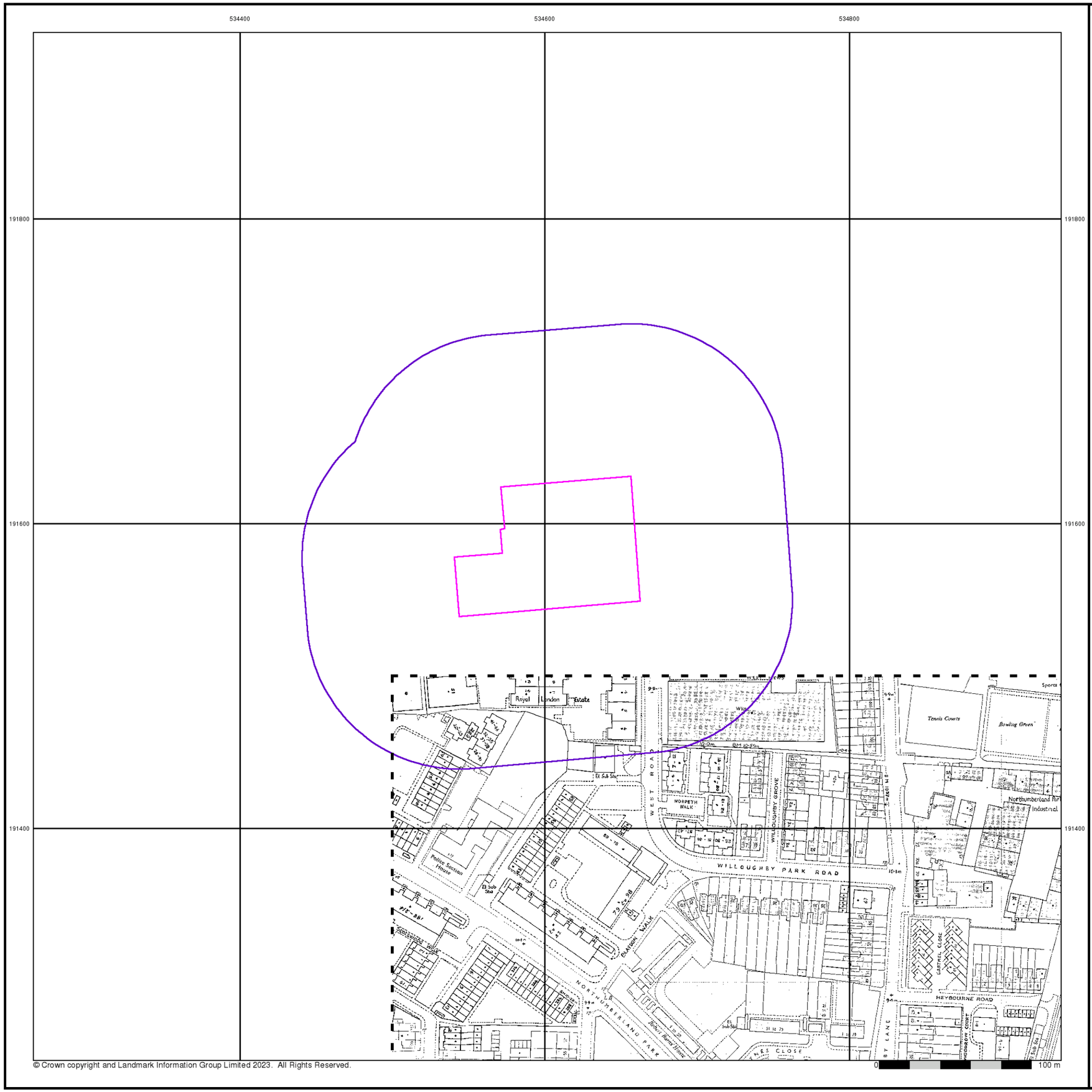

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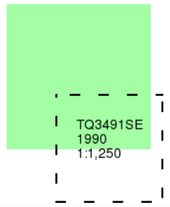
Additional SIMs

Published 1990

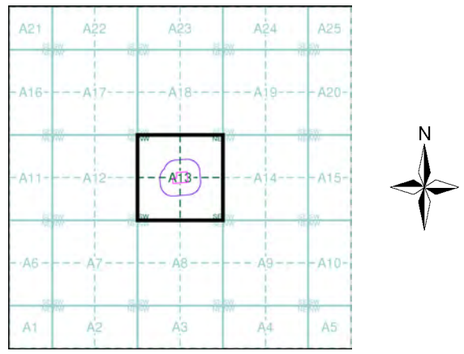
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



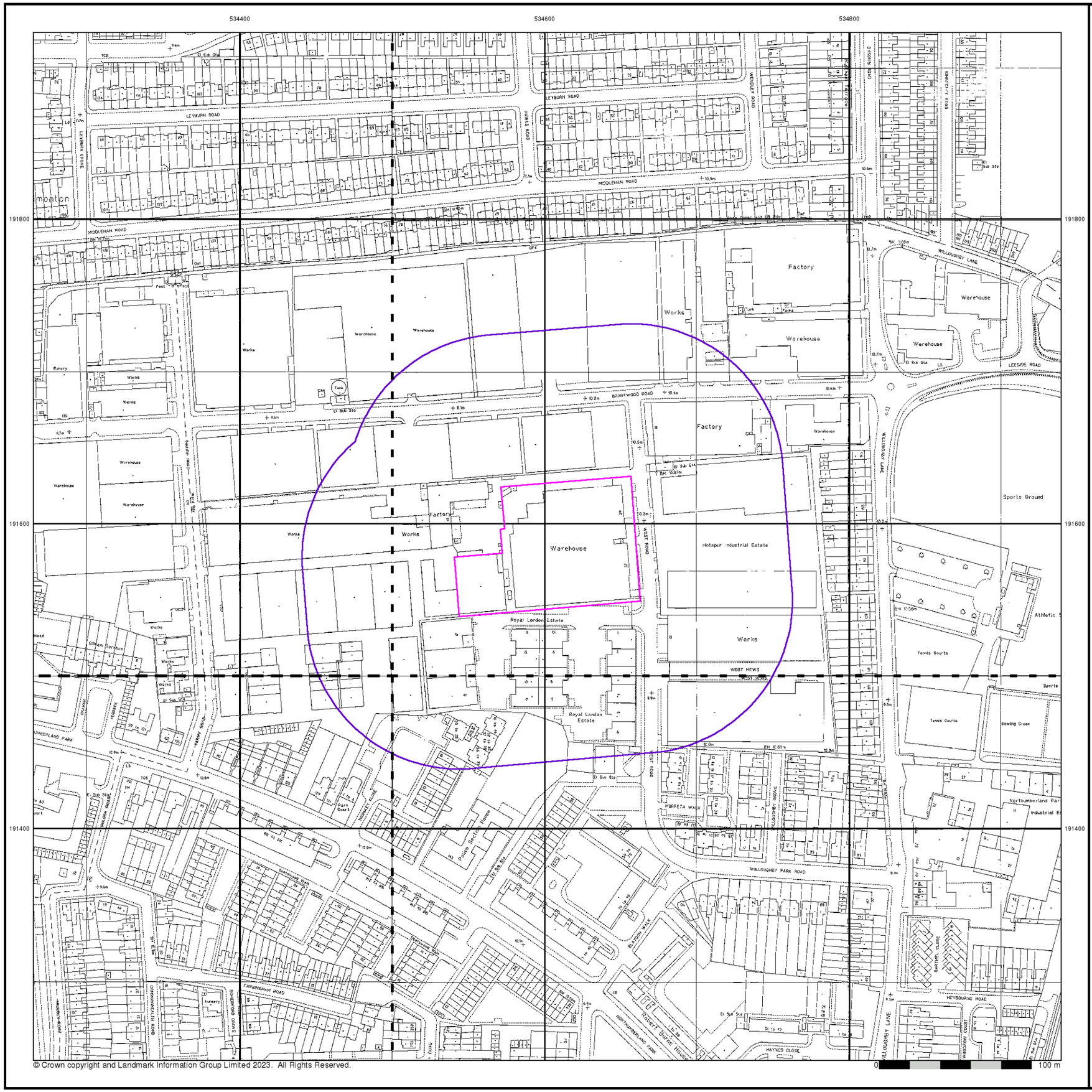
Order Details

Order Number:	327179692_1_1
Customer Ref:	577557
National Grid Reference:	534610, 191580
Slice:	A
Site Area (Ha):	0.85
Search Buffer (m):	100

Site Details

37-39, West Road, LONDON, N17 0RE

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



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Large-Scale National Grid Data

Published 1991

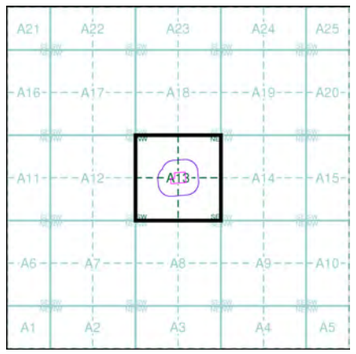
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999.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)

TQ3491NW 1991 1:1,250	TQ3491NE 1991 1:1,250
TQ3491SW 1991 1:1,250	TQ3491SE 1991 1:1,250

Historical Map - Segment A13



Order Details

Order Number:	327179692_1_1
Customer Ref:	577557
National Grid Reference:	534610, 191580
Slice:	A
Site Area (Ha):	0.85
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0 100 m

Large-Scale National Grid Data

Published 1991 - 1994

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.

