



## **APPENDIX D**

### **COAL AUTHORITY REPORT**



The Coal  
Authority

# CON29M

## coal mining report

EDWARD STREET HOSPITAL, EDWARD STREET, WEST BROMWICH, WEST  
MIDLANDS, B70 8NL



### Known or potential coal mining risks

|                                |        |
|--------------------------------|--------|
| Past underground coal mining   | Page 3 |
| Future underground coal mining | Page 3 |



### Further action

No further reports from the Coal Authority are required. Further information on any next steps can be found in our Professional opinion.

For more information on our reports please visit  
[www.groundstability.com](http://www.groundstability.com)



### Professional opinion

According to the official mining information records held by the Coal Authority at the time of this search, evidence of, or the potential for, coal mining related features have been identified. It is unlikely that these features will impact on the stability of the enquiry boundary.

Your reference: **290170534\_2**  
Our reference: **51002953862001**  
Date: **25 January 2022**

Client name:  
**NLIS Hub**

If you require any further assistance please  
contact our experts on:  
**0345 762 6848**  
[groundstability@coal.gov.uk](mailto:groundstability@coal.gov.uk)



The Law  
Society

# Enquiry boundary

## Key

Approximate position of enquiry boundary shown



We can confirm that the location is  
**on the coalfield**



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This report is prepared in accordance with the latest Law Society's Guidance Notes 2018, the User Guide 2018 and the Coal Authority's Terms and Conditions applicable at the time the report was produced.



## Accessibility

If you would like this information in an alternative format, please contact our communications team on **0345 762 6848** or email [communications@coal.gov.uk](mailto:communications@coal.gov.uk).

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# Detailed findings

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## 1 Past underground coal mining

The property is in a surface area that could be affected by underground mining in 1 seam of coal at 250m to 320m depth, and last worked in 1878.

Any movement in the ground due to coal mining activity associated with these workings should have stopped by now.

## 2 Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

## 3 Future underground coal mining

The property is not in an area where the Coal Authority has received an application for, and is currently considering whether to grant a licence to remove or work coal by underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.



## 4 Mine entries

There are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

## 5 Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

## 6 Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

## 7 Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

## 8 Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

## 9 Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

## 10 Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

## 11 Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

## 12 Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

## 13 Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

## 14 Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.



# Statutory cover



## Coal mining subsidence

In the unlikely event of any coal mining related subsidence damage, the Coal Authority or the mine operator has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land or property in connection with lawful coal mining operations.

When the works are the responsibility of the Coal Authority, our dedicated public safety and subsidence team will manage the claim. The house or land owner ("the owner") is covered for these works under the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994). Please note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

If you believe your land or property is suffering from coal mining subsidence damage and you need more information on what to do next, please use the following link to our website which sets out what your rights are and what you need to consider before making a claim.

[www.gov.uk/government/publications/coal-mining-subsidence-damage-notice-form](http://www.gov.uk/government/publications/coal-mining-subsidence-damage-notice-form)



## Coal mining hazards

Our public safety and subsidence team provide a 24 hour a day, 7 days a week hazard reporting service, to help protect the public from hazards caused by past coal workings, such as a mine shaft or shallow working collapse. To report any hazards please call **01623 646 333**. Further information can be found on our website: [www.gov.uk/coalauthority](http://www.gov.uk/coalauthority).



# Glossary



## Key terms

**adit** - horizontal or sloped entrance to a mine

**coal mining subsidence** - ground movement caused by the removal of coal by underground mining

**Coal Mining Subsidence Act 1991** - the Act setting out the duties of the Coal Authority to repair damage caused by coal mining subsidence

**coal mining subsidence damage** - damage to land, buildings or structures caused by the removal of coal by underground mining

**coal seams** - bed of coal of varying thickness

**future opencast coal mining** - a licence granted, or licence application received, by the Coal Authority to excavate coal from the surface

**future underground coal mining** - a licence granted, or licence application received, by the Coal Authority to excavate coal underground. Although it is unlikely, remaining coal reserves could create a possibility for future mining, which would be licensed by the Coal Authority

**mine entries** - collective name for shafts and adits

**payments to owners of former copyhold land** - historically, copyhold land gave rights to coal to the copyholder. Legislation was set up to allow others to work this coal, but they had to issue a notice and pay compensation if a copyholder came forward

