

Phase 1 Preliminary Site Risk Assessment



<p>WWII Strategic Targets (within 5km of Site)</p>	<p>The following strategic targets were located in the vicinity of the Site:</p> <ul style="list-style-type: none"> ■ 3No. Royal Air Force (RAF) airfields. ■ Military camps and training areas. ■ Transport infrastructure and public utilities. ■ Anti-invasion defences.
<p>WWII Bombing Decoys (within 5km of Site)</p>	<p>None identified.</p>
<p>WWII Bombing</p>	<p>During WWII the Site was located in the Rural District (RD) of Ploughley, which officially recorded 278No. High Explosive (HE) bombs with a regional bombing density of 3.5 bombs per 405 hectares (ha).</p> <p>No readily available records have been found to indicate that the Site was bombed.</p>
<p>Post-WWII Military Activity on or Affecting the Site</p>	<p>None identified.</p>
<p>Recommendation</p>	<p>A detailed desk study, whilst always prudent, is not considered essential in this instance.</p>

This summary is based on a cursory review of readily available records. Caution is advised if you plan to action work based on this summary.

It should be noted that where a potentially significant source of UXO hazard has been identified on the Site, the requirement for a detailed desk study and risk assessment has been confirmed and no further research will be undertaken at this stage. It is possible that further in-depth research as part of a detailed UXO desk study and risk assessment may identify other potential sources of UXO hazard on the Site.



Appendix D – Preliminary Unexploded Ordnance Risk Assessment



Express Preliminary UXO Risk Assessment

Client	Curtins
Project	Great Wolf Lodge, Chesterton
Site Address	Great Wolf Lodge, Chesterton, Oxfordshire, OX26 1TE
Report Reference	EP8343-00
Date	06/03/19
Originator	AH

Assessment Objective

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the Great Wolf Lodge, Chesterton site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

Background

This assessment uses the sources of information available in-house to 1st Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1st Line Defence’s extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.


The assessment directly follows CIRIAC681 guidelines “Unexploded Ordnance, a Guide for the Construction Industry”. The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense ‘first step’ in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1st Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely ‘no’ risk from UXO to a project.





Risk Assessment Considerations	
<p>Site location and description/current use</p>	<p>The site is located in Chesterton, within the Cherwell District of Oxfordshire.</p> <p>The site currently comprises the western section of a golf course. It is composed of open land, varying degrees of vegetation and several bodies of water.</p> <p>The north of the site is bound by the A409 roadway and the west by the M40 roadway. The east is bound by an access way, multi-storey structures associated with Bicester Hotel Golf and Spa, a body of water and light vegetation. The south is bound by vegetation, hardstanding car-park areas and additional multi storey structures.</p> <p>The site is approximately centred on the OS grid reference: SP 5496821678</p> 
<p>Are there any indicators of current/historical military activity on/close to the site?</p>	<p>An in-house geo-data set indicates that the site is located approximately 1km north-east of RAF Weston-on-the-Green. First acquired for military use in 1916 the No 28 Training Depot Station was subsequently established at the airfield, before its closure in 1921.</p> <p>After a brief period of being returned to agricultural use, the airfield was again requisitioned at the outbreak of WWII. Despite only acting as a satellite airfield during this time (for RAF Brize Norton and RAF Bicester), Weston-on-the-Green was subject to bombing on several occasions during the Battle of Britain.</p> <p>Following the end of WWII, the site was transferred to the control of Upper Hayford, and subsequently was used as a dropping zone for training parachutists. The airfield remains active today and is currently in use as a military and civilian gliding centre.</p> <p>Our in-house geo-data set indicates that the site is also located approximately 2.8 km from the Bicester Garrison and the Central Ordnance Depot at Bicester. However, given the distance of this military feature from the site, this feature is not anticipated to elevate the risk of Allied UXO on site.</p>
<p>What was the pre- and post-WWII history of the site?</p>	<p>Pre-WWII historical OS mapping dated to 1923 indicates that the site was composed of a number of adjoining open fields. Access routes are recorded across the site, as well as a 'Quarry' located within the north-east.</p> <p>The north of the site is bound by a roadway, while the east, south and west of the site is bound by more areas of open land.</p> <p>Post-WWII historical mapping dated to 1955 does not record any significant changes within the site or its vicinity.</p>
<p>Was the area subject to bombing during WWII?</p>	<p>During WWII the site was situated within the Rural District (RD) of Ploughly. According to Home Office (HO) statistics, Ploughly sustained an overall very low density of bombing, with an average of 3.5 items of ordnance falling per 1,000 acres. This consisted of 275 HE bombs and three oil bombs falling across 79,910 acres of land.</p>





	<p>Despite the relatively very-low density of bombing with the RD of Ploughly, the site’s localised density of bombing is anticipated to have been greater, given the proximity of RAF Weston-on-the-Green, which was a known Luftwaffe target. Several bombing incidents on surrounding the airfield are of note. On the 9th of August 1940 the Luftwaffe dropped 16 HE bombs across the area. While some of these hit the Weston-on-the-Green airfield, the remainder were dropped in the surrounding areas. Later in August, incendiary bombs were also dropped on the airfield, followed by more bombing in September. In 1941 the airfield was again bombed, this time six HE were dropped and an Allied plane was shot down, amongst other incidents. These incidents have led one anecdotal source to claim that Weston-on-the-Green was “the most heavily bombed location in Oxfordshire¹”.</p> <p>Local incident records, not available to 1st Line Defence at this preliminary stage, would therefore need to be ascertained in order to determine the locations of these raids and whether the site had sustained any bombing.</p>
<p>Is there any evidence of bomb damage on/close to the site?</p>	<p>Given the site war-time composition of open land it has not been possible to identify signs of bomb damage, such as missing or ruined pre-war structures, within historical OS mapping.</p> <p>WWII-era aerial photography would need to be acquired in order to ascertain the exact war-time conditions of the site.</p>
<p>To what degree would the site have been subject to access?</p>	<p>War-time access to areas of open land are generally considered to have been infrequent.</p> <p>Infrequent access increases the likelihood that signs of UXO, such as entry holes or craters, would have gone unnoticed.</p>
<p>To what degree has the site been developed post-WWII?</p>	<p>It is understood that no significant post-war development has taken place on site.</p>
<p>What is the nature and extent of the intrusive works proposed?</p>	<p>The nature and extent of works proposed was not available at the time of writing.</p>

¹ https://www.blhs.org.uk/index.php/head_military/world-war-ii





Summary and Conclusions

During WWII, the site was situated within the Rural District of Ploughly. Home Office statistics suggest that Ploughly sustained an overall over low density of bombing with an average of 3.5 items of ordnance falling per 1,000 acres. However, given the presence of RAF Weston-on-the-Green approximately 1km south-west of the site, this density may have been significantly higher for the local site area.

Weston airfield is known to have been targeted on several occasions. This includes one incident in which 16 HE bombs were dropped across a two mile radius over the airfield, in which only some of the bombs dropped actually fell within the airfield. Given the sites proximity to the airfield, it is conceivable that the remaining bombs, which did not fall on the airfield, could have fallen within the site or its proximity. Further research would therefore need to be done in order to determine the locations of nearby bombing incidents in relation to the site.

Given the lack of structural features on site during WWII it has not been possible to discern obvious indications of damage on site within historical OS mapping, such as missing or ruined pre-war structures. Given the sites war-time composition, access, is also anticipated to have been infrequent. Infrequent access increases the likelihood that obvious signs of UXO would have gone unnoticed and unreported.

Recommendations

Although no direct evidence could be found to suggest that the site footprint was subject to bombing, it has not been possible to discount the risk from UXO at this stage, due to its proximity to RAF Weston-on-the Green and a number of documented raids in its surroundings. Further research is therefore recommended in the form of a Detailed UXO Risk Assessment.

Additional records, for instance RAF site plans, aerodrome log books, local ARP bombing records and WWII-era aerial photography, would be required in ordered determine the sites exact location in relation to the Weston-on-Green airfield, and whether it did sustain any bombing as a result of its position in relation to this target. If it is possible to account of all of the bombs which fell in relation to the airfield, and none are located in close proximity to the site, it should be possible to discount the possibility of UXO contamination.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1st Line Defence.





Appendix E – Detailed Unexploded Ordnance Risk Assessment



1ST LINE DEFENCE



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Great Wolf Lodge
Client	Curtins
Site Address	Great Wolf Lodge, Bicester Hotel Golf & Spa, Chesterton, Bicester OX26 1TE
Report Reference	DA8343-00
Date	3 rd April 2019
Originator	JMa



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Executive Summary

Site Location and Description

The site is located in Chesterton, within the Cherwell District of Oxfordshire. It is bound north by the A4095 and west by the M40. It is generally bordered east by structures associated with the Bicester Golf Club. To the south it is bordered by hardstanding open ground, a recreation ground, and two detached structures.

The site is situated within Bicester Golf Club. It encompasses the western section of the golf course. It is occupied by open land, varying degrees of vegetation and several bodies of water.

The site is approximately centred on the OS grid reference: **SP 5496821678**.

Proposed Works

Information regarding the exact scope of the proposed works was unavailable during the production of this report. From the provided site plan it is understood that a number of site investigation works are planned across the site footprint.

