

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) Pollution of controlled waters is being, or is likely to be, caused.”

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

“the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter”

Controlled Waters are defined Section 104 of the Water Resources Act 1991. In summary, they comprise relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured.

The Environment Agency has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land. This is reinforced in The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process, rather than Local Authority or Environment Agency directly, except in cases of very high pollution risk or where harm is occurring. In the planning process, guidance is provided by National Planning Policy Framework (NPPF) of March 2012. The NPPF requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be agreed with the planners.

Source Protection Zones

Source Protection Zones (SPZs) are defined by the Environment Agency (for England and Wales), SEPA (Scotland) and the Environment and Heritage Service (Northern Ireland) for groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area. The size and shape of a zone depends upon subsurface conditions, how the groundwater is removed, and other environmental factors.

SPZs are classified into four categories:

- **Zone 1 (Inner protection zone).** Any pollution that can travel to the abstraction point within 50 days from any point within the zone is classified as being inside Zone 1. This applies at and below the groundwater table. This zone also has a minimum 50 m protection radius around the abstraction point. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- **Zone 2 (Outer protection zone).** The outer zone covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area, whichever area is the largest. This travel time is the minimum period over which the Environment Agency considers that pollutants need to be diluted, reduced in strength or delayed by the time they reach the abstraction point.
- **Zone 3 (Total catchment).** This is the total area needed to support removal of water from the abstraction point, and to support any discharge from this.
- **Zone of special interest.** This may occasionally be defined as a special case. This is usually where local conditions mean that industrial sites and other potential sources of contamination could affect the groundwater source, even though they are outside the normal catchment area.

Groundwater Vulnerability Assessments

From 1 April 2010 The Environment Agency Groundwater Protection Policy began to use aquifer designations which are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Table 1. Aquifer Classification (“Geological Classification”).

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Environment Agency Guidance

The Environment Agency's stance on groundwater resources is:

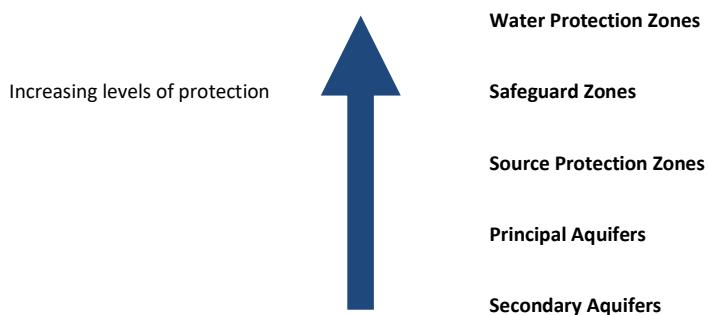
“to protect and manage groundwater resources for present and future generations in ways that are appropriate for the risks we identify”
(Groundwater Protection: Policy and Practice GP3, 2012).

At present, the legislation and guidance pertaining to the protection of controlled waters in the UK is complex; however, the core objectives seek to enforce the position given above.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document introduced areas of focus for developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was revised in 1998, since which there have been substantial changes in legislation, driven by key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Gaps in the 1998 PPPG that emerged as the result of further legislative changes were addressed in the Environment Agency Policy document Groundwater Protection: Policy and Practice (GP3), Version 1 of November 2012. The three main parts of GP3 were:

- Groundwater principals;
- Position statements and legislation; and
- Technical information.

The Environment Agency has a tiered risk based approach to drinking water protection as summarised below:



APPENDIX H - COMPLYING WITH CONTROL OF ASBESTOS REGULATIONS 2012

Complying with Control of Asbestos Regulations (CAR): Risk Assessments, Licensing and Training

This appendix outlines CAR risk assessments and where they should be applied in relation to assessing and remediating brownfield sites. The information below details the different classifications of work with asbestos under CAR, summarises the legal requirements for asbestos awareness training for all involved in the investigation and management of asbestos containing soil (ACS), and details the potential requirements for suitable proficiency training relating specifically to ACS.

CAR RISK ASSESSMENTS

A CAR Risk Assessment is required for any work which may expose employees to asbestos. It is recommended that a precautionary approach is adopted if there is any doubt about risks associated with asbestos.

There are three main activities for potential asbestos exposure during work on brownfield sites:

- Site reconnaissance visits;
- Site investigation works; and
- Site remediation.

CAR risk assessments are needed at each stage but may be incorporated during the site investigation stage into the overarching health and safety risk assessments.

The CAR risk assessment must:

- Identify the type of asbestos to which employees are liable to be exposed, where possible, or assume it is present in different forms;
- Determine the type and extent of exposures to asbestos that may occur during the work
- Identify the steps to be taken to prevent exposure or reduce it to the lowest level reasonably practicable; and,
- Consider the effects of control measures that have been or will be taken.

The CAR risk assessment should include any information used to inform the risk assessment such as asbestos reports or desk study information. In the event that this information is not available, the assessor should be assumed that all forms of asbestos may be present on site.

For all investigation and remediation of ACSs, a detailed written work plan should be produced and followed as detailed on the HSE website and in the CAR.

The CAR risk assessments for specific investigations or remediation projects, will determine whether or not work is 'licensable work' (LW), notifiable non-licensable work' (NNLW) or 'non-licensed work' (NLW). In addition, training requirements are also defined by the CAR risk assessment.

Some examples of control measures that apply during site reconnaissance, site investigation works, and site remediation are given below and should be applied depending on the asbestos risks identified for the site at each stage of investigation:

- Avoiding stirring up dust;
- Cleaning footwear after site works;
- Removing and bagging any overalls for disposal/laundry;
- Respirators and hygiene facilities for high risk sites;
- Segregated welfare units;
- Wetting ground
- Minimising soil disturbances;
- Implementation or retention of capping/break layers;
- Implementation of awareness training;
- Air monitoring;
- Managing stockpiles;
- Area segregation;
- Wheel washing
- Road washing/cleaning

It is important to note that during site reconnaissance visits, site investigation works and site remediation that asbestos should not be considered in isolation and control measures are likely to form part of a wider health and safety precautions.