**shaft** - vertical entry into a mine

**site investigation** - investigations of coal mining risks carried out with the Coal Authority's permission

**stop notice** - a delay to repairs because further coal mining subsidence damage may occur and it would be unwise to carry out permanent repairs

**subsidence claim** - a formal notice of subsidence damage to the Coal Authority since it was established on 31 October 1994

**withdrawal of support** - a historic notice informing landowners that the coal beneath their property was going to be worked

**working facilities orders** - a court order which gave permission, restricted or prevented coal mine workings



## **APPENDIX E**

### **DETAILED UXO THREAT & RISK ASSESSMENT**



**1ST LINE DEFENCE**



## Detailed Unexploded Ordnance (UXO) Risk Assessment

|                  |                                       |
|------------------|---------------------------------------|
| Project Name     | Edward Street Hospital, West Bromwich |
| Client           | Geo Environmental Group               |
| Site Address     | Edward Street, West Bromwich, B70 8NL |
| Report Reference | DA14372-00                            |
| Date             | 12 <sup>th</sup> November 2021        |
| Originator       | RA                                    |



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## Executive Summary

### Site Location and Description

The site is located in the town of West Bromwich in the borough of Sandwell, West Midlands.

To the north of the site lies Edward Street with Edward Street Car Park beyond. To the north-west of the site are several structures including the Masonic Hall and the Shiloh Apostolic Church. The site is bordered to the east by Edward Street, small areas of open hardstanding ground and a structure associated with Guru Nanak Gurdwara. Open vegetated ground lies to the south of the site with tram/ railway tracks and access paths beyond. Lodge Road lies to the west of the site.

The site is currently occupied by several structures associated with the Edward Street Hospital. In addition to the structures on site there are areas of open hardstanding ground and open vegetated ground.

The site is approximately centred on the OS grid reference: **SP 0018291237**.

### Proposed Works

The scope of proposed works is understood to be a redevelopment of the hospital facilities with spaces for new services added. Proposed intrusive works will include window-sampling boreholes and hand dug foundation pits.

See proposed site plans presented in **Annex C**.

### Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by Alveley Member- Sandstone. This underlying bedrock was formed in the Carboniferous Period.

Site-specific geotechnical information was not available to 1<sup>st</sup> 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

1<sup>st</sup> Line Defence has assessed that there is a **Low-Medium Risk** from items of German aerial delivered and anti-aircraft UXO. There is an assessed **Negligible Risk** from Allied ordnance across the site. This assessment is based on the following factors:

#### German Aerial Delivered Ordnance

- During WWII, the site was located within the County Borough of West Bromwich. According to official Home Office bombing statistics, West Bromwich sustained an overall low density bombing campaign, with an average of 22.7 items of ordnance dropped per 1,000 acres. Bombing in West Bromwich may be attributed to the proximity of Birmingham and various targets located within the area.
- Pre- and post WWII OS mapping indicates the site to comprise a *General Hospital on Edward Street*, consisting of several large hospital buildings and interspersed open land.
- Available written and anecdotal accounts reference multiple HE bomb strikes and incendiary bombing at the hospital on site. This looks to have occurred on the 19<sup>th</sup>/20<sup>th</sup> of November 1940, as referenced by multiple accounts. The exact number and locations of bombs during this raid are unclear, though at least three HE bombs are mentioned in one account from the West Bromwich Local History Society. No further raids on the hospital were evidenced within available materials.
- Following bombing on the 19<sup>th</sup>/20<sup>th</sup> November 1940, anecdotal accounts and a Surveys of Damage report by the Ministry of Home Security Research and Experiments Department record that damage was sustained to the hospital, including to some of the hospital wards and corridors, while part of the boiler room/laundry was destroyed completely. The exact locations of such damage is unclear. Debris is also noted across the site area, although the prevention of the demolition of the hospital by fire is noted to have been credited to those present at the time.
- Despite such damage noted, a comparison of pre and post-war OS mapping and WWII-era aerial imagery indicates much of the hospital survived the war structurally intact. No significant damage, such as clearance or ruined buildings can be



### UXO Risk Assessment

seen in 1948 imagery, though indicators of blast/repairs can be seen in the form of discoloured roofing. Further repairs are anticipated to have been undertaken prior to the photography available.

