

# EXPLOSIVE ORDNANCE (EO) THREAT ASSESSMENT (EOTA)

Garages Adjacent Bluebell Close, Upper Sydenham, SE26 6SN

This assessment draws together all the available information with regards to the site of concern regarding potential Explosive Ordnance (EO) Contamination. It assigns an Explosive Ordnance Threat Level and proposes an appropriate Risk Management Strategy to reduce any associated risks.

*This assessment has been produced in compliance with the Construction Industry Research and Information Association guidelines (Report CIRIA 681, dated Dec 08) for the preparation of detailed Risk Assessments in the management of UXO risks in the construction industry, for which PLANIT was an instrumental driver for improved UXO risk management and transparency.*

HIGHEST EXPLOSIVE ORDNANCE THREAT LEVEL: MEDIUM



## CLIENT CONTACT DETAILS

Client:	<b>Renkap Limited</b> Sutton Yard 65 Goswell Road London EC1V 7EN
Tel:	07988 719 155
POC:	Gonzalo Marquesini FRICS
Email:	<a href="mailto:gonzalo.m@renkap.com">gonzalo.m@renkap.com</a>

## OUR CONTACT DETAILS

Company:	<b>PLANIT UXB Limited</b> PO BOX 285 Nunburnholme York YO42 9AU
Tel:	08000 588 747
Email:	<a href="mailto:help@planit-international.com">help@planit-international.com</a>

---

### **LEGAL NOTICE**

*This document is of UK origin and is © PLANIT UXB Limited. It contains proprietary information which is disclosed for the purposes of assessment and evaluation only. The contents of this document shall not in whole or in part, (i) be used for any other purpose, (ii) be disclosed to any member of the recipient's organization not having a need to know such information nor to any third party individual, organisation or government, (iii) be stored in any retrieval system nor be reproduced or transmitted in any form by photocopying or any optical, electronic, mechanical or other means, without the prior written permission of PLANIT UXB Limited, PO BOX 285, Nunburnholme, York, YO42 9AU.*



*Notwithstanding the above, permission is granted for the Client as defined above to issue this report to contractors and other parties engaged in construction work on the work site to which this report refers, but not to other entities for any reason whatsoever.*

---

## DOCUMENT CONTROL

Copy No.	Recipient
1	PLANIT FILE
2	CLIENT E-COPY
3	CLIENT HARDCOPY (NOT ISSUED)

Document Reference:	
Date of Issue:	<b>18 March 2025</b>
Copy No:	<b>2 of 2</b>

Document Review	Name	Signature
Author Review:	Daniel WHELAN	
Peer Review:	Andrew HAMILTON	

## GLOSSARY OF TERMS

AAA	Anti-Aircraft Ammunition
AP	Anti-Personnel/Armour Piercing (weapon)
ARP	Air-Raid Precautions
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BD Section	Bomb Disposal Section
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
EOTA	Explosive Ordnance Threat Assessment
HE	High Explosive
IB	Incendiary Bomb
LSA	Land Service Ammunition
Luftwaffe	German Air Force
MoD	Ministry of Defence
RA	Royal Arsenal
SAA	Small Arms Ammunition
SI	Site Investigation
UXAAA	Unexploded Anti-Aircraft Artillery [projectile]
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	'Doodlebug' – self-propelled, ground to ground missile deployed against Britain from July 1944. V – "Vergeltungswaffe" (Vengeance)
V-2	Long Range Rocket (first ballistic missile used against London from Sep 1944)
WWI	First World War 1914 – 1918 (The Great War)
WWII	Second World War 1939 - 1945

## EXECUTIVE SUMMARY

SITE	The Site address is given as ‘Garages Adjacent to Bluebell Close, Upper Sydenham, SE26 6SN at National Grid Reference TQ339716.																																									
POTENTIAL THREAT SOURCE	If a UXO-related threat exists, the following items of EO may be anticipated to be potentially present on the site of concern together with the estimated bomb penetration depth (BPD) and potential offset (i.e., lateral movement underground post-impact):																																									
<table><tr><th>Type of Ordnance</th><th>Av. Penetration Depth (m bgl)</th><th>Geology Multiplication Factor</th><th>Barrier Geology (m bgl)</th><th>Adjusted Av. Penetration Depth (m bgl) to 1sf</th><th>Offset (m)</th></tr><tr><td>British AAA projectiles</td><td>2.0</td><td>1</td><td>na</td><td>2.0</td><td>0.7</td></tr><tr><td>Air-dropped Bombs: 50kg</td><td>4.0</td><td>1</td><td>na</td><td>4.0</td><td>1.3</td></tr><tr><td>Air-dropped Bombs: 250kg</td><td>6.0</td><td>1</td><td>na</td><td>6.0</td><td>2.0</td></tr><tr><td>Air-dropped Bombs: 500kg</td><td>9.0</td><td>1</td><td>na</td><td>9.0</td><td>3.0</td></tr><tr><td>Air-dropped Bombs: 1000kg</td><td>11.0</td><td>1</td><td>na</td><td>11.0</td><td>3.7</td></tr></table>							Type of Ordnance	Av. Penetration Depth (m bgl)	Geology Multiplication Factor	Barrier Geology (m bgl)	Adjusted Av. Penetration Depth (m bgl) to 1sf	Offset (m)	British AAA projectiles	2.0	1	na	2.0	0.7	Air-dropped Bombs: 50kg	4.0	1	na	4.0	1.3	Air-dropped Bombs: 250kg	6.0	1	na	6.0	2.0	Air-dropped Bombs: 500kg	9.0	1	na	9.0	3.0	Air-dropped Bombs: 1000kg	11.0	1	na	11.0	3.7
Type of Ordnance	Av. Penetration Depth (m bgl)	Geology Multiplication Factor	Barrier Geology (m bgl)	Adjusted Av. Penetration Depth (m bgl) to 1sf	Offset (m)																																					
British AAA projectiles	2.0	1	na	2.0	0.7																																					
Air-dropped Bombs: 50kg	4.0	1	na	4.0	1.3																																					
Air-dropped Bombs: 250kg	6.0	1	na	6.0	2.0																																					
Air-dropped Bombs: 500kg	9.0	1	na	9.0	3.0																																					
Air-dropped Bombs: 1000kg	11.0	1	na	11.0	3.7																																					
The average bomb penetration depth (BPD) of a 500kg UXB is estimated at 9.0m bgl with a maximum offset of 3.0m.																																										
THREAT PATHWAY	For the purposes of this assessment, it has been assumed that site investigation and development works would include energetic intrusive engineering into WW2 ground volumes. It is anticipated that personnel or key equipment may complete the risk pathway during excavation and/or piling operations that may bring them into physical contact with potential threat items.																																									
KEY FINDINGS	<ul style="list-style-type: none"><li>Given the evidence the potential for contamination from large air-dropped bombs cannot be reasonably ignored given the potential consequences of an unplanned encounter..</li><li>The possibility for British AAA to have returned to earth unexploded and remain under the Site today is extremely unlikely but cannot be reasonably ignored.</li><li>The possibility of the Site being potentially affected by <i>Ad Hoc</i> EO because of military activity may be reasonably discounted.</li><li>There are no other identifiable potential sources of EO-related contamination.</li></ul>																																									

THREAT LEVEL	The Ordnance Threat Levels for the Site from the Threat Assessment Matrices as they apply to various energetic activities are assessed as:																											
<table><tr><th rowspan="2">Ordnance Type</th><th colspan="5">Engineering Activity</th></tr><tr><th>No Excavations, no energetic engineering, Controlled Public Access</th><th>Shallow Excavations by hand/ Uncontrolled Public Access</th><th>Shallow Excavations by machine/ Controlled Public Access</th><th>Deep Excavations &gt; 1mbgl, Energetic compaction/ rolling</th><th>Boreholes/ Piling</th></tr><tr><td>British AAA</td><td colspan="2">NEGLECTIBLE</td><td colspan="3">LOW</td></tr><tr><td>German HE bomb 50-500kg</td><td>NEGLECTIBLE</td><td>LOW</td><td colspan="3">MEDIUM</td></tr></table>						Ordnance Type	Engineering Activity					No Excavations, no energetic engineering, Controlled Public Access	Shallow Excavations by hand/ Uncontrolled Public Access	Shallow Excavations by machine/ Controlled Public Access	Deep Excavations > 1mbgl, Energetic compaction/ rolling	Boreholes/ Piling	British AAA	NEGLECTIBLE		LOW			German HE bomb 50-500kg	NEGLECTIBLE	LOW	MEDIUM		
Ordnance Type	Engineering Activity																											
	No Excavations, no energetic engineering, Controlled Public Access	Shallow Excavations by hand/ Uncontrolled Public Access	Shallow Excavations by machine/ Controlled Public Access	Deep Excavations > 1mbgl, Energetic compaction/ rolling	Boreholes/ Piling																							
British AAA	NEGLECTIBLE		LOW																									
German HE bomb 50-500kg	NEGLECTIBLE	LOW	MEDIUM																									
THREAT MITIGATION	An Explosive Ordnance Threat Management Strategy <b>IS REQUIRED</b> prior to intrusive engineering works at the Site. The Threat Mitigation Strategy should be developed by a specialist considering the specific planned intrusive works.																											
THREAT REVIEW	A review of these recommendations must be undertaken considering any additional, relevant information being provided. Such a review may, if the EO Threat Level is deemed to have altered, make alternative recommendations from those made above to implement work safely.																											
AIM & METHODOLOGY	<p>The aim of this assessment is to identify any threats that may be posed by EO during the proposed engineering works at the site of concern and, where a threat is identified, to recommend a threat mitigation strategy that will reduce this threat to acceptable levels i.e., ALARP.</p> <p>The following key considerations are assessed when evaluating EO Threat levels:</p> <ul style="list-style-type: none"><li>The likelihood that the site of concern was contaminated by EO, considering:<ul style="list-style-type: none"><li>Historical use of the site in relation to ordnance manufacturing, storage, and disposal.</li><li>Historical use of the site in relation to Military training and related activities.</li><li>Evidence of offensive aerial and/ or naval bombardment during armed conflict.</li></ul></li><li>The likelihood that EO may be encountered during proposed engineering works.<ul style="list-style-type: none"><li>Evidence of Unexploded Bombs (UXBs).</li><li>Previous EO incidents and/or EO survey/clearance activities.</li><li>Extent of post-war redevelopment.</li><li>Extent and effectiveness of post-War UXO Survey/ Clearance operations.</li></ul></li><li>The likelihood and consequences of encountering and/or initiating EO during the proposed engineering works.</li></ul> <p>PLANIT UXB Limited’s approach to EO threat assessment has been fundamental in driving change throughout the UK Commercial Explosive Ordnance Disposal (EOD) Industry and was instrumental in the drafting of CIRIA</p>																											