Respiratory protective equipment (RPE)

RPE is the last line of defence and its requirement would be defined by the CAR risk assessment. HSE (2013b) advises that RPE should have an assigned protection factor of 20 or more for all work with asbestos. In certain instances, full face-piece, positive pressure respirators with a protection factor of 40 are necessary (to EN 12942:1998, TM3).

Suitable types of RPE for most **short** duration non-licensed asbestos work:

- Disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3)
- Half mask respirator (to standard EN140) with P3 filter
- Semi-disposable respirator (to EN405) with P3 filter

These filters are not suitable for people with beards/stubble or for long or continuous use.

LICENSING

CAR defined certain types of activities involving asbestos as 'licensable work' (LW) or as 'notifiable non-licensable work' (NNLW). All other work would be 'non-licensable work' (NLW).

LW is defined as:

- work where exposure is not 'sporadic and low intensity'
- work where the risk assessment cannot demonstrate that the control limits (four hour and 10 minute limits) will not be exceeded
- work on asbestos coating
- work on AIB or insulation where risk assessment is either of first two points above or not of short duration (where short duration is defined for any work liable to disturb asbestos as taking less than two hours per week (including ancillary work) and no one person carries out that work for more than one hour').

NNLW includes work with:

- AIB or asbestos insulation of short duration that is not licensable
- fire-damaged asbestos cement or asbestos cement damaged so as to create significant dust and debris
- asbestos ropes, yarns, woven cloths in poor condition or handling cutting or breaking up the materials
- asbestos papers, felts and cardboard in poor condition, unencapsulated or not bound into another material.

Work with weathered asbestos cement, air monitoring and collecting samples of ACM in buildings would not normally be notifiable.

It is impossible to specify definitively what activities will and will not be licensable. This decision should be made as part of the CAR risk assessment. CAR is not primarily aimed at work with ACSs and there is little published information on airborne asbestos concentrations during work with ACSs. Nevertheless, CAR will require some remediation projects, and occasionally site investigations, to be LW. Investigations on other sites may involve NNLW. The decision as to whether work is LW or NNLW should be made during the CAR risk assessment by those in charge of the brownfield site investigations and remediation projects.

TRAINING REQUIREMENTS

Asbestos health and safety courses are offered by a number of providers in the UK. Training courses that include the problem of identifying ACMs in soil should be undertaken at regular intervals by those involved in the investigation, assessment and management of sites where ACs are known or suspected. It is the role of the employer to identify the level of training required for an employee based on their role, experience and duties. Reference to Regulation 10 of CAR should be referred to for more information on training requirements.

Recognising asbestos within soils is challenging due to the heterogeneity of such soils and the discolouration of asbestos by smeared soil. Specific training for ground workers should include understanding fibre release potential, potential control measures in the field, how to take representative ACSs safely, sample labelling and what analytical tests are available and when they should be implemented.

Health and safety training required under CAR includes asbestos awareness, non-licensable work (including notifiable non-licensable work) and licensable work with asbestos.

In addition to health and safety training, some staff involved in the technical identification on site of ACMs, sampling and analysis may require technical proficiency training (competency training).

Training vs. Competence

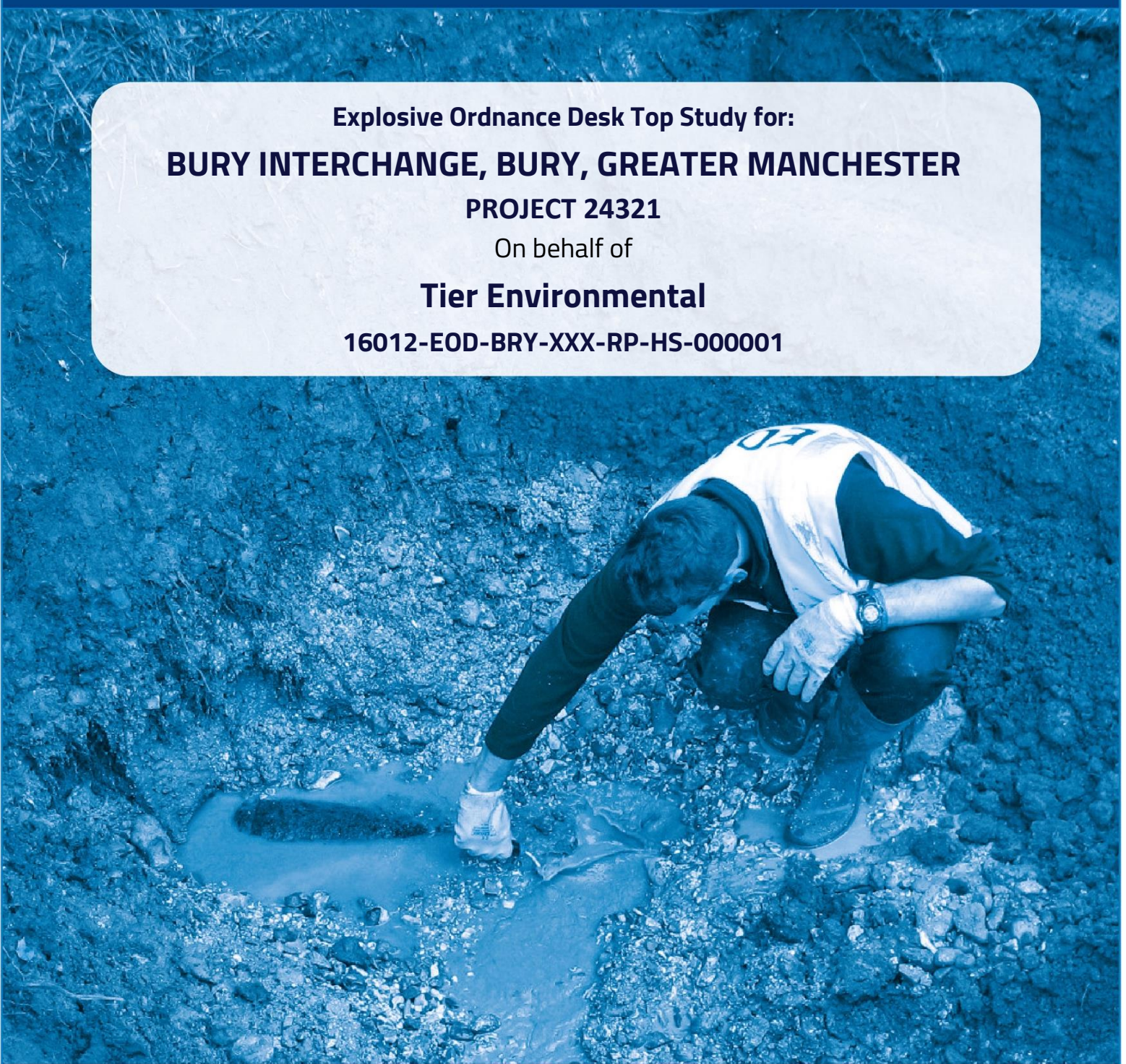
HSE (2005) identifies that 'training alone does not make people competent. Training must be consolidated by practical experience so that the person becomes confident, skilful and knowledgeable in practice on the job'. It is critical that ACS surveyors demonstrate competency with details of relevant field experience alongside training and examples of previous works/references.

