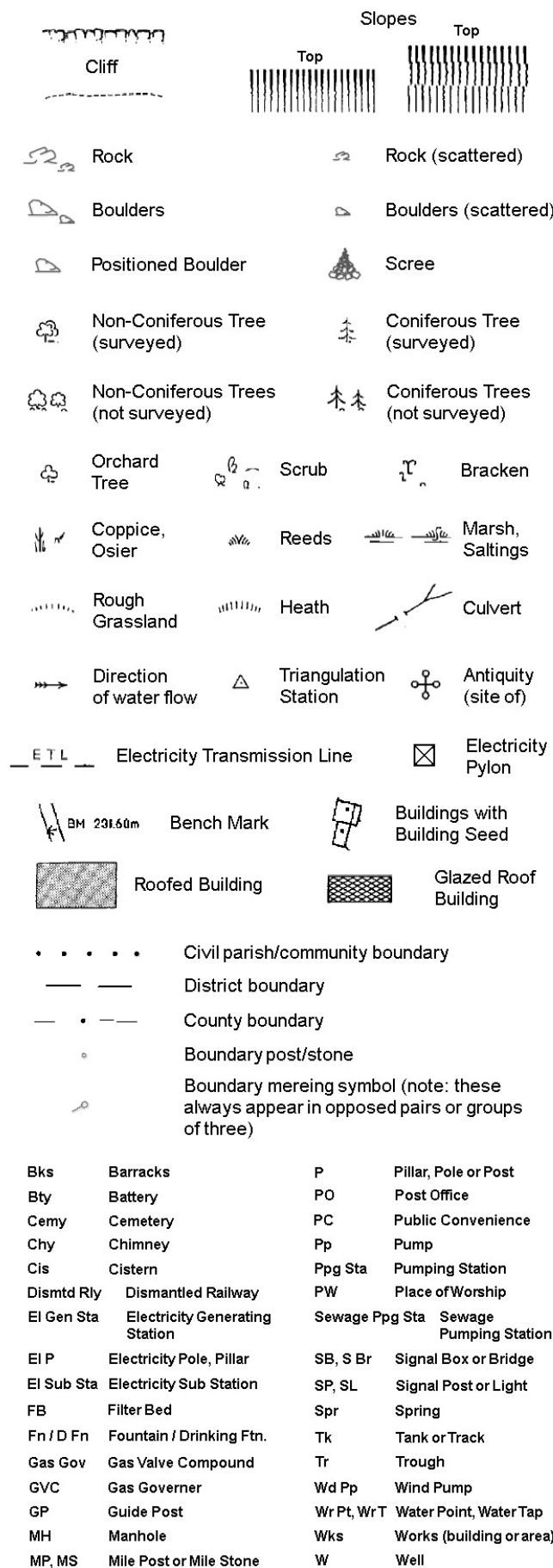
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



Large-Scale National Grid Data 1:2,500 and 1:1,250

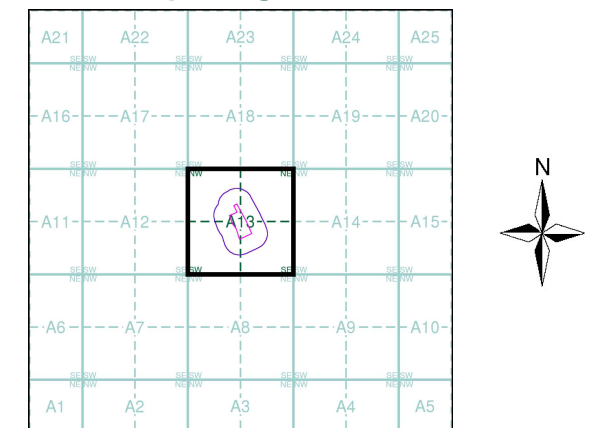


EOD Contracts Ltd

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:2,500	1892	2
Lancashire And Furness	1:2,500	1908	3
Lancashire And Furness	1:2,500	1933	4
Ordnance Survey Plan	1:1,250	1949 - 1951	5
Ordnance Survey Plan	1:2,500	1951 - 1952	6
Ordnance Survey Plan	1:1,250	1952 - 1955	7
Ordnance Survey Plan	1:2,500	1953 - 1958	8
Ordnance Survey Plan	1:1,250	1958 - 1970	9
Ordnance Survey Plan	1:2,500	1959 - 1965	10
Ordnance Survey Plan	1:2,500	1966 - 1971	11
Ordnance Survey Plan	1:1,250	1968 - 1990	12
Additional SIMs	1:1,250	1978 - 1989	13
Additional SIMs	1:1,250	1985 - 1987	14
Ordnance Survey Plan	1:1,250	1986 - 1989	15
Large-Scale National Grid Data	1:1,250	1992	16
Large-Scale National Grid Data	1:1,250	1993 - 1995	17
Large-Scale National Grid Data	1:1,250	1996	18
Historical Aerial Photography	1:2,500	2000	19

Historical Map - Segment A13



Order Details

Order Number: 306464951_1_1
Customer Ref: 23040 Dutton Street BROWNFIELD
National Grid Reference: 383860, 399250
Slice: A
Site Area (Ha): 1.48
Search Buffer (m): 100

Site Details

, 37, Park Street, Manchester, M3 1EU

Landmark
INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



EOD Contracts Ltd

Lancashire And Furness

Published 1938

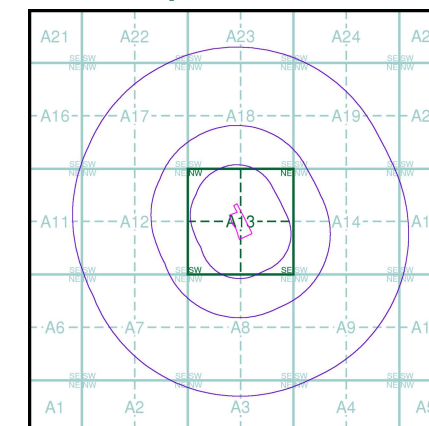
Source map scale - 1:10,560

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; these maps were used to update the 1:10,560 maps. The published date given therefore 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. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

104NW 1938 1:10,560	104NE 1938 1:10,560
104SW 1938 1:10,560	104SE 1938 1:10,560

Historical Map - Slice A



Order Details

Order Number: 306464951_1_1
Customer Ref: 23040 Dutton Street BROWNFIELD
National Grid Reference: 383860, 399250
Slice: A
Site Area (Ha): 1.48
Search Buffer (m): 1000

Site Details

, 37, Park Street, Manchester, M3 1EU

Landmark
INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Description/Remarks

AERIAL PHOTOGRAPH Oblique

The aerial photograph shows massive damage across the site, buildings are missing throughout

Date

1953