- Several references were found to the hospital being completely evacuated during the bombing raid on site. Additionally, ground conditions noted subsequent to bombing, including damage, rubble and debris specifically noted within the boundary, are not thought to have been favourable to the detection of UXO indicators. However, as the raid on the 19th/20th of November 1940 is the only raid specifically noted to have occurred on site, with no evidence found to subsequent raids, as well as the fact that the main hospital structures look intact within WWII-era imagery, its anticipated that post-raid checks and access would have resumed relatively swiftly. It is understood that the hospital remained in regular use for the duration of the war after the clear up from this incident, with repairs made as soon as possible in order to keep the hospital functioning during wartime.
- In summary, multiple references to bombing and bomb damage within the proposed site during wartime were encountered, with the hospital subsequently being evacuated for a period. Such factors would typically be a cause for potential concern. However, the hospital looks to largely have remained structurally intact post-war, with no further raids evidenced following that on the 19th/20th of November 1940. As such, it is anticipated that repairs would have been made, and access resumed as soon as possible in order to keep the hospital functioning during wartime. The chance of a UXB going missing on site during this raid is therefore not considered to be significant, although it cannot be discounted entirely.
- Whilst attempts are usually made by 1<sup>st</sup> Line Defence to isolate 'zone' specific areas of bombing or significant damage, it has not been possible to isolate such areas on site on this occasion owing to the limited nature of the records available. In this instant, it's not considered likely that any one area was damaged significantly enough to elevate any one particular area of the proposed site, as the site appears largely structurally intact post-war. Accordingly there is a **Low-Medium Risk** of items of German aerial delivered and anti-aircraft unexploded ordnance assessed across the whole site footprint.

#### Allied Ordnance

- 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 conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

#### Post-war Redevelopment

- Significant development has occurred on site. Pre-WWII buildings on site appear to have been cleared and new structures have since been constructed. The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

### Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Edward Street Hospital in West Bromwich:

#### **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                                             |
| JSEODOC      | Joint Services Explosive Ordnance Disposal Operation Centre |
| LAA          | Light Anti-Aircraft                                         |
| LCC          | London County Council                                       |
| LRRB         | Long Range Rocket Bomb (V-2)                                |
| LSA          | Land Service Ammunition                                     |
| NFF          | National Filling Factory                                    |
| OB           | Oil Bomb                                                    |
| PAC          | Pilotless Aircraft (V-1)                                    |
| PB           | Phosphorous Bomb                                            |
| PM           | Parachute Mine                                              |
| POW          | Prisoner Of War                                             |
| RAF          | Royal Air Force                                             |
| RCAF         | Royal Canadian Air Force                                    |
| RFC          | Royal Flying Corps                                          |
| RNAS         | Royal Naval Air Service                                     |
| ROF          | Royal Ordnance Factory                                      |
| SA           | Small Arms                                                  |
| SAA          | Small Arms Ammunition                                       |
| SD2          | Anti-personnel "Butterfly Bomb"                             |
| SIP          | Self-Igniting Phosphorous                                   |
| U/C          | Unclassified bomb                                           |
| UP           | Unrotated Projectile (rocket)                               |
| USAAF        | United States Army Air Force                                |
| UX           | Unexploded                                                  |
| UXAA         | Unexploded Anti-Aircraft                                    |
| UXB          | Unexploded Bomb                                             |
| UXO          | Unexploded Ordnance                                         |
| V-1          | Flying Bomb (Doodlebug)                                     |
| V-2          | Long Range Rocket                                           |
| WAAF         | Women's Auxiliary Air Force                                 |
| X            | Exploded                                                    |





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# **1<sup>st</sup> Line Defence Limited**

## **Detailed Unexploded Ordnance (UXO) Risk Assessment**

Site: Edward Street Hospital, West Bromwich  
Client: Geo Environmental Group

### **1. Introduction**

#### **1.1. Background**

1<sup>st</sup> Line Defence has been commissioned by Geo Environmental Group to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at Edward Street Hospital, West Bromwich.

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 Edward Street Hospital, West Bromwich. 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**

1<sup>st</sup> 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, 1<sup>st</sup> 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 the Library of Birmingham.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Geo Environmental Group.
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1<sup>st</sup> 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 the Library of Birmingham.