	<p>681. If the likelihood of encountering EO is significant, information about the nature of that EO and the expected level of contamination is considered within the source-pathway-receptor context of contamination. Our approach provides transparency to our EO threat assessment process allowing the Client to make valid decisions on what is a specialist activity, empowering them to maintain control over this vital aspect of their project.</p> <p>Should a confirmed pathway exist, the information is processed through our proprietary Threat Assessment Model to arrive at a valid and transparent Threat Level, which allows relevant conclusions to be made about the EO Threat at the site of concern and aid the development of an appropriate Threat Mitigation Strategy if required.</p>
<b>RELIABILITY OF HISTORICAL RECORDS</b>	<p>This assessment is drawn from detailed research into the available historical evidence. Every effort is made to gather all the relevant material; however, PLANIT cannot be held responsible for any changes to the assessed level of risk or proposed risk mitigation strategies due to subsequent information that may come to light later.</p> <p>The accuracy and detail of wartime historical records is difficult to verify, not least of which is due to the conditions under which much of this information was gathered and recorded. Additionally, recording of information was less formalised in the early days of the German air campaign against the UK mainland (Pre-Bomb Census Record) and much information recorded early on was lost during subsequent air raids. Records for rural, sparsely populated areas are not always reliable, being based on second-hand information in many cases; records of attacks on military installations were often recorded independently from general records and many such archives have been lost or remain undisclosed to the public.</p> <p>Consequently, the exact location, quantity, and nature of the EO threat cannot be definitive but rather remains subjective and is based on the careful analysis by experts of the available information. PLANIT cannot accept liability for any gaps in the historical record.</p>

## CONTENTS

	Page Number
CONTACT DETAILS .....	1
DOCUMENT CONTROL .....	2
EXECUTIVE SUMMARY .....	5
CONTENTS .....	8
SITE LOCATION & DESCRIPTION .....	9
REVIEW OF DATASETS .....	12
THREAT ANALYSIS .....	22
THREAT ASSESSMENT .....	27
THREAT MATRICES .....	29
THREAT MITIGATION OPTIONS .....	32

## REFERENCES:

1. blob-WxR6ad-2024-12-10140719UTC0000 [Site Layout].



## SITE LOCATION & DESCRIPTION

### SITE OF CONCERN

The Site address is given as 'Garages Adjacent to Bluebell Close, Sydenham, SE26 6SN at National Grid Reference TQ339716

The Site is in Upper Sydenham, just north of the National Sports Centre at Crystal Palace. Bluebell Close leads east opposite No 15 Sydenham Hill, leading into an area of garaging. Two rows of garages attend an area of hardstanding of concrete slab construction which dominates the site. A tarmac footpath runs along the northwest boundary enclosing a triangular grassed area containing shrubs and a couple of mature trees. The southwestern corner of the site leads into Bluebell Close.

