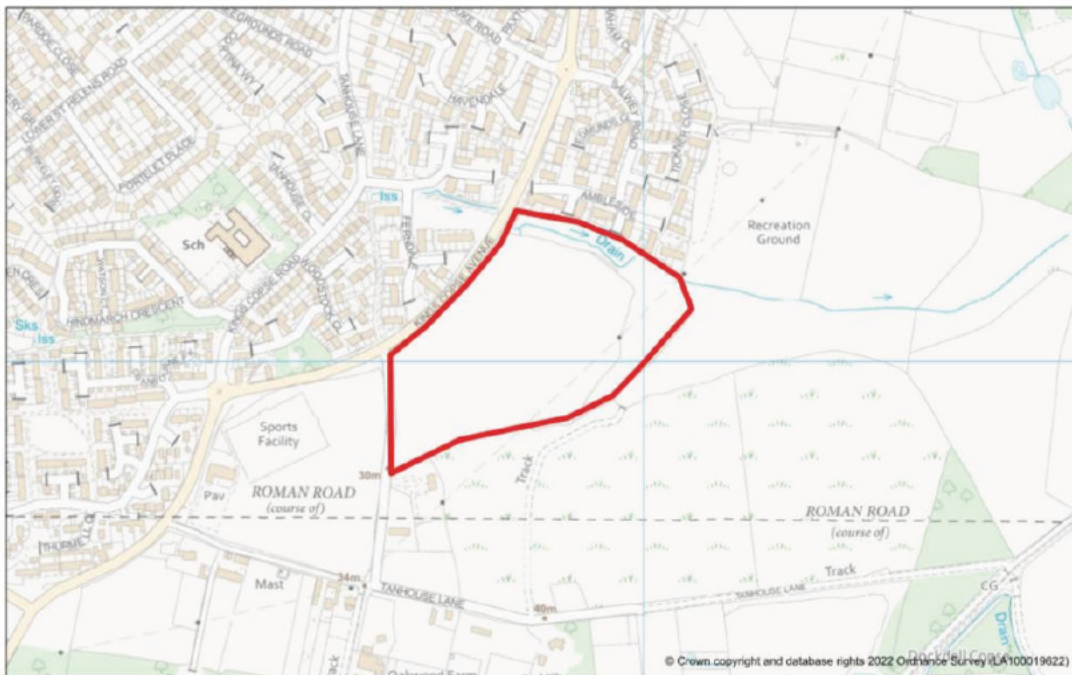




Detailed UXO Risk Assessment

FIG Reference: 3997R

Client: Eastleigh Borough Council

Project: Hedge End

Site Location: Kings Copse Avenue, Hedge End

Date: 27 September 2024

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Document Approval

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Signature		
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Acronyms and Abbreviations

AAA	Anti-Aircraft Artillery
AP	Armour Piercing
AP	Anti-Personnel
ARP	Air Raid Precaution (Wardens)
BD	Bombing Density
BGL	Below Ground Level
BGS	British Geological Survey (UK)
BH	Borehole
CDM	Construction (Design and Management) Regulations 2015 (UK)
CIRIA	Construction Industry Research and Information Association
CPT	Cone Penetrometer Test
CW	Chemical Weapons
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
ERP	Emergency Response Plan
ERW	Explosive Remnants of War
FFE	Free From Explosives
GI	Ground Investigation
GPS	Global Positioning System
HE	High Explosive
HSE	Health and Safety Executive
HSWA	Health and Safety at Work Act 1974
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operations Centre (UK)
LAA	Light anti-Aircraft
LE	Low Explosive
LM	Luftmine (Germany)
LSA	Land Service Ammunition
MOD	Ministry of Defence (UK)
NEQ	Net Explosive Quantity
RAF	Royal Air Force
RN	Royal Navy
ROF	Royal Ordnance Factory
SAA	Small Arms Ammunition
SAP	Semi-Armour-Piercing
SI	Site Investigation
SIP	Self-Igniting Phosphorous
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V1	Vengeance Weapon 1 - Flying bombs or doodlebugs
V2	Vengeance Weapon 2 - Long range rocket
WW	World War

1. Executive Summary

Site details

The site is located south and east of Kings Copse Avenue, Hedge End in Eastleigh, Hampshire, with an approximate central grid reference of SU 49895 12038.