Geology and Bomb Penetration Depth

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 a **Low Risk** from both items of German aerial delivered UXO and Allied UXO across the site. This assessment is based on the following factors:

- The site is situated to the west of the village of Chesterton. During WWII this area was located in the Rural District of Ploughley. According to Home Office (HO) statistics this area sustained a very-low density of bombing with 3.5 bombs dropped per 1,000 acres.
- Despite this density, available records indicate that Chesterton, was subject to three air-raids during the initial stages of the war, largely due to its proximity to RAF Weston-on-the-Green. ARP Logbooks for Oxfordshire record these incidents on the 9th August 1940; 25th/26th August 1940; and 26th/27th August 1940. After this point, there was bombing recorded in the wider area, on RAF Weston-on-the-Green, RAF Bicester, and the village of Little Chesterton, but no further incidents were recorded to have affected Chesterton.
- A precise location of the incidents affecting Chesterton is not given, but it is stated that the bombs dropped on the 26th/27th fell in 'fields'. The time and amount of bombs was also recorded. The raids on the 9th August 1940; 25th/26th August 1940; and 26th/27th August 1940 resulted in 11 HE bombs, 8 HE plus 100 incendiary bombs and 3 HE bombs being dropped respectively. Therefore, it is likely that air-raid incidents within this area were well investigated due to their light and sporadic nature.
- A 1948 photograph of the site area, presented in **Annex J**, indicates that the majority of the site was comprised of well-maintained agricultural fields. Therefore, they were likely accessed on an intermittent basis during Harvest seasons. The northern section of the site, which was occupied by a quarry, would have experienced more consistent access. The lack of dense vegetation, within the agricultural fields, would have made UXO more apparent within the site.
- Based on these conditions and the lack of evidence within any of the available bomb records to suggest that any bomb strikes fell specifically on or next to the site, the risk from UXO is considered to be low and has not been elevated above the 'background' level of risk for the region.



Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Great Wolf Lodge Site:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

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
JSEOD	Joint Services Explosive Ordnance Disposal
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

Contents

Executive Summary	II
Glossary	IV
Contents	V
Annexes	VII
1. Introduction	1
1.1. <i>Background</i>	1
2. Method Statement	2
2.1. <i>Report Objectives</i>	2
2.2. <i>Risk Assessment Process</i>	2
2.3. <i>Sources of Information</i>	2
3. Background to Bombing Records	3
3.1. <i>General Considerations of Historical Research</i>	3
3.2. <i>German Bombing Records</i>	3
3.3. <i>Allied Records</i>	3
4. UK Regulatory Environment and Guidelines	4
4.1. <i>General</i>	4
4.2. <i>CDM Regulations 2015</i>	4
4.3. <i>The 1974 Health and Safety at Work etc. Act</i>	4
4.4. <i>CIRIA C681</i>	5
4.5. <i>Additional Legislation</i>	5
5. The Role of Commercial UXO Contractors and The Authorities	5
5.1. <i>Commercial UXO Specialists</i>	5
5.2. <i>The Authorities</i>	6
6. The Site	6
6.1. <i>Site Location</i>	6
6.2. <i>Site Description</i>	6
7. Scope of the Proposed Works	6
7.1. <i>General</i>	6
8. Ground Conditions	7
8.1. <i>General Geology</i>	7
8.2. <i>Site Specific Geology</i>	7
9. Site History	7
9.1. <i>Introduction</i>	7
9.2. <i>Ordnance Survey Historical Maps</i>	7
10. Introduction to German Aerial Delivered Ordnance	8
10.1. <i>General</i>	8
10.2. <i>Generic Types of WWII German Aerial Delivered Ordnance</i>	8
10.3. <i>Failure Rate of German Aerial Delivered Ordnance</i>	9
10.4. <i>UXB Ground Penetration</i>	9
10.4.1. <i>The J-Curve Effect</i>	9
10.4.2. <i>WWII UXB Ground Penetration Studies</i>	9
10.4.3. <i>Site Specific Bomb Penetration Considerations</i>	10
10.5. <i>V-Weapons</i>	10

11.	The Likelihood of Contamination from German Aerial Delivered UXBs	11
11.1.	<i>World War I</i>	11
11.2.	<i>World War II Bombing of Rural District of Ploughly</i>	11
11.3.	<i>WWII Home Office Bombing Statistics</i>	12
11.4.	<i>RAF Airfield Logbooks</i>	12
11.5.	<i>Oxfordshire Local Bomb Incident ARP Records</i>	13
11.6.	<i>WWII-Era Aerial Photography</i>	13
11.7.	<i>Abandoned Bombs.....</i>	13
11.8.	<i>Bomb Disposal Tasks</i>	14
11.9.	<i>Evaluation of German Aerial Delivered UXO Records.....</i>	14
12.	Introduction to Allied Explosive Ordnance	15
12.1.	<i>General</i>	15
12.2.	<i>Defending the UK From Aerial Attack.....</i>	16
12.2.1.	<i>Anti-Aircraft Artillery (AAA)</i>	16
13.	The Likelihood of Contamination from Allied Ordnance	17
13.1.	<i>Introduction</i>	17
13.2.	<i>Military History of the Site of Proposed Works</i>	17
13.3.	<i>Evaluation of Contamination Risk from Allied UXO</i>	18
14.	The Likelihood of UXO Contamination Summary	20
15.	The Likelihood that UXO Remains	21
15.1.	<i>Introduction</i>	21
15.2.	<i>UXO Clearance.....</i>	21
15.3.	<i>Post-war Redevelopment</i>	21
16.	The Likelihood of UXO Encounter	22
16.1.	<i>Introduction</i>	22
16.2.	<i>Encountering Aerial Delivered Ordnance.....</i>	22
17.	The Likelihood of UXO Initiation	23
17.1.	<i>Introduction</i>	23
17.2.	<i>Initiating Aerial Delivered Ordnance</i>	23
18.	Consequences of Initiation/Encounter	24
18.1.	<i>Introduction</i>	24
18.2.	<i>Consequences of Detonation</i>	24
19.	1st Line Defence Risk Assessment	24
19.2.	<i>Assessed Risk Level</i>	24
20.	Proposed Risk Mitigation Methodology	25
20.1.	<i>General</i>	25
	Bibliography.....	26

Annexes

List of Report Annexes	
Annex A	Site Location Maps
Annex B	Recent Aerial Photography
Annex C	Client Provided Site Plan
Annex D	Pre and Post-WWII Historical Maps
Annex E	Examples of German Aerial Delivered Ordnance
Annex F	The 'J-curve' Effect Principle
Annex G	Examples of UXO Incidents
Annex H	WWI Bomb Plot Map
Annex I	Oxfordshire ARP Logbooks
Annex J	1948 RAF Aerial Photography of the Site
Annex K	Examples of Anti-Aircraft Projectiles

1st Line Defence Limited

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Great Wolf Lodge
Client: Curtins

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Curtins to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at the proposed Great Wolf Lodge site.

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.'

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 Great Wolf Lodge. 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 aerial 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 and Oxfordshire History Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Curtins.
- Available material from 33 Engineer Regiment (EOD) Archive (now 28 Regt).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to The National Archives and Oxfordshire History Centre.

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.'¹

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.

¹ <http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/>.

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 co-ordinators, 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 on 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 UXO for 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 aerial 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.

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 (JSEOD) to arrange for investigation and/or disposal. 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 JSEOD's 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 JSEOD 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.

6. The Site

6.1. Site Location

The site is located in Chesterton, within the Cherwell District of Oxfordshire. It is bound north by the A4095 and west by the M40. It is generally bordered east by structures associated with the Bicester Golf Club. To the south it is bordered by hardstanding open ground, a recreation ground, and two detached structures.

The site is approximately centred on the OS grid reference: **SP 5496821678**.

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

6.2. Site Description

The site is situated within Bicester Golf Club. It encompasses the western section of the golf course. It is occupied by open land, varying degrees of vegetation and several bodies of water.

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

Information regarding the exact scope of the proposed works was unavailable during the production of this report. From the provided site plan it is understood that a number of site investigation works are planned across the site footprint.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows that the bedrock of the site is comprised of Limestone of the Cornbrash Formation. There are no superficial deposits recorded for the site.

8.2. Site Specific Geology

Site-specific geotechnical data was not available during the production of this report.

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.

WWI Period		
Date	Scale	Description
1900	1,10,560	This map indicates that the site was occupied by open ground. A path can be viewed crossing the centre of the site from north to south. An area labelled 'Chesterton Belt' can be viewed to the north of the site.

Pre-WWII		
Date	Scale	Description
1922	1,2,500	This map edition indicates the presence of a quarry within the northern section of the site. No other change of note could be identified since the previous map edition.

Post-WWII		
Date	Scale	Description
1955	1,10,560	This map does not appear to show any significant change since the previous edition.

10. Introduction to German Aerial 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 aerial delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Aerial 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 aerial 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 **Annex E**.

Generic Types of WWII German Aerial 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 F). 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)	There were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs generally would 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.

10.3. Failure Rate of German Aerial Delivered Ordnance

It has been estimated that 10% of WWII German aerial 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 and 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 G**.

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 Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial 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 F**).

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 made as to 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.

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 have been used:

- WWII geology – Cornbrash 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 lack or limitations of site specific geotechnical information. An assessment can be made once such 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 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

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 since even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time.

11. The Likelihood of Contamination from German Aerial 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. A WWI map of air raids and naval bombardments across England is presented in **Annex H**. This source does not record any WWI bombing incidents to have affected the region of the site.

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 Rural District of Ploughly

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 Ploughley Rural District, which sustained a low density of bombing according to Home Office statistics, with an average of 3.5 items recorded per 1,000 acres. Air raids in the vicinity were fairly sparse, owing to the region's largely rural nature, its distance from major cities and the lack of any significant strategic or industrial targets. The many airfields in the area were however targeted on occasion, primarily during 'tip and run' raids, when Luftwaffe bombers would drop their remaining cargo on any facilities on their route home. Weston-on-the-Green airfield, situated approximately 1.25km south-west of the site, was bombed in this regard, becoming the most heavily bombed location in Oxfordshire. RAF Bicester, situated approximately 5km to the north-east, was also attacked, on the 13th of October 1940.