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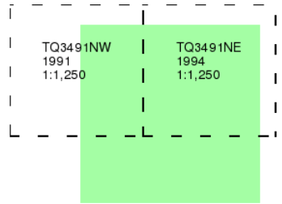

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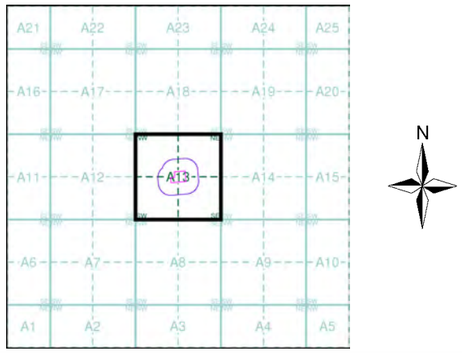

Order Details

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National Grid Reference:	534610, 191580
Slice:	A
Site Area (Ha):	0.85
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Site Details

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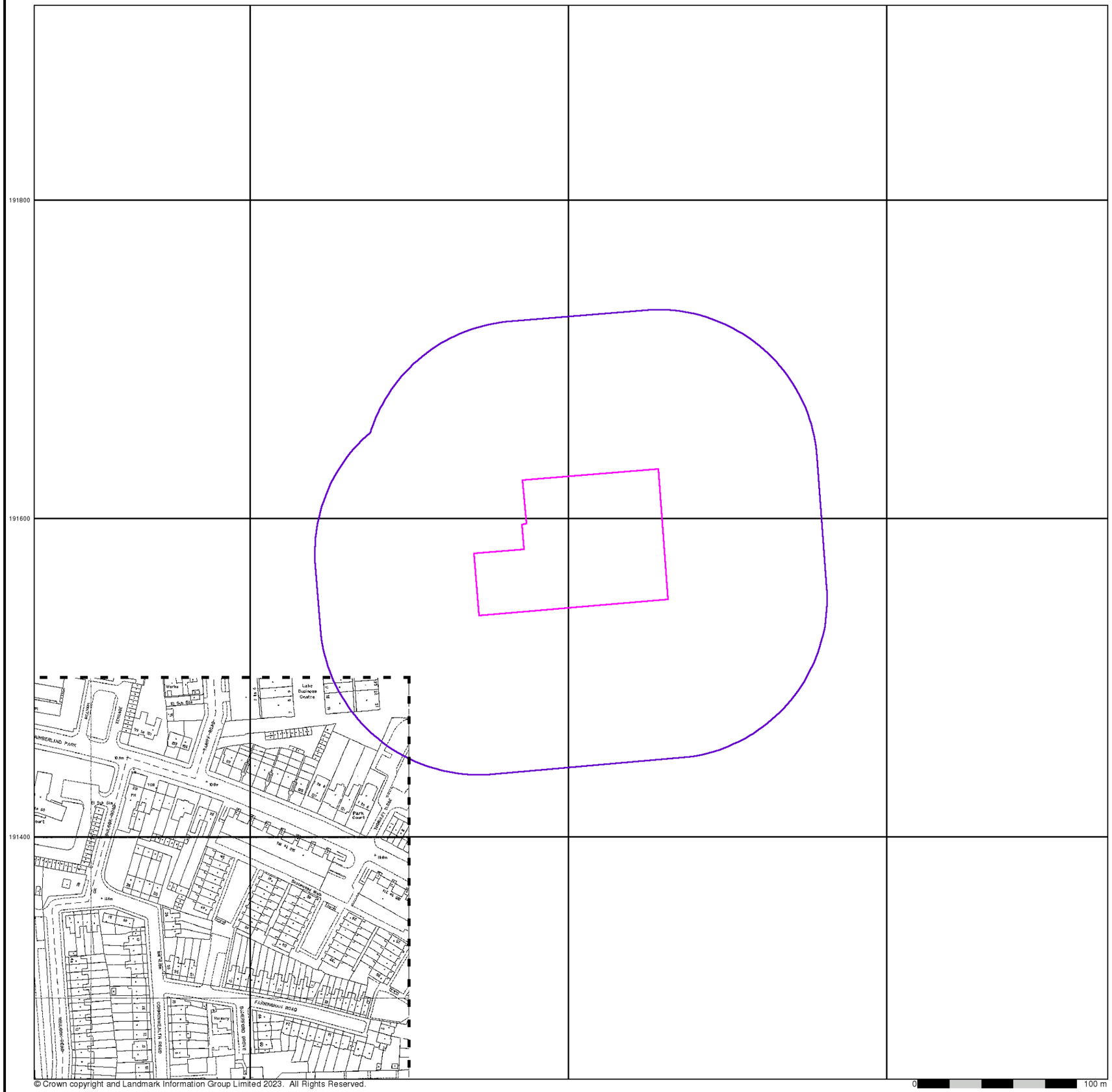

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Large-Scale National Grid Data

Published 1996

Source map scale - 1:1,250

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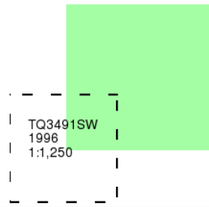
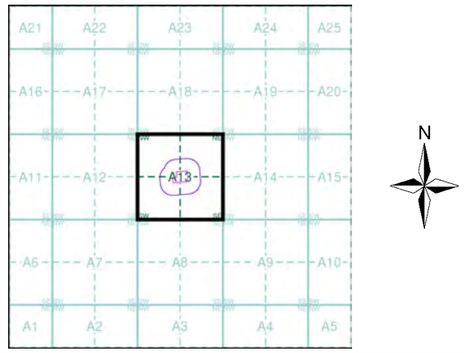


Historical Map - Segment A13



Order Details

Order Number:	327179692_1_1
Customer Ref:	577557
National Grid Reference:	534610, 191580
Slice:	A
Site Area (Ha):	0.85
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Site Details

37-39, West Road, LONDON, N17 0RE

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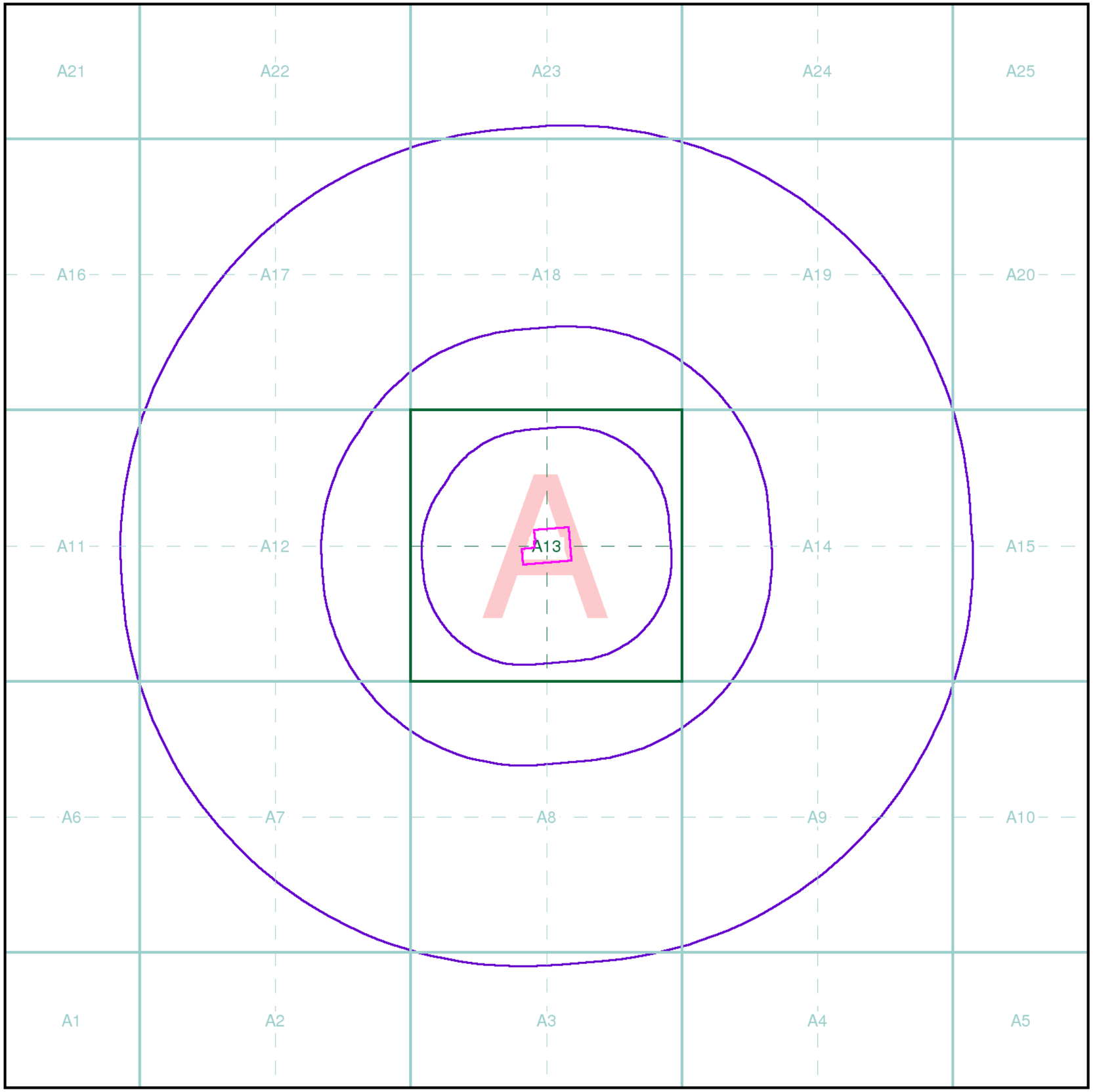

Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice
Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment
A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant
A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:

Envirocheck reports are compiled from 136 different sources of data.

Client Details
Mr W Nitch-Smith, TRC Companies Ltd, Work.Life, 20 Red Lion Street, London, WC1R 4PQ

Order Details
Order Number: 327179692_1_1
Customer Ref: 577557
National Grid Reference: 534610, 191580
Site Area (Ha): 0.85
Search Buffer (m): 1000

Site Details
37-39, West Road, LONDON, N17 0RE

Full Terms and Conditions can be found on the following link:
http://www.landmarkinfo.co.uk/Terms/Show/515

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Web: www.envirocheck.co.uk

Annex C: Site Photographs

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
1	13/12/23

Description:

Street view from the south-eastern corner.
The Site starts from the white building.
The parked vehicles are from the neighboring southern site.

Photo No.	Date
2	13/12/23

Description:

Street view from the north-eastern corner, along West Road.
(West Road – name of the street on the east side of the building).

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
3	13/12/23

Description:

Street view from the north-eastern corner. Road along north boundary leading to small parking area at the back.

Photo No.	Date
4	13/12/23

Description:

Small parking area at the back, at the north-western corner.
The waste bin (red) can also be seen.

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
5	13/12/23

Description:

Photo at the north side of the warehouse, showing old cemented type roof drain and corrugated roofing.

Photo No.	Date
6	13/12/23

Description:

Inside the building showing the ceiling and part of the corrugated roof.
The water pipes are for the fire sprinkler system.

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
7	13/12/23

Description:

Commercial stock in warehouse.

Photo No.	Date
8	13/12/23

Description:

Commercial stock in warehouse.

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
9	13/12/23

Description:

Commercial stock in warehouse.

Photo No.	Date
10	13/12/23

Description:

Electrical main supply line entering building inside warehouse, at north eastern corner.

Photographic Log

Client Name:	Site Location:	Project No.:
Goya Developments	37-39 West Road	577557.0000.0000

Photo No.	Date
11	13/12/23

Description:

Water line connection inside warehouse on the east side.

Photo No.	Date
12	13/12/23

Description:

Aircon unit in warehouse.

Annex D: Detailed UXO Risk Assessment

Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	37-39 West Road, London
Client	TRC Companies Ltd
Site Address	37-39 West Road, London, N17 0RE
Report Reference	DA19126-00
Date	14/12/2023
Author	MT
Quality Assurance	HW
Final Check	AB

1st Line Defence
3 Maple Park, Essex Road, Hoddesdon. EN11 0EX
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Web www.1stlinedefence.co.uk Company Reg No. 07717863

1ST LINE DEFENCE

Executive Summary

Site Location and Description

The site is located in Tottenham, within the London Borough of Haringey. It is bordered to the north by an access road and an industrial building, to the east by West Road, to the south by an access road and two industrial buildings, and to the west by an industrial building and hardstanding ground.