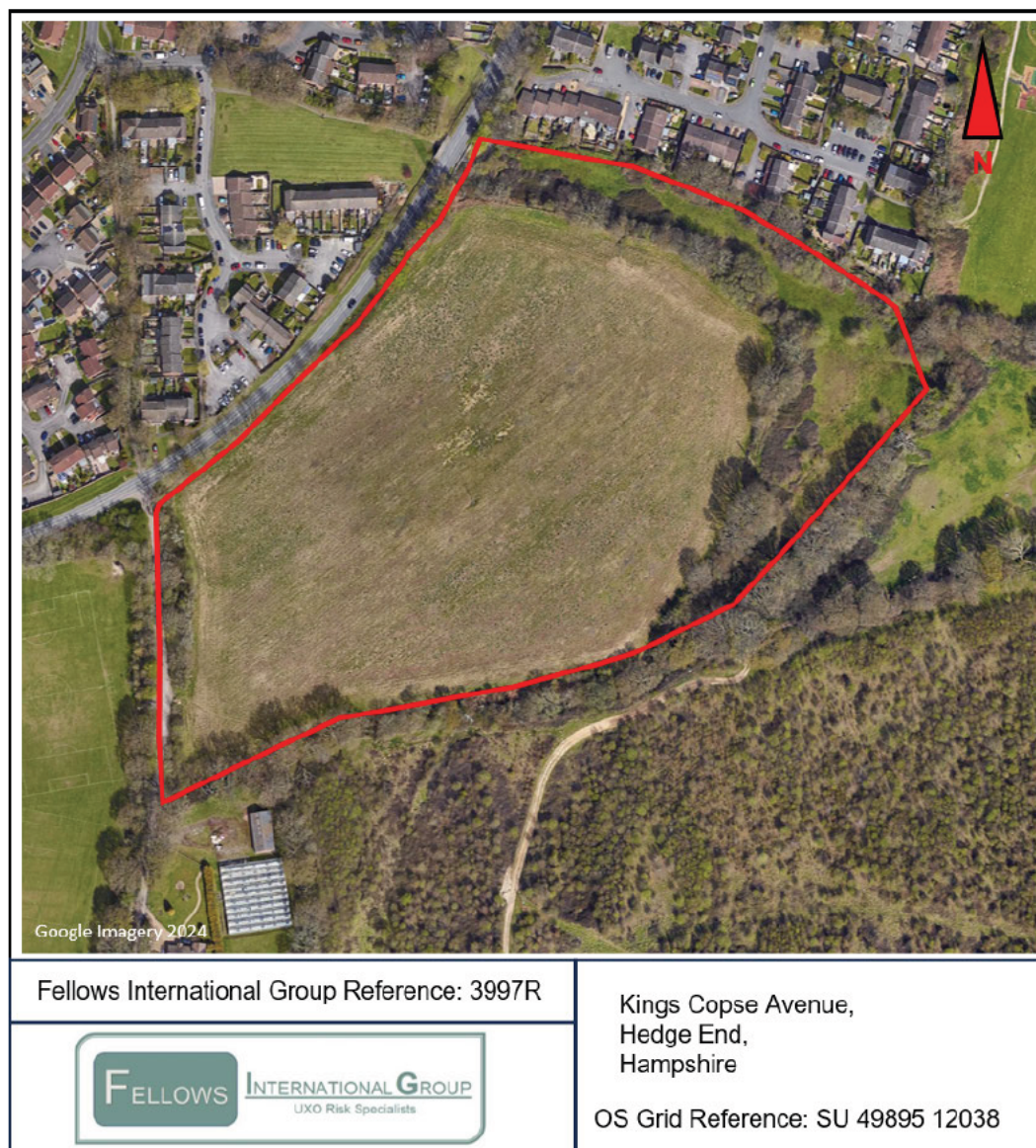


Figure 1. Showing the site area. (Google, 2024).

2. Risk Assessment

Unexploded Ordnance (UXO) risk at the site is assessed as:

UXO	RISK
German Air Service Munitions	Low Risk
Anti-aircraft Munitions	Low Risk
Other Munitions	Low Risk

Full detail of the UXO risk and the risk assessment process is detailed within section 5.

Summary

The area in proximity to the site experienced a low level of bombing during WW2. Two WW2 military sites have been identified within 1km of the site but are not considered to pose any raised UXO risk.

3. Recommendations to Reduce UXO Risk to ALARP

UXO Risk mitigation recommendations

For all works within the site area:

UXO Awareness Training

A UXO Awareness Brief (UXOAB) to be delivered to all site personnel. This can also include a site safety walk-through and discussion of existing safety and emergency documentation.

Emergency Response Plan

A site-specific emergency response plan (ERP) should be produced to provide clear and precise guidance on what to do should UXO be encountered, and / or detonated as part of the site works. It should be accompanied by emergency management team roles and responsibilities.

The ERP should be included in the health and safety plan for the proposed works and communicated to the work force at the operational level, typically as part of a toolbox talk.

Fellows International Group Limited can provide all of the above services and would be pleased to provide a proposal accordingly.

For further information, or to discuss requirements, please get in touch.

Web – www.fellowsint.com Tel – 08000 424 424 Email – info@fellowsintgroup.com

4. Site History

Historical developments

Historical analysis of the site area was carried out employing detailed research, historic mapping, and historic aerial photography. The table below depicts in chronological order the changes that the site has undergone from 1938 to 2024.

Research has not identified any specific military use of the site.

During WW2 the site comprised open ground east of Tanhouse Lane associated with agriculture with mature vegetation present in the north and northeast.