Records of bombing incidents in the civilian areas of Bicester were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. 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 for Bicester are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German aerial delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Rural District of Ploughly between 1940 and 1945.

Record of German Ordnance Dropped on the Rural District of Ploughly		
Area Acreage		79,910
Weapons	High Explosive bombs (all types)	275
	Parachute mines	0
	Oil bombs	3
	Phosphorus bombs	0
	Fire pots	0
	Pilotless aircraft (V-1)	0
	Long range rocket bombs (V-2)	0
Total		278
Number of Items per 1,000 acres		3.5

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 were not recorded, both types of item should not be overlooked when assessing the general risk to personnel and equipment.

11.4. RAF Airfield Logbooks

The logbooks of RAF Weston-on-the-Green and Bicester were consulted during the production of this report. RAF Weston-on-the-Green is located approximately 1km south-west of the site and acted as a satellite ground for RAF Bicester, which was situated 5km to the north-east.

No references to any bombing incidents on the site or the immediate surrounding area could be found within these records.

11.5. Oxfordshire Local Bomb Incident ARP Records

Bomb incident records were obtained from Oxfordshire History Centre. This record was compiled by local Air Raid Precaution (ARP) personnel and volunteers during the war and covers the whole county. A description of the associated written records for bombs which fell in the site area is presented in the table below. Imagery of these entries are presented in **Annex I**.

Oxfordshire Bomb Incident Records	
Date Range	Comments
9 th August 1940	Eleven HE bombs were dropped in a straight line between Weston-on-the-Green and Chesterton.
25 th /26 th August 1940	Eight HE bombs were dropped on Chesterton. A 'large number' (approximately 100) incendiary bombs were also dropped over the Bicester area, including a great number in the Weston-on-the Green-District.
26 th /27 th August 1940	Three HE bombs were dropped on Chesterton. This record provides further detail, stating that these bombs were dropped in a field.
2 nd /3 rd September 1940	Six HE bombs were dropped between Weston-on-the-Green and Little Chesterton. The record states the bombs fell in open fields.
12 th /13 th August 1941	A plane was shot down by enemy aircraft at Weston-on-the-Green.

11.6. WWII-Era Aerial Photography

A high-resolution scan of WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photograph provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (see **Annex J**).

WWII-Era Aerial Photography	
Date	Description
16 th May 1948	This photograph shows that the site was mainly occupied by well-maintained agricultural fields. A quarry can be viewed in the northern area of the site. There does not appear to be any signs of obvious bomb damage such as cratering or ground disturbance. A wider view of the site area, showing its distance from RAF Weston-on-the-Green, RAF Bicester and the village of Chesterton is presented in Annex J2 .

11.7. 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.

11.8. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) (now 29 Regt) is currently facing considerable delay. 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 Curtins will be advised.

11.9. Evaluation of German Aerial Delivered UXO Records

Factors	Conclusion
<p>Density of Bombing</p> <p><i>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.</i></p>	<p>During WWII the site was located in the Rural District of Ploughley. According to Home Office (HO) statistics this area sustained a very-low density of bombing with 3.5 bombs dropped per 1,000 acres.</p> <p>Despite this low density the Chesterton area sustained several air raids during WWII, largely due to its proximity to RAF Weston-on-the-Green. ARP Logbooks for Oxfordshire record three notable incidents on/near the village on the 9th August 1940; 25th/26th August 1940; and 26th/27th August 1940. The bombs dropped on 26th/27th August 1940 fell in a field.</p> <p>After this point, there was bombing recorded at RAF Weston-on-the-Green, RAF Bicester and Little Chesterton but no further incidents were recorded to have affected Chesterton itself.</p>
<p>Damage</p> <p><i>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.</i></p>	<p>A post-WWII aerial photograph, dated 16th March 1948, does not show any visible signs of bomb damage on or near the site. Signs such as cratering and ground disturbances do not appear to be present.</p>
<p>Access Frequency</p> <p><i>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.</i></p>	<p>The two main features occupying the site were agricultural fields and a quarry.</p> <p>It is anticipated that the agricultural fields would have been used more frequently during harvest season as opposed to colder seasons. Therefore, it is likely that the majority of the site would have been subject to intermittent access. The area that was occupied by a quarry may have experienced more consistent access than the remaining areas of the site.</p> <p>It is anticipated that air raids within this area would have been well investigated due to their relative novelty. The ARP Logbooks indicate that incidents within open ground were often reported.</p>

Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	<p>The photograph, presented in Annex J, indicates that the agricultural fields appear to have been well maintained and lacking in pockets of dense vegetation. Therefore, it is anticipated that the majority of the site would have been relatively conducive to the observation of UXO.</p> <p>The area occupied by the quarry would have been less conducive. The possible presence of sand, gravel, and stone would have obscured signs of UXO.</p>
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	1 st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1 st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1 st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

12. Introduction to Allied Explosive 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 were usually subject to clearance before they 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 however 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
<ul style="list-style-type: none"> • Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII. 	<ul style="list-style-type: none"> • 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.

12.2.1. 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 LSA 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	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as "Z" batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The closest recorded HAA to the site was located approximately 11km south-west of the site, however the range of a projectile can be up to 15km. The site would also have been in range of mobile light anti-aircraft guns.

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial 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 Aerial Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex K**.

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. Military History of the Site of Proposed Works

The site is located approximately 1.25km north-east of RAF Weston-on-the-Green.

It is understood that the airfield was built in open land acquired by the Royal Flying Corps in 1916 as the No 28 Training Depot Station. It was subsequently closed in 1921 and became used for agriculture in 1922. The airfield was requisitioned at the outbreak of WWII, acting as a satellite ground for RAF Brize Norton and RAF Bicester. During the war, it was subject to bombing on several occasions.

Following the end of WWII, the site was transferred to the control of Upper Hayford, and subsequently was used as a dropping zone for training parachutists. The airfield remains active today and is currently in use as a military and civilian gliding centre.

13.3. Evaluation of Contamination Risk from Allied UXO

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

Sources of Allied UXO Contamination	Conclusion
<p>Military Camps</p> <p><i>Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.</i></p>	<p>1st Line Defence could find no evidence of a military camp within the site.</p> <p>In-house geo-data set does indicate that the site is located approximately 2.8 km from the Bicester Garrison and the Central Ordnance Depot at Bicester. However, given the distance of this military feature from the site, this feature is not anticipated to elevate the risk of Allied UXO on site.</p>
<p>Anti-Aircraft Defences</p> <p><i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i></p>	<p>1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site, although such features may have been employed to defend nearby RAF stations. The closest HAA was located approximately 11km south-west of the site, however the range of a projectile can be up to 15km.</p> <p>The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.</p>
<p>Home Guard Activity</p> <p><i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i></p>	<p>1st Line Defence has no evidence of any Home Guard activities on the site.</p>
<p>Defensive Positions</p> <p><i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i></p>	<p>There is no evidence of any defensive features formerly located on or bordering the site footprint.</p>
<p>Training or firing ranges</p> <p><i>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.</i></p>	<p>There is no evidence of such features affecting the site.</p>
<p>Defensive Minefields</p> <p><i>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.</i></p>	<p>There is no evidence of defensive minefields affecting the site.</p>
<p>Ordnance Manufacture</p> <p><i>Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.</i></p>	<p>No information of ordnance being stored, produced, or disposed of within the proposed site could be found.</p>



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 of a military airfield. It was however situated approximately 1.25km north-east of RAF Weston-on-the-Green, see [Section 13.2](#) for more information. Given its distance, this feature is not anticipated to elevate the risk of Allied UXO on site.

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German aerial 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	<p>The research has evaluated pre- and post-WWII Ordnance Survey maps, RAF Airfield Logbooks, Oxfordshire ARP Logbooks, and a high-resolution post-WWII era aerial photograph.</p> <p>The record set is of generally satisfactory quality. The high-resolution post-WWII era aerial photograph is able to accurately show the wartime condition of the site. The ARP Logbooks also provide a relatively comprehensive account of German bombing incidents within the site's locality. However, the precise location of incidents is not often stated.</p>
German Aerial Delivered Ordnance	<ul style="list-style-type: none"> • The site is situated to the west of the village of Chesterton. During WWII this area was located in the Rural District of Ploughley. According to Home Office (HO) statistics this area sustained a very-low density of bombing with 3.5 bombs dropped per 1,000 acres. • Despite this density, available records indicate that Chesterton, was subject to three air-raids during the initial stages of the war, largely due to its proximity to RAF Weston-on-the-Green. ARP Logbooks for Oxfordshire record these incidents on the 9th August 1940; 25th/26th August 1940; and 26th/27th August 1940. After this point, there was bombing recorded in the wider area, on RAF Weston-on-the-Green, RAF Bicester, and the village of Little Chesterton, but no further incidents were recorded to have affected Chesterton. • A precise location of the incidents affecting Chesterton is not given, but it is stated that the bombs dropped on the 26th/27th fell in 'fields'. The time and amount of bombs was also recorded. The raids on the 9th August 1940; 25th/26th August 1940; and 26th/27th August 1940 resulted in 11 HE bombs, 8 HE plus 100 incendiary bombs and 3 HE bombs being dropped respectively. Therefore, it is likely that air-raid incidents within this area were well investigated due to their light and sporadic nature. • A 1948 photograph of the site area, presented in Annex J, indicates that the majority of the site was comprised of well-maintained agricultural fields. Therefore, they were likely accessed on an intermittent basis during Harvest seasons. The northern section of the site, which was occupied by a quarry, would have experienced more consistent access. The lack of dense vegetation, within the agricultural fields, would have made UXO more apparent within the site. • Based on these conditions and the lack of evidence within any of the available bomb records to suggest that any bomb strikes fell specifically on or next to the site, the risk from UXO is considered to be low and has not been elevated above the 'background' level of risk for the region.