Figure 1: Site Location

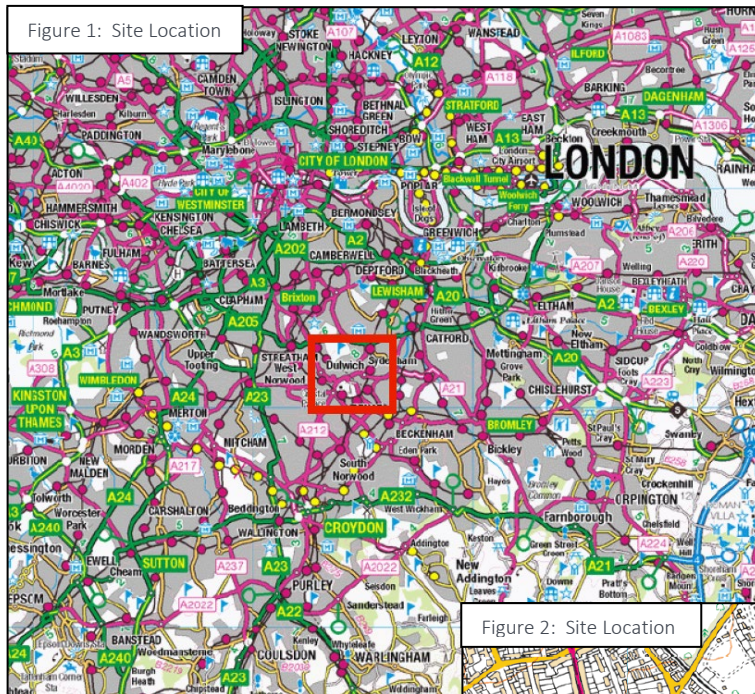


Figure 2: Site Location

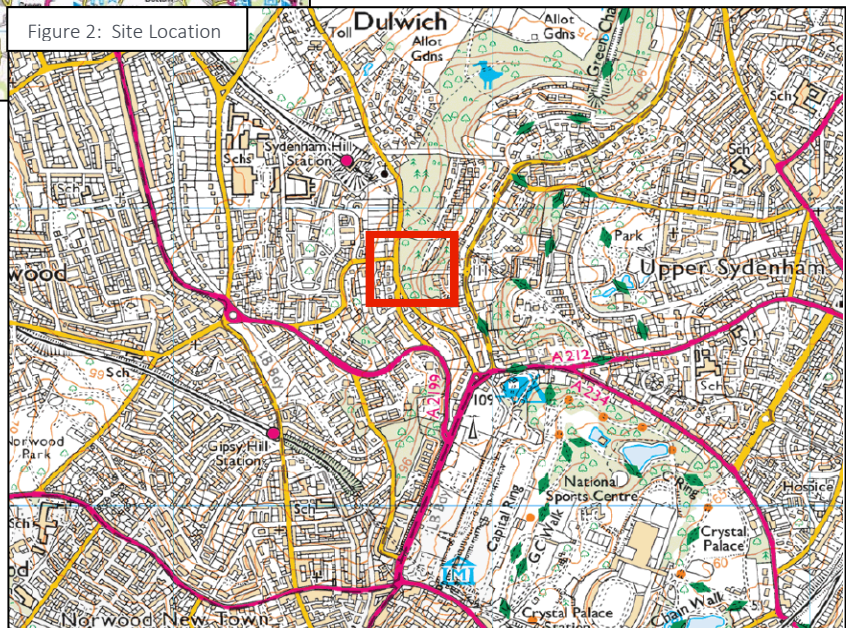


Figure 3: Site Location

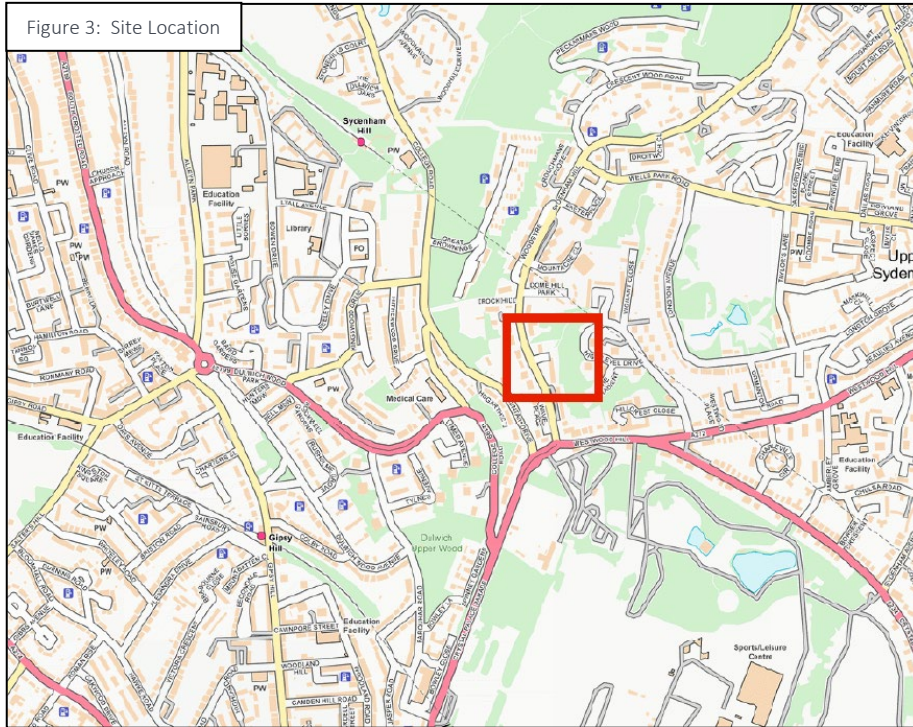


Figure 4: Site Layout

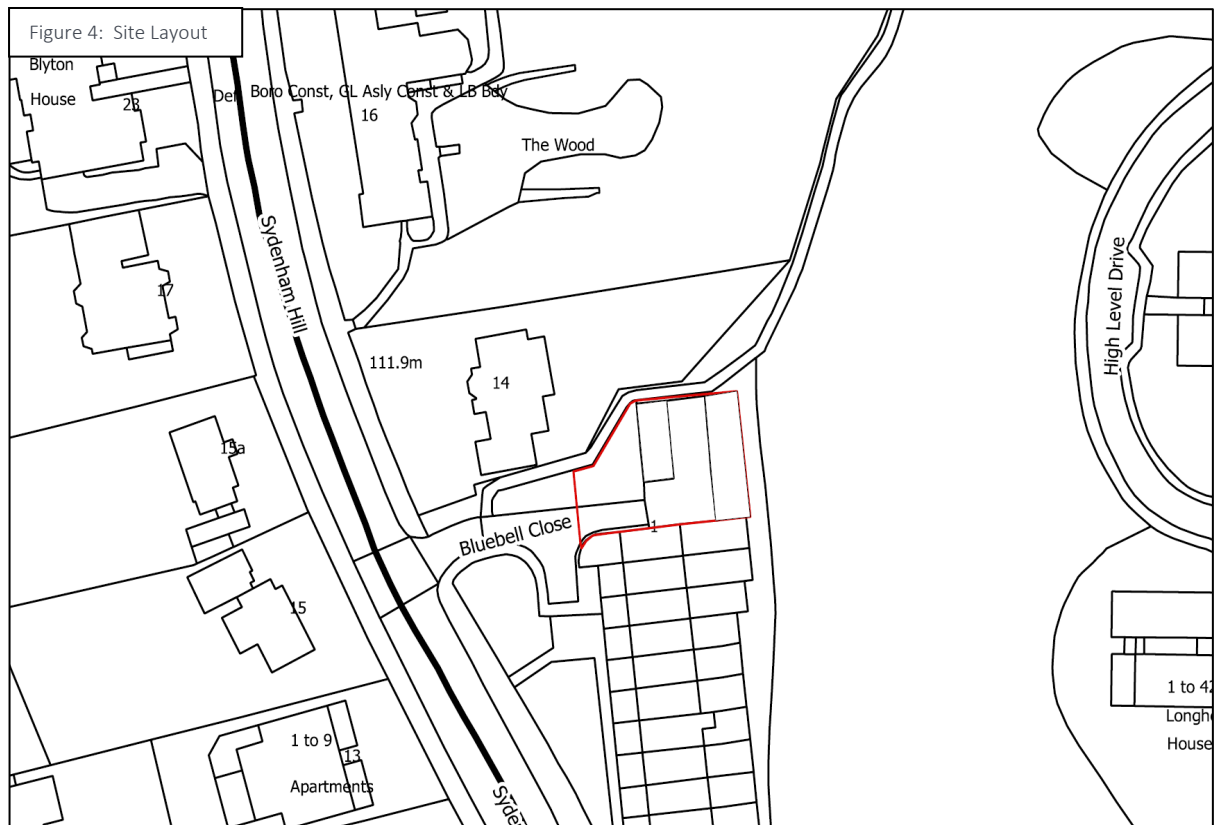




Figure 5: Aerial Image - 2003



<b>SCOPE OF PROPOSED WORKS</b>	<p>The proposed works are unspecified, but it is supposed that both site investigation and development works will involve energetic intrusion into WW2 ground volumes.</p>
<b>GEOLOGICAL ENVIRONMENT</b>	<p>Specific information pertaining to the underlying ground conditions at the Site is not provided at the time of writing. A historic borehole at BNG Ref: 533870, 171710 is north of the site and provides the following insight:</p> <ul style="list-style-type: none"> <li>• Made Ground: 0.0 to 2.2m bgl over,</li> <li>• (London Clay) orange coloured sandy CLAY: 2.2 to 10.0m bgl over,</li> <li>• Brown/ Grey CLAY: 10.0 to 34.0m</li> </ul>

## REVIEW OF RELEVANT DATASETS

### SOURCES OF INFORMATION

PLANIT ensures that Explosive Ordnance Threat Assessments (EOTAs) are as comprehensive as possible and detailed research is undertaken to collate all the available EO-related information that relates to the site of concern. Information sources may include, but are not restricted to:

- National Historic Archives.
- Local Authority & Council Archives.
- English Heritage National Monuments Record.
- Ministry of Defence Archives
- PLANITs extensive archives drawn from many years of detailed research and operational experience of UXO Risk Management activities in the UK and abroad.
- Joint Service EOD Centre (JSEOD).
- Historic Mapping and Aerial Photography.
- Specific UXO-related documents such as military bombing and casualty records.
- Local libraries and history groups.
- Open sources such as published books and internet searches.
- Anecdotal evidence from eyewitnesses.

*NB: The MoD information office that deals with requests for information relevant to EO clearance operations completed by the MoD is currently facing significant delays. Although a request has been submitted, any information that may be relevant has not yet been forwarded for timely inclusion in this assessment. However, if any relevant information comes to light from this source that affects the threat assessment, this will be notified to the client as a matter of urgency.*

### SITE HISTORY

Immediately pre-War, the Site was mostly undeveloped with its southwestern-most corner crossing a large residential property and the map record us unchanged post-War. By no later than 1969, the properties to the south of the site have been cleared away to make room for the garages which appear no later than 1971 from which time the site has remained essentially unchanged.