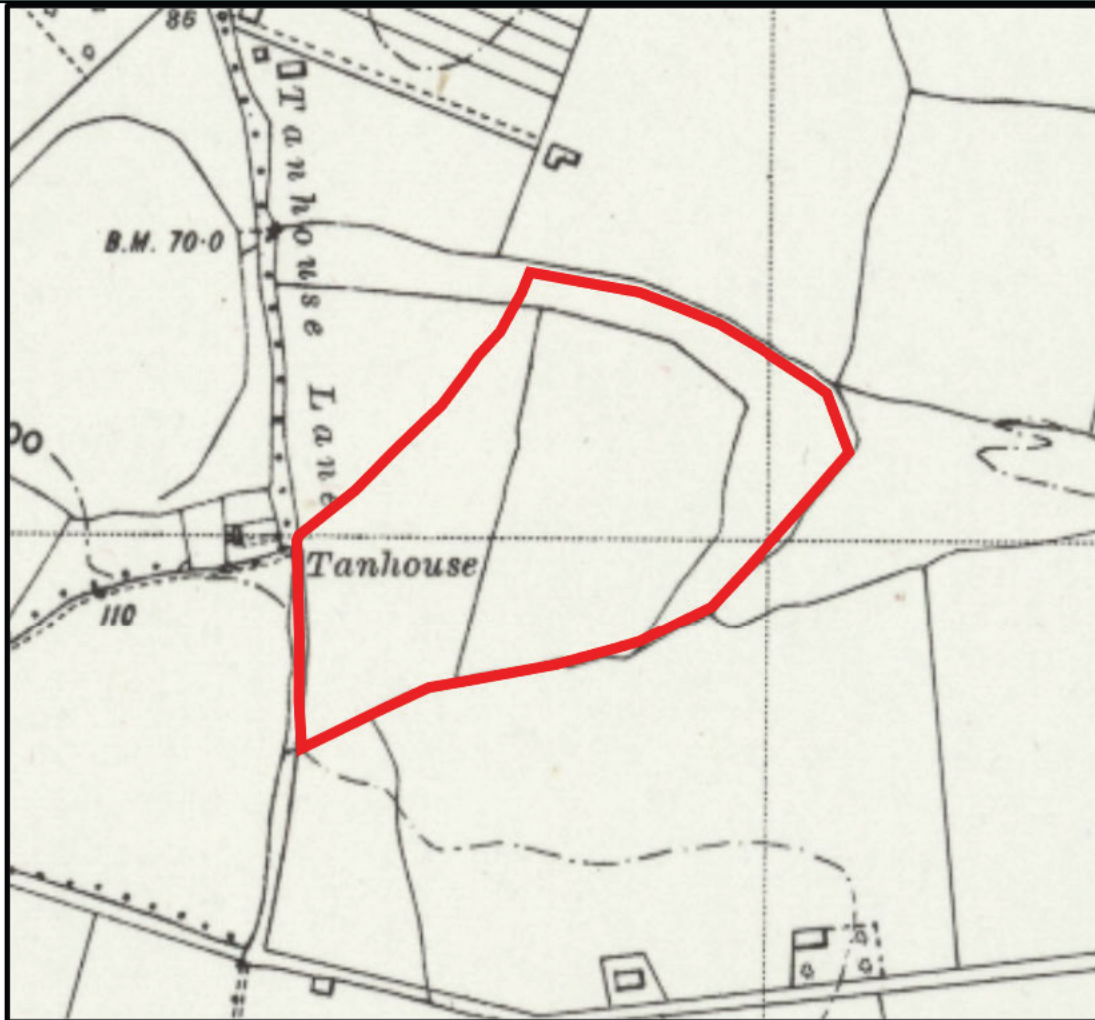
Proposed Scope of Works

The site is proposed to be developed to provide approximately 200 residential homes with access from Kings Copse Avenue and associated parking and landscaping. It is assumed that there may potentially be a range of pilling, deep and shallow excavations across the site area.

Ground conditions – Local Geology

The local geology of the site comprises of a bedrock of LONDON CLAY FORMATION – CLAY, SILT AND SAND. This is consistent across the site.

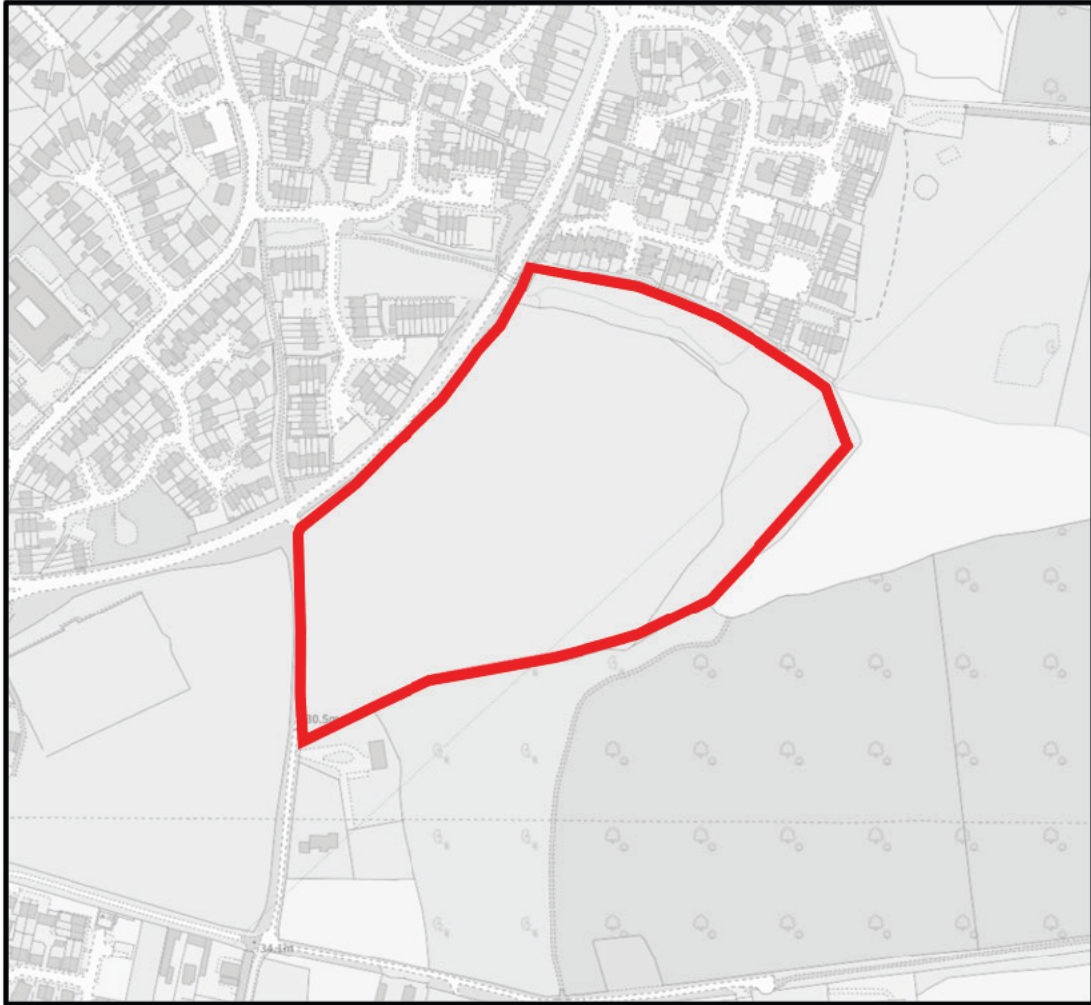
Mapping



Showing a section of 1938 mapping.

The site area is comprised of open ground associated with agriculture and a section of Tanhouse Lane along the western boundary.

Mapping



Showing 2024 mapping.

Field boundaries previously evident have been cleared. Significant residential housing development is evident to the north.

Table 1. Summary table showing development of the site.



Figure 2. Showing a September 1940 dated air photograph detailing the site and the surrounding area.

5. UXO Risk at the Site

German Air Service Munitions

During WW2 the site was located in the Rural District of Winchester which experienced a relatively low bombing density. The nearest identified Luftwaffe target was airfield at Hamble, approximately 5km southwest. Two bombing raids were recorded within Hedge End during the nights of 16/17 May 1941 and 16/17 April 1942 resulting in four HE bomb strikes and two parachute mine strikes. A V1 Flying Bomb strike was recorded approximately 660m south of the site within the grounds of HMS Cricket, a Combined Operations base and landing craft marshalling area, on 15 July 1944. Taking into account the low level of recorded bombing activity in proximity to the site the risk of encountering German air service munitions is therefore considered to be **Low**.

World War One Aerial Bombing

There are no records of WW1 bombing in proximity to the site. As such WW1 bombing, will not be considered further in this report.