Allied Ordnance	<ul style="list-style-type: none"> • There is no evidence 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 site is situated approximately 1.25km south of RAF Weston-on-the-Green, which remains active today as a military gliding centre. It was built for use by the Royal Flying Corps in 1916 and was later used by the RAF as a satellite ground for RAF Brize Norton and RAF Bicester during WWII. However, given its distance this feature is not anticipated to elevate the risk from Allied UXO on site. • The risk from HAA or LAA projectiles is also considered to be Low. The conditions in which such projectiles may have fallen unnoticed within the site boundary are analogous to those regarding aerial delivered ordnance.
------------------------	--

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 Regt). It should also be noted that in addition to 29 Regt 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

Present-day aerial imagery indicates some post-war development to the site and vicinity. The site's western border is now defined by the M40, to the east the site is bordered by multiple structures. The quarry is no longer present. The different agricultural fields have been consolidated into one section of a larger golf course.

The risk of UXO remaining is considered to be substantially mitigated at the location of and down to the depths of such post-war foundation and excavation works.

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 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.

16.2. Encountering Aerial Delivered Ordnance

Since an aerial 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.

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 Aerial 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 (some examples are presented in **Annex G2**). 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.

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.

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 both German and Allied ordnance at the site of proposed works.

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

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at Great Wolf Lodge:

Type of Work	Recommended Mitigation Measure
All Works	<ul style="list-style-type: none"> 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

3rd April 2019

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



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Tel: +44 (0)1992 245 020

Client: **Curtins**

Project: **Great Wolf Lodge**

Ref: **DA8343-00**

Source: Google Maps


 **Approximate site boundary**





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Ref: **DA8343-00**

Source: Google Earth™ Mapping Services

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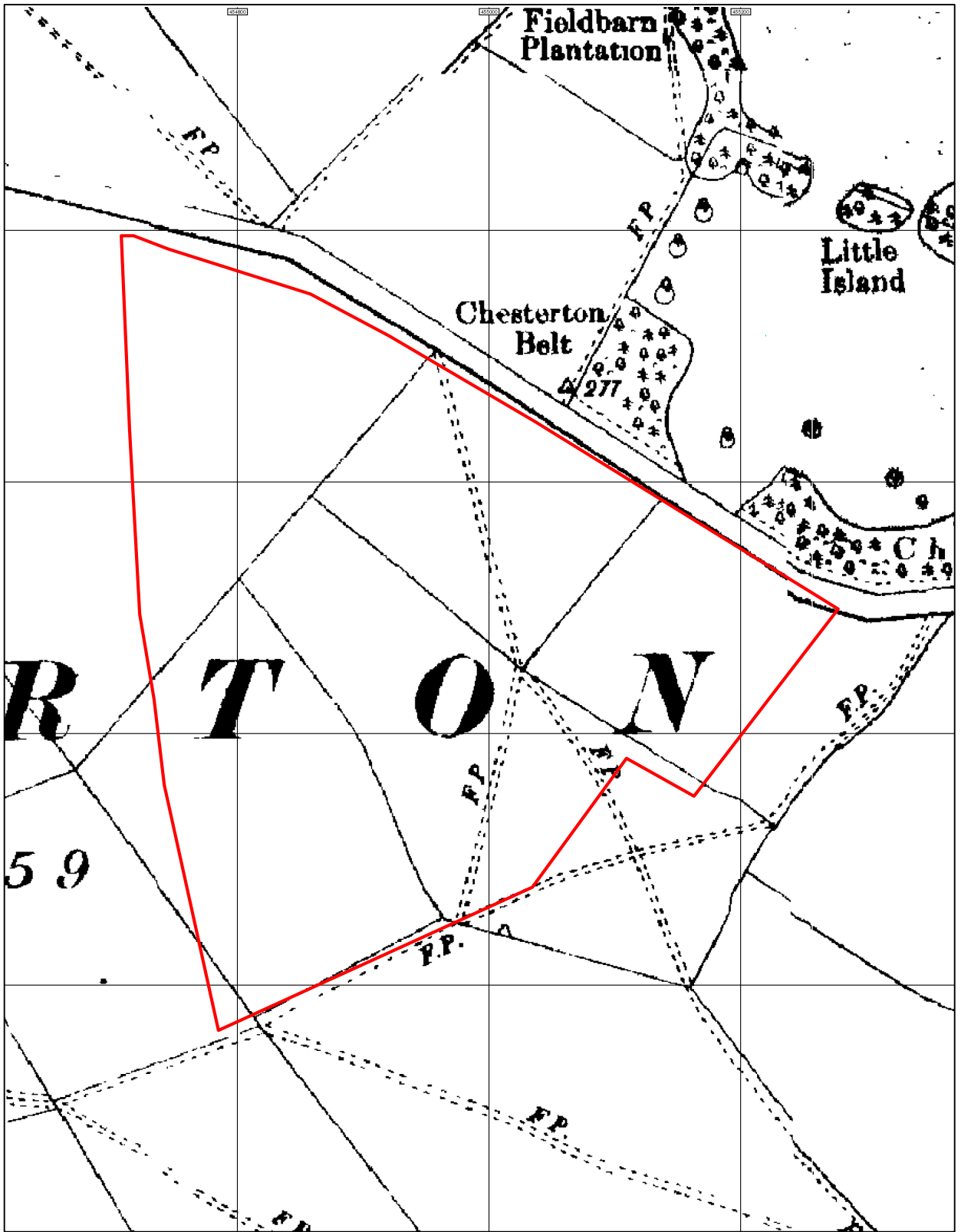
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Ref: **DA8343-00**