### **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. 1<sup>st</sup> 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 1<sup>st</sup> 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. 1<sup>st</sup> 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.'<sup>1</sup>

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

#### **3.3. Allied Records**

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

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<sup>1</sup> <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 for parties to:

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

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

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

#### **4.4. CIRIA C681**

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

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII 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 1<sup>st</sup> 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 1<sup>st</sup> Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

### **5.2. The Authorities**

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

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

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

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



## **6. The Site**

### **6.1. Site Location**

The site is located in the town of West Bromwich in the borough of Sandwell, West Midlands.

To the north of the site lies Edward Street with Edward Street Car Park beyond. To the north-west of the site are several structures including the Masonic Hall and the Shiloh Apostolic Church. The site is bordered to the east by Edward Street, small areas of open hardstanding ground and a structure associated with Guru Nanak Gurdwara. Open vegetated ground lies to the south of the site with tram/railway tracks and access paths beyond. Lodge Road lies to the west of the site.

The site is approximately centred on the OS grid reference: **SP 0018291237**.

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

### **6.2. Site Description**

The site is currently occupied by several structures associated with the Edward Street Hospital. In addition to the structures on site there are areas of open hardstanding ground and open vegetated ground.

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

## **7. Scope of the Proposed Works**

### **7.1. General**

The scope of proposed works is understood to be a redevelopment of the hospital facilities with spaces for new services added. Proposed intrusive works will include window-sampling boreholes and hand dug foundation pits.

See site plans presented in **Annex C**.

## **8. Ground Conditions**

### **8.1. General Geology**

The British Geological Survey (BGS) map shows the site to be underlain by Alveley Member-Sandstone. This underlying bedrock was formed in the Carboniferous Period.

### **8.2. Site Specific Geology**

Site-specific geotechnical data was not provided by the client during the production of this report. The Geology of Britain viewer was also checked but no information was available.



## 9. Site History

### 9.1. Introduction

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

### 9.2. Ordnance Survey Historical Maps

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

| Pre-WWII |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date     | Scale   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1938     | 1:2,500 | The site is shown to have been occupied by several structures all labelled as <i>General Hospital</i> . Open ground is interspersed between buildings.<br><br>The site is bordered by several structures, including a <i>Church</i> and a <i>Masonic Hall</i> to the north-west and structures of mixed use, including several residential houses to the south-east. An embankment and railway tracks lay to the south of the site. <i>Edward Street</i> runs along the north of the site and the junction of <i>Edward Street</i> and <i>Lombard Street West</i> also borders the site to the north of the site. |

| Post-WWII |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date      | Scale    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 1955      | 1:10,000 | The site is still shown to have been occupied by several structures associated with the <i>Hospital</i> . Some changes appear to have occurred, however. The structure in the westernmost area of the site appears to be smaller than in pre-WWII mapping.<br><br>A structure in the central area, towards the southern boundary also appears to be smaller. A structure has been built next to this one. The main structure in the central area appears to have been slightly extended. Small structures immediately outside the eastern boundary appear to have been cleared. However, it may be noted that this map is lower in quality than the previous map which could account for some of these changes.<br><br>Some structures to the north east of the site appear to have been cleared and a newer structure has been constructed. |
| 1960-65   | 1:2,500  | The site is still occupied by several structures associated with the <i>General Hospital</i> . A tennis court has been built in the west and some possible new structures can be seen in the south.<br><br>Some of the structures appear to have changed slightly in their composition but again this unclear if it is due to the quality of the maps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



**9.3. Summary of the Historical Background of the Site**

Edward Street Hospital was founded in 1869 and was then known as the District General Hospital. A red brick building, it was built to the design of Martin & Chamberlain of Birmingham and was funded by penny subscriptions of local people in the town. Additions were made to the hospital in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. For photographs of the hospital's early period see **Annex E1**.