World War Two Aerial Bombing

Fellows International Group has reviewed Air Raid Precaution (ARP) records, Bombing Density Records, aerial photography, bomb damage maps, historical images of bomb damage held by The National Archives, the Hampshire Archives and internal Fellows International Group documents related to the site area. It is worth noting historical records and Air Raid Precaution (ARP) reports cannot establish a full description of air raids that may have occurred during WW2 as the accuracy of wartime records are frequently difficult to verify. During WW2, the site was located within the administrative area of the Rural District of Winchester.

Administrative Areas	Land Area		Numbers of items of Ordnance Recorded								Ordnance Density	
	Acres	Hectares	High Explosive Bombs	Parachute Mines	Oil Bombs	Phosphorus Bombs	Fire Pots	V1	V2	Total	Per 1,000 Acres	Per 100ha
Winchester (RD)	110432	44725	795	19	26	0	0	13	0	853	7.7	1.9

Table 2. Ministry of Home Security records of German Ordnance dropped within the Rural District of Winchester during WW2

Post War Explosive Ordnance Clearance (EOC) Tasks/Reports

EOC tasks/reports are potential indicators of the existence of legacy unexploded munitions.

There are no recorded post war EOC tasks on or in proximity to the site

Abandoned Bombs

Unexploded bombs that were deemed too difficult to recover and posed no risk if they detonated, were sometimes simply just abandoned. The locations were recorded on an abandoned bomb register. They are a further indicator of bombing activity, particularly in relation to unexploded bombs.

The are no abandoned bombs recorded on or in proximity to the site.

Decoy Sites

RAF and Royal Navy decoy sites were constructed in the vicinity of legitimate targets to deceive and decoy enemy bombers. For obvious reasons, such sites were often built in remote and uninhabited areas. Some were more successful than others and received relatively high bombing rates.

A starfish-type decoy site was identified 1.3km east of the site. The decoy was one of several intended to disrupt German bombing of Southampton.

Bomb penetration

Due to the local geology, the previous land usage and the history of the area, maximum bomb penetration depth of a SC50 (50kg) bomb is assessed to be 6m bgl. The SC250 (250kg) bomb is considered to have a maximum bomb penetration depth of 10m bgl.

Please see section 9 for details of aerial bombing and how bomb penetration is calculated.

Anti-aircraft Munitions

Three HAA batteries were located within 5km of the site. Taking into account the size of the site area (approximately 7 hectares), and the distance to these AA batteries the risk of encountering UXO fall to earth anti-aircraft munitions is therefore assessed to be **low**.

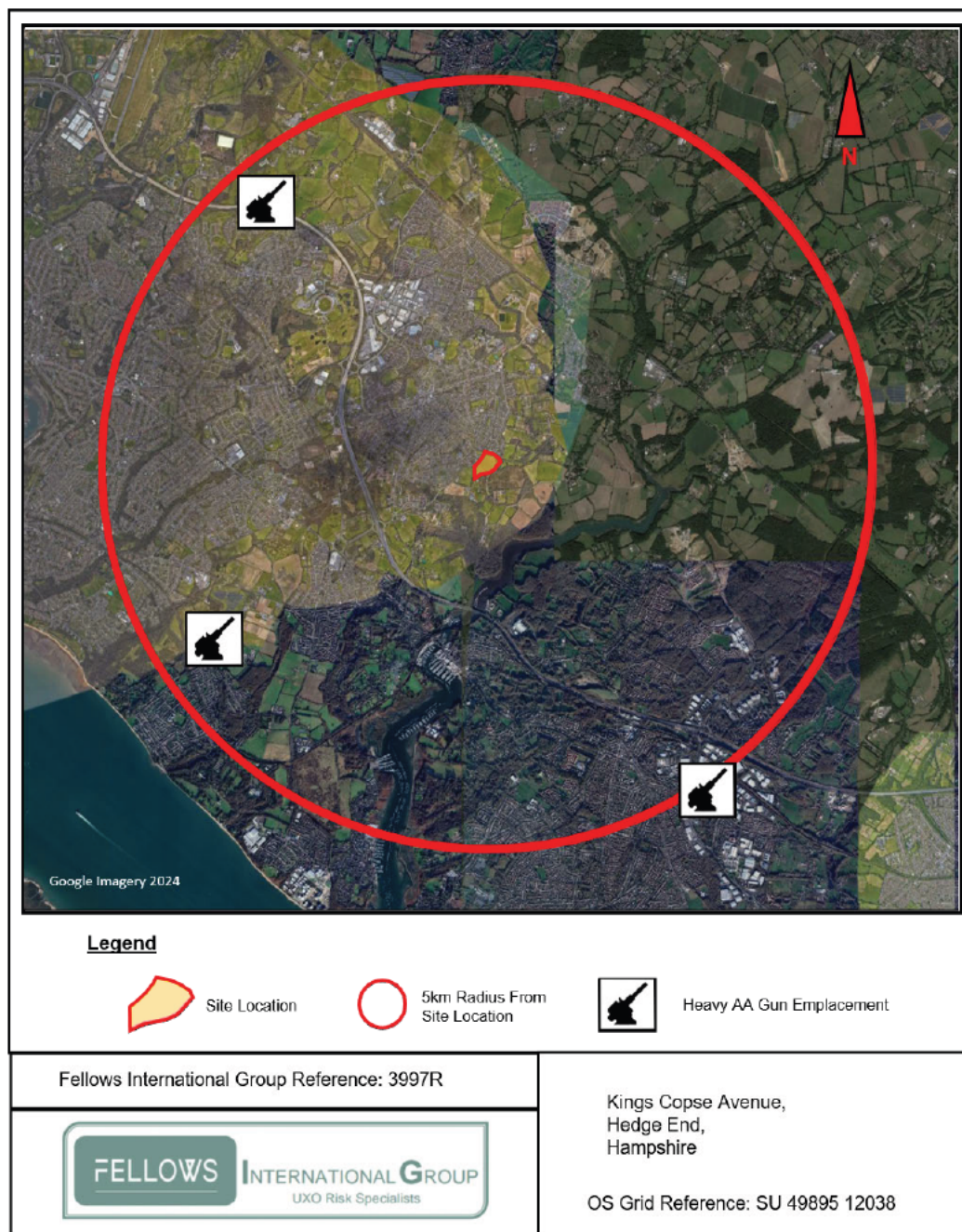


Figure 3. Showing anti-aircraft positions within 5km of the site during WW2.