Recent aerial photography from 2022 shows the site to comprise multiple industrial buildings across much of the site with open, hardstanding ground in the north-eastern and north-western corners.

The site is approximately centred on the OS grid reference: **TQ 34602 91589**.

Proposed Works

The client has indicated that no immediate ground works are going to be taking place at the site.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by the London Clay Formation – clay, silt and sand; sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period. The superficial deposits comprise the Enfield Silt Member – clay and silt; sedimentary superficial deposit formed between 116 thousand years ago and the present during the Quaternary period.

Site-specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

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

UXO Risk Assessment

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

The Risk from German Air-Delivered UXO

- During WWII, the site was situated within the Municipal Borough of Tottenham, which sustained an overall very high density of bombing, with an average of 103.9 bombs recorded per 1,000 acres according to official Home Office bombing statistics. This can be attributed to the presence of key infrastructure targets close to the site such as reservoirs and water treatment works, see **Annex J**, located approximately 1.1km to the east and south east of the site, as well as the districts proximity to the City of London.
- During the war the site was occupied by two large industrial buildings in the eastern section of the site, part of a third larger industrial building in the western section of the site, several smaller buildings near the centre of the site, and their associated grounds.
- London Bomb Census mapping recorded two bombing incidents bordering the site to the south between 7th October 1940 and 6th June 1941. However, the local Haringey Bomb Map appears to plot these two incidents further to the south of the site. The Haringey Bomb Map also plots a bombing incident bordering the site to the east on West Road on the 25th September 1940. This incident involved an exploded anti-aircraft shell and not a bomb, causing little if any damage to the surrounding area.
- Written records including the 'Haringey Air Raid Incident Records' and 'MCC Log Book of Air Raid Incidents' corroborate the Haringey Bomb Map with no bomb strikes recorded on site and only a single incident – the aforementioned anti-aircraft shell - was bordering the site to the east on the 25th September 1940.
- No bomb damage is recorded on site, or directly bordering it on Middlesex County Council War Damage mapping. Wartime and post-war aerial photography of the site and its surroundings from 1941 and 1946, and oblique imagery from 1950, corroborates this lack of damage with no obvious signs of damage visible on the site or in its direct surroundings.

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- Access and ground cover across the site is thought to have been mostly conducive to UXO detection throughout the war, being occupied by large industrial buildings and their associated lands. Higher levels of access would increase the likelihood that evidence of UXO would have been noticed and reported.
- In summary, while positive evidence of an incident is recorded on the site's eastern border this involved an anti-aircraft shell rather than a bomb and no damage was recorded to surrounding buildings following the incident. Wartime/post-war aerial imagery and oblique photography shows the site to be in good condition with no obvious signs of damage and the incident is well documented across maps and written records. It is thought likely that the site would have remained occupied and in use throughout the war and that conditions should have been such that evidence of UXO would have been noted and reported.
- While it is possible that the undeveloped land to the north of the site resulted in northern section of the site being vulnerable to the 'J-curve effect' (**Annex E**), the likelihood of this occurring is nonetheless, not considered realistic. Taking the above factors into consideration, the site has been assessed as holding an overall **Low Risk** of UXO contamination. Proactive risk mitigation measures are not considered necessary on this occasion but on-site UXO awareness briefings for personnel are still recommended as a sensible minimum precaution.

The Risk from Allied UXO

- No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA.
- The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

Post-WWII Redevelopment

- The site appears to have undergone some post-war redevelopment. While the original large industrial buildings are still present on site they have had extensions added that cover much of the open ground near the centre of the site. Much of this redevelopment occurred at some point between 1952 and 1999, with a small extension connecting the two large industrial buildings in the southern section of the site constructed between 2006 and 2009.
- The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

Recommended Risk Mitigation Measures	
The following risk mitigation measures are recommended to support the proposed works at the 37-39 West Road, London site:	
Activity	Recommended Risk Mitigation Measure
All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.
Note – proactive on-site UXO support/survey should not be necessary for any works taking place at the location of and down to the depths of significantly worked post-war made ground/post-war fill.	

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Glossary

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

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Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: 37-39 West Road, London
Client: TRC Companies Ltd

1. Introduction

1.1. Background

1st Line Defence has been commissioned by TRC Companies Ltd to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at 37-39 West Road, London.

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

UXO in the UK can originate from three principal sources:

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

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

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

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2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at 37-39 West Road, London. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

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

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

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

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

2.3. Sources of Information

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

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

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3. Background to Bombing Records

3.1. General Considerations of Historical Research

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

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

3.2. German Bombing Records

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

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

3.3. Allied Records

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

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4. UK Regulatory Environment and Guidelines

4.1. General

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

4.2. CDM Regulations 2015

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

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

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

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

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

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

4.4. CIRIA C681

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

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

4.5. Additional Legislation

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

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5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

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

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

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

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

5.2. The Authorities

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

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

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

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

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6. The Site

6.1. Site Location

The site is located in Tottenham, within the London Borough of Haringey. It is bordered to the north by an access road and an industrial building, to the east by West Road, to the south by an access road and two industrial buildings, and to the west by an industrial building and hardstanding ground.

The site is approximately centred on the OS grid reference: **TQ 34602 91589**.

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

6.2. Site Description

Recent aerial photography from 2022 shows the site to comprise multiple industrial buildings across much of the site with open, hardstanding ground in the north-eastern and north-western corners.

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

7. Scope of the Proposed Works

7.1. General

The client has indicated that no immediate ground works are going to be taking place at the site.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site to be underlain by the London Clay Formation – clay, silt and sand; sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period. The superficial deposits comprise the Enfield Silt Member – clay and silt; sedimentary superficial deposit formed between 116 thousand years ago and the present during the Quaternary period.

8.2. Site-Specific Geology

Site-specific geotechnical data was not provided by the client during the production of this report.

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9. Site History

9.1. Introduction

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

9.2. Ordnance Survey Historical Maps

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

Pre-WWII		
Date	Scale	Description
1938	1:10,560	This pre-war OS map shows the site to comprise two industrial buildings, two smaller buildings and associated grounds in the centre of the site with a section of another industrial building in the western section of the site. The site is bordered to the north by open ground, to the east by *West Road*, to the south by an industrial building and to the west by an industrial building and associated grounds.

Post-WWII		
Date	Scale	Description
1952	1:10,000	This post-war OS map shows the site to have remained mostly unchanged, with the only change being the addition of a third small building near the centre of the site. The site's direct surroundings have remained mostly unchanged to the east, south and west while to the north the site is now bordered by an access road.

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10. Introduction to German Air Delivered Ordnance

10.1. General

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

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

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

10.2. Generic Types of WWII German Air Delivered Ordnance

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

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

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10.3. Failure Rate of German Air Delivered Ordnance

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

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

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

10.4. UXB Ground Penetration

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

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

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

10.4.1. The J-Curve Principle

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

10.4.2. WWII UXB Ground Penetration Studies

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

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

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10.4.3. Site Specific Bomb Penetration Considerations

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

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

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

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the flying bomb or pilotless aircraft, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 2,419 V-1s and 517 V-2s were recorded in the London Civil Defence region alone.

Although these weapons caused considerable damage, their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today. Even if the 1,000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time. Therefore, any V-weapons referenced in this report are referenced not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

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11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex G**. This source shows that Zeppelin bomb strikes occurred in the general area of the site.

The district of Tottenham is recorded to have been bombed on one occasion by Zeppelin SL.11. A map of this Zeppelin's flight path, see **Annex H**, shows that no bombs were dropped on the site, with the closest bombing incidents occurring approximately 750m to the north east of the site within the vicinity of Kenninghall Open Space. Information regarding the bombing of Tottenham was obtained from Ian Castle's 'Britain's First Blitz-1914-1918' project.

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

11.2. World War II Bombing of the Municipal Borough of Tottenham

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

During WWII the site was located within the Municipal Borough of Tottenham, which sustained an overall very high density of bombing, as represented by bomb density data figures and maps, see **Annex I**. This was mainly due to the presence of key infrastructure targets close to the site such as reservoirs and water treatment works, see **Annex J**, located approximately 1.1km to the east and south east of the site, as well as the districts proximity to the City of London.

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

Records of bombing incidents are presented in the following sections.

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11.3. WWII Home Office Bombing Statistics

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

Record of German Ordnance Dropped on the Municipal Borough of Tottenham		
Area Acreage		3,013
Weapons	High Explosive bombs (all types)	283
	Parachute mines	4
	Oil bombs	18
	Phosphorus bombs	0
	Fire pots	0
	Pilotless aircraft (V-1)	5
	Long range rocket bombs (V-2)	3
Total		313
Number of Items per 1,000 acres		103.9
Source: Home Office Statistics This table does not include UXO found during or after WWII.		

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

11.4. London Civil Defence Region Bomb Census Maps

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced both consolidated and weekly bomb census maps for the London Civil Defence Region, as well as census mapping of V-1 pilotless aircraft. These maps collectively show the approximate locations of bombs, mines and rockets dropped in the region. The site area was checked on each available map sheet. Those showing bomb incidents on and in the immediate vicinity of the site are discussed below and are presented in **Annex K**.

Consolidated London Bomb Census Maps – **Annex K1**	
Date Range	Comments
Night Bombing up to 7th October 1940	No bomb strikes are recorded on or directly bordering the site. No bombing incidents are recorded in the direct surroundings of the site.
7th October 1940 to 6th June 1941	While no bomb strikes are recorded on the site, two bomb strikes are recorded bordering the site to the south.

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Weekly London Bomb Census Maps – **Annex K2-K3**	
Date Range	Comments
7th – 14th October 1940	No bomb strikes are recorded on or directly bordering the site. The closest incident is recorded approximately 70m to the north of the site.
4th – 11th November 1940	No bomb strikes are recorded on or directly bordering the site. The closest incident is recorded approximately 100m to the north of the site.
5th – 12th May 1941	The southern section of the site is highlighted as being within the area of an incendiary shower.

V-1 Pilotless Flying Bomb Census Map – **Annex L**	
Date Range	Comments
1944 - 1945	The closest recorded V-1 was located approximately 750m to the north-east of the site within the vicinity of Kenninghall Open Space. The date of this strike was 2nd/3rd August 1944.

11.5. Haringey Bomb Map

A local bomb map compiled by ARP wardens and volunteers showing bomb strikes on the borough was obtained from the Haringey Archives. Bomb strikes plotted on this map correspond with written records in the Haringey Air Raid Incident Records. The section showing the area of the site is described in the table below and presented in **Annex M**.

Haringey Bomb Map	
Date Range	Comments
1939 - 1945	While no bomb strikes are recorded on the site, one bombing incident is recorded bordering the site to the east on West Road.

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11.6. Haringey Air Raid Incident Records

Written records were obtained from the Haringey Archives. A transcript of the relevant written records is presented in the table below. Example imagery of these entries are presented in **Annex N**.