**9.4. Pre-WWII Oblique Photography of the Site**

Pre-WWII aerial photography has been obtained from the Aerofilms collection available from *Britain From Above*. This imagery provides a view of the site in 1937 (see **Annex E2**). See below for a description:

| Title of Photograph                                                                                                                                             | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The E.M.B. Co<br>Electrical and<br>Mechanical<br>Engineering Works,<br>Hill & Long Ltd<br>Furniture Factory and<br>the General Hospital,<br>West Bromwich, 1937 | The photograph has been zoomed in to focus on the hospital and immediately surrounding area.<br><br>The hospital can be seen from the south-east with several structures visible, most of which appear to be the original red brick buildings. There are some structures in the south-east area that appear to be more modern. The railway embankment and tracks can be seen to the south of the site and the structures associated with the public baths can be seen to the north of the hospital. |



## 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 **Appendices i-iii**.

| 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 <b>Annex F</b> ). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works. |
| 1kg Incendiary bombs (IB)                              | In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII. | IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.                                                                                                                                                                                                                                                                                                                                               |
| Large Incendiary bombs (IB)                            | These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.               | If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Aerial or Parachute mines (PM)                         | These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.                      | If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.                                                                                                                                                            |
| Anti-personnel (AP) bomblets                           | These were not commonly used and are generally considered to pose a low risk to most works in the UK.                        | SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.                                                                                                                                                                                                                                                                                                                                             |

### **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, 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 Principle**

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 drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

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

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

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

#### 10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the *flying bomb* or *pilotless aircraft*, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in West Bromwich were generally too far to be considered for V-weapon strikes by the Luftwaffe.

The risk from V-weapons is therefore considered negligible and will not be further addressed in this report.

## **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. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex H**. This source does not record any WWI bombing incidents to have affected the site area or West Bromwich.

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 West Bromwich**

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 County Borough of West Bromwich, which sustained an overall low density of bombing, as represented by bomb density data figures presented below. West Bromwich itself did not contain many Luftwaffe targets, although some were present including the Swan Lane Gas Works located approximately 1km north-west from this area identified within available Luftwaffe sources presented in **Annex I**. However, the borough suffered during WWII as a result of its proximity to Birmingham. West Bromwich bordered the north-west of Birmingham, which did contain a number of significant Luftwaffe industrial targets, and consequently a number of bombs also landed in the West Bromwich area. The south of the borough bore the brunt of bombing, again due to its location in proximity to Birmingham, primarily around the areas of Lombard Street, and Tantany. West Bromwich also sustained its heaviest raids when Birmingham was also heavily targeted. The borough sustained its heaviest raid between the 19<sup>th</sup> and 20<sup>th</sup> of November 1940, in which a number of residential properties, public buildings and factories were damaged, including the General District Hospital on Edward Street.

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

Records of bombing incidents are presented in the following sections.



### 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 County Borough of West Bromwich between 1940 and 1945.

| Record of German Ordnance Dropped on the County Borough of West Bromwich |                                  |     |
|--------------------------------------------------------------------------|----------------------------------|-----|
| <b>Area Acreage</b>                                                      | <b>7,180</b>                     |     |
| <b>Weapons</b>                                                           | High Explosive bombs (all types) | 158 |
|                                                                          | Parachute mines                  | 0   |
|                                                                          | Oil bombs                        | 5   |
|                                                                          | Phosphorus bombs                 | 0   |
|                                                                          | Fire pots                        | 0   |
|                                                                          | Pilotless aircraft (V-1)         | 0   |
|                                                                          | Long range rocket bombs (V-2)    | 0   |
| <b>Total</b>                                                             | <b>163</b>                       |     |
| <b>Number of Items per 1,000 acres</b>                                   | <b>22.7</b>                      |     |

Source: Home Office Statistics

This table does not include UXO found during or after WWII.

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

### 11.4. Bomb Census Mapping for the Handsworth Area

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced both consolidated and weekly bomb census maps for the London Civil Defence Region, as well as census mapping of V-1 pilotless aircraft. These maps collectively show the approximate locations of bombs, mines and rockets dropped in the region. The site area was checked on each available map sheet. The maps for the area only appear to cover two raids but have been consulted- copies are presented in **Annex J**.

| Weekly London Bomb Census Maps                   |                                                                                                                                                                                                           |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date Range                                       | Comments                                                                                                                                                                                                  |
| 19 <sup>th</sup> /20 <sup>th</sup> November 1940 | No bombs are recorded on site. One 250kg HE bomb is recorded just outside the northern boundary, across Edward Street, at the location of the public baths.                                               |
| Unknown Date                                     | No bombs are recorded on site. One HE bomb is recorded just outside the northern boundary of the site at the location of the public baths. This map may be recording the same strike as the previous map. |

### 11.5. Bomb Census Reports

Bomb census reports compiled by the Research and Experiments Branch of the Ministry of Home Security during WWII were consulted at The National Archives. These reports recorded information such as the date, time, type and damage caused by bomb incidents for a selected time period in the region and are therefore not often comprehensive.