Other Munitions

Research has not identified any military use of the site. The nearest military sites in a 1km radius to the site were HMS Cricket, a Combined Operations Base and landing craft training and marshalling site and WW2 D-Day temporary camp identified as Camp C3. These sites are not considered to pose any significant UXO risk. The risk of encountering other munitions is therefore assessed as **low**.



Figure 4. Showing the location of the WW2 sites in context to the Site.

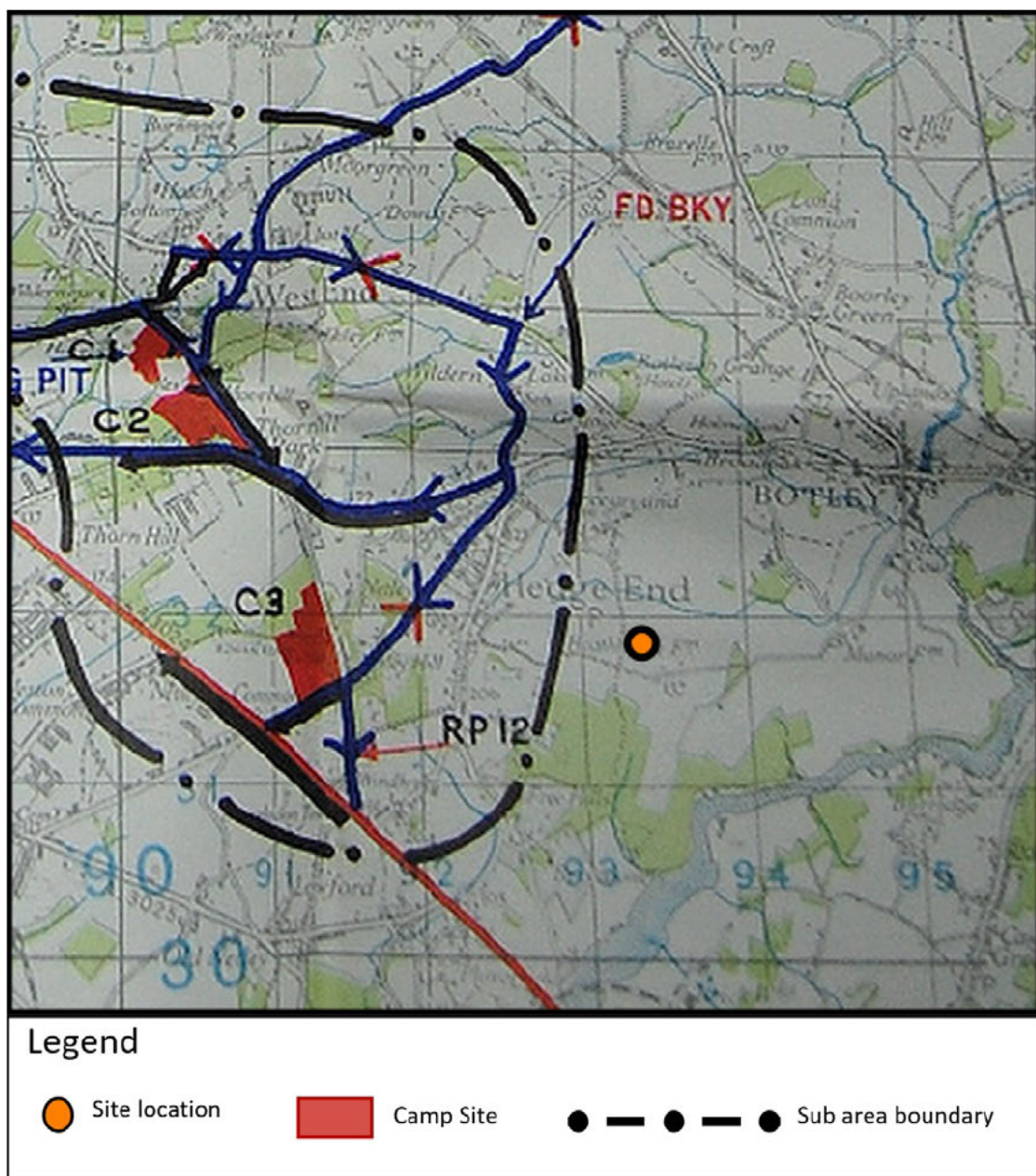


Figure 5. Showing the location of the WW2 D-Day camp C3 in proximity to the site.

Risk Assessment

In establishing the UXO risk at this site, Fellows International Group take the following factors into account:

- The amount and nature of WW1 and WW2 German aerial bombing
- The nature and conditions of the site during at the time
- Other military use of the site i.e., AA Gun sites, storage, training
- The extent of post-war development and UXO clearance operations on site
- The scope and nature of the proposed works and assessed bomb penetration depth
- The nature of non-aerial ordnance that may have contaminated the site area

The risk assessment matrix below is based upon the chance of encountering items of ordnance and the consequence of interaction with them. This can range from the detonation by design (via fuze and explosive training) of a large aerial bomb to the accidental breakage of old Home Guard glass bottle grenades. In accordance with standard UK risk assessment methodologies, the overall risk is gained by multiplying the likelihood (chance of encounter) with the consequence (consequence of interaction) and is graded from negligible to Very High risk.

Descriptors

Chance of encounter

1	2	3	4	5
Not at all likely	Unlikely	Possible	Likely	Almost certain

Consequence of interaction with munition

1	2	3	4	5
First aid incident	Minor injuries	Severe injuries	Fatalities	Multiple fatalities

Overall risk calculation (Chance of Encounter X Consequence of interaction)

1-5	6-10	11-15	16-20	21-25
Negligible	Low Risk	Medium Risk	High Risk	Very High Risk

Risk Assessment

Activity	Threat Item	Chance of encounter	Consequence of interaction	Risk
Shallow excavation (<2m)	HE Bombs	2	5	10
	AAA Munitions	2	4	8
	Other Munitions	2	3	6
Window Sampling / Shallow Boreholes	HE Bombs	2	5	10
	AAA Munitions	2	4	8
	Other Munitions	2	3	6
Deeper excavations (>2m)	HE Bombs	2	5	10
	AAA Munitions	2	4	8
	Other Munitions	2	3	6
Piling / deep boreholes	HE Bombs	2	5	10
	AAA Munitions	2	4	8
	Other Munitions	2	3	6

6. Report Methodology

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the site as described by the client.