Haringey Air Raid Incident Records			
Date/Map Plot	Type of bomb	Record Transcription	Comments
12th September 1940 48	UX AA Shell	31 Malvern Road, Koref Factory, West Road	NIL damage, unconfirmed 23.9.40 *This incident occurred approximately 80m to the south-east of the site.*
14th September 1940 59	Incendiary Bomb	14 Willoughby Park Road	House Rendered uninhabitable. *This incident occurred approximately 175m to the south of the site.*
18th September 1940 140	HE Bomb	142-146 Northumberland Park	Two dwelling houses severely damaged. Others slightly. Northumberland Park blocked from Northumberland Grove to Tarrif Road. *This incident occurred approximately 155m to the south-west of the site.*
25th September 1940 217	Exploded AA Shell	Roadway, outside Brown's Factory, West Road	Small crater in roadway. *This incident occurred on the eastern border of the site.*
9th October 1940 275	HE. Bomb	Lazarus Factory, Brantwood Road	Severe damage to factory. *This incident occurred approximately 120m to the north of the site.*
20th October 1940 360	HE Bomb	West Road, Northumberland Park	2 large craters in Roadway. Gas and water mains damaged. Telephone wires down. *This incident occurred approximately 65m to the south of the site.*
20th October 1940 362	HE Bomb	Lazarus Furniture Factory, Brantwood Road	To factory and inside water mains. *This incident occurred approximately 55m to the north of the site.*
20th October 1940 362	HE Bomb	Hotrie Engineering Works, Brantwood Road	To factory. Large crater in rear. *This incident occurred approximately 55m to the north of the site.*
11th November 1940 443	UX HE Bomb	Messrs. Lazarus', Brantwood Road	NIL damage *This incident occurred approximately 120m to the north of the site.*
11th November 1940 444	UX HE Bomb	Waste ground rear Messrs Whites, Brantwood Road	NIL damage *This incident occurred approximately 120m to the north of the site.*

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11.7. MCC Log Book of Air Raid Incidents

Written records were obtained from the London Metropolitan Archives. A transcript of the relevant written records is presented in the table below. Example imagery of these entries are presented in **Annex O**.

MCC Log Book of Air Raid Incidents			
Date	Incident Time	Record Transcription	Comments
21st October 1940	23:27	Minor damage HE. West Road, Northumberland Park. Brantwood Road. Willoughby Lane.	*West Road borders the site to the east.*
21st October 1940	00:19	HE Brantwood Road, H. Lazarus Factory, Willoughby Lane opposite Willoughby Park Road. West Road blocked.	1 wounded *West Road borders the site to the east.*

11.8. Middlesex County Council War Damage Map

Map sheets compiled by Middlesex County Council (MCC) showing the extent of wartime bomb damage over the area of the site were consulted at London Metropolitan Archives. The section showing the area of the site is described in the table below and presented in **Annex P**.

It should be highlighted that this source only records the following damage categories: 'Category 1: Total damage, building to be demolished', 'Category 2: Some repairs possible, but could become Cat 1' and 'Category 3: Borderline areas, uncertain whether repairs possible, might have to be demolished'. The lesser damage categories, such as seriously damaged but repairable at cost and general blast damage, were not used.

MCC War Damage Map	
Date Range	Comments
1940 - 1945	This damage map indicated that no serious damage was recorded on any of the buildings on site or on any buildings bordering the site.

11.9. WWII-Era Aerial Photography

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

WWII-Era Aerial Photography	
Date/Title	Description
17th June 1941	This wartime aerial image shows the site as it was during WWII in 1941. The site is seen to be occupied by three large industrial buildings and three smaller buildings. All buildings on site appear to be in good condition with no obvious signs of damage, such as ruins or roof repairs, visible. Buildings directly bordering the site to the south and west also appear to be in good condition.
10th September 1946	This post-war aerial image shows the site as it was after WWII in 1946. The site is seen to be in the same condition as in earlier imagery.
1950	This post-war oblique image shows the site as it was after WWII in 1950. The buildings on site are seen to be in good condition with no obvious signs of significant damage having occurred.

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11.10. Abandoned Bombs

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

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

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

11.11. Bomb Disposal Tasks

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

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11.12. Evaluation of German Air Delivered UXO Records

German Air Delivered UXO Records Summary	
Factors	**Conclusion**
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.*	During WWII, the site was situated within the Municipal Borough of Tottenham, which sustained an overall very high density of bombing, with an average of 103.9 bombs recorded per 1,000 acres according to official Home Office bombing statistics. This can be attributed to the presence of key infrastructure targets close to the site such as reservoirs and water treatment works, see **Annex J**, located approximately 1.1km to the east and south east of the site, as well as the districts proximity to the City of London. London Bomb Census mapping recorded two bombing incidents bordering the site to the south between the 7th October 1940 to 6th June 1941, however the local Haringey Bomb Map appears to plot these two incidents further to the south of the site. The Haringey Bomb Map also plots a bombing incident bordering the site to the east on West Road on the 25th September 1940. This incident involved an exploded anti-aircraft shell and not a bomb, causing little if any damage to the surrounding area. The 'Haringey Air Raid Incident Records', a written record obtained from the Haringey Archive, provides numbered incident reports that correspond with the Haringey Bomb Map and corroborates that the only bombing incident directly bordering the site was on West Road on the site's eastern border.
Damage *If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	The MCC war damage mapping shows no buildings on site, or directly bordering it, to have suffered any significant levels of damage. It should be noted that only severe damage was tracked on this mapping. Both wartime and post-war aerial photography and oblique images also show the site to be in good condition, with no obvious signs of damage, such as ruined buildings, cratering or roof repairs, visible on buildings on site or on buildings directly bordering the site.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	Given that the site was occupied by industrial buildings and their associated grounds, ground cover is likely to have been conducive to UXO detection. Having suffered no obvious signs of damage, ground cover across the site is likely to have been conducive to UXO detection for the duration of the war, with obvious signs of UXO likely to have been easier to identify.
Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post- raid checks for evidence of UXO.*	The site was occupied by industrial buildings and their associated grounds. The site would therefore have likely experienced regular levels of access throughout much of the war. High levels of access increases the likelihood that evidence of UXO would have been identified and reported.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.

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

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12. Introduction to Allied Ordnance

12.1. General

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

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

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

12.2. Defending the UK From Aerial Attack

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

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

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

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12.3. Anti-Aircraft Artillery (AAA)

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

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

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

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

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13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

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

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

13.2. Evaluation of Contamination Risk from Allied UXO

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

Allied UXO Records Summary	
Sources of Allied UXO Contamination	**Conclusion**
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 2.2km to the east of the site, in the vicinity of the Waltham Forest Muslim Cemetery. Despite this distance the maximum effective range of an AA projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are generally analogous to those regarding German air delivered ordnance.
Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	No evidence of training or firing ranges could be found within the site or surrounding area.

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

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14. The Likelihood of UXO Contamination Summary

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

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, official Home Office bombing statistics, London Bomb Census Mapping, Haringey Bomb Mapping, written archival records including air raid incident reports, Middlesex County Council War Damage Mapping and WWII-era aerial photography. The record set is of generally good quality, with a large number of corroborating records to consult, including bomb and damage mapping, written incident records and high resolution photography of the site.
German Air-Delivered Ordnance	• During WWII, the site was situated within the Municipal Borough of Tottenham, which sustained an overall very high density of bombing, with an average of 103.9 bombs recorded per 1,000 acres according to official Home Office bombing statistics. This can be attributed to the presence of key infrastructure targets close to the site such as reservoirs and water treatment works, see **Annex J**, located approximately 1.1km to the east and south east of the site, as well as the districts proximity to the City of London. • During the war the site was occupied by two large industrial buildings in the eastern section of the site, part of a third larger industrial building in the western section of the site, several smaller buildings near the centre of the site, and their associated grounds. • London Bomb Census mapping recorded two bombing incidents bordering the site to the south between 7th October 1940 and 6th June 1941. However, the local Haringey Bomb Map appears to plot these two incidents further to the south of the site. The Haringey Bomb Map also plots a bombing incident bordering the site to the east on West Road on the 25th September 1940. This incident involved an exploded anti-aircraft shell and not a bomb, causing little if any damage to the surrounding area. • Written records including the 'Haringey Air Raid Incident Records' and 'MCC Log Book of Air Raid Incidents' corroborate the Haringey Bomb Map with no bomb strikes recorded on site and only a single incident – the aforementioned anti-aircraft shell - was bordering the site to the east on the 25th September 1940. • No bomb damage is recorded on site, or directly bordering it on Middlesex County Council War Damage mapping. Wartime and post-war aerial photography of the site and its surroundings from 1941 and 1946, and oblique imagery from 1950, corroborates this lack of damage with no obvious signs of damage visible on the site or in its direct surroundings. • Access and ground cover across the site is thought to have been mostly conducive to UXO detection throughout the war, being occupied by large industrial buildings and their associated lands. Higher levels of access would increase the likelihood that evidence of UXO would have been noticed and reported. • In summary, while positive evidence of an incident is recorded on the site's eastern border this involved an anti-aircraft shell rather than a bomb and no damage was recorded to surrounding buildings following the incident. Wartime/post-war aerial imagery and oblique photography shows the site to be in good condition with no obvious signs of damage and the incident is well documented across maps and written records. It is thought likely that the site would have remained occupied and in use throughout the war and that conditions should have been such that evidence of UXO would have been noted and reported. • While it is possible that the undeveloped land to the north of the site resulted in northern section of the site being vulnerable to the 'J-curve effect' (**Annex E**), the likelihood of this occurring is nonetheless, not considered realistic. Taking the above factors into consideration, the site has been assessed as holding an overall **Low Risk** of UXO contamination. Proactive risk mitigation measures are not considered necessary on this occasion but on-site UXO awareness briefings for personnel are still recommended as a sensible minimum precaution.

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Allied Ordnance	• No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. • The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

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15. The Likelihood that UXO Remains

15.1. Introduction

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

15.2. UXO Clearance

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

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

15.3. Post-War Redevelopment

The site appears to have undergone some post-war redevelopment. While the original large industrial buildings are still present on site they have had extensions added that cover much of the open ground near the centre of the site. Much of this redevelopment occurred at some point between 1952 and 1999, with a small extension connecting the two large industrial buildings in the southern section of the site constructed between 2006 and 2009.