Source: Curtins



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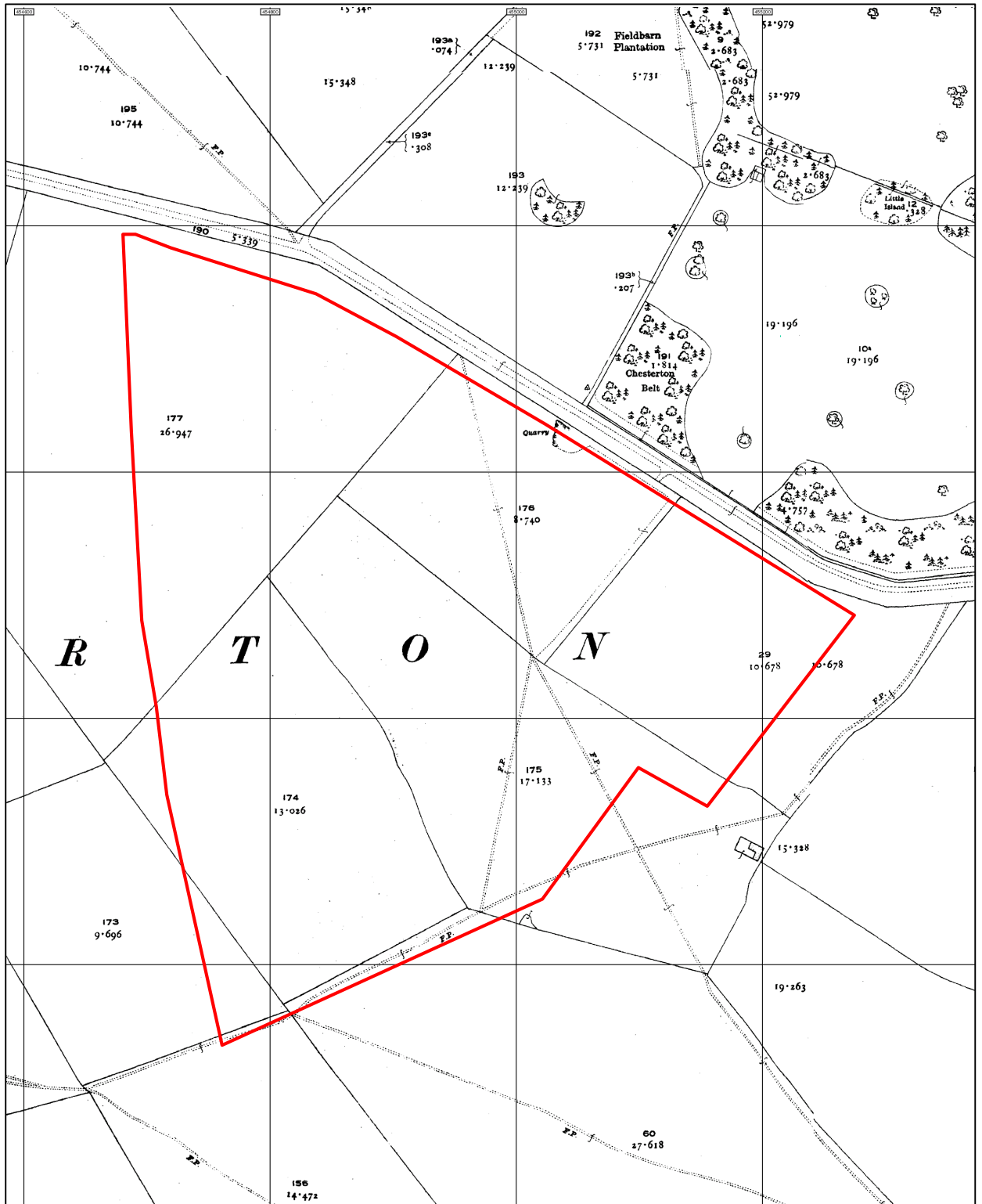
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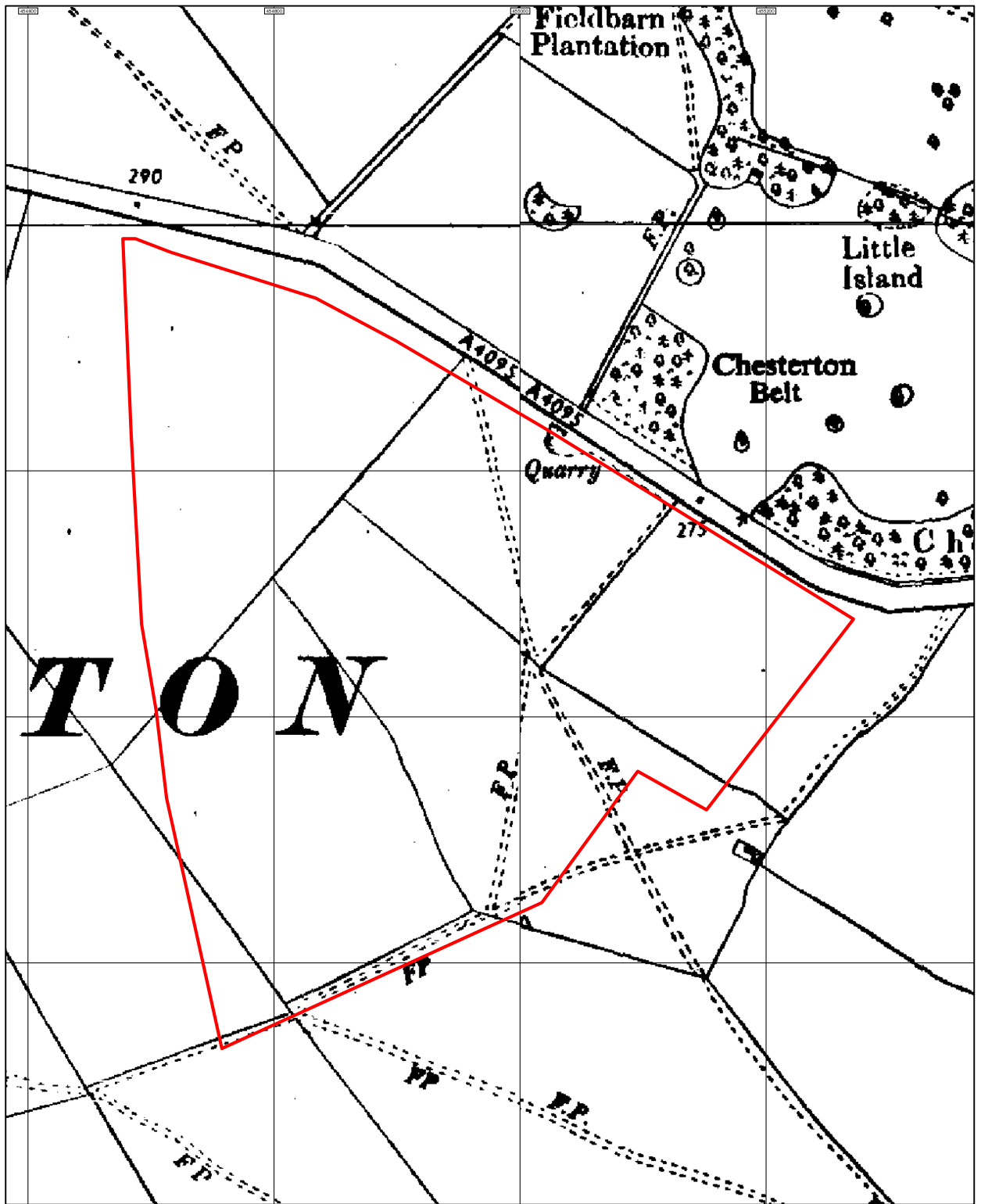
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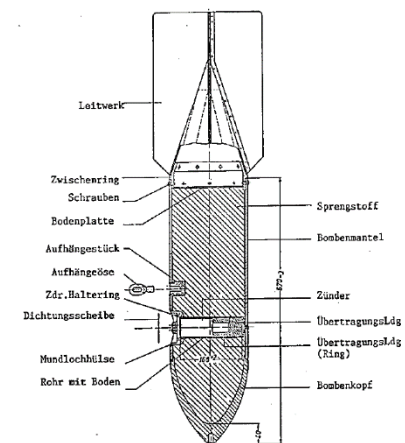
 **Approximate site boundary**



Examples of German Air-Delivered Ordnance

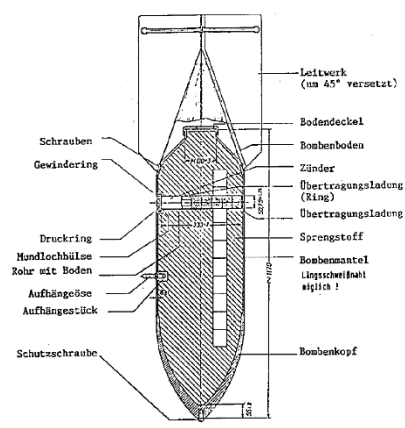
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

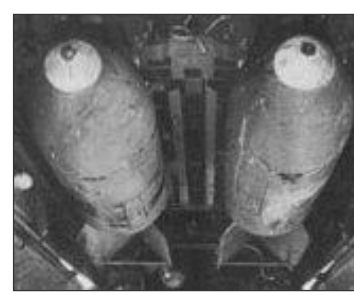
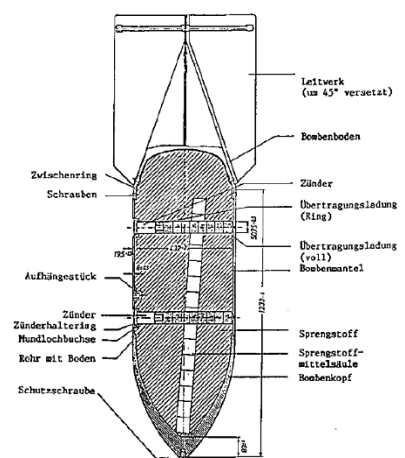


SC250 bomb being loaded onto German bomber



SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, triallene. Bombs recovered with Triallene filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming



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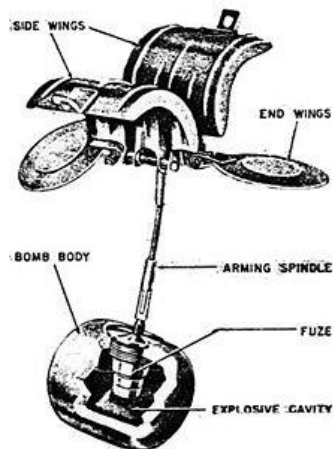
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Project: Great Wolf Lodge	
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Examples of German Air-Delivered Ordnance

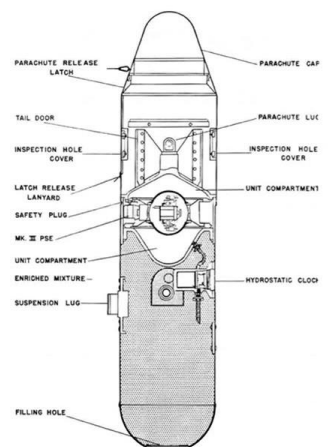
SD2 Anti-Personnel 'Butterfly Bomb'

Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it spun.



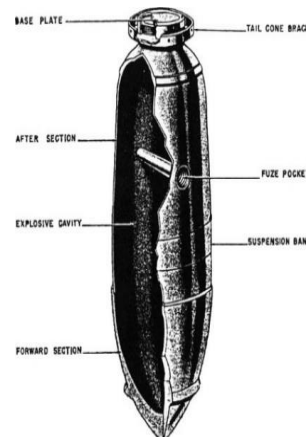
Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage in a 100m radius.



SC 1000kg

Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shiping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction.



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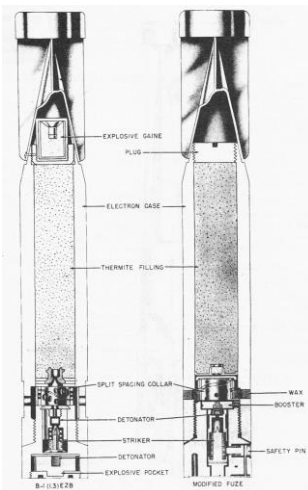
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German Incendiary Bombs

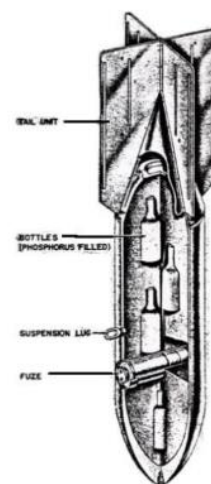
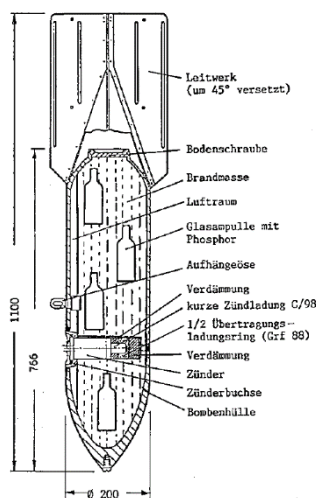
1kg Incendiary Bomb

Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)
Explosive Weight	Approx. 680g (1.5lb) Thermit 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters on towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



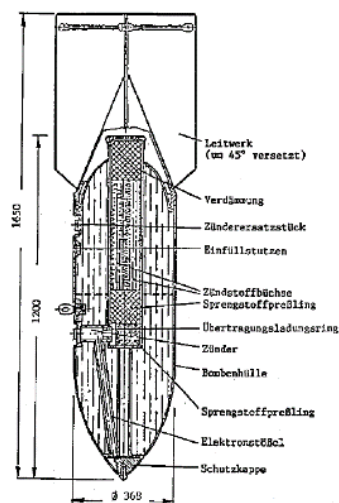
C50 A Incendiary Bomb

Bomb Weight	Approx. 41kg (90.4lb)
Explosive Weight	Approx. 0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against any targets where an incendiary effect is required
Remarks	Early fill was a phosphorus/carbon disulphide incendiary mixture



Flam C-250 Oil Bomb

Bomb Weight	Approx. 125kg (276lb)
Explosive Weight	Approx. 1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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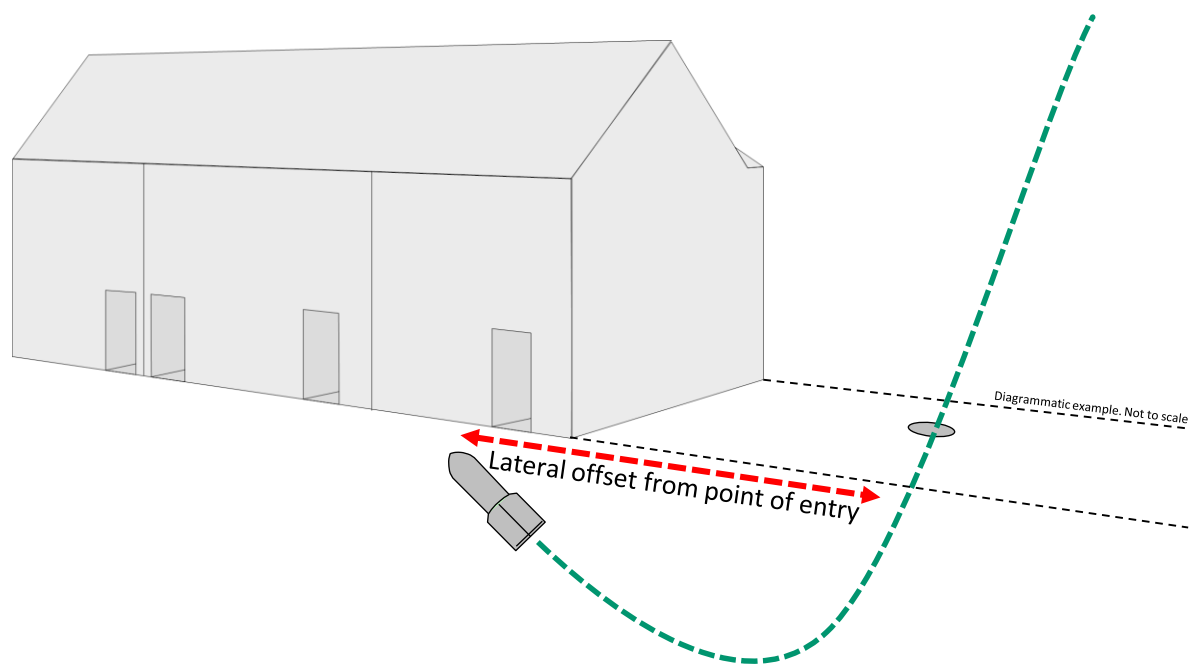
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'J-Curve' Effect



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 250kg bomb found in Bermondsey 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**).



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.

March 2015



Bethnal Green WW2 bomb: Experts remove unexploded device



An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

A 200m (650ft) exclusion zone was set up around the device.

August 2016



Bath WW2 bomb scare: Device defused, police say



A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The discovery of the bomb on Thursday led to the evacuation of hundreds of homes and many road closures in the Lansdown area of the city.

A cordon around the site was lifted on Friday evening, more than 24 hours after residents were asked to leave their homes.

May 2016



London City Airport reopens after WW2 bomb moved



London City Airport has reopened after an unexploded 500kg World War Two bomb was safely moved from the area.

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

All flights were cancelled on Monday after an exclusion zone was put in place, with the closure affecting up to 16,000 passengers and nearby residents being evacuated from their homes.

May 2015



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Client: Curtins	
Project: Great Wolf Lodge	
Ref: DA8343-00	Source: BBC News

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 astonishingly 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



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

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 struck 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



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Client: **Curtins**

Project: **Great Wolf Lodge**

Ref: **DA8343-00**

Source: Various news sources

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Unexploded Second World War bomb discovered under Somerset footpath

By Western Daily Press | Posted: January 21, 2014



The unexploded bomb was found in Somerset.

Comments (0)

An unexploded bomb dropped in Britain during the Second World War has finally been discovered - underneath a popular footpath in Somerset.

21 August 2014 Last updated at 15:01

Unexploded WW2 bomb found at Kenfig Pool, Bridgend



Dean Smith believes the shell was made in Germany

Bomb experts have been called to a south Wales nature reserve after an unexploded World War Two shell was discovered by a walker in Bridgend.

Dean Smith, 38, of Pyle, was walking near Kenfig Pool on Saturday when he saw a tin sticking out of the sand.

He reached down to pick it up, but ending up falling and landed with the 25-long (0.5m) bomb on top of him.

The site has been cordoned off by police and the Royal Logistics Corps will carry out a controlled explosion.

Related Stories

- 'Panic' as dog nearly drowns grenade
- WW2 bomb found at wind farm exploded
- WWII bomb found in kitchen cupboard

Mortar thought to be from WWII found on Oshawa's Camp-X grounds

August 24, 2016 | 5:42 am



What is believed to be a World War II mortar has been discovered in south Oshawa. A man out in Intrepid Park, the site of the Camp-X Second World War training grounds, discovered the round with his metal detector on Tuesday evening. Durham police are held the scene overnight awaiting military officials from Trenton to come and properly detonate the mortar.

Unexploded bomb found in farmer's field

17 May 2010



A live Second World War mortar shell was blown up by Army experts after a farmer found it in his field. The discovery was made in the field alongside the A20 between Folkestone and Dover.

The mortar shell, which was around a foot long and 3in in diameter, was around 50ft from the main road.

The farmer alerted police and PC Trevor Moody and PCSO Michelle Brady went to the field.

PC Moody contacted the Army who sent in a bomb disposal unit.

An Army officer confirmed the live shell was from the Second World War and was packed with high explosives.

They moved it a safe distance away from the A20 and carried out a controlled explosion.

PC Moody said: "Given that we live in an area that saw much action during the Second World War, it is not uncommon for us to be alerted about unexploded bombs."

The incident was on Thursday.

Click here for more news from Kent.

Royal Navy bomb disposal experts remove a World War Two shell discovered in a nature reserve

- A World War Two bomb was discovered in a Plymouth nature reserve
- Amateur metal detector found the shell and partially dug it up
- Royal Navy experts carried the explosive away before disposing of it

By VALERIE EDWARDS FOR MAILONLINE
PUBLISHED: 01:29, 13 January 2016 | UPDATED: 09:51, 13 January 2016

338 shares

A World War Two bomb was reportedly found at Efford Nature Reserve in Plymouth after a member of the public was metal detecting and partially dug it up.

The Royal Navy Bomb Disposal team was called in to remove the bomb and police have closed off Military Lane, with the possibility of Military Road also being closed.

Police were called at around 1.30pm yesterday after what appeared to be a shell was discovered and partially dug up near Military Lane, Efford.



Holiday beach cordoned off after landslide sends more than a THOUSAND Second World War bombs and rockets tumbling onto the sands

- Bad weather led to ground movement which exposed the huge arsenal at Mappleton, East Riding
- A dog walker stumbled across the deadly find on Saturday and 15 controlled explosions were carried out
- Rockets, mortar bombs and 25-pounder bombs were recovered after they were fired into the cliffs by RAF aircraft during the war
- Most of the devices were dummy rounds used for bombing practice but contain enough explosives to cause terrible injuries



Bomb Beach Alley: Rockets were found after a landslide on Mappleton beach in 2012

Army bomb disposal team called to Blacksole Bridge in Herne Bay

by Aidan Barlow | aibarlow@thekmgroupp.co.uk | 08 July 2015

It was like a scene from Dad's Army when Army bomb disposal experts found wartime explosives made by the Home Guard in makeshift bottles.

A team was called to the Blacksole Bridge in Herne Bay after the wartime bombs were found.

The team from the Royal Logistics Corps set up a 30 metre exclusion zone for pedestrians around the railway embankment after the suspected homemade phosphorous bombs were found.



The scene at Blacksole Bridge after wartime explosives were found in the railway cutting

Unexploded bomb found in Axminster

Update: The bomb disposal unit has made the device safe and the road has re-opened.

Six homes have been evacuated today after the discovery of an unexploded device in Axminster.

A Royal Navy bomb disposal team have been called to the scene after a 'historic German device' was discovered in a garden.

Police have set up a 20m cordon around the garden in Alexandra Road and evacuated homes in the surrounding area as a precaution.



Storms and floods unearth unexploded wartime bombs

By Claire Marshall
BBC environment correspondent

There has been a dramatic increase in the number of wartime bombs unearthed because of the winter storms and flooding.

Bomb disposal teams in the South West have dealt with double the number of unexploded ordnance than in the same period last year.

Since mid December, the Royal Navy's Southern Dive Unit has retrieved or disposed of 244 items of ordnance.