APPENDIX I – UXO REPORT



Unexploded Ordnance Risk Mitigation

Explosive Ordnance Desk Top Study for:
BURY INTERCHANGE, BURY, GREATER MANCHESTER
PROJECT 24321
On behalf of
Tier Environmental
16012-EOD-BRY-XXX-RP-HS-000001



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Company Registration Number 4483560



EXPLOSIVE ORDNANCE DESK TOP STUDY

For

Bury Interchange, Bury, Greater Manchester

Conducted by **EOD Contracts Limited**
On behalf of **Tier Environmental**

Document Control & Enquiries

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TERMS AND DEFINITIONS

Abandoned Explosive Ordnance

Explosive Ordnance that has not been fired or primed, may or may not have Initiation systems, may be part of a planned abandonment e.g. Sea Dumping or is abandoned due to nefarious reasons

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.

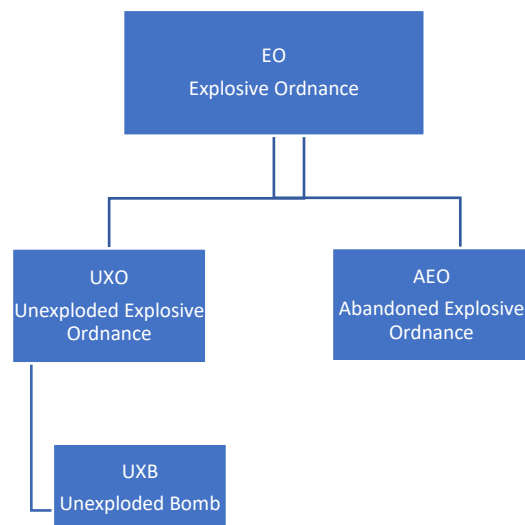
V2 see Long Range Rocket.

WWI

World War 1 (1914 – 1918)

WWII

World War 2 (1939 – 1945)



EXECUTIVE SUMMARY

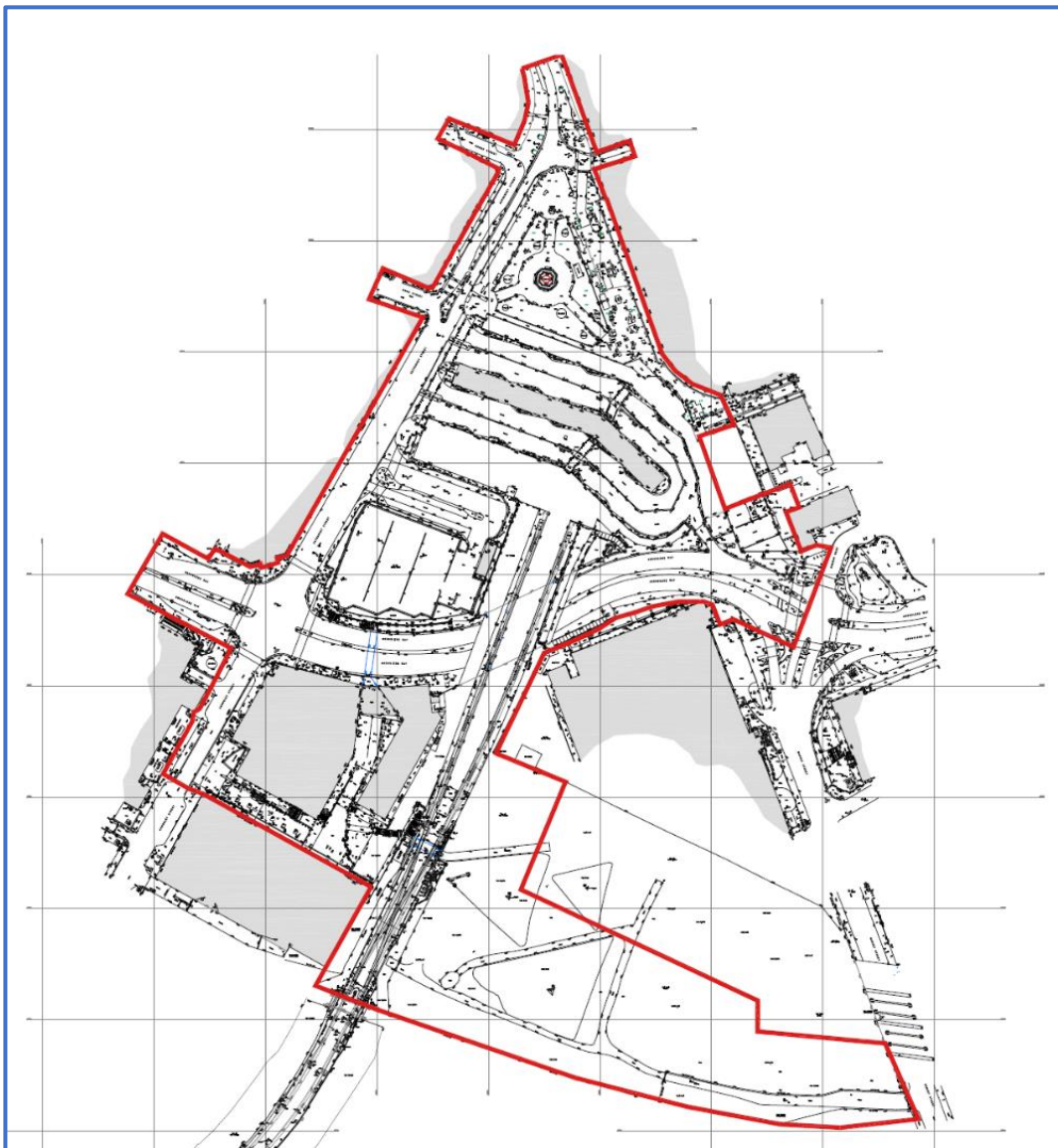
INSTRUCTION

EOD Contracts Ltd, have been commissioned by Tier Environmental (The Client) to undertake a desktop study for potential historic Unexploded Ordnance (UXO) contamination for the future works at Bury Interchange, Bury, Greater 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), 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 in the centre of Bury a market town on the River Irwell in the Metropolitan Borough of Bury, Greater Manchester, England. During WWII the site was located within the Air Raid Precautions reporting area Region (10) North Western Region HQ Manchester, Lancashire.

Table 1 Site Location

Title	Description (Centre of Site)
Address	Bury Interchange, Bury, Grater Manchester
Post Code	BL9 0BL
Grid Reference	SD8035110464
what3words	kings.grand.pool

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

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:

Historical UXO Contamination

The indications of UXO contamination are:

Bomb Strikes	The nearest recorded bomb strike is over 450m from the site and therefore outside the expected offset (j curve) of 5.3m
Bomb Damage	No bomb damage was recorded
Reconstruction	Reconstruction was noted pre-1980, this covered the majority of the site
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	Therefore, so far as reasonably practicable the risk level on site is deemed as LOW .
Risk Depth	The expected bomb depth is not applicable.

RECOMMENDATIONS

It is recommended that no further risk mitigation strategy is required.

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

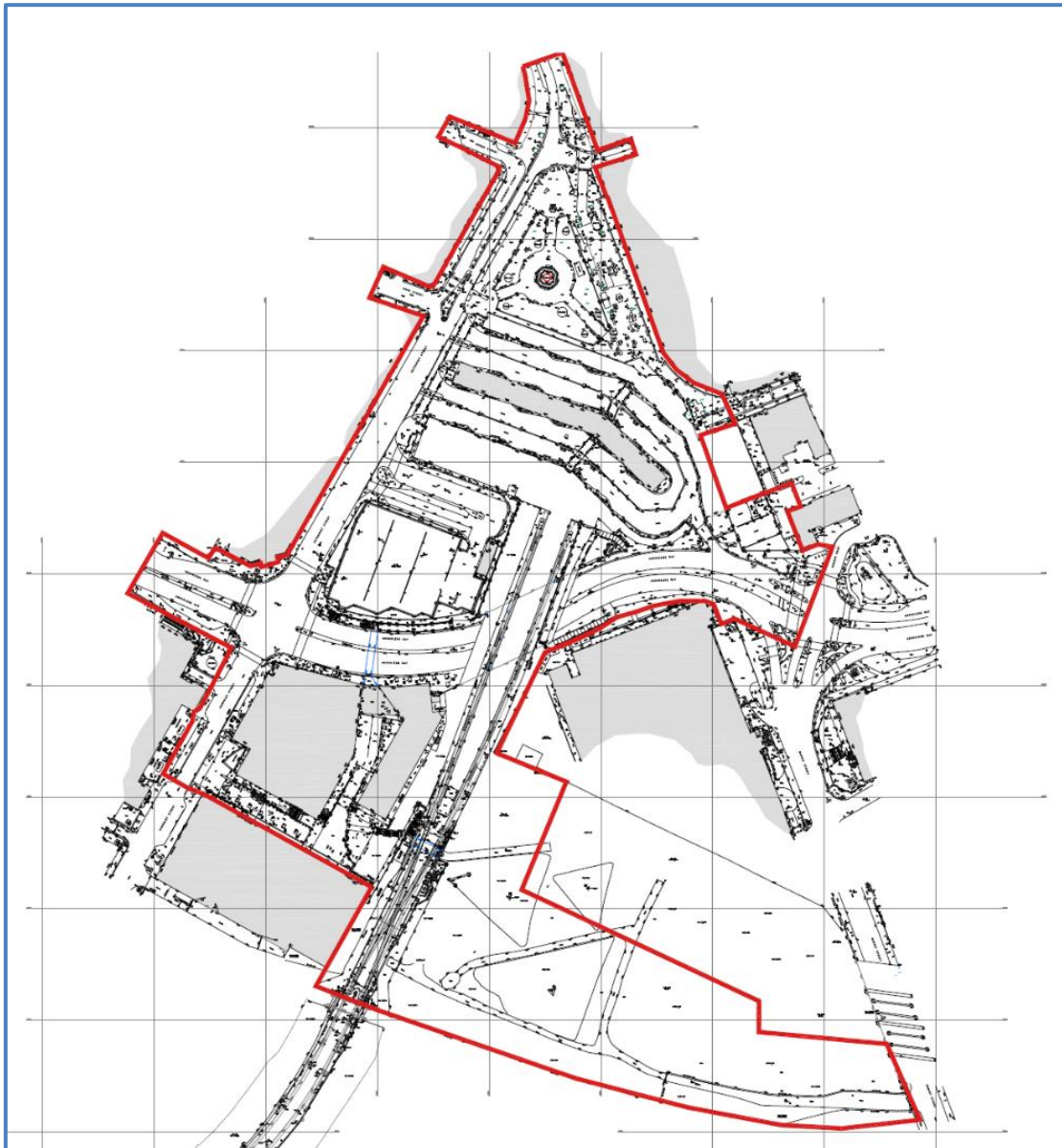
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Figure 1.1: Clients Supplied Site Diagram, This DTS will be covering all areas shown within the Red Boundary.



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 Frame Work

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:
 - 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
- English Heritage

PART 3: SITE DESCRIPTION AND DETAILS

Location

The site is located in the centre of Bury a market town on the River Irwell in the Metropolitan Borough of Bury, Greater Manchester, England. During WWII the site was located within the Air Raid Precautions reporting area Region (10) North Western Region HQ Manchester, Lancashire.

Table 3.1 Site Location

Title	Description (Centre of Site)
Address	Bury Interchange, Bury, Grater Manchester
Post Code	BL9 0BL
Grid Reference	SD8035110464
what3words	kings.grand.pool

Description and Current Usage

The site boundaries are to the northeast is Mill Gate Shopping Centre, to the south is a rail line and to the northwest is Knowsley Street and Back Knowsley Street. At present the site is bisected by the A58, the northern end of the site is occupied by the Bury Interchange a bus and rail station, with car parking in the very northern apex is Kay Gardens. The southern end of the site is bisected by a rail line running north to south, this area has car parking for a hotel and offices in the west and in the east is a college and open ground.

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	2.7	2.7
Clayey Sand and Gravel	3.5	6.2
Clay with Gravel	1.1	7.3
Gravel	0.9	8.4

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



Site

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
1938-1939	1:10,560	The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument.
1946	NA	AERIAL PHOTOGRAPH. The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument. To the east of the site is cleared ground. This may or may not be from bomb damage
1956	1:10,000	The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument. To the east of the site is cleared ground. This may or may not be from bomb damage
1965-1969	1:10,000	Shows further buildings on the site
1980-1984	1:10,000	The station and sidings have been removed, a subway now bisects the site, and the school building has been replaced with Bury Interchange, rail and coach station
2024	1:10,000	Shows present configuration of buildings and usage

Post WWII Construction

Post WWII the construction of the present buildings, car parking and a subway under the site, prior to the 1980s. 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.

Bury in the Blitz

The first time the air raid warning sounded in Bury was June 20th, 1940. With 6 air raids up to October 1941. A record from Nov 1943 notes 326 houses in the borough had been damaged excluding:

- Christmas Eve, 1944. Tottington's V1 pulsejet-propelled missiles, Hitler's forces were able to load up Heinkel H111 bombers, fly them over the North Sea In Tottington, the bomb landed on a row of cottages in Chapel Street, killing two men and four women and injuring 14 others and flattening the properties, including a shop.

Site Specific Bombing Information

Record of air raids on and in the vicinity of the site have been scrutinized, the bomb impact map is attached in Annex D, the mapping indicates HE bombs were dropped in Bury, however the nearest recorded bomb is 450m west of the site in a field near the Grammer School.

Abandoned Bombs/UXO

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

Anti-Aircraft Artillery

The nearest recorded location of an anti-aircraft gun (AA) position is over 5km from the site.

Bomb Damage

Aerial photographs and mapping have been reviewed for bomb damage to the site, there is an area to the east of the site that shows buildings having been cleared post WWII, this area can not be confirmed as bomb damage as no bombs have been recorded in this area.

Explosive or Munition Factories

No explosive or munition factories were noted, the site was allotments.

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

No UXO contamination pathways from:

- The nearest Air delivered ordnance bombs was 450m from the site
- The nearest Anti-Aircraft Weapons(AA) is over 5km
- 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 weapon penetration depths have been assessed as part of the tables in Annex F, however as no bombs were recorded no further information on bomb penetration is required.

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

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 **LOW** 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 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.

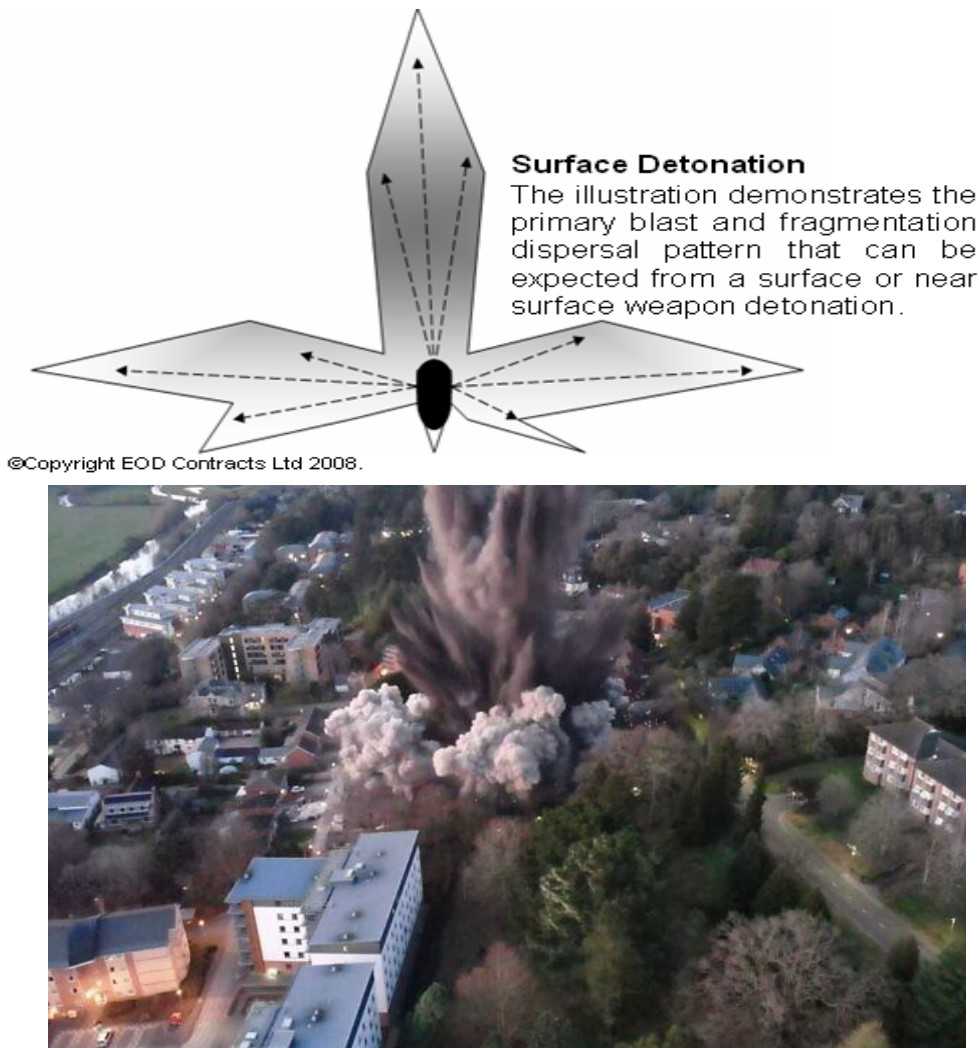
Intrusive earthwork, piling driving and dynamic ground compaction are by nature, aggressive, significant force (kN) is often required to achieve the desired results. As a precaution it is prudent to assume that any external stimulus, no matter how slight, may result in an unstable weapon detonating.

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 **LOW**.

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	The nearest recorded bomb strike is over 450m from the site and therefore outside the expected offset (j curve) of 5.3m
Bomb Damage	No bomb damage was recorded
Reconstruction	Reconstruction was noted pre-1980, this covered the majority of the site
Military Usage	No military usage was noted
Explosive/Munition Factory	The site was not used in the production of explosives or munitions

Risk Level

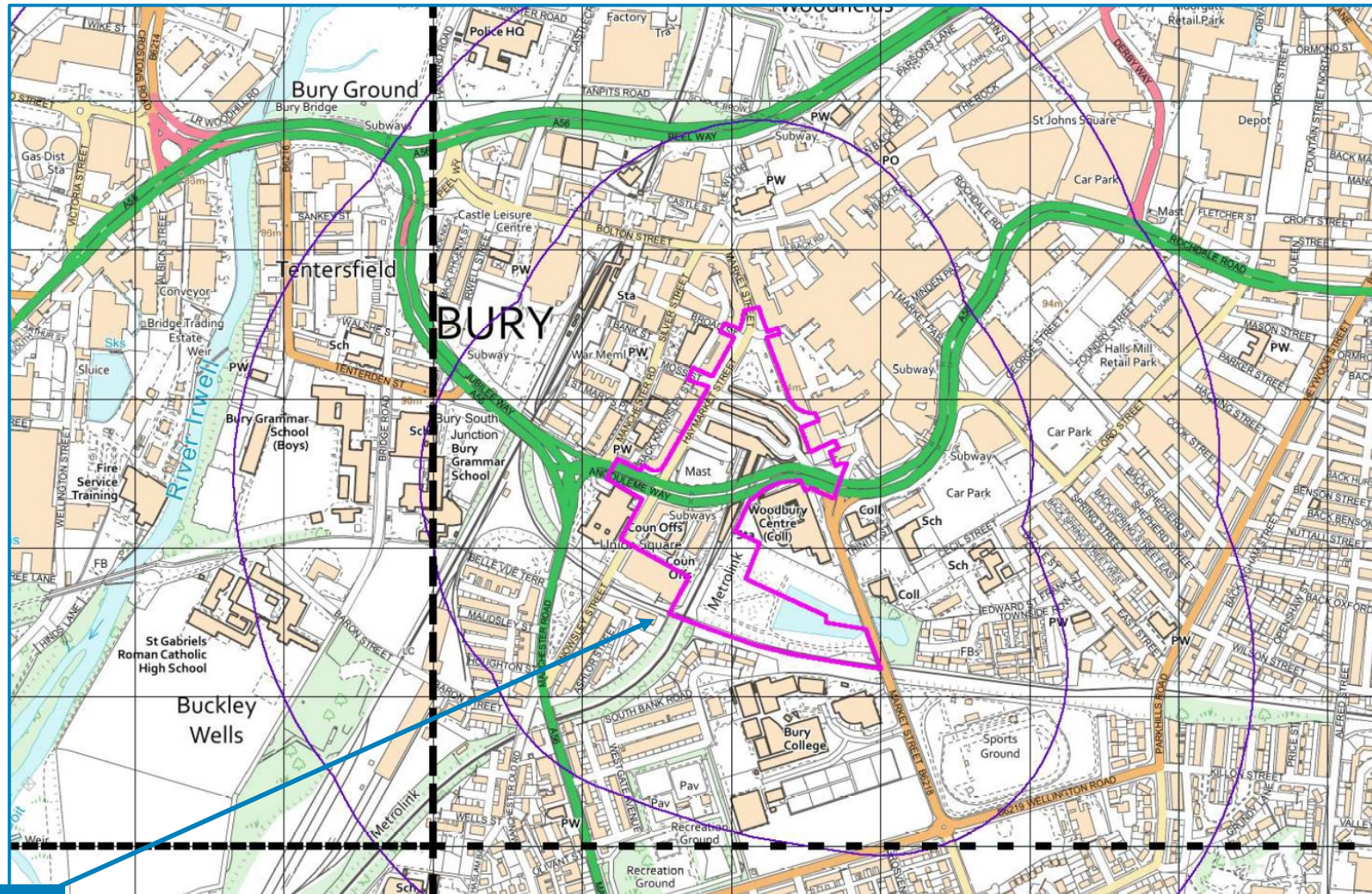
The overall risk has been determined to apply to all ground works within the site footprint.

Risk Level	Therefore, so far as reasonably practicable the risk level on site is deemed as LOW .
Risk Depth	The expected bomb depth is not applicable.

PART 8: RECOMMENDATIONS

It is recommended that no further risk mitigation strategy is required.

SITE LOCATION



Site

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	1938-1939	1:10,560	The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument.
B-4	1946	NA	AERIAL PHOTOGRAPH. The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument. To the east of the site is cleared ground. This may or may not be from bomb damage
B-5	1956	1:10,000	The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing. At the northern apex of the site is a garden with a monument. To the east of the site is cleared ground. This may or may not be from bomb damage
B-6	1965-1969	1:10,000	Shows present further buildings on the site
B-7	1980-1984	1:10,000	The station and sidings have been removed, a subway now bisects the site and the school building has been replaced with Bury Interchange
B-8	2024	1:10,000	Shows present configuration of buildings and usage

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit

Sand Pit

Other Pits

Quarry

Shingle

Orchard

Osiers

Reeds

Marsh

Mixed Wood

Deciduous

Brushwood

Fir

Furze

Rough Pasture

Arrow denotes flow of water

Trigonometrical Station

Site of Antiquities

Bench Mark

Pump, Guide Post, Signal Post

Well, Spring, Boundary Post

285 Surface Level

Sketched Contour

Instrumental Contour

Main Roads Fenced/Un-Fenced

Minor Roads Fenced/Un-Fenced

Sunken Road

Raised Road

Road over Railway

Railway over River

Railway over Road

Level Crossing

Road over River or Canal

Road over Stream

Road over Stream

County Boundary (Geographical)

County & Civil Parish Boundary

Administrative County & Civil Parish Boundary

County Borough Boundary (England)

County Burgh Boundary (Scotland)

Rural District Boundary

Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry

Gravel Pit

Sand Pit

Disused Pit or Quarry

Refuse or Slag Heap

Lake, Loch or Pond

Dunes

Boulders

Coniferous Trees

Non-Coniferous Trees

Orchard

Scrub

Coppice

Bracken

Heath

Rough Grassland

Marsh

Reeds

Saltings

Building

Glasshouse

Sloping Masonry

Pylon

Electricity Transmission Line

Pole

Cutting

Embankment

Standard Gauge Multiple Track

Standard Gauge Single Track

Siding, Tramway or Mineral Line

Narrow Gauge

Geographical County

Administrative County, County Borough or County of City

Municipal Borough, Urban or Rural District, Burgh or District Council

Borough, Burgh or County Constituency

Civil Parish

BP, BS Boundary Post or Stone

Ch Church

CH Club House

F E Sta Fire Engine Station

FB Foot Bridge

Fn Fountain

GP Guide Post

MP Mile Post

MS Mile Stone

Pol Sta Police Station

PO Post Office

PC Public Convenience

PH Public House

SB Signal Box

Spr Spring

TCB Telephone Call Box

TCP Telephone Call Post

W Well

1:10,000 Raster Mapping

Gravel Pit

Refuse tip or slag heap

Rock

Rock (scattered)

Boulders

Boulders (scattered)

Shingle

Mud

Sand

Sand Pit

Slopes

Top of cliff

General detail

Underground detail

Overhead detail

Narrow gauge railway

Multi-track railway

Single track railway

County boundary (England only)

Civil, parish or community boundary

District, Unitary, Metropolitan, London Borough boundary

Constituency boundary

Area of wooded vegetation

Non-coniferous trees

Non-coniferous trees (scattered)

Coniferous trees

Coniferous trees (scattered)

Positioned tree

Orchard

Coppice or Osiers

Rough Grassland

Heath

Scrub

Marsh, Salt Marsh or Reeds

Water feature

Flow arrows

MHW(S) Mean high water (springs)

MLW(S) Mean low water (springs)

Telephone line (where shown)

Electricity transmission line (with poles)

Bench mark (where shown)

Triangulation station

Point feature (e.g. Guide Post or Mile Stone)

Pylon, flare stack or lighting tower

Site of (antiquity)

Glasshouse

General Building

Important Building

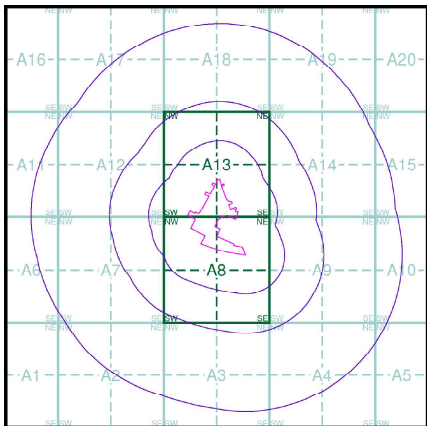


EOD Contracts Ltd

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:10,560	1850 - 1851	3
Lancashire And Furness	1:10,560	1894	4
Lancashire And Furness	1:10,560	1910 - 1911	5
Lancashire And Furness	1:10,560	1931	6
Lancashire And Furness	1:10,560	1938 - 1939	7
Ordnance Survey Plan	1:10,000	1955 - 1956	8
Ordnance Survey Plan	1:10,000	1965 - 1969	9
Ordnance Survey Plan	1:10,000	1974	10
Manchester	1:25,000	1975	11
Ordnance Survey Plan	1:10,000	1980 - 1984	12
Ordnance Survey Plan	1:10,000	1989	13
Ordnance Survey Plan	1:10,000	1992	14
10K Raster Mapping	1:10,000	1999	15
10K Raster Mapping	1:10,000	2006	16
VectorMap Local	1:10,000	2024	17

Historical Map - Slice A



Order Details

Order Number: 362890111_1_1
Customer Ref: 24321 TIER Bury Interchange
National Grid Reference: 380440, 410460
Slice: A
Site Area (Ha): 6.83
Search Buffer (m): 1000

Site Details

Bury Interchange, Bury, BL9 0BL

Landmark
INFORMATION GROUP

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



EOD Contracts Ltd

Lancashire And Furness

Published 1938 - 1939

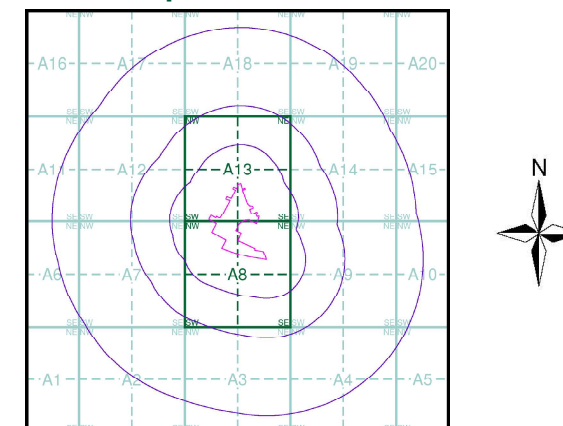
Source map scale - 1:10,560

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)

087NE 1938 1:10,560	088NW 1939 1:10,560
087SE 1938 1:10,560	088SW 1938 1:10,560

Historical Map - Slice A



Order Details

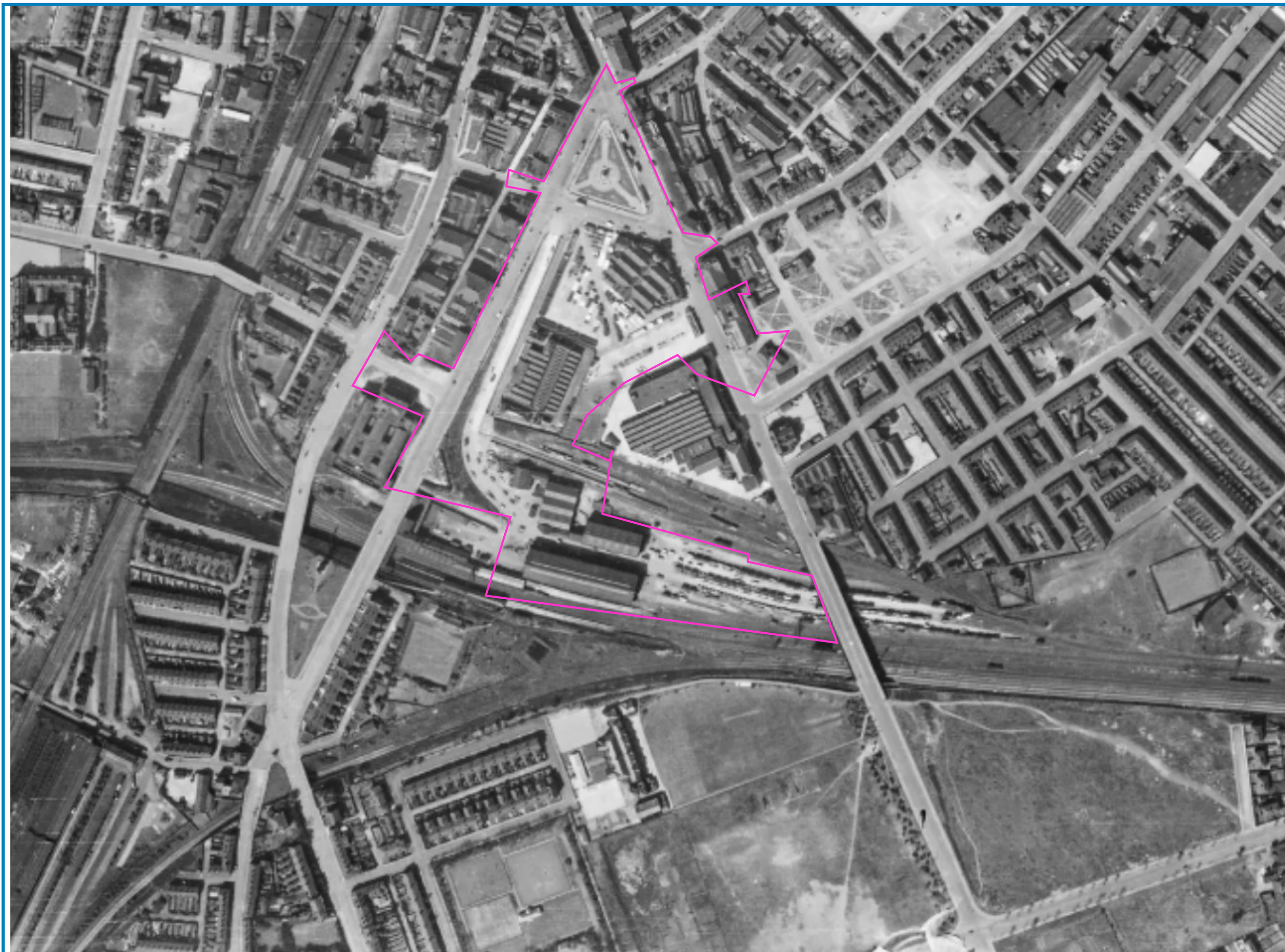
Order Number: 362890111_1_1
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Description/Remarks

AERIAL PHOTOGRAPH

The site is a rail station to the south with sidings, to the north of the sidings is a large building with hard standing, further north is a school building with hard standing.

At the northern apex of the site is a garden with a monument.

To the east of the site is cleared ground. This may or may not be from bomb damage

Date

1946



Ordnance Survey Plan

Published 1955 - 1956

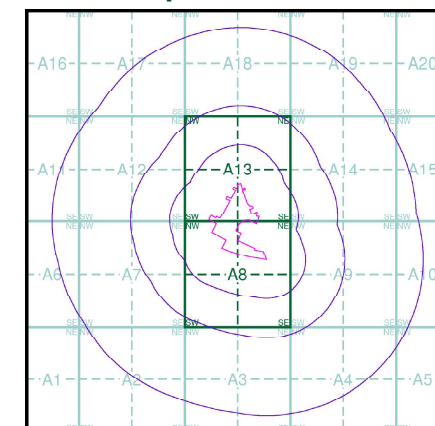
Source map scale - 1:10,000

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)

SD71SE	SD81SW
1956	1956
1:10,560	1:10,560
SD70NE	SD80NW
1955	1955
1:10,560	1:10,560

Historical Map - Slice A



Order Details

Order Number: 362890111_1_1
Customer Ref: 24321 TIER Bury Interchange
National Grid Reference: 380440, 410460
Slice: A
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