Figure 6: Site 1938

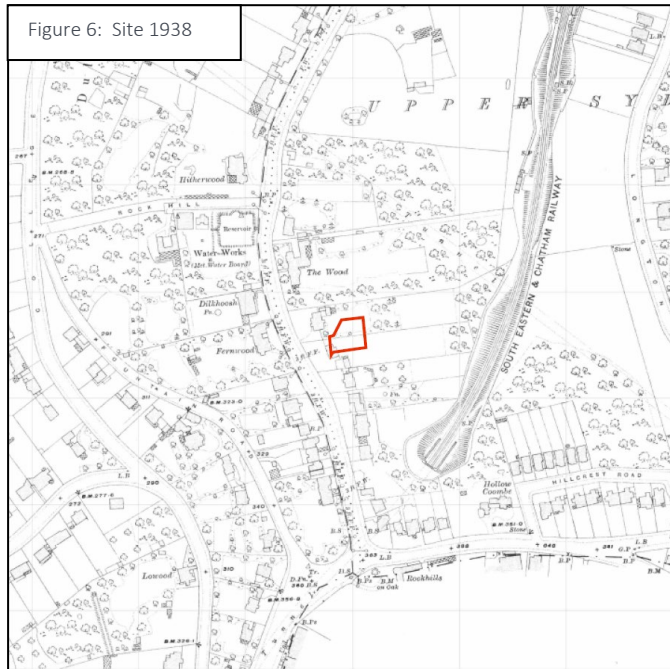


Figure 7: Site 1951

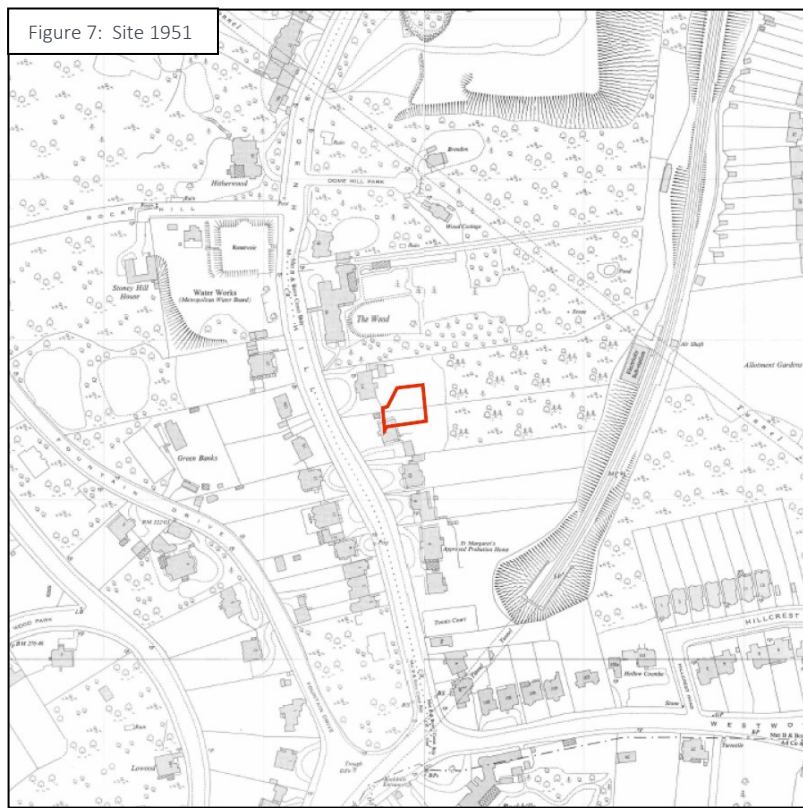


Figure 8: Site 1960

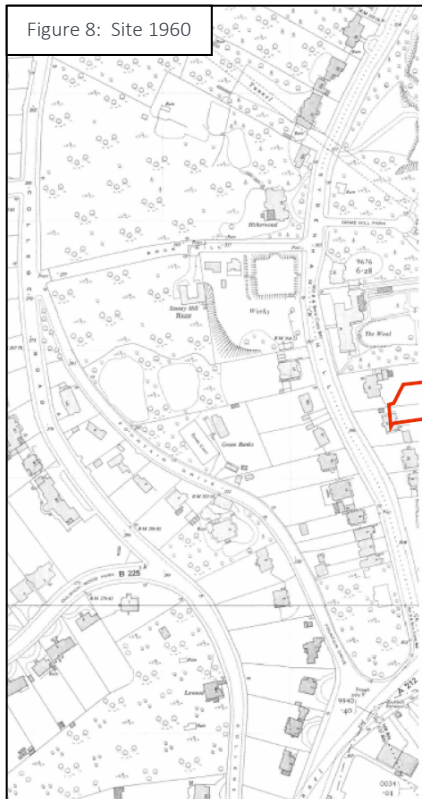




Figure 9: Site 1969

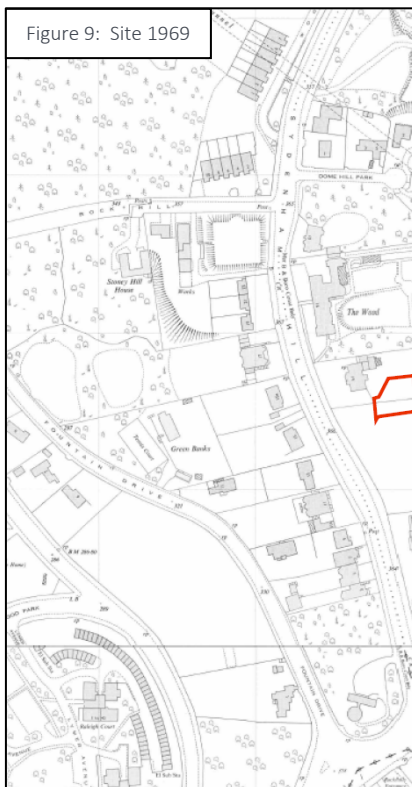
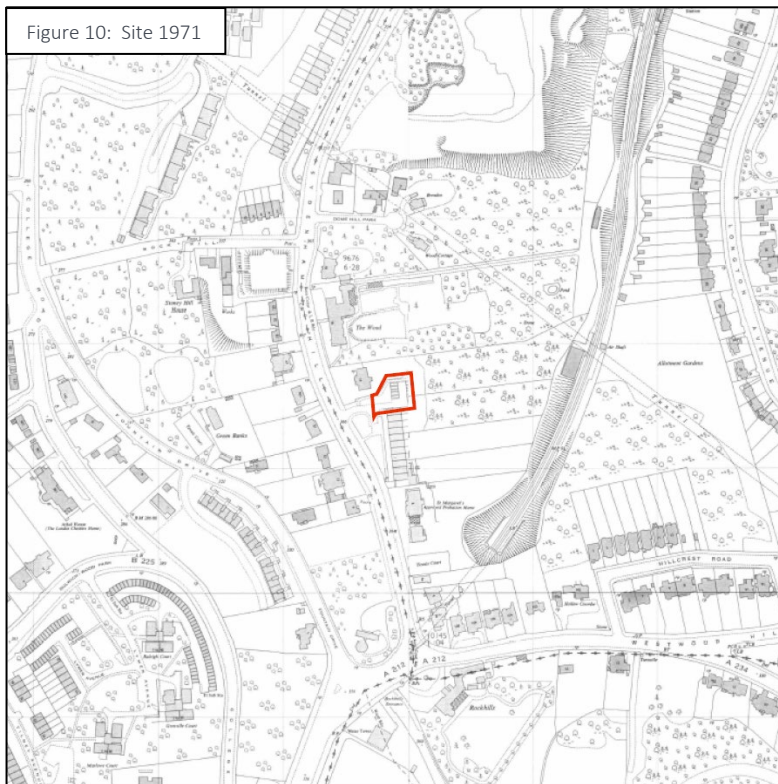
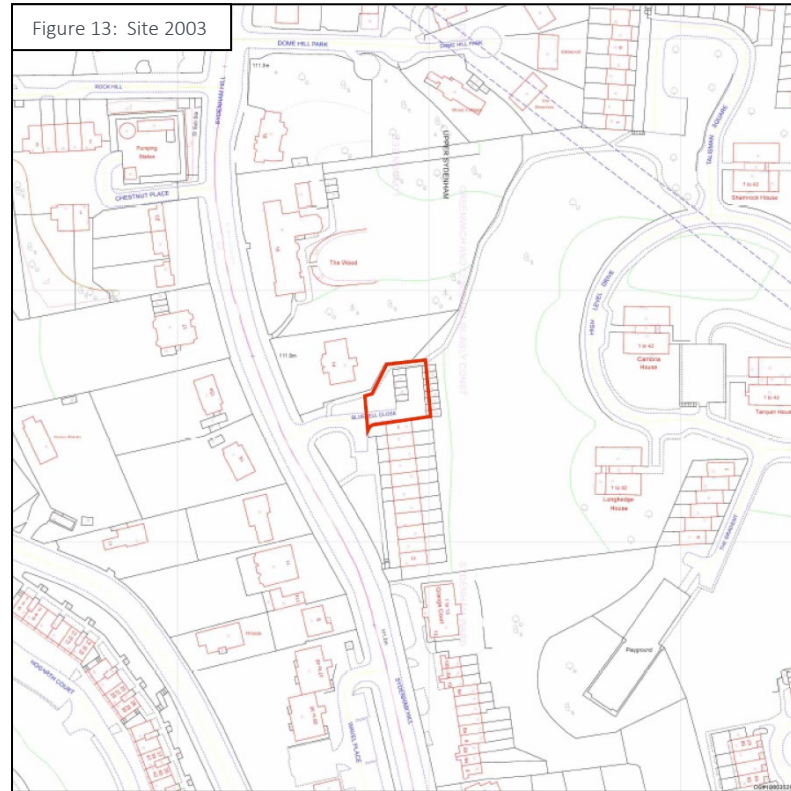


Figure 10: Site 1971



[illegible]

Figure 12: Site 1991



<p><b>ORDNANCE MANUFACTURE &amp; STORAGE</b></p>	<p>During WW1 and WW2, London housed several facilities involved in the manufacture, storage, filling and testing ordnance.</p> <p>None of these sites would have posed a potential threat to the site of concern.</p>
<p><b>MILITARY HISTORY</b></p>	<p>There is no evidence that the Site was ever used as a military installation.</p>
<p><b>CIVIL DEFENCE</b></p>	<p><b>Anti-Aircraft Artillery (AAA) Batteries.</b> The Luftwaffe targeted AAA batteries. They were also a source of unexploded AA shells which could land a great distance from the firing point during WWII, although typically fell within 15km and could be distributed over a wide area. AAA batteries present a potential source of UXO hazard because of the storage, use and disposal of ordnance associated with the armaments used. They may have a risk from small caches of ammunition buried locally to them. Three types of AAA batteries existed:</p> <ul style="list-style-type: none"> <li>• Heavy Anti-Aircraft (HAA) batteries of large guns designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.</li> <li>• Light Anti-Aircraft (LAA) weaponry designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields.</li> <li>• Rocket batteries (ZAA) firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were also relatively permanent emplacements.</li> </ul> <p>Many AAA batteries were associated with searchlights and consequently 'visible' at night, providing clear targets to the Luftwaffe bombers and a potential for UXB.</p>



	<p>London possessed a peak of 199 Heavy Anti-Aircraft (AA) Batteries during WW2, including 4.5, 3.7 and 3-inch AA guns, sited in some 70 separate locations. None of these were sited on or near to the site of concern to have created a direct source of potential ordnance contamination.</p> <p><b>Decoy Sites.</b> To draw enemy aircraft away from towns and other strategically important targets, a series of decoys were developed between 1940 and 1941. They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. Almost 800 static decoy sites were built at around 600 locations in England and numerous temporary and mobile decoys were also deployed.</p> <p>Several different types of decoys were devised:</p> <ul style="list-style-type: none"> <li>• Night-time dummy airfields (Q sites).</li> <li>• Daytime dummy airfields (K sites).</li> <li>• Diversionary fires to simulate successful bombing raids on airfields (QF sites), petroleum depots (P sites) and major towns and cities (Starfish or SF sites).</li> <li>• Simulated urban lighting (QL sites).</li> <li>• Dummy Heavy Anti-Aircraft (HAA) batteries, factories, and buildings (C series).</li> <li>• Mobile decoys representing 'hards' for troop embarkation (MQLs), tanks and other vehicles.</li> </ul> <p>As would be expected Region 5 (London) had several Civil Defence ('Starfish') sites designed to protect the city from aerial attack. None of these sites would indicate the possibility that erroneous Luftwaffe bombing would have produced a consequent UXO risk on the site of concern.</p>
<b>WW1</b>	<p>Greater London suffered several 'Zeppelin' aerial bombardments during WW1 as well as several aerial attacks by Gotha and Giant Bombers. A number of these raids are known to have delivered ordnance in the vicinity of the site of concern. However, due to the limited number of bombs dropped at this time and the degree of development that has occurred since then, the risks from WW1 unexploded ordnance from this source are negligible.</p>
<b>WW2 – GERMAN AERIAL BOMBING CAMPAIGN</b>	<p><b>Strategic Targets.</b> Prior to WWII, the Luftwaffe conducted numerous aerial photographic reconnaissance missions over Britain, recording key military, industrial and commercial facilities for attack, in the event of war. In addition, logistics infrastructure and public services, such as railways, canals, power stations, reservoirs, water and gas works were also considered viable bombing targets.</p> <p><b>Bombing Statistics.</b> The site of concern was placed within Region 5 (London), Group 4 for Civil Defence purposes and the figures for bombs falling in the area are well recorded. Region 5 received some 15, 107.5 Tonnes of HE bombs throughout the war and the Borough of Lewisham was recorded as receiving <b>200 - 299 bombs per 1000 acres</b> between 1339 and 1945 and <b>33 – 64 bombs per km<sup>2</sup></b> from the outbreak of hostilities until October 1941 (See Figures 14 &amp; 15). Sydenham is recorded as receiving 34 High explosive bombs between 7 Oct 40 to 6 Jun 41. A summary of the bombs that fell on Region 5, Group 4 and Lewisham itself throughout WW2 are shown below:</p>