Every reasonable effort has been made to ensure that all available historical information has been accessed and checked. Where possible, evidence has been included in the report to enable the client to understand the basis of the risk assessment. Fellows International Group cannot be held responsible for any changes to the assessed level of risk or risk mitigation measures based on documentation or other information that may come to light at a later date. The accuracy of wartime records is frequently difficult to verify. As a result, conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence. Fellows International Group cannot be held responsible for inaccuracies or gaps in the available historical information. All sources are referenced at Section 13.

The report recommends 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 (ALARP).

This report follows the guidelines outlined in CIRIA Report C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry' and CIRIA C785, 'Unexploded Ordnance (UXO) Risk Management'. Fellows International Group has been supporting the UK construction industry with UXO Risk Management measures for over two decades and offer the complete UXO risk management process from the preliminary and detailed desk study through to the physical site survey and finally, the identification and removal or disposal of an item, either in house or in liaison with military disposal assets. Our desk top studies enable our clients to accurately assess the UXO risk and take proportionate, cost-effective action to manage the risk posed by unexploded aerial bombs and other munitions. As one of the first companies to offer this service in the UK, Fellows International Group have unrivalled experience delivering the UXO Risk Management process and are proud of our reputation for quality and cost-effective delivery, gained from our years of experience. Fellows can support you through the whole risk management process from project start to final delivery. While Fellows International Group is mainly active in the UK, we also have a long history of operating overseas on projects all over the globe. We are proud to support both the construction and offshore industries with the right experience, people, qualifications and equipment to best identify, quantify and mitigate the UXO risk wherever it may be.



7. Requirement for UXO Risk Assessment

Background

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction or development projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, the legislation outlined below makes very clear 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.

CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) defines the responsibilities of parties involved in the construction of temporary or permanent structures. CDM 2015 establishes a duty of care extending from clients, principal 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 CDM 2015 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 or obtain an appropriate assessment of potential UXO risks at the site.
- Emplace appropriate risk mitigation measures if necessary
- Supply all parties with relevant risk information
- Prepare a suitably robust emergency response plan.

Other legislation

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.

8. Sources of Potential Unexploded Ordnance

UXO found at construction and development sites in the UK originates from three principal sources:

- Munitions deposited as part of military training or exercises.

In the UK, this can be historical from both World Wars and before but also more recent, especially as land reserved for military use is released for development.

- Dumping

Munitions abandoned or dumped, either deliberately post war, accidentally lost in transit or due to ineffective working practices during manufacture, storage and transportation.

- Wartime activity (including aerial bombing)

This includes ordnance resulting from wartime activities including enemy bombing, long range shelling, area or site denial weapons (mine fields or airfield pipe mines) and munitions from defensive activity such as anti-aircraft batteries or pre-invasion measures.

Other factors which may increase UXO risk

Transportation of aggregates containing munitions to an area that was previously free of UXO has led to small munitions contaminating a previously low risk site. This is usually related to construction activities employing material dredged from a contaminated offshore borrow site although the use of explosive contaminated soil or fill from higher risk areas should also be considered.

9. Aerial Bombing

General

During WW1 and WW2, many towns and cities across the UK were subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place, notably the London 'Blitz'. Bombing also affected many other towns and cities including Birmingham, Portsmouth and Bristol.

Approximately 10% 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.

Although the main focus of historical UXO research generally concerns German air-delivered ordnance dropped during WW2, all other forms of explosive contamination will also be considered.

One of the most common types of UXO discovered today is the aircraft delivered high explosive (HE) bomb. These are comparatively thick-skinned and dropped from enemy aircraft. If the bomb did not detonate when it was dropped, the force of impact enabled the bomb to penetrate the ground, often leaving behind it an entry hole. These entry holes were not always apparent, and some went unreported, leaving the bomb buried and unrecorded. The bomb then became an Unexploded Bomb or UXB.

Additional forms of German aerial UXO will be considered including WW2 'Vengeance' weapons (V1 and V2 rockets), small Incendiary Bombs (IBs), and Anti-personnel (AP) bomblets.

World War Two aerial bombing

Targeting

Although the Luftwaffe had designated primary bombing targets across the UK, their high-altitude night-time bombing was not accurate. As a result, thousands of buildings were damaged and civilian fatalities were common. Bombs were also jettisoned over opportunistic targets and residential areas were often struck.

When Luftwaffe aircraft wished to escape due to interception by fighter aircraft or anti-aircraft fire, they would jettison their bombload to increase speed and manoeuvrability. This is commonly referred to as tip and run and it has resulted in bombs being found in unexpected locations.

UXB Initiation

Unexploded ordnance does not normally spontaneously explode. Military high explosive is generally reasonably stable and requires significant energy, normally via a fuze and initiation system for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of other potential initiation mechanisms.

Direct impact

Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g., from piling machinery or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Although it is unlikely, such violent action could cause a bomb to detonate.

Fuzes

Most German bomb and mine fuzes were electric and were highly engineered compared to their British equivalents. A small proportion of German WW2 bombs employed clockwork fuzes. It is probable that clockwork or mechanical fuze mechanisms would have corroded since the Second World War, and this will generally prevent them from functioning.

Friction impact

Impact from construction machinery or processes could initiate the shock-sensitive fuze explosive. The effects of chemical breakdown of explosive fill 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 around the fuze pocket which could detonate the main charge.

Consequence of interaction

When considering the potential consequences of a detonation, it is necessary to identify who may be affected. These will vary depending on the site-specific conditions but can be summarised as:

- 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.

Failure Rate of German air-delivered ordnance

It has been estimated that 10% of the German HE bombs dropped during WW2 failed to explode as designed. There are a number of reasons why an air-delivered weapon might fail to function as designed:

- Malfunction of the fuze or initiation mechanism (either electric or clockwork)
- Failure of the bomber aircraft to arm bombs correctly
- Jettisoning of the bomb before it was armed or from a very low altitude. Likely if the bomber was under attack or attempting a forced landing due to damage.

Unexploded ordnance is still regularly encountered across the UK and is dealt with on a routine basis by military and commercial Bomb Disposal teams.