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

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16. The Likelihood of UXO Encounter

16.1. Introduction

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

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

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

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

16.2. Encountering Air Delivered Ordnance

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

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17. The Likelihood of UXO Initiation

17.1. Introduction

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

17.2. Initiating Air Delivered Ordnance

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

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

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

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

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18. Consequences of Initiation/Encounter

18.1. Introduction

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

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

18.2. Consequences of Detonation

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

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

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19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

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

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

19.2. Assessed Risk Level

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

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

Please note – although the risk from unexploded ordnance on this site has been assessed as 'Low', this does not mean there is 'no' risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the 'Proposed Works' section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at 37-39 West Road, London:

Recommended Risk Mitigation Measures	
Activity	Recommended Risk Mitigation Measure
All Works	• **UXO Risk Management Plan** It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. • **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

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

1st Line Defence Limited **14/12/2023**

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

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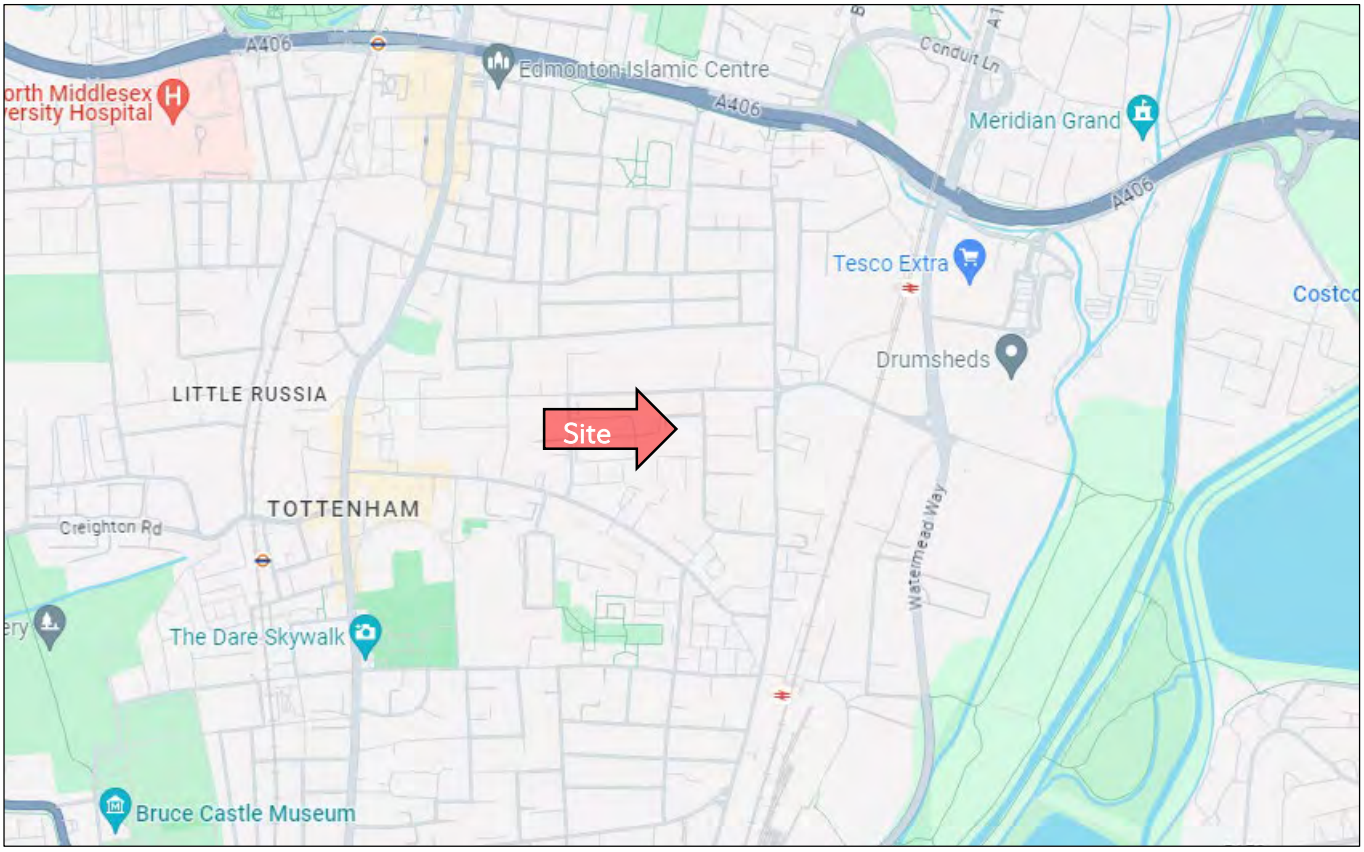
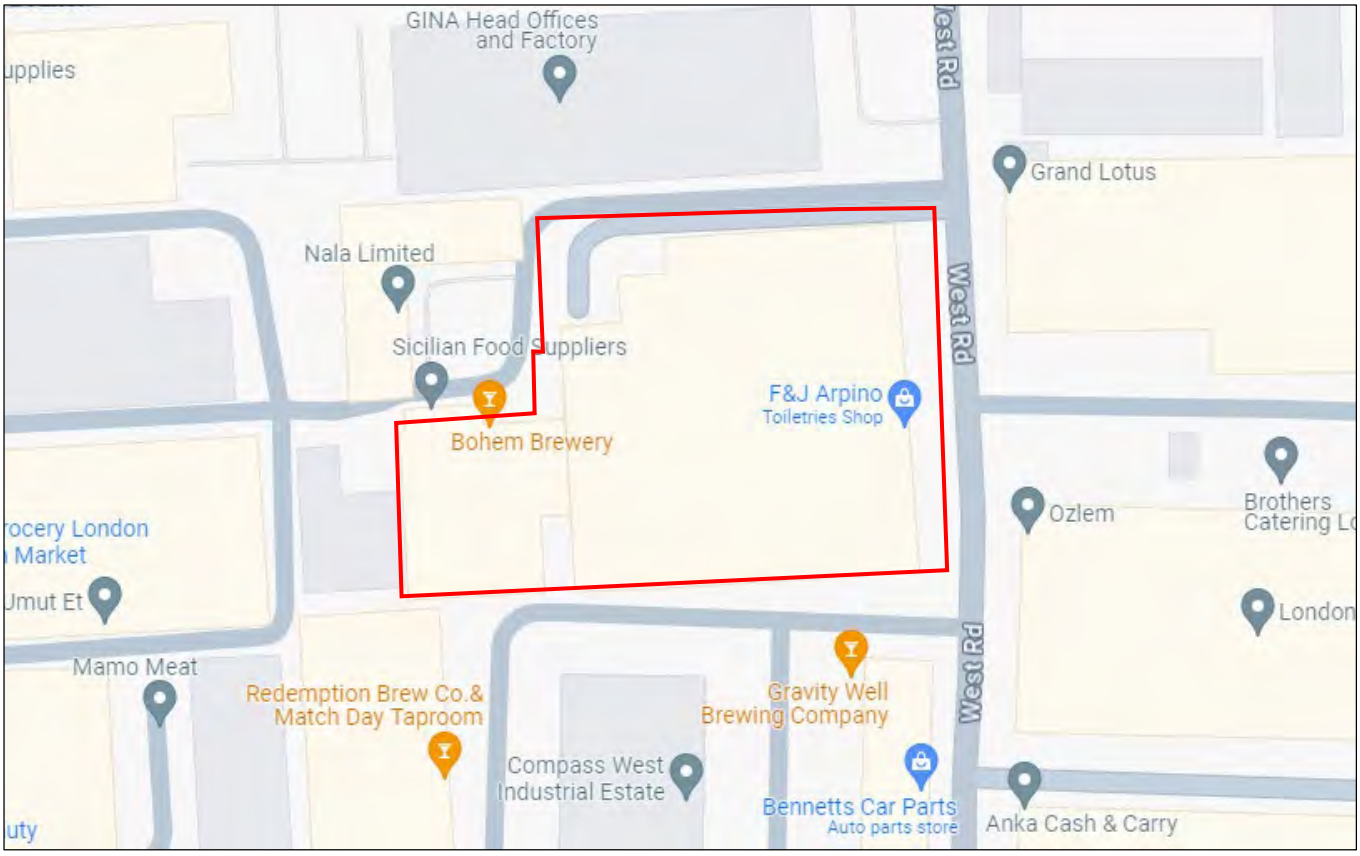
Site Location Maps

Annex: A





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Client: TRC Companies Ltd

Approximate site boundary

Project: 37-39 West Road, London

N

Ref: DA19126-00

Source: Google Maps

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Recent Aerial Photography

Annex: B

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Approximate site boundary

Project: 37-39 West Road, London

N

Ref: DA19126-00

Source: Google Earth

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Client Provided Site Plan

Annex: C

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Client:	TRC Companies Ltd	Approximate site boundary	N
Project:	37-39 West Road, London		
Ref:	DA19126-00	Source: TRC Companies Ltd	

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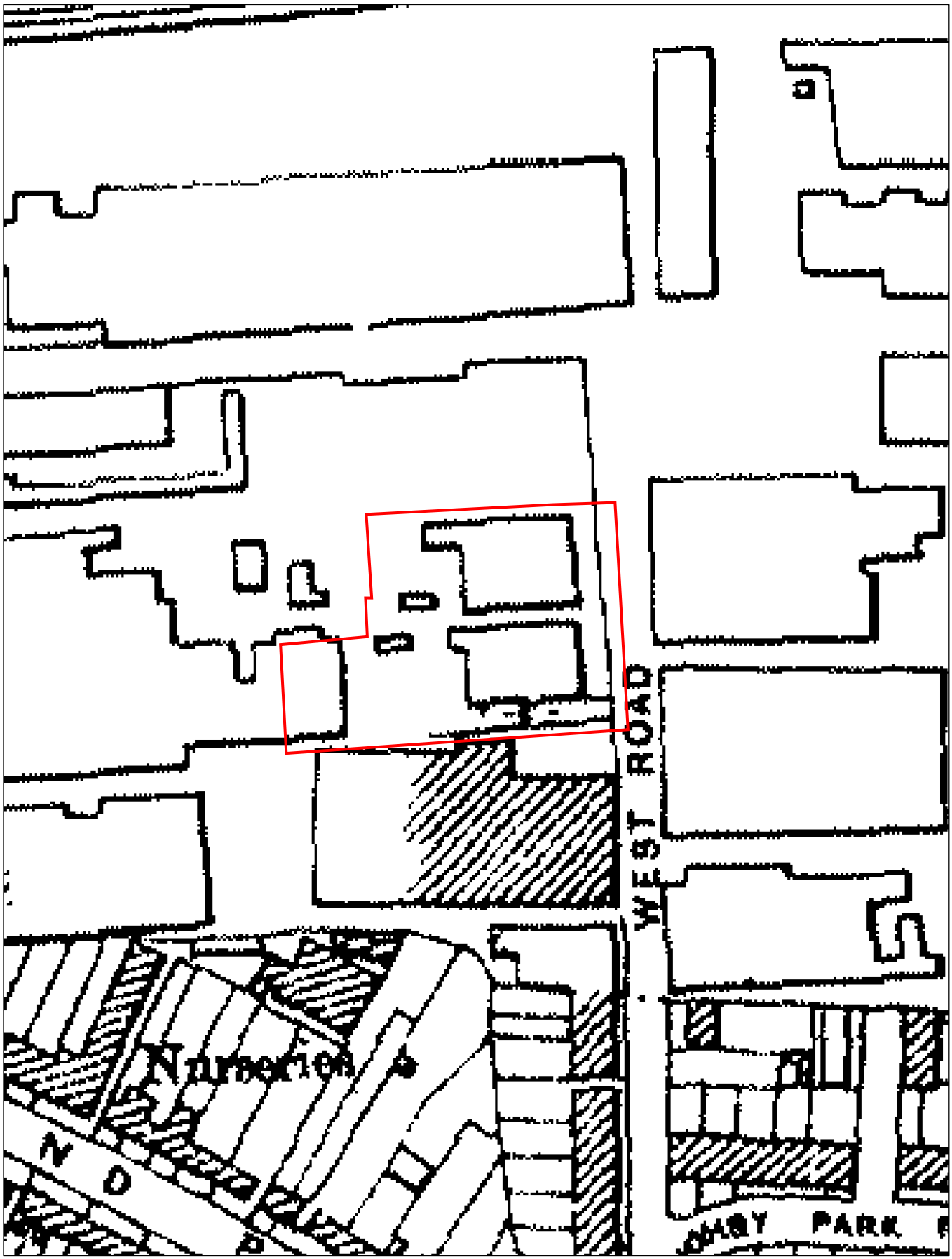
Pre-WWII Historical Map 1938