	<table><thead><tr><th>Ordnance Type</th><th>Group 4</th><th>Lewisham</th></tr></thead><tbody><tr><td>50Kg HE</td><td>790 (54),</td><td>190 (12)</td></tr><tr><td>250Kg HE</td><td>449 (65)</td><td>120 (16)</td></tr><tr><td>500Kg HE</td><td>112 (18)</td><td>26 (7)</td></tr><tr><td>1000Kg HE</td><td>16 (12)</td><td>4</td></tr><tr><td>Parachute Mine</td><td>71 (5)</td><td>15</td></tr><tr><td>V1 'Doodlebug'</td><td>330</td><td>115</td></tr><tr><td>V2 Long Range Rocket</td><td>82</td><td>12</td></tr><tr><td>Small Incendiary Bombs</td><td>16 101</td><td>5917</td></tr><tr><td>50Kg Phosphorus Bomb</td><td>27 (10)</td><td>9 (15)</td></tr><tr><td>Fire Pots</td><td>1</td><td>3 (2)</td></tr><tr><td>Oil Bomb</td><td>140</td><td>29 (1)</td></tr><tr><td>Containers</td><td></td><td>26</td></tr><tr><td>Unclassified Ordnance</td><td>3425 (130)</td><td>1 009 (22)</td></tr></tbody></table> <p>NOTE: Figures in brackets indicate UXBs.</p>	Ordnance Type	Group 4	Lewisham	50Kg HE	790 (54),	190 (12)	250Kg HE	449 (65)	120 (16)	500Kg HE	112 (18)	26 (7)	1000Kg HE	16 (12)	4	Parachute Mine	71 (5)	15	V1 'Doodlebug'	330	115	V2 Long Range Rocket	82	12	Small Incendiary Bombs	16 101	5917	50Kg Phosphorus Bomb	27 (10)	9 (15)	Fire Pots	1	3 (2)	Oil Bomb	140	29 (1)	Containers		26	Unclassified Ordnance	3425 (130)	1 009 (22)
Ordnance Type	Group 4	Lewisham																																									
50Kg HE	790 (54),	190 (12)																																									
250Kg HE	449 (65)	120 (16)																																									
500Kg HE	112 (18)	26 (7)																																									
1000Kg HE	16 (12)	4																																									
Parachute Mine	71 (5)	15																																									
V1 'Doodlebug'	330	115																																									
V2 Long Range Rocket	82	12																																									
Small Incendiary Bombs	16 101	5917																																									
50Kg Phosphorus Bomb	27 (10)	9 (15)																																									
Fire Pots	1	3 (2)																																									
Oil Bomb	140	29 (1)																																									
Containers		26																																									
Unclassified Ordnance	3425 (130)	1 009 (22)																																									
UNEXPLODED ORDNANCE (UXO)	No UXO is recorded on the site.																																										
ABANDONED BOMBS	<p>No Abandoned Bombs are recorded on the site. The closest recorded abandoned bombs are:</p> <ul style="list-style-type: none"><li>Folio No. 4/160 – Deptford Borough Council Cemetery, Lewisham, recorded as 1 x 50Kg HE bomb or AA Projectile.</li><li>Folio no. 4/656 – Ladywell Cemetary, Lewisham. Recorded as 1 x 250Kg HE, which was removed in 1948.</li></ul>																																										
BOMB CENSUS MAPS	<p>The site appears in the London Bomb Damage maps and shows the property which encroaches into the southwestern corner of the site as having suffered from ‘<i>General Blast Damage</i>’ with the properties further south suffering from less blast damage. The property at the southern end of Sydenham Hill is shown as ‘<i>Completely Destroyed</i>’. (See Figure 16). A V1 ‘Doodlebug’ and a V2 Long Range Rocket Bomb (LRRB) are shown as detonating to the south of the site and others to the northeast and northwest.</p> <p>Detailed bomb census maps survive which cover the site, but do not record any large bombs on the site although a few are in proximity.</p>																																										

Figure 14: Bombs per 1000 acres

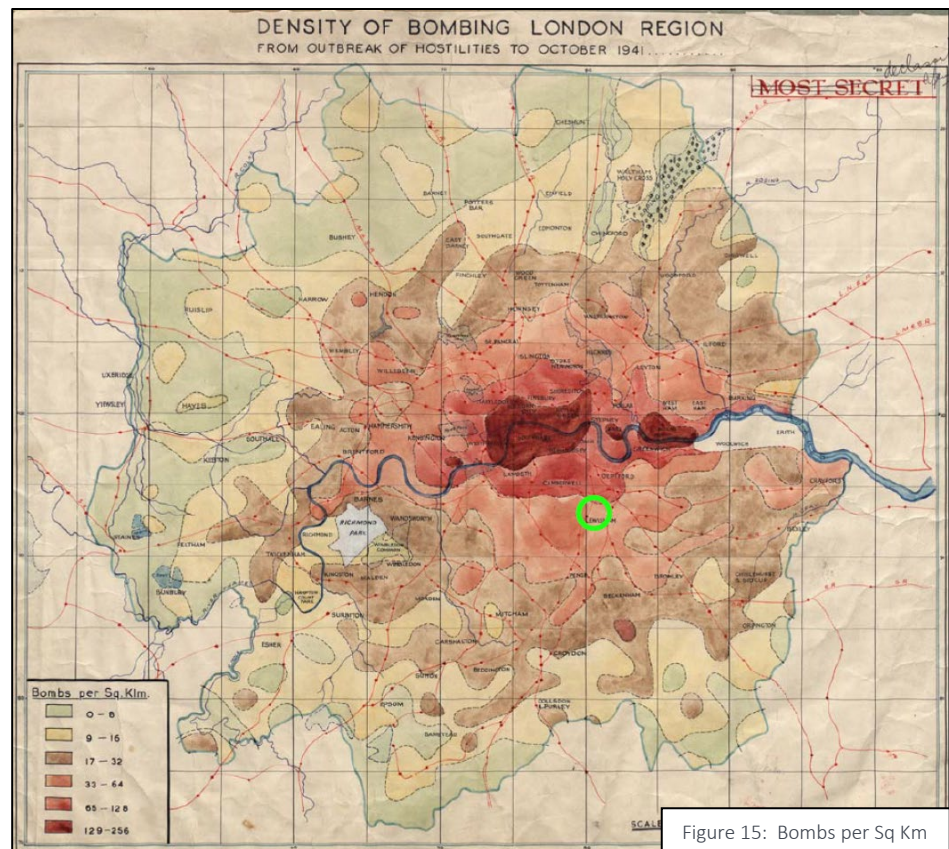
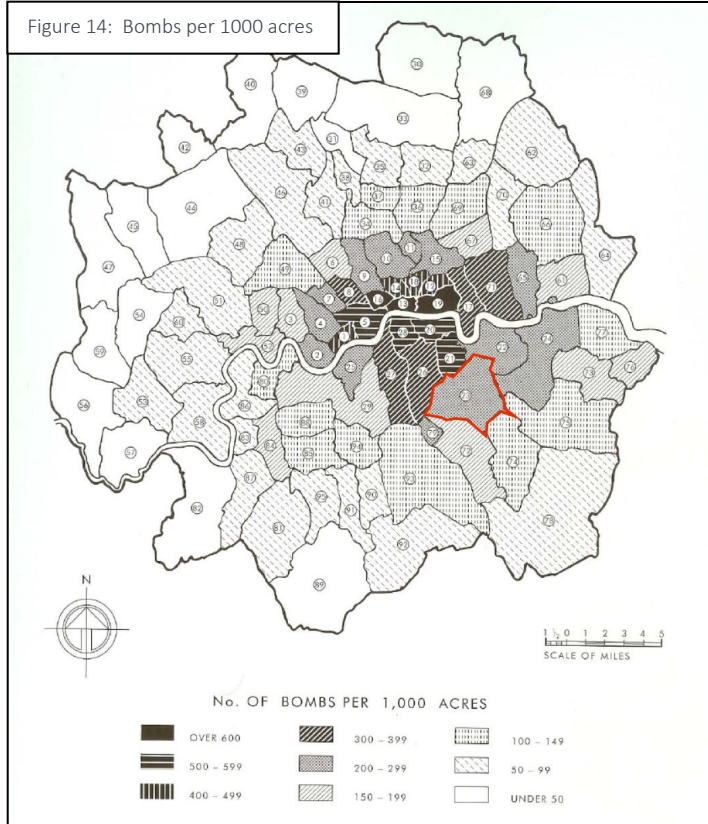


Figure 15: Bombs per Sq Km



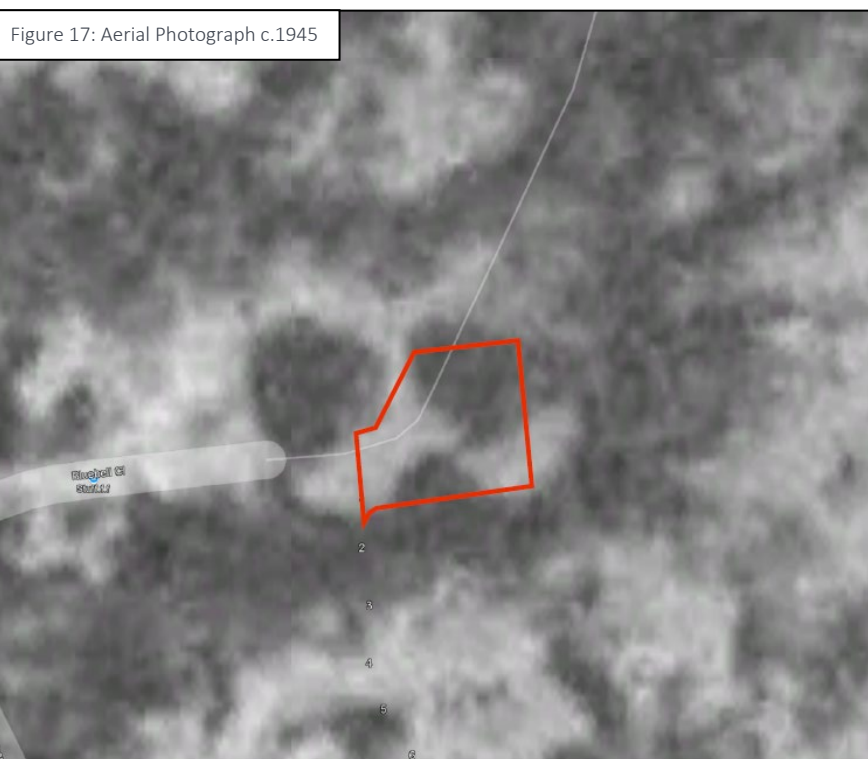
Figure 16: London Bomb Damage Map

Legend:

- Total Destruction
- Damaged beyond Repair
- Seriously Damaged
- Seriously Damaged - Repairable
- General Blast Damage
- Blast Damage - Minor
- Clearance Areas
- V2 LRRB
- V1 'Doodlebug'

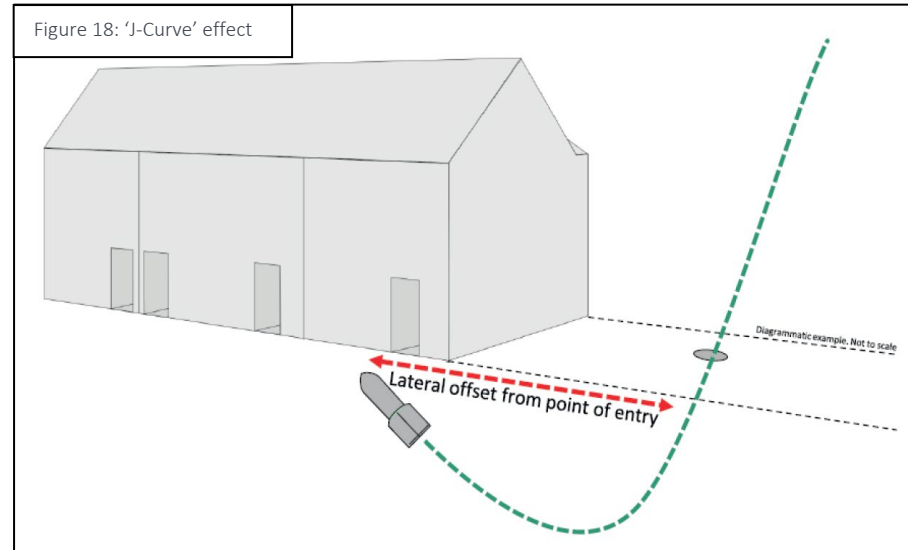
[illegible]

<p><b>HISTORICAL MAPS</b></p>	<p>Historic maps of the period are a useful indicator of whether an area may have suffered bomb damage. The street layout prior to WW2 is the start state and major changes to street layouts or building boundaries may indicate that the change was due to bomb damage.</p> <p>In this instance, the map record shows no significant changes across the Site from the pre-War layout to that seen immediately post-War.</p>
<p><b>HISTORICAL AERIAL PHOTOGRAPHY</b></p>	<p>The same rationale applies with historic aerial photography as it does when we examine historical street plans – changes between pre-war and post-war images may indicate the possibility of damage caused by bombs falling on the site. Sometimes, detail is such that it allows bomb damage to be seen directly on sites of concern.</p> <p>Historic aerial photography is available but poor quality. It does not appear to offer any evidence of potential bomb damage.</p>



THREAT ANALYSIS	
IS THERE EVIDENCE THAT THE SITE WAS POTENTIALLY AFFECTED BY LARGE, AIR-DROPPED HIGH EXPLOSIVE BOMBS?	<p><b>Yes.</b></p> <p>The historical record is acknowledged as being incomplete from a national perspective but there is evidence that the Site may have been affected by large air-dropped, high explosive bombs during WW2 with 'general blast damage' recorded to the property formerly located to the southwest of the site area and bombs recorded in proximity.</p>
WAS THE SITE POTENTIALLY AFFECTED BY OTHER EXPLOSIVE ORDNANCE CONTAMINATION EVENTS?	<p><b>Yes.</b></p> <p>The potential for British anti-aircraft artillery falling back to earth as UXOs and remaining on the Site undiscovered can rarely be entirely ruled out, although it is very unlikely in any event. The potential for contamination from this source increases in areas which suffered aerial bombardment responded to by air defences, which is the case here.</p> <p>The detonation of the V1 and V2 '<i>Terror Weapons</i>' to the south of the site had the potential to create damage in proximity to the site itself given their very large explosive payload.</p> <p>No other EO/ UXO contamination events are known to potentially impact on the site.</p>
IF AN EO-RELATED THREAT EXISTS, WHAT ORDNANCE TYPES ARE ANTICIPATED?	<p>The bombs recorded as falling in Region 5 Group 4 show a typical distribution of bomb types experienced nationally when 50kg and 250kg bombs predominated.</p> <p>We must consider the possibility that Anti-Aircraft Artillery (AAA) projectiles could remain as a potential threat to any site with significant AA defences in proximity during WW2, which had cause to engage the enemy.</p> <p>Given the historic use of the Site, the possibility that <i>Ad Hoc</i> Explosive Ordnance resulting from military activity could remain to the present day may be reasonably discounted.</p> <p>The following items of Explosive Ordnance (EO) may be anticipated to be potentially present on the Site:</p> <ul style="list-style-type: none"> <li>German air-dropped bombs – 50 to 500kg.</li> <li>British Anti-Aircraft Artillery projectiles returning to earth unexploded.</li> </ul>
WHAT IS THE EXPLOSIVE ORDNANCE (EO) ENCOUNTER DEPTH?	<p><b>Ministry of Homeland Defence Security Bomb Penetration Studies.</b> A major study was completed by the Ministry of Homeland Security during WW2, during which the penetration depths of 1 328 air-dropped bombs (as reported by the BD Sections of the day and mostly in the Birmingham area) were recorded. It was concluded, not surprisingly, that the penetration depths of different sized bombs varied according to the geology into which they fell.</p> <p>The average Bomb Penetration Depth (BPD) of 430 x 50Kg HE bombs in London Clay was found to be 4.6m and that for a 250Kg bomb 6.1m. Also, they concluded that a 500Kg bomb, the largest common bomb dropped during the War, had a likely penetration depth of 6m in sand and 8.7m in clay – the maximum observed for a 500Kg was 10.2m and for a 1000Kg bomb was 12.7m. It should be remembered that these depths were achieved unencumbered by obstacles to penetration such as buildings, concrete, and brickwork.</p> <p><b>The 'J' Curve.</b> The 'J-curve' (See Figure 18) describes the path of a bomb (dropped from a normal altitude of about 5 000m) into homogenous ground will continue its line of flight (unless deflected by a</p>

substantial obstacle) but then turn upwards towards the surface before it stops. The horizontal distance (the 'offset') between the point of entry and final resting position was typically 1/3 of the ultimate penetration depth for a bomb. Therefore, if a bomb landed close to the exterior of a building or site and did not explode, the path that the bomb subsequently travelled beneath the ground, the "J-Curve", may have delivered it beneath the building or site footprint. The J-curve is often misunderstood and used to describe the path taken by a bomb dropped from low flying aircraft to which it should not be applied.



The final penetration depth of an air-dropped depends upon several factors; the velocity (as a function of the mass and speed) of the bomb, – PLANIT uses a standard velocity of 267m/s for assessment purposes – the angle of penetration of the bomb, the physical features through which the bomb travelled prior to impact with the ground, and the geology of the ground into which it entered - Generally, the softer the ground, the deeper the expected penetration depth of the bomb. Peat, alluvium, and soft clays are easier to penetrate than gravels and/or sand and water content also plays a part. In addition, it must be remembered that 'barrier geology' such as very dense gravels or bedrock i.e., geology dense enough to stop the progress of a bomb underground, is an important factor in determining the median BPD.

The following UXO encounter depths and offsets from WW2 ground levels are estimated:

Type of Ordnance	Av. Penetration Depth (m bgl)	Geology Multiplication Factor	Barrier Geology (m bgl)	Adjusted Av. Penetration Depth (m bgl) to 1sf	Offset (m)
British AAA projectiles	2.0	1	na	2.0	0.7
Air-dropped Bombs: 50kg	4.0	1	na	4.0	1.3
Air-dropped Bombs: 250kg	6.0	1	na	6.0	2.0
Air-dropped Bombs: 500kg	9.0	1	na	9.0	3.0
Air-dropped Bombs: 1000kg	11.0	1	na	11.0	3.7

The average bomb penetration depth (BPD) of a 500kg UXB is estimated at 9.0m bgl with a maximum offset of 3.0m.