A transcript of the associated written records of bomb incidents in the West Bromwich area is presented in the table below.

| Ministry of Home Security Bomb Census Reports |                 |                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                                          | Type of bomb    | Comments                                                                                                                                                                                                                                                                                                                                               |
| 27 <sup>th</sup> /28 <sup>th</sup> July 1942  | I.Bs and H.E.s  | 'At approximately 01.30 27/28.7.42. Birmingham was attacked by some 55 planes... I.B.'s and flares were dropped followed by H.E.<br>Areas affected- City Area, Harborne, Hall Green, Solihull, Smethwick, Oldbury, <b>W. Bromwich</b> , Castle Bromwich, Little Bromwich and Hansworth'.<br><i>The exact locations of these incidents are unknown.</i> |
| 28 <sup>th</sup> July 1942                    | I.B.s and H.E.s | Incendiaries were dropped over West Bromwich, followed by H.E. bombing.<br><i>The exact locations of these incidents are unknown.</i>                                                                                                                                                                                                                  |

### 11.6. Anecdotal Accounts of Bombing

Several first-hand accounts of the bombing of the hospital on the night of the 19<sup>th</sup> of November 1940 have been collected and are presented below. Anecdotal evidence of bombing at the Gala Baths just to the north of the site has also been included. Passages of particular note have been put in bold.

| WWII-Era Aerial Photography                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source                                          | Account                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Delia Lowndes via WW2 People's War <sup>2</sup> | ' <b>Having arrived at the District General Hospital, West Bromwich from Ireland on 30<sup>th</sup> June 1940, I was very much a new recruit when the hospital was bombed on the night of 19<sup>th</sup> November 1940.</b><br>I was on duty that evening when the bombing started at 7.30pm and went on relentlessly for the next 8 hours over the town of West Bromwich, with the hospital in its midst.<br>The initial assault was carried out by means of <b>incendiary bombs which continued to come through the roof of the hospital on to the wards and corridors.</b> We had been given some instructions on how to handle these types of bombs and the procedures for putting them out by the use of sand bags and stirrup pumps. All to be done as quickly as possible to prevent a fire taking hold and spreading around the hospital.<br>The incendiary bombs were meant to cause fires which would guide following bombs to their targets, dropping high explosive bombs to increase the damage. <b>A number of high explosive bombs were dropped on the hospital which caused considerable damage, cutting off water supplies and filling the hospital full of smoke. A decision had to be made to take patients in the wards down to the air raid shelters situated in the hospital grounds.</b> This is where my nightmare started.<br>One patient could not be moved to the shelters for medical reasons. I being a junior nurse was allocated the duty of staying with him. <b>We could hear the bombs coming down and</b> |

<sup>2</sup> <https://www.bbc.co.uk/history/ww2peopleswar/stories/54/a1968654.shtml>

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|                                                                                      | <p><b>exploding all around the hospital for what seemed a life time.</b> The patient was very brave and remained calm in his bed for what seemed to be an eternity.</p> <p><b>After some considerable time at this post, another wave of bombers came over, their bombs blew out what remained of the windows and parts of the hospital buildings. The decision was then made to evacuate all the patients to Hallam Hospital (now The Sandwell and Dudley Hospital).</b> Outside, the incendiaries had started a number of fires in two of the outer buildings, one was the Hospital Laundry recently refurbished with new laundry equipment. <b>The roof the swimming baths was well and truly burning fiercely causing two large fires to be burning on two sides of a set of railway lines, leaving only one route for possible evacuation of the patients. This was also later subjected to a bomb.</b> Staff had, however, managed to clear a route of debris for an escape to Hallam Hospital. At about 3am we were on our way to the safety of Hallam where we felt we were in paradise, escaping