Annex: D1



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Client:	TRC Companies Ltd	Approximate site boundary	N
Project:	37-39 West Road, London		
Ref:	DA19126-00	Source: Landmark Maps	

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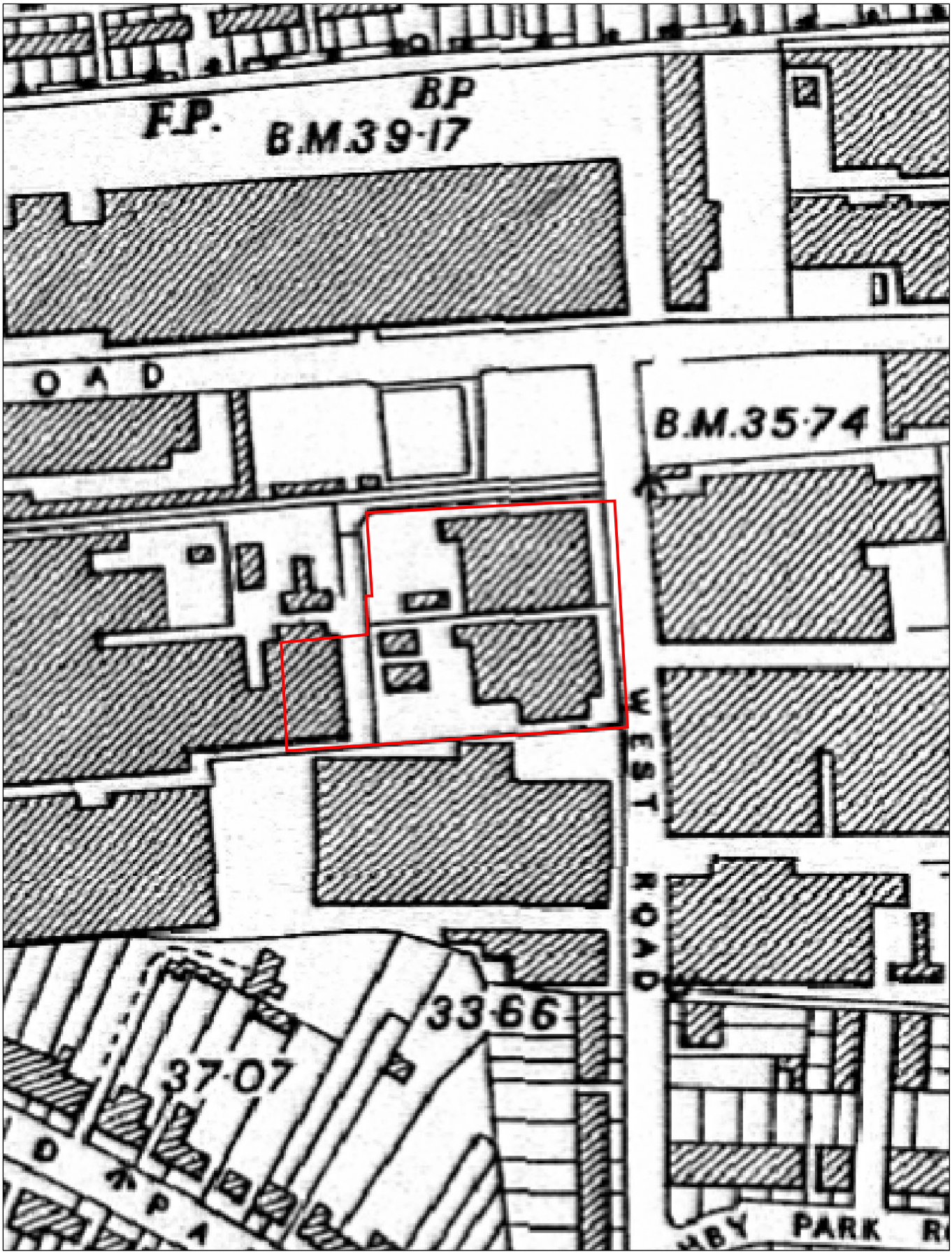
Post-WWII Historical Map 1952

Annex: D2



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Approximate site boundary

Project: 37-39 West Road, London

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Source: Landmark Maps

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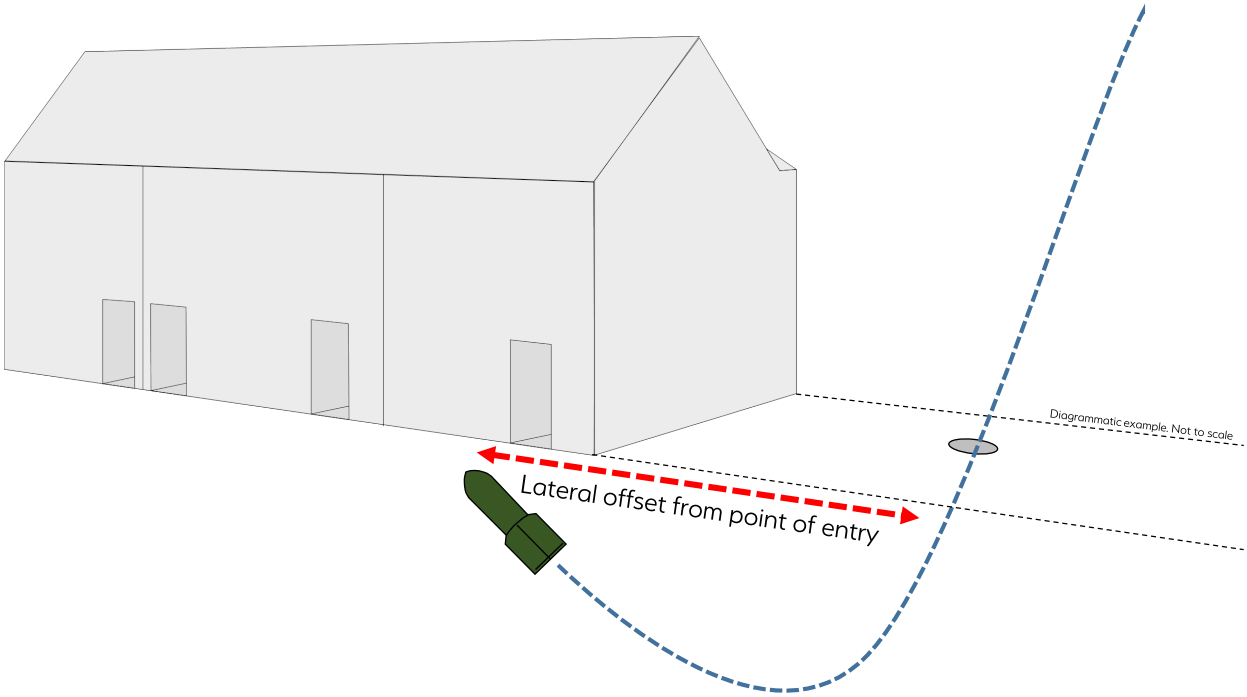
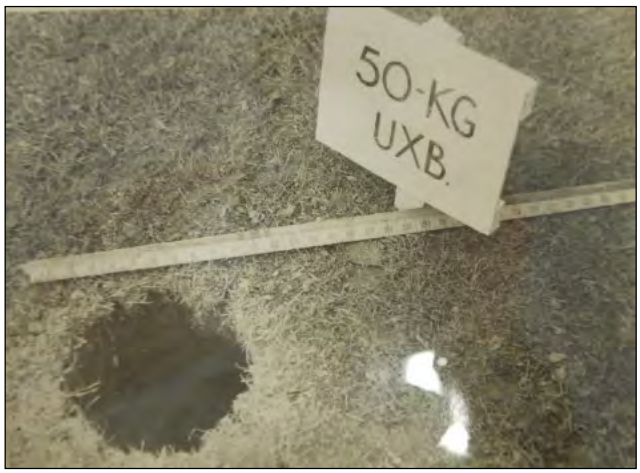
Example of UXO Entry Hole / The 'J-curve' Effect Principle





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

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

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

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BBC NEWS

Bermondsey bomb: World War Two device safely removed

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

Two primary schools were closed and hundreds of homes were evacuated as a precaution.

A cordon and 656ft (200m) exclusion zone was lifted at about 18:15 GMT as the bomb was removed to a quarry in Kent to be detonated, police said.

The Metropolitan Police force said the device was a 'SA' 250kg WWII German air-dropped bomb, known to the Army's Royal Logistic Corps bomb disposal experts.

250kg German HE Bomb, March 2015

BBC NEWS

WW2 bomb found near London City Airport blown up

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

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

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

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

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

500kg German HE Bomb, February 2018

BBC NEWS

Exeter WW2 bomb is detonated after homes evacuated

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

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

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

1000kg German HE bomb, February 2021

BBC NEWS

Great Yarmouth: Huge blast after unplanned WW2 bomb detonation

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

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

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

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

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

250kg German HE Bomb, February 2023

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Source:	BBC News

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

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

BASF Provides Some Details

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

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

1st March 2013

WWII bomb injures 17 at Hattingen construction site

Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

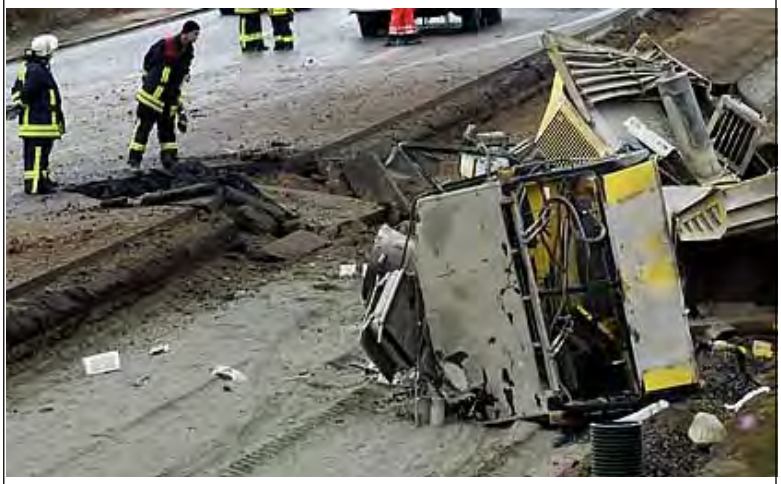
19th September 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struct the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

BBC NEWS

World War II bomb kills three in Germany

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010

June 2006

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Town hall evacuated after suspected WWII bomb found

1 December, 2022 12:00 am 2 Min Read

Forest Road and the town hall have now reopened

By Waltham Forest Echo

A police cordon outside Waltham Forest Town Hall

Waltham Forest Town Hall was evacuated today after the discovery of a suspected unexploded bomb from World War II.