<p><b>HOW COULD AN UNCONTROLLED DETONATION BE BROUGHT ABOUT?</b></p>	<p>Unexploded Bombs rarely spontaneously explode. High Explosive (HE) requires a great deal of energy to create the necessary conditions for detonation to occur. In the case of WWII German bombs being disturbed during intrusive ground works, there are a few scenarios to be considered:</p> <ul style="list-style-type: none"> <li>• <b>Direct impact onto the main body of the bomb.</b> Although this is a possibility, there is little chance of generating enough energy to detonate the explosive fill unless the fuse itself is directly struck.</li> <li>• <b>Re-starting the mechanical clock-timer in a bomb fuse.</b> This is a possibility. It is probable that environmental conditions have corroded the fuse sufficiently to prevent clockwork mechanisms from functioning. However, under some conditions, fuse elements will be in a good condition and additional movement of a bomb fuse may be sufficient to restart a previously ‘jammed’ mechanical clockwork mechanism.</li> <li>• <b>Induction of a static charge, creating a sufficient current to initiate an electric fuse.</b> This is an unlikely event. Environmental conditions are likely to have corroded the fuse, degrading its components sufficiently to prevent them from functioning. Any elements of the fuse capable of holding a charge would have dissipated in the time since the bomb failed to function.</li> <li>• <b>Friction impact initiating fuse elements causing bombs to detonate.</b> Although remote, this is the most likely scenario that may result in a bomb detonating. Weathering within the fuse pocket can cause the explosives within the fuse to breakdown, crystallize and exude from the fuse itself. Violent physical disturbance of this exuded material carries the remote possibility of initiating the fuse mechanism which in turn will initiate the bomb.</li> </ul>
<p><b>WHAT WOULD THE EFFECTS OF SUCH A DETONATION BE TO THE SITE?</b></p>	<p>The effects of WWII German bombs detonating have been the subject of a few well recorded studies. The general effect of an explosive detonation will depend upon:</p> <ul style="list-style-type: none"> <li>• The size of the bomb and its Net Explosive Quantity (NEQ) (i.e., how much explosive material it contains).</li> <li>• The type of fill in the bomb (i.e., high explosive, incendiary, photoflash).</li> <li>• The physical location of the bomb. Whether it is: <ul style="list-style-type: none"> <li>○ On the surface.</li> <li>○ Partially buried.</li> <li>○ Buried (A bomb is considered ‘buried’ when it is more than 2½ times its own length below ground level and covered).</li> </ul> </li> <li>• The locations of the bomb in relation to other structures.</li> <li>• The strength and design of structures near to the seat of an explosion.</li> <li>• The nature of the ground (i.e., sand, gravel, clay, marsh etc.).</li> <li>• The location of the bomb in relation to human and animal populations.</li> </ul> <p>There would be the potential for ground shock to damage important underground structures including sewers, communication cables, and foundations.</p> <p>The potential Damage Radii to various underground structures has been assessed by extrapolating from the Joint Service Publication 364 which is the MOD Manual for assessing bomb damage. Potential damage radii for underground structures are assessed as:</p>



	<table border="1"> <thead> <tr> <th>Underground Structure</th><th>Damage Radius (m)</th></tr> </thead> <tbody> <tr> <td>Brick Walls</td><td>30</td></tr> <tr> <td>Foundations</td><td>60</td></tr> <tr> <td>Cast Iron/ Concrete Pipes</td><td>15</td></tr> <tr> <td>Earthenware/ brick Sewers</td><td>25</td></tr> <tr> <td>Electric Cables/ Steel Pipes</td><td>12</td></tr> </tbody> </table>	Underground Structure	Damage Radius (m)	Brick Walls	30	Foundations	60	Cast Iron/ Concrete Pipes	15	Earthenware/ brick Sewers	25	Electric Cables/ Steel Pipes	12
Underground Structure	Damage Radius (m)												
Brick Walls	30												
Foundations	60												
Cast Iron/ Concrete Pipes	15												
Earthenware/ brick Sewers	25												
Electric Cables/ Steel Pipes	12												
<p><b>WOULD THE SITE CONDITIONS AFFECT THE BOMB FAILURE RATE?</b></p>	<p><b>No.</b></p> <p>There is no reason to suggest that bomb failure rates at the Site may have been higher than that routinely experienced, i.e., <b>10-15% of all bombs dropped</b> because of the predominantly soft ground (Peat and silt) which covers the site area.</p>												
<p><b>WOULD UXBs HAVE BEEN DISCOVERED DURING WW2?</b></p>	<p><b>Density of Bombing.</b> The Site is not known to have been extensively bomb damaged in WW2, but <i>general</i> blast damage was recorded for the structure in the southwest corner of the site – Sydenham itself only received 34 HE bombs throughout the War. This would have made data gathering at the time easier and the likelihood of overlooking UXBs lower.</p> <p><b>Frequency of Access.</b> The Site was essentially undeveloped during the War, forming the garden of an adjacent property except for the very southwestern corner. This decreases the likelihood that items of UXO would have been missed and gone unreported.</p> <p><b>Ground Cover.</b> The physical characteristics of most of the site would not act to retard the progress of UXBs underground by reducing their overall velocity prior to and immediately after impact with the presence of significant built structures and hardstanding.</p> <p><b>Peripheral Bomb Damage.</b> The Site was likely partially affected by bomb-damage during WW2, which would have made data gathering and survey harder and subsequently less effective at locating UXB entry holes.</p>												
<p><b>DOES THE SITE'S DEVELOPMENT HISTORY AFFECT THE POTENTIAL FOR UXO ENCOUNTER?</b></p>	<p><b>Yes.</b></p> <p>There can be difficulties in accurately determining the exact extent of post WW2 development. The fact that a degree of post-War redevelopment would have taken place at the site is worthy of note, especially that involving the clearance of the site and the subsequent construction of the garages and access road. These activities would have been relatively shallow even when considering attendant utilities. There has not been any significant deep intrusive engineering undertaken across the Site Post-War, which would have created opportunities to identify deeper UXO and have effectively 'cleared' developed ground volumes of threat items by physical excavation of ground.</p> <p>It is worth noting that historical development either immediately post-War or in the 1950/ 60/ 70 and 80s would not have taken any account of the potential for UXBs at the site of concern nor would any effective technology be available to detect such potential threat items. Modern structures tend to have foundation designs that go deeper than historic buildings and risk encountering UXBs at depths beyond existing historic foundation levels that were not detected by excavation or bomb survey.</p>												
<p><b>IF A UXB-RELATED THREAT EXISTS, DOES IT VARY ACROSS THE SITE?</b></p>	<p><b>No, despite that the EO-related threat is influenced by several factors.</b></p> <p>Generally, volumes of ground within the Site already subjected to extensive redevelopment involving the displacement of earth, may be considered free from the threat of small calibre UXO/EO within the volumes of ground excavated/disturbed. Additionally, volumes of ground within the site already subjected to historical piling may be considered a lower potential threat, within the ground volume</p>												

	<p>occupied by the piles, from large, air-dropped bombs, than areas that have not been subjected to the same degree of intrusive engineering. This is not to state that there is no threat.</p> <p>The same cannot be said of areas of the Site where WW2 ground volumes, including those beneath existing structures down to the adjusted bomb penetration depth, would be considered to remain potentially at risk from the presence of UXO.</p>
--	--

THREAT ASSESSMENT	
POTENTIAL EXPLOSIVE ORDNANCE THREAT ITEMS	<p>Official bomb maps do not record high explosive bombs on the site but in proximity and no incendiary bombs are recorded. The London Bomb Damage Map extract records <i>general</i> bomb damage to the property located in the extreme southwest corner of the site. As the site was essentially a garden at the time the bombs fell, a UXB could have entered the ground volume unnoticed although you would anticipate an entry hole of a UXB being relatively easily located in a managed garden. Sometimes the damage caused by a large UXB passing through a building can be misinterpreted as a smaller bomb detonating – Whether this was the case with the damaged structure can never be known. V1 and V2 weapons detonating nearby would have obscured the picture further in trying to decipher what weapon caused what damage. The amount of evidence suggesting the potential for contamination from this source cannot be ignored given the potential consequences of an unplanned encounter.</p> <p>The possibility that Anti-Aircraft Ammunition (AAA) fell back to earth within the Site can never be known with certainty. This is very unlikely in any case; however, AA defences were very active over the area which raises this possibility, especially in areas without hardstanding. The post-War redevelopment of the site into garaging would have further reduced the potential encounter risk from this source.</p> <p>The potential for <i>ad hoc</i> military activity to have generated explosive ordnance contamination at any site is generally unquantifiable but can be reasonably discounted in this instance.</p> <p>Within ground volumes that have not been developed significantly Post-War, the potential for UXO encounter remains as it did immediately Post-War. The following items of Explosive Ordnance (EO) are assessed as potentially present under the Site today:</p> <ul style="list-style-type: none"> <li>• German air-dropped high explosive bombs 50-500kg.</li> <li>• British AAA returned to earth unexploded.</li> </ul>
ENGINEERING WORKS	The intended works are unspecified at the time of writing. It is supposed that the works will include energetic intrusion into potentially <i>at-risk</i> WW2 ground volumes.
RISK PATHWAY	For the purposes of this assessment, it has been assumed that engineering works would likely include energetic intrusion into <i>at risk</i> ground volumes. It is anticipated that personnel or key equipment would complete the risk pathway during intrusive engineering works that could bring them into proximity with potential threat items.
CURRENT EXPLOSIVE ORDNANCE THREAT LEVELS	The Ordnance Threat Levels for the Site as they relate to various energetic activities are assessed as:

	Ordnance Type	Engineering Activity				
		No Excavations, no energetic engineering, Controlled Public Access	Shallow Excavations by hand/ Uncontrolled Public Access	Shallow Excavations by machine/ Controlled Public Access	Deep Excavations > 1mbgl, Energetic compaction/ rolling	Boreholes/ Piling
	British AAA	NEGLIGIBLE		LOW		
	German, HE bomb 50-500kg	NEGLIGIBLE	LOW	MEDIUM		

## THREAT MATRICES

### ORDNANCE DANGER RATING (ODR)

The 'Ordnance Danger Rating' (ODR) is assessed for the different types of ordnance in terms of the potential harm that may result were the ordnance to detonate as designed and is a function of the calibre of the ordnance and whether it is encountered on the 'surface' or 'buried'<sup>1</sup>.

Potential Threat Item	Ordnance Category Description	Danger Radii (m)	Ordnance Danger Rating (ODR)
	No Explosive Ordnance (EO) assessed to be present.	NA	1
British AAA	Landmines, Anti-Personnel, HE; HE in Bulk <5Kg; Pyrotechnics, Small Arms Ammunition (SAA): Projectiles, HE <75mm calibre; Projectiles, Mortar, HE 50mm to < 75mm calibre; Grenades, Hand, HE; Grenades, Rifle, HE. British AAA Projectiles, HE < 125mm calibre; Rockets, HE, Anti-Tank (HEAT); Bombs PIAT, HE	100+	2
German HE Bombs 50—500kg	Aerial Bombs, HE, 50Kg (Surface/ buried); Aerial Bombs, Blast, HE & Sea Mines 20-250Kg; Aerial Bomb, HE, 250-500Kg (Buried) Bombs, Mortar, HE <105mm calibre; Bombs, Mortar, Spigot, HE; Landmines, Anti-Tank	300+	3
	Projectile, HE > 125mm calibre; Aerial Bombs, HE, 1000kg (buried), HE, 1500-2500Kg (Surface); Aerial Bomb, Blast, HE & Sea Mines 500-1500Kg (Surface)	500+	4
	Aerial Bombs, HE, 2000-10000Kg (Buried); Aerial Bombs, Blast, HE & Sea Mines 1500-4000Kg (Surface)	800+	5

<sup>1</sup> An item of Explosive Ordnance (EO) is 'buried' when it is 2 ½ times its own length underground.