Bomb penetration

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

- Size 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 alluvial deposits are easier to penetrate than gravel and sand. Layers of hard strata will significantly retard and may stop the trajectory of a UXB.

Impact angle and velocity

It is assumed that bombs struck at an angle 80-85° from vertical and at c. 270 metres per second. These are standard figures used for bomb release from an aircraft at normal altitude. Other factors such as low speed or altitude of the bombing aircraft may alter these figures, but no records are available to suggest any low-level raids or incidents.

Buried bombs

When bombs strike but do not detonate, they can easily remain undetected. Note that the entry hole of an SC50 (the most commonly deployed German HE bomb) could have been as small as 20cm in diameter and therefore easily obscured within dense crops, or unmaintained vegetation, rough soil or rubble from previous damage.

The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an air-delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface.

Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth but can be up to 15m leading to bombs settling underneath undamaged buildings.

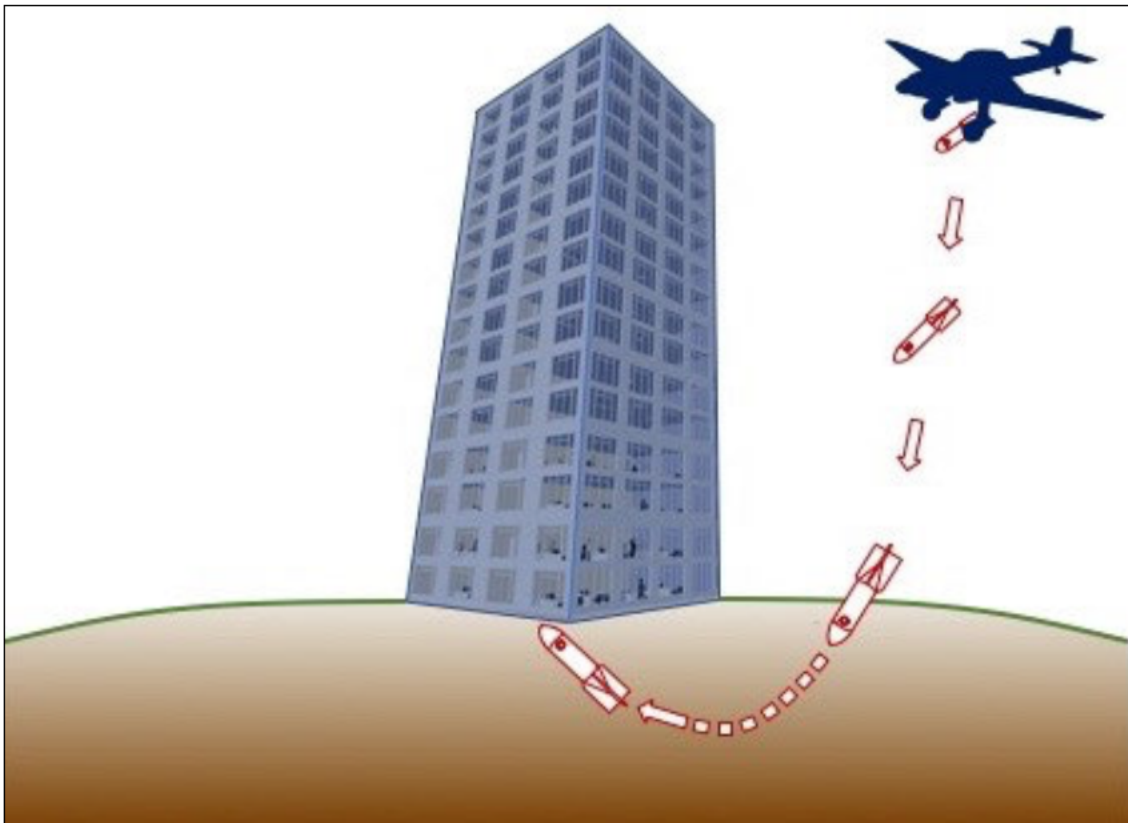


Figure 6. Demonstrating the J-Curve.

10. Military Ordnance

In addition to aerial bombs, there may also be a risk from other items including discarded or forgotten land munitions from both wartime and peacetime military use. Typical military activities may include:

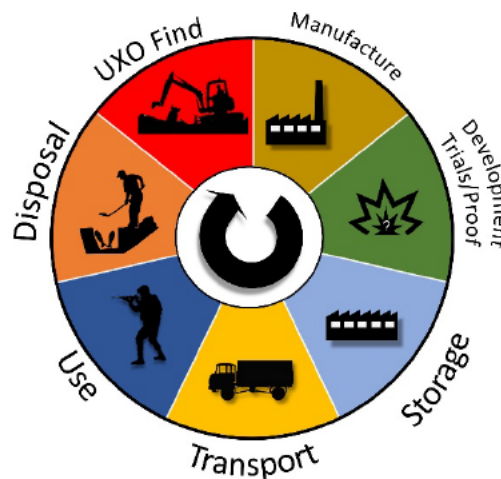


Figure 7. Showing the ordnance lifecycle.

- Former minefields; often on beaches on the South and East coasts of England
- Home Guard weapons and munitions
- Anti-Aircraft sites
- Training & firing ranges
- Military bases
- Munition's manufacture and storage sites

The potential risk of encountering ordnance on sites is particularly elevated in areas previously associated with military activity. As the threat of invasion lingered over Britain during WW2, large areas of land were requisitioned for military training and exercises. Thousands of tonnes of munitions including HE bombs, artillery projectiles, Naval shells, bulk explosives, and infantry weapons such as grenades and small arms ammunition were used in weapon testing and military training. It has been estimated that at least 20 per cent of the UK's land has been used for military training at some point.

11. Air Service Ordnance

FELLOWS INTERNATIONAL GROUP
UXO Risk Specialists

AIR SERVICE ORDNANCE



Approximate Scale

Bombs



Allied bombs



German 50kg Bomb



British 4lb Practice Bomb

Anti-personnel and Incendiary Bombs



German 'Butterfly' Bomb

German Incendiary Bomb

Smoke Floats



British Pyrotechnic Smoke Float

Aerial bombs

The most commonly dropped German aerial weapon was the SC50 (50kg). The next largest weapon is the SC250 (250kg) HE bomb. These were dropped primarily against soft targets such as gas and electricity installations, factories, housing and transport infrastructure. Although the Luftwaffe deployed larger bombs, their deployment was infrequent, the majority of bombs dropped were SC50 (50kg) and SC250 (250kg) HE bombs.