Waltham Forest Council confirmed the closure of the town hall and the neighbouring Assembly Hall at around 1.30pm today – and their reopening at around 4.30pm.

This incident occurred approximately 3.5km to the south-east of the site.

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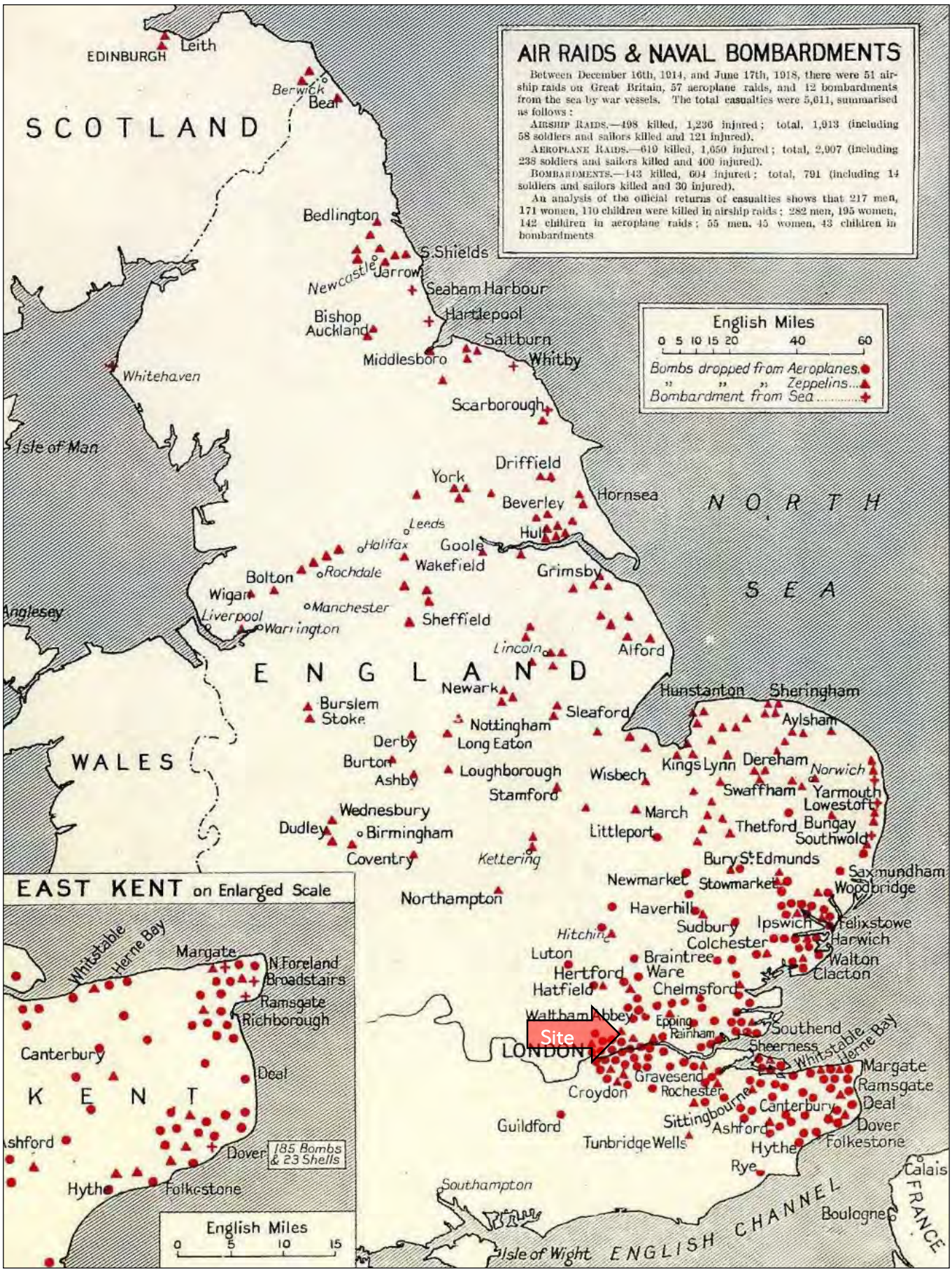
WWI Map of Air Raids and Naval Bombardments



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Project: 37-39 West Road, London

Ref: DA19126-00

Source: J. Morris, German Air Raids on Britain

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The 2/3 September 1916 raid on London: *SL.11* (Hptmn Wilhelm Schramm)

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Source: Castle, I., London 1914-17: The Zeppelin Menace, Osprey Publications Ltd., 2008

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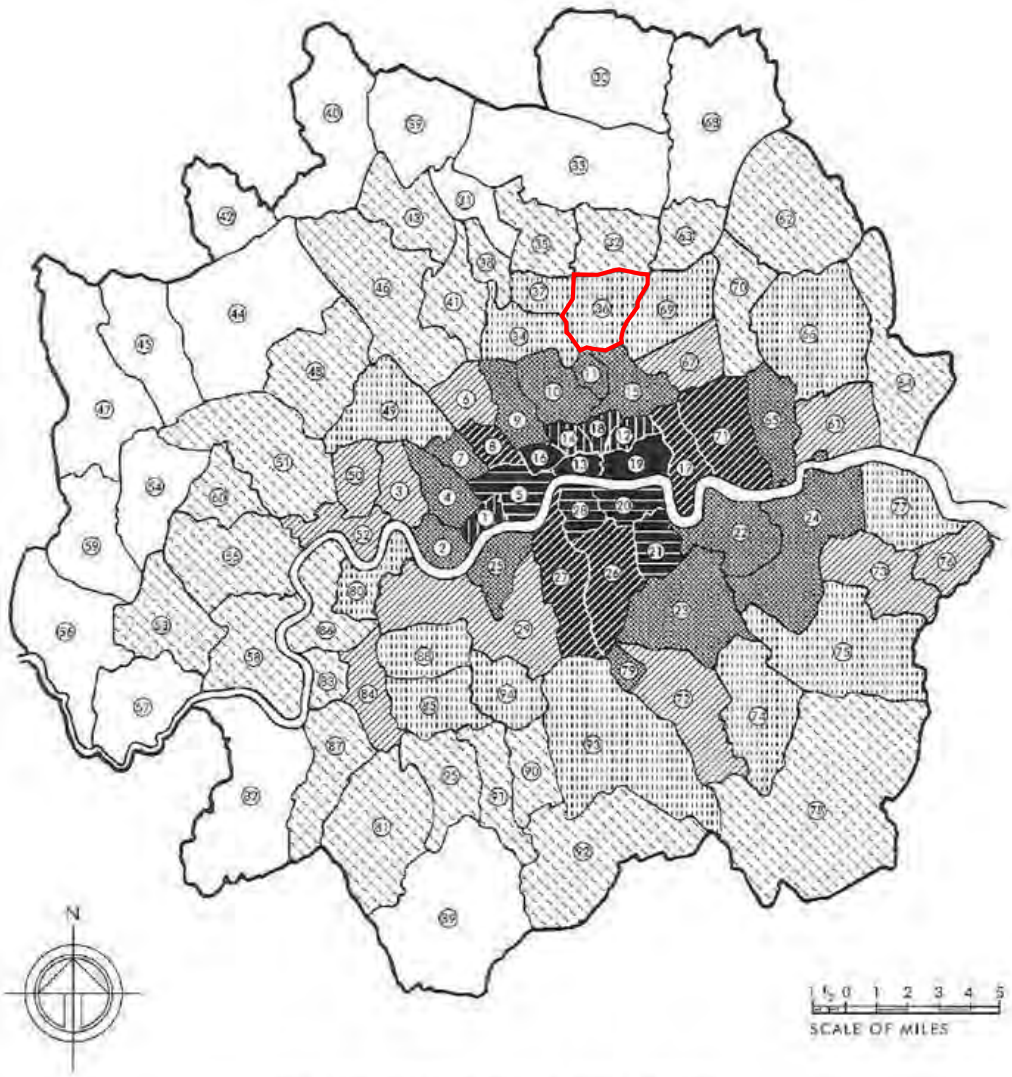
London WWII Bomb Density Map

Annex: I



No. OF BOMBS PER 1,000 ACRES

	OVER 600		300 - 299		100 - 149
	500 - 599		200 - 299		50 - 99
	400 - 499		150 - 199		UNDER 50

1	Chelsea	25	Battersea	49	Willesden	72	Beckenham
2	Fulham	26	Camberwell	50	Acton	73	Bexley
3	Hammersmith	27	Lambeth	51	Ealing	74	Bromley
4	Kensington	28	Southwark	52	Brentford and Chiswick	75	Chislehurst and Sidcup
5	Westminster	29	Wandsworth	53	Feltham	76	Crayford
6	Hampstead	30	Cheshunt	54	Hayes and Harlington	77	Erith
7	Paddington	31	East Barnet	55	Heston and Isleworth	78	Orpington
8	St. Marylebone	32	Edmonton	56	Staines	79	Penge
9	St. Pancras	33	Enfield	57	Sunbury	80	Barnes
10	Islington	34	Hornsey	58	Twickenham	81	Epsom and Ewell
11	Stoke Newington	35	Southgate	59	Yiewsley and West Drayton	82	Esher
12	Bethnal Green	36	Tottenham	60	Southall and Norwood	83	Kingston on Thames
13	City of London	37	Wood Green	61	Barking	84	Malden and Coombe
14	Finsbury	38	Friern Barnet	62	Chigwell	85	Merton and Morden
15	Hackney	39	Potters Bar	63	Chingford	86	Richmond
16	Holborn	40	Elstree	64	Dagenham	87	Surbiton
17	Poplar	41	Finchley	65	East Ham	88	Wimbledon
18	Shoreditch	42	Bushey	66	Ilford	89	Banstead
19	Stepney	43	Barnet U.D.	67	Leyton	90	Beddington and Wallington
20	Bermondsey	44	Harrow	68	Waltham Holy Cross	91	Carshalton
21	Deptford	45	Ruislip and Northwood	69	Walthamstow	92	Coulsdon and Purley
22	Greenwich	46	Hendon	70	Wanstead and Woodford	93	Croydon
23	Lewisham	47	Uxbridge	71	West Ham	94	Mitcham
24	Woolwich	48	Wembley			95	Sutton and Cheam