## ENCOUNTER RISK (ER)

The Encounter Risk (ER) is a function of the Ordnance Danger Rating (ODR) and the Likelihood Factor (LF) (i.e., how likely is it that certain items are present underground) – The higher the Ordnance Danger Rating (DR) and the higher the Likelihood Factor (LF), the higher the Encounter Risk (ER).

Likelihood of Encounter	Likelihood Factor (LF)	EXPLOSIVE ORDNANCE DANGER RATING (ODR)				
		1	2	3	4	5
		ENCOUNTER RISK (ER) = LF x ODR				
Extremely Unlikely	0	0				
Very Unlikely	1	1	British AAA 2	German HE 50- 500kg 3	4	5
Unlikely	2	2	4	6	8	10
Likely	3	3	6	9	12	15
Very Likely	4	4	8	12	16	20
Extremely Likely	5	5	10	15	20	25

## ORDNANCE THREAT LEVEL

The 'Ordnance Threat Level' is a function of the Encounter Risk (ER) and the Site Activity Factor (SAF) i.e., what type of activity is being undertaken at the site.

Encounter Risk (ER)	Explosive Ordnance (EO) Type	Site Activity Factor (SAF)				
		No Excavations, no energetic engineering, Controlled Public Access	Shallow Excavations by hand/ Uncontrolled Public Access	Shallow Excavations by machine/ Controlled Public Access	Deep Excavations > 1mbgl, Energetic compaction/ rolling	Boreholes/ Piling
		1	2	3	4	5
		Explosive Ordnance (EO) Threat Level = ER x SAF				
0		0				
1 (1 – 2)	British AAA	1	2	3	4	5
2 (3- 5)	German HE 50-500kg	2	4	6	8	10
3 (6 – 9)		3	6	9	12	15
4 (10 – 15)		4	8	12	16	20
5 (16+)		5	10	15	20	25

Explosive Ordnance Threat Level	ASSETS AFFECTED				EXPLOSIVE ORDNANCE (EO) THREAT MITIGATION REQUIREMENTS
	PEOPLE	PLANT	PROPERTY	ENVIRONMENT	
NEGLIGIBLE	NOT APPLICABLE				
LOW	First aid injury	Slight damage	Slight damage	Slight Effect	Monitor & manage potential risks
MEDIUM	Medical Injury to Lost time <7 days	Slight Damage to Item write off	Minor to Major damage	Minor to Local Effect	Review & emplace strict control measures if necessary
HIGH	Lost time injury >7 days to Fatality	Unit level to Multiple damage	Major wider damage to Catastrophe	Major to Massive Effect	Intolerable Risk Level. Immediate control measures required to mitigate risks to acceptable levels prior to any further works

THREAT MITIGATION OPTIONS		
ACTIVITY	THREAT MITIGATION OPTIONS	FINAL THREAT LEVEL
GENERAL	<p>If planned intrusive engineering works are breaking into ground volumes where the potential for EO encounter is created, i.e., Within previously undisturbed ground volumes, then a UXO Threat Management Strategy <b>IS REQUIRED</b> prior to intrusive engineering works at the site of concern. The Threat Mitigation Strategy should be developed by a specialist considering the specific planned intrusive works.</p> <p><b>Explosive Ordnance Safety Awareness Briefings.</b> An explosive ordnance Safety Briefing should be included as part of routine site health and safety training and form a key element of the Site Health &amp; Safety Plan. This should be conducted by a trained specialist and would assist conformance with the CDM Regulations 2015.</p> <p>The briefing will instruct all personnel on the identification of EO hazards, actions to take in the event of an EO incident to protect personnel, key equipment, property, and the public.</p> <p><b>Explosive Ordnance Site Safety Instructions.</b> Explosive Ordnance Site Safety Instructions should be drafted for inclusion in the site-specific health and safety manual and would include information on dealing with an EO incident safely and appropriately. These instructions would form part of the permanent site documentation and will be an aide memoire for identifying potential EO hazards, making a preliminary threat assessment as well as specific guidelines on what to do in the event of a confirmed incident.</p>	AS LOW AS REASONABLY PRACTICABLE (ALARP)
SITE INVESTIGATION	<p>Site investigation works may be supported by UXO survey as appropriate. Consideration should be given to whether the works are shallow or deep from the perspective of UXO Survey: 'Shallow' Survey is survey of the ground from 0.0m bgl to 6.5m bgl and 'Deep' UXO Survey is that beyond 6.5mbgl. In this instance, the maximum estimated bomb depth is only 1.4m bgl.</p> <ul style="list-style-type: none"> <li>• <b>Boreholes.</b> PLANIT can conduct a non-intrusive survey of a small, discrete area which will accurately allow your borehole to proceed into a volume of ground under which there are no ferrous obstructions. Several locations may be provided within a survey box, allowing maximum flexibility for positioning, and preventing any boreholes being terminated because of encountering a potential threat item at depth.</li> <li>• <b>Trial Pits.</b> Using shallow non-intrusive survey, the area for your trial pit can quickly be surveyed and confirmed as free from ferrous anomalies/UXO. Data is interpreted on-site and therefore locations can be changed very efficiently in the event of a potential obstacle.</li> </ul>	ALARP



	<p><b>Window Sampling.</b> Using shallow non-intrusive survey, the area for your window sample can quickly be surveyed and confirmed as free from ferrous anomalies/UXO. Data is interpreted on-site and therefore locations can be changed very efficiently in the event of a potential obstacle.</p>	
<p><b>SHALLOW INTRUSIVE ENGINEERING</b></p>	<p>There are two options available to effectively deal with the EO Threat when conducting shallow intrusive ground works.</p> <p><b>On-Site UXO Support.</b> On-site UXO Support for shallow ground works would involve the presence of an appropriately trained and experienced UXO Technician during this phase of construction. The role of the UXO Technician is to:</p> <ul style="list-style-type: none"> <li>• Conduct EO Safety Awareness Briefings as required.</li> <li>• Monitor all intrusive ground works using visual and instrument aided means to locate any EO that may be uncovered during site works.</li> <li>• Provide an immediate and expert assessment of any EO that may be discovered.</li> <li>• Assist in implementing an appropriate and safe response to an EO incident.</li> <li>• Design and emplace protective works as an immediate response to protect personnel, key equipment, property, and the public as may be required.</li> <li>• Advise on best safe working practice considering the perceived EO Threat.</li> <li>• Act as the liaison with the Authorities on behalf of the Client in the event of an EO incident.</li> </ul> <p><b>Non-Intrusive UXO Survey.</b> PLANIT can deploy industry leading technology that will survey your site of concern non-intrusively (if ground conditions permit) to identify potential EO Threat Items.</p> <p>Any anomalies identified following the non-intrusive survey that may be EO should then be subject to Controlled Excavation to confirm them as EO and remove the threat or discount them.</p> <p>Once the non-intrusive survey and controlled excavation are complete, there is no further requirement for UXO Support at the site of concern since all EO Threats would have been identified and dealt with.</p>	<p><b>ALARP</b></p>
<p><b>DEEP INTRUSIVE ENGINEERING WORKS</b></p>	<p>There are a few options available to effectively deal with potential EO Threats when conducting deep intrusive ground works. Which approach is applicable will depend upon the ground conditions of the site of concern:</p> <p><b>Deep Non-Intrusive UXO Survey.</b> PLANIT can deploy industry leading technology that will survey your site of concern non-intrusively (if ground conditions permit) to identify potential EO Threat Items at depth – UXO Survey should proceed to the expected UXB penetration depth or maximum depth of intrusive ground works, whichever is shallower. As a benchmark, PLANITs Deep Non-Intrusive Survey can identify a bomb 500Kg HE to some 8.0m bgl in average ground and larger bombs deeper. This approach is ideal for covering large areas quickly and can be employed to survey piling runs and borehole locations.</p>	<p><b>AS LOW AS REASONABLY PRACTICABLE (ALARP)</b></p>

	<p>Any anomalies identified following the non-intrusive survey that may be EO should then be subject to Controlled Excavation to confirm them as EO and remove the threat or discount them.</p> <p>Once the non-intrusive survey and controlled excavation are complete, there is no further requirement for UXO Support at the site of concern since all EO Threats would have been identified and dealt with.</p> <p><b>Magcone UXB Survey.</b> PLANIT can deploy world class Magcone Survey Systems to survey either pile locations or small areas ahead of intrusive engineering including piling and drilling. The Magcone system is very versatile and can survey to great depths if required.</p> <p><b>Down-Hole Magnetometer UXO Survey.</b> PLANIT can deploy down-borehole UXO Survey equipment that will clear ahead of a piling or borehole rig as it descends underground. The main drawbacks of this approach are that it is time consuming, ‘blind’ (insofar as the borehole may proceed for some depth before a potential threat item is identified, at which stage the borehole will have to be terminated and relocated, wasting time and money), equipment heavy and expensive.</p> <p>Any anomalies identified during this survey that may be EO should either be subject to Controlled Excavation to confirm them as EO and remove the threat or discount them or relocate the borehole or adjust the piling plan.</p> <p><i>UXO Survey should proceed to the expected UXB penetration depth or maximum depth of intrusive ground works, whichever is shallower.</i></p>	
--	--	--