During the same period last year, they dealt with just 108 items.

Almost 70 years after the end of WWII, one legacy of that conflict continues to turn up on beaches and harbours around Britain.

Unexploded shells, bombs and mines continue to be discovered every year, and the Royal Navy's Southern Dive Unit is tasked with making these devices safe.

Its area of responsibility stretches for some 2,250km (1,400 miles). It begins from the highwater mark in Hull and proceeds seaward to the territorial limit, and then runs clockwise around the British Isles - including the Isle of Wight, Channel Islands, and Isles of Scilly - to finish in Liverpool.

Related Stories

- Ancient trees revealed by storms



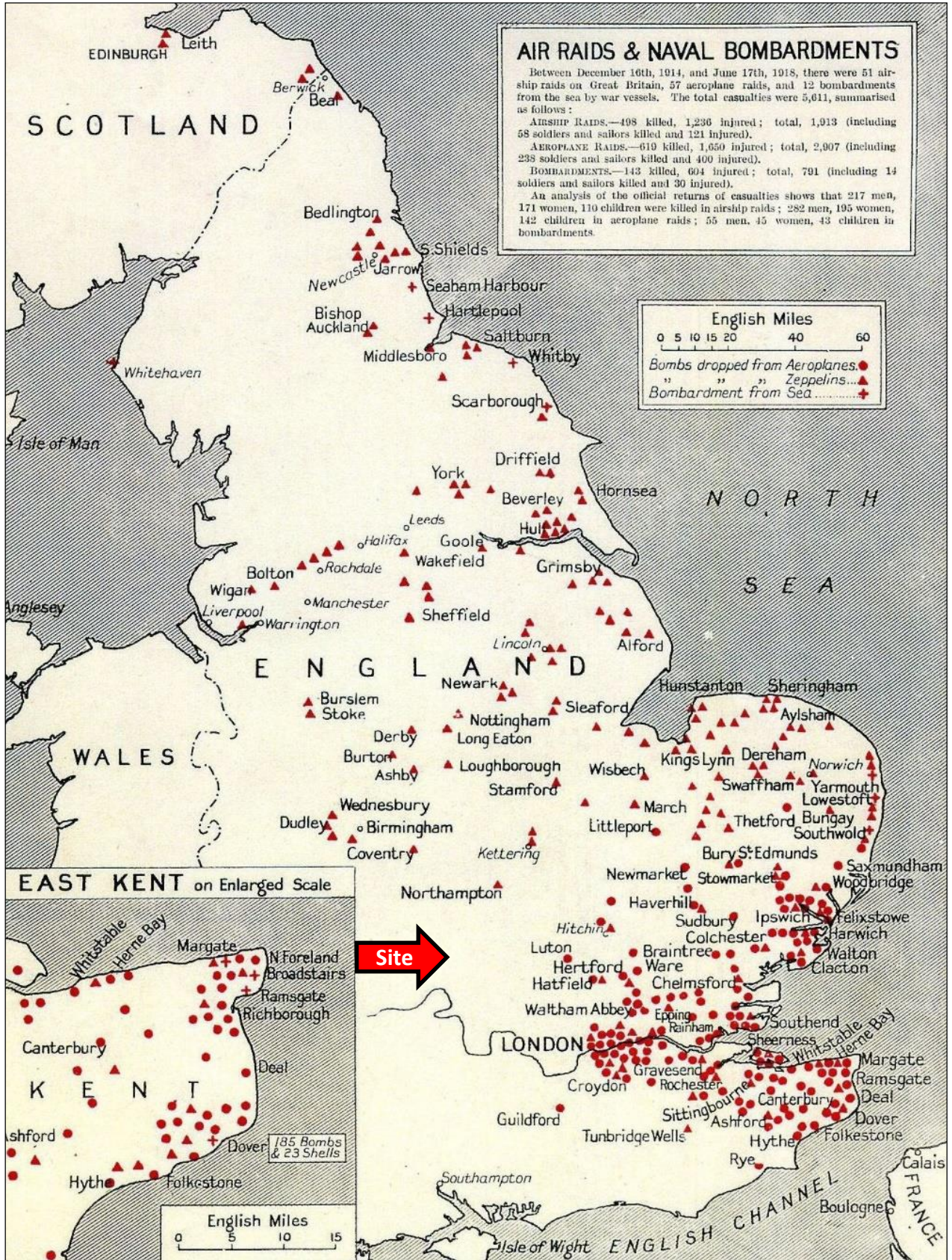
Land Service Ammunition (LSA) resulting from historic military activity is commonly encountered across the UK by the public and construction industry alike. Such finds are much more common in rural areas than in urban environments, and can often be anticipated in areas such as former RAF stations or ranges. However, many such items are encountered entirely by surprise where the landowner or developer has no knowledge of any previous military use of the land.



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Project: Great Wolf Lodge	
Ref: DA8343-00	Source: Various news sources
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REGISTER OF AIR RAIDS AND ALARMS

DATE 9th AUGUST, 1940.

I. SIGNALS

TIME

- a. Air Raid message Yellow
- b. Lights warning Purple
- c. Action warning Red
- d. Cancel action White

II. BOMBS

No. dropped

High Explosive ✓ 16 (at 2317/9)

Medium

Incendiary

Smoke

Delayed action

Unexploded

Poison Gas: Type:-

Machine Gunning

Where dropped WESTON-ON-THE-GREEN AND CHESTERTON.

Remarks. 5 bombs dropped on Aerodrome emergency landing ground and 11 in a straight line between Weston-on-the-Green and Chesterton. All bombs were of small calibre forming small craters. Explosions were heard at a considerable distance. Bicester A.R.P. personnel mobilised on hearing bombs dropped. A bundle of Hitler's speech leaflets were dropped at Piddington.



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Client: Curtins

Project: Great Wolf Lodge

Ref: DA8343-00

Source: Oxfordshire History Centre

REGISTER OF AIR RAIDS AND ALARMS

DATE 25th/26th AUGUST, 1940.

I. SIGNALS		TIME
a. Air Raid message	Yellow	-
b. Lights warning	Purple	2221/25
c. Action warning	Red	-
d. Cancel action	White	0453/26

II. BOMBS		No. dropped
High Explosive		22 (between 2258/25 and 2300/25)
Medium		6 at 0400/26
Incendiary		100 (estimated - see remarks)
Smoke		
Delayed action		
Unexploded	2 (H.E.) - 1 Cottisford and 1 Tackley.	
Poison Gas:	3 (I.B.) - Chesterton.	
	Type:-	

Machine Gunning

Where dropped HIGHFIELD, COTTISFORD (5 H.E.), CHESTERTON (8 H.E.), LITTLE CHESTERTON (4 H.E.), WESTON-ON-THE-GREEN (5 H.E.), TACKLEY (2 H.E.) KIRTLINGTON, SHIPTON-ON-CHERWELL, (4 H.E.)

Remarks. According to Mr. Stenning, it is estimated that a large number (100) of Incendiary Bombs were dropped over the Bicester Area, but the correct number cannot be ascertained. A great number of these Incendiary Bombs were dropped in the Weston-on-the-Green district. Whilst they were still flaring on the ground another 'plane dropped H.E. Bombs amongst them.



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Client: Curtins	
Project: Great Wolf Lodge	
Ref: DA8343-00	Source: Oxfordshire History Centre

REGISTER OF AIR RAIDS AND ALARMS

DATE 26th/27th AUGUST, 1940.

I. SIGNALS			TIME
a.	Air Raid message	Yellow	2128/26
b.	Lights warning	Purple	2134/26
c.	Action warning	Red	-
d.	Cancel action	White	0400/27

II. BOMBS		No. dropped
High Explosive		22
Medium		
Incendiary		16
Smoke		
Delayed action		
Unexploded	13 (H.E.)	
Poison Gas:	1 (I.B.)	
	Type:-	

Machine Gunning

Where dropped NORTH ASTON (12 unexploded H.E. 0005/27), WESTON-ON-THE-GREEN (7 H.E. 2155/26), CHESTERTON (3 H.E. 2255/26), ISLIP (1 H.E. 2230/26), STEEPLE BARTON (4 H.E. 2245/26), DUNS TEW (2 I.B. and 1 unexploded I.B.), TACKLEY (4 I.B. 0120/27), COTTISFORD & JUNIPER (4 H.E. 2230/26), BIGNELL PARK, NR. BICESTER (3 H.E. 1 unexploded H.E. 2221/26), DRAYTON (2 I.B.), IRONSTONE WORKS RAILWAY, NR. DRAYTON (2 I.B.), DIGWOOD FARM, WEST OF BANBURY (2 I.B.), HANWELL (4 I.B.)



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Project: Great Wolf Lodge

Ref: DA8343-00

Source: Oxfordshire History Centre

III. SERVICES CALLED REMARKS. At Islip bombs dropped in garden of a house. Bombs dropped between Barton and Wootton fell in open country or woods. The target possibly was Heyford R.A.F. Station. At Weston-on-the-Green the bombs dropped in a field, the target in this instance presumably being the Weston-on-the-Green R.A.F. Landing Ground. The bombs dropped at Chesterton also fell in a field. At Tackley the incendiary bombs set fire to stubble in a field, the target possibly being Shipton Cement Works. No damage was done at Duns Tew. At Cottisford and Juniper no damage was done, the target presumably being Tusmore R.A.F. Landing Ground. Flares are reported to have been dropped by enemy 'planes in several areas, and one report received stated that enemy 'planes were showing searchlights. A small fire was started at Northleigh Common, Northleigh at 0300/27 hours. It is thought that this may have been caused by incendiary bombs.