Allied bombs can also be encountered. Air activity over Great Britain sometimes resulted air service ordnance being accidentally dropped or deliberately jettisoned if aircraft were in difficulties. Additionally, airfield sites often incorporated a bombing target used for bombing practice. Small practice bombs were used for these purposes and contain either a flash component or are designed to smoke emit smoke.

Incendiary bombs

The German 1 kg B1E incendiary bomb consisted of a cylinder of magnesium alloy, with an incendiary filling of thermite. Attached to the body was a steel tail with three fins. These bombs did not explode but were ignited by a small percussion charge, fired upon impact. They were dropped in a variety of containers. Later an explosive anti-handling version was introduced.

Anti-personnel bombs

A Butterfly Bomb (or *Sprengbombe Dickwandig* 2kg or SD2) was a German 2-kilogram anti-personnel submunition used by the Luftwaffe during the Second World War. It was so named because the thin cylindrical metal outer shell which hinged open when the bomblet deployed gave it the superficial appearance of a large butterfly. These broke open in air and scattered the sub-munitions.

Smoke floats and Pyrotechnics

Pyrotechnics are used in a variety of roles ranging from marking targets to search and rescue. Some pyrotechnics contain a flash element, and some are designed to burn.

Rubbish Dumps

Air Service Ordnance is often encountered on military airfield sites. These sites were sometimes used as a convenient way to disposal of unwanted munitions or munitions related material.

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Small Arms Ammunition



Mills Grenade



No.80 Smoke Grenade



No.76 SIP Grenade



GS MK V Mine

Approximate Scale

Small Arms Ammunition



British .303 Ammunition

Grenades



British No.36 Mills Grenade



British No.80 Smoke Grenade



British No.76 SIP Grenade



Land Mines



British GS MK V Mine

LAND SERVICE ORDNANCE



Approximate Scale

2 inch mortar bomb

3 inch mortar bomb

2pdr anti-tank projectile

25pdr High Explosive Shell

Mortar Bombs

British 3 inch mortar bomb



British 2 inch mortar bomb



Artillery Projectiles



British 25pdr High Explosive Shell



British 2pdr - solid shot anti-tank

12. Land Service Ordnance

Small Arms Ammunition

The most common type of ordnance encountered on land formerly used by the military are items of Small Arms Ammunition (SAA). SAA refers to the complete round or cartridge designed to be used with hand-held infantry weapons such as rifles, machine guns and pistols. SAA can include bullets, cartridge cases and primers/caps. Items of SAA can be accidentally initiated by striking the casing or coming into contact with fire. SAA presents only minimal risk although it must be disposed of correctly if found on-site.

Hand Grenades

There are a number of different types of hand grenade. They were used in very large number. Some contain explosive and were used for defensive and offensive purposes. Some were designed to emit or burst smoke to provide a smokescreen to cover troop movements or to indicate troop positions. The No.76 SIP (Self Igniting Phosphorus) smoke grenade resembled a milk bottle and was issued in large numbers to Home Guard units. Caches of these grenades were often buried and are sometimes found during shallow excavations or building demolition.

Mortar Bombs

Mortars are used by infantry as organic support weapons. There are many different types but most evidence tail fins used to stabilise the bomb in flight. Many types were used. The most common being high explosive, smoke, illuminating (ejects a parachute with a flare attached and is used for illumination at night) types.

Land Mines

Mines are laid for defensive purposes. They can be laid in minefields or individually. Anti-personal and anti-tank mines were laid in large numbers on UK beaches during WW2. Clearance operations after the war removed many, but some still continue to be found today.

Artillery Projectiles

Artillery projectiles are fired from both small and large artillery guns. They comprise of many different types and are used for both offensive and defensive purposes.

Areas where anti-aircraft guns were located can be at risk from shallow buried unexploded Anti-Aircraft projectiles fired during WW2.

At the onset of WW2 two types of Anti-Aircraft Artillery (AAA) guns were deployed:

- Heavy Anti-Aircraft Artillery (HAA), using large calibre weapons, such as the 3.7" QF (Quick Firing) gun. Normally fixed batteries.
- Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons, such as 40mm Bofors gun. Often mobile, vehicle mounted batteries.

LAA batteries were intended to engage fast, low flying aircraft and were typically deployed around military bases, RAF airfields or important installations. These batteries were mobile and could be moved to new positions with relative ease when required. The most numerous of these were the 40mm Bofors gun, which could fire up to 120 x 40mm HE shells per minute to over 1,800m.

HAA projectiles were high explosive shells, usually fitted with a time delay or a barometric pressure fuze to make them explode at a pre-determined height. If they failed to explode or strike an aircraft, they would eventually descend back to earth.

Dependent upon site conditions, larger AAA projectiles can be encountered beyond a depth of 2m.

The smaller 40mm projectiles are similar in appearance and effect to SAA and, although still dangerous, present a lower hazard due to its decreased explosive content.

Numerous unexploded AAA shells were recovered during and following WW2 and are still occasionally encountered on sites today.

13. Examples of Recent Unexploded Bomb Finds in the UK

	<u>Plymouth - Devon - February 2024</u> An unexploded German SC500 bomb was discovered by a homeowner digging in the back garden of the property. Removed and disposed of at sea Left Image: showing the bomb partially recovered.
	<u>Great Yarmouth - February 2023</u> An unexploded German 250kg bomb discovered during construction works. Context: Sea wall. Destroyed in situ Left Image: Showing the bomb detonating during the render safe procedure Below image: showing the location where the bomb was destroyed. 
	 <u>Exeter, Devon - March 2021</u> An unexploded German 1,000kg bomb discovered during construction works. Context: Open ground, undeveloped since WWII. Destroyed in situ. Left Image: Where the bomb was discovered. Right image: an example of the bomb found.

14. References

The following sources of information were consulted in putting together this report:

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National Library of Scotland – Period OS Maps

Defence of Britain Project - Historical Information (AA Batteries, Anti-Invasion Defences etc.)

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