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Source: The London Metropolitan Archives

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London – Tottenham

Water treatment works and reservoir

TN 81

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Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

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Night Bombing up to 7th October 1940

Night Bombing - 7th October 1940 to 6th June 1941

Recorded bomb strike

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Ref: DA19126-00

Source: The National Archives, Kew

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7th -14th October 1940

4th – 11th November 1940

Recorded HE bomb strike

Recorded UXB strike

Recorded incendiary bomb shower

Recorded oil bomb strike

Key to weekly map symbol colours

Monday - Brown
Tuesday - Vermilion
Wednesday - Blue
Thursday - Black
Friday - Green
Saturday - Violet
Sunday - Yellow

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Ref: DA19126-00

Source: The National Archives, Kew

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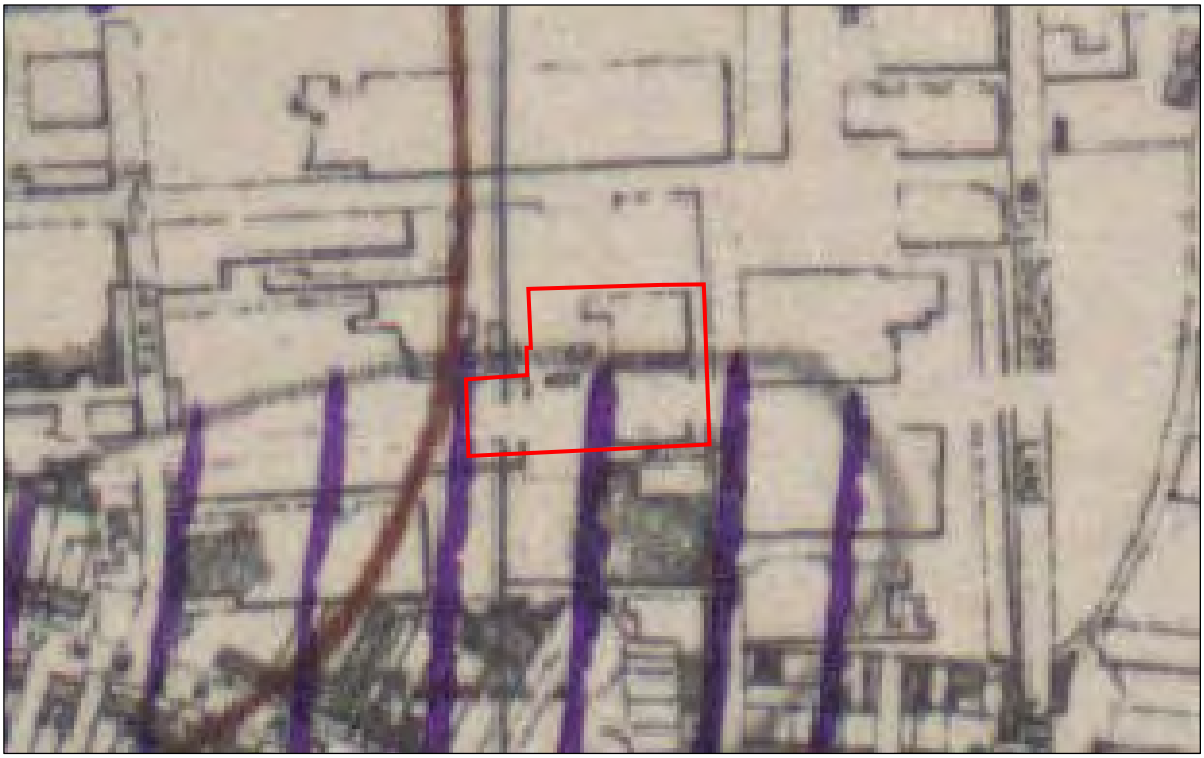
5th -12th May 1941



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Source: The National Archives, Kew

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London V-1 'Flying Bomb' Map

Annex: L

V-1 Flying Bomb

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Haringey Bomb Map

Annex: M

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Project:	37-39 West Road, London		
Ref:	DA19126-00	Source: Haringey Archives	

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Date	Occ.No.	Time	Type of Bomb	Location	Casualties	Damage.
Thursday 12.9.40.	47	[illegible]	[illegible]	31, Malvern Road.	NIL	NIL
	48	1415	AA shell Unexploded AA shell	Koref Factory, West Road.	NIL ?	NIL ?
						Unconfirmed 23.9.40.
Saturday 14.9.40.	59	0330 Reported 1210	I.B.	14, Willoughby Park Road.	NIL	House rendered uninhabitable.
18.9.40	140	2130	H.E.	142-146, Northumberland Park	Included in above	Two dwelling houses severely damaged. Others slightly Remarks. Northumberland Park blocked from Northumberland Grove to Tarrif Road.
Wednesday 25.9.40	217	0455	I.B. Exploded AA shell	Rubber Factory, Portland Road.	Nil	Nil
				Roadway, outside Brown's Factory, West Road.	Nil	Small crater in roadway.
9.10.40 Weds.	275	2045	H.E.	Lane. Lazarus' Factory, Brantwood Road	NIL	NIL (8th
	276	2123	H.E.	1-3, Greenfield Road	NIL 1	Severe damage to factory
20.10.40 Sunday	360	2327	H.E.	West Road, Northumberland Park.	NIL	2 large craters in Roadway. Gas and water mains damaged. Telephone wires down.
20.10.40 Sunday	362	2327	H.E.	Lazarus'~~s~~ Furniture Factory, Brantwood Road.	1	To factory and inside water main.
		2327	~~Motric Engineering~~ H.E.	Motric Engineering works, Brantwood Road.	NIL	To factory. Large crater in rear.
11.11.40	442	2100	I.B.	Northumberland Park Station	NIL	NIL
	443	Reported 0830. Fell 2400. 10.11.40.	Unexploded H.E.	High Road junction Colsterworth Rd. Messrs. Lazarus', Brantwood Road	NIL NIL	NIL NIL
	444	Reported 0847	Unexploded H.E.	Waste ground rear Messrs Whites, Brantwood Road.	NIL	NIL
	445	[illegible]	[illegible]	[illegible]		

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DATE	MESSAGE TIME	INCIDENT TIME	PARTICULARS	REMARKS
21/10/40.	00·19	23·27.	MINOR BOMBING H.E. WEST RD. NORTHUMBERLAND PARK. BRANTWOOD RD. WILLOUGHBY LANE.	
	00·39.	SEE 00·19.	H.E. BRANTWOOD RD. H. LAZARUS FACTORY. WILLOUGHBY LANE OPPOS. WILLOUGHBY PARK RD. WEST RD. BLOCKED.	1. WOUNDED.

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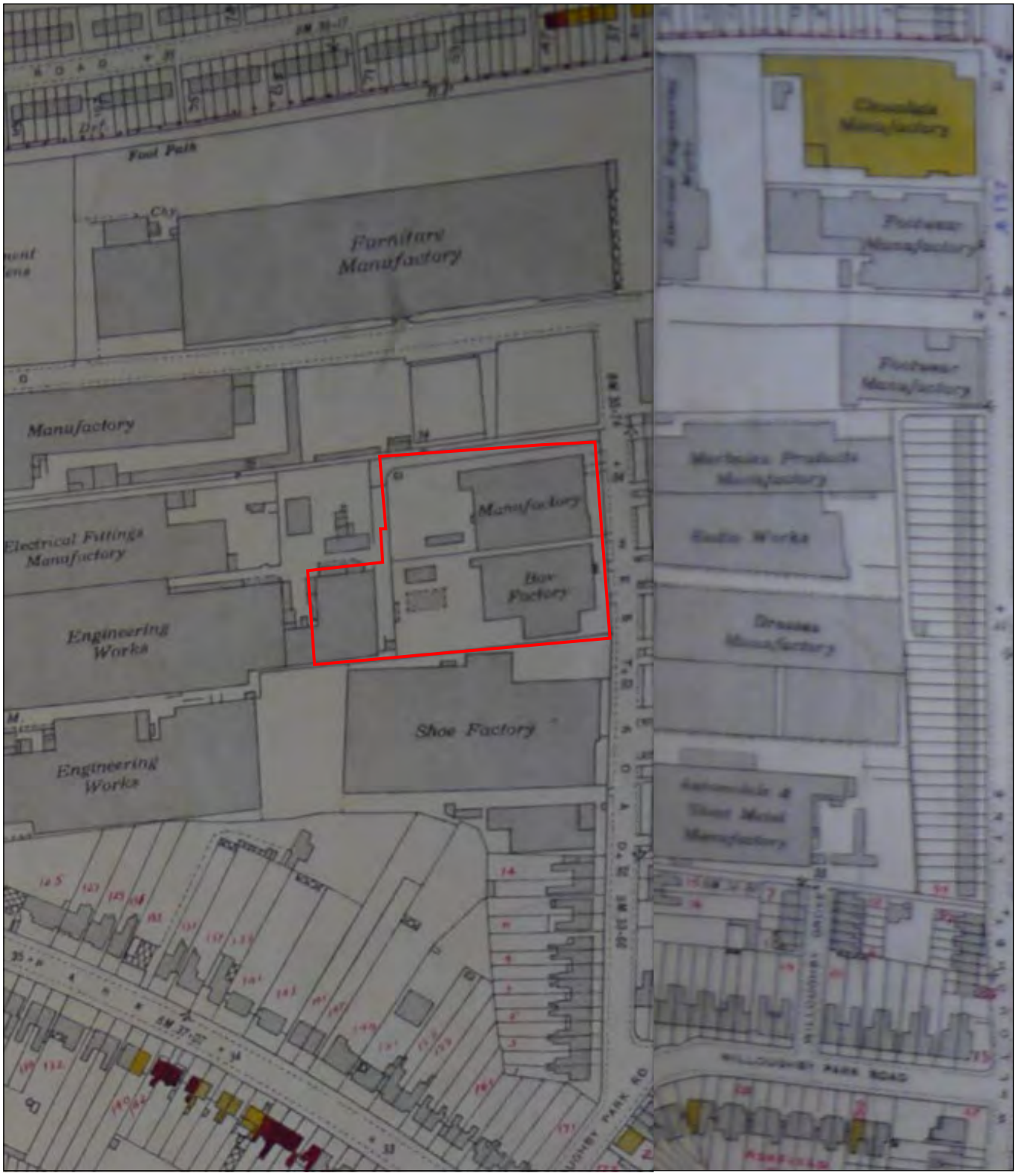
Middlesex County Council War Damage Map

Annex: P



	Category 1 - "Total damage, building to be demolished."
	Category 2 - "Some repairs possible, but could become Cat 1."
	Category 3 - "Border line areas, uncertain whether repairs possible, might have to be demolished."

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RAF Aerial Photography 17th June 1941

Annex: Q1

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Ref: DA19126-00

Source: National Monuments Record Office (Historic England)

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