IV. DAMAGE

a. Utilities

 Gas _____

 Electricity _____

 Water _____

 Sewers _____

 G. P. O. LINES _____

b. Roads _____

c. Buildings ISLIP. Outhouses damaged. 2 dwelling houses had windows and doors blown out, ceilings down and slates blown off.

BIGNELL PARK. Summerhouse demolished.

d. Livestock ISLIP. 1 pig and 1 chicken killed.

V. CASUALTIES NIL.

Deaths			Injured		
M.	F.	C.	M.	F.	C.



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Project: **Great Wolf Lodge**

Ref: **DA8343-00**

Source: Oxfordshire History Centre

REGISTER OF AIR RAIDS AND ALARMS

DATE 2nd/3rd SEPTEMBER, 1940.

I. SIGNALS

		TIME
a. Air Raid message	Yellow	-
b. Lights warning	Purple	2235/2
c. Action warning	Red	-
d. Cancel action	White	0248/3

II. BOMBS

No. dropped

High Explosive 7 (at 2355/2)
 Medium
 Incendiary
 Smoke
 Delayed action
 Unexploded
 Poison Gas: Type:-

Machine Gunning

Where dropped Between WESTON-ON-THE-GREEN and LITTLE CHESTERTON (6 H.E.)
 OTMOOR BOMBING GROUND (1 H.E.)

Remarks. The bombs at Weston and Little Chesterton fell in open fields.
 The bomb at Otmoor fell half a mile from Murcot.



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Client: Curtins

Project: Great Wolf Lodge

Ref: DA8343-00

Source: Oxfordshire History Centre

REGISTER OF AIR RAIDS AND ALARMS

PAGE 114.

DATE 12th/13th AUGUST, 1941.

I. SIGNALS

		TIME
a. Air Raid message	Yellow	2335/12
b. Lights warning	Purple	2350/12
c. Action warning	Red	0023/13
d. Cancel action	White	0145/13

II. BOMBS

No. dropped

High Explosive 8 (at 0030/13)

Medium

Incendiary

Smoke

Delayed action

Unexploded

Poison Gas: Type:-

Machine Gunning

Where dropped KIDLINGTON.

Remarks. 7 H.E. bombs were dropped on the Kidlington R.A.F. Landing Ground, running north to south. The eighth was dropped on the south side of Langford Lane in a potato field. Two training 'planes were also attacked by enemy aircraft at 0030/13. One was shot down at Weston-on-the-Green and the other crashed one mile north of Sturdy's Castle in the Parish of Tackley. Both occupants were killed.



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Source: Oxfordshire History Centre



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Client: **Curtins**

 **Approximate site boundary**

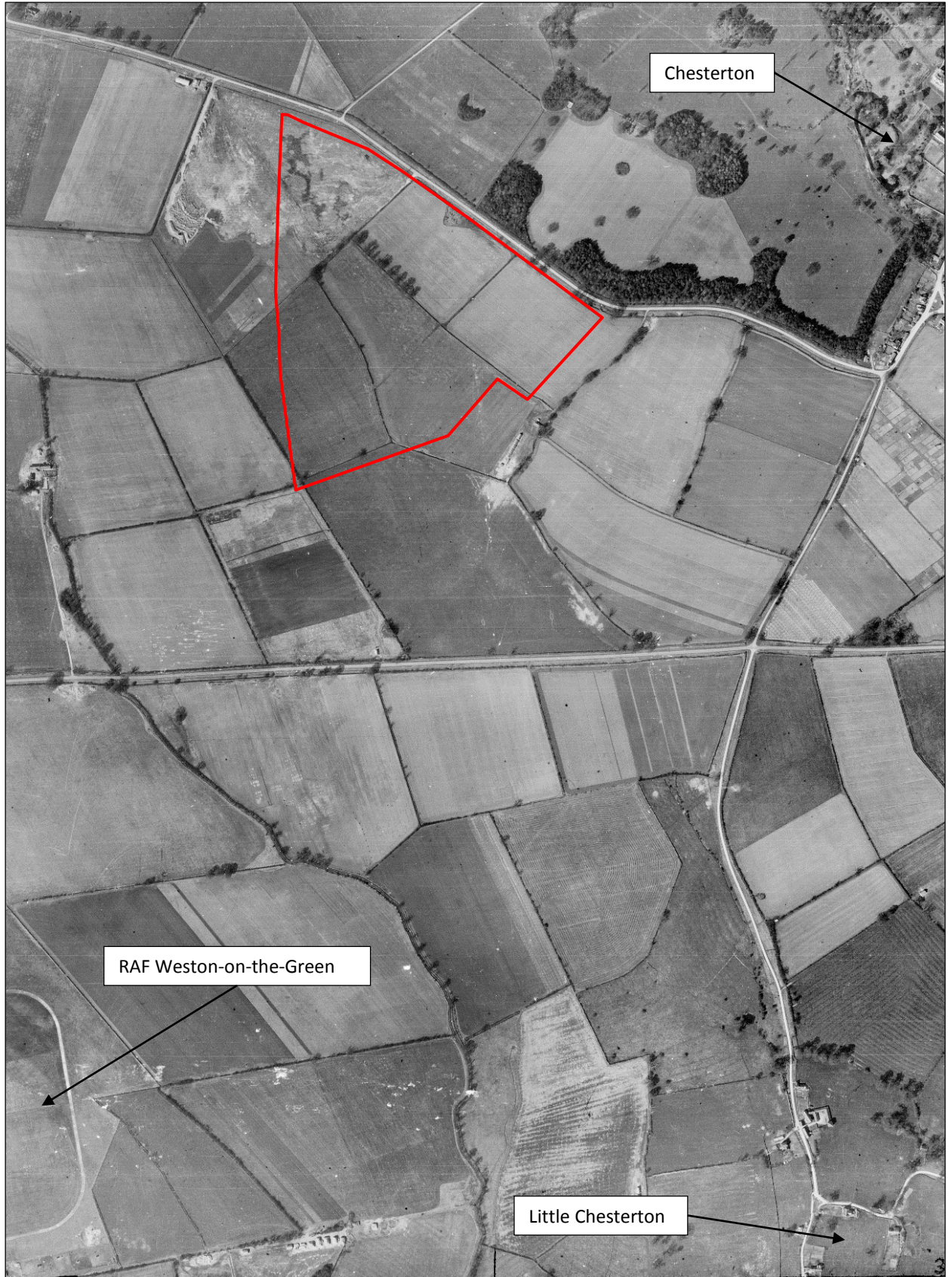


Project: **Great Wolf Lodge**

Ref: **DA8343-00**


Source: National Monuments Record Office (Historic England)

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Client: **Curtins**

 **Approximate site boundary**



Project: **Great Wolf Lodge**

Ref: **DA8343-00**

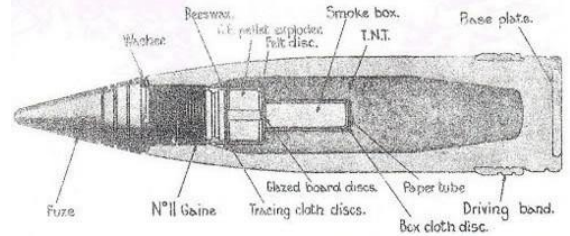
Source: National Monuments Record Office (Historic England)

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Examples of Anti-Aircraft Projectiles

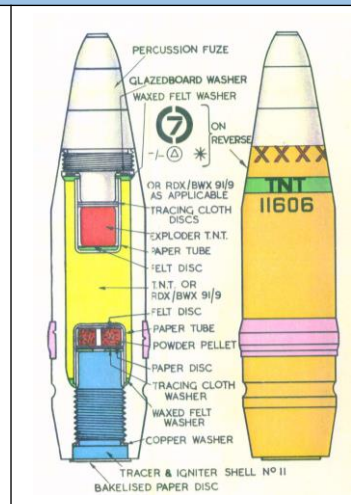
3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



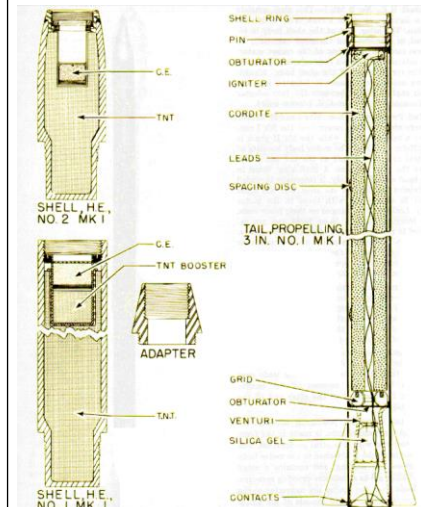
40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



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Project: **Great Wolf Lodge**
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Appendix F – Qualitative Risk Assessment Rationale

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment, the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
----------------	------------	----------

Phase 1 Preliminary Site Risk Assessment



Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	<p>High concentrations of cyanide on the surface of an informal recreation area.</p> <p>Major spillage of contaminants from site into controlled water.</p> <p>Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).</p>
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	<p>Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria.</p> <p>Leaching of contaminants from a site to a Principal or Secondary A aquifer. Non-Aquifer/Unproductive Strata with negligible permeability</p> <p>Death of a species within a designated nature reserve.</p> <p>Lesser toxic and asphyxiate effects</p>
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	<p>Pollution of non-classified groundwater (non-aquifer with negligible permeability and unproductive strata).</p> <p>Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).</p>
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	<p>The presence of contaminants at such concentrations that protective equipment is required during site works.</p> <p>The loss of plants in a landscaping scheme.</p> <p>Discoloration of concrete.</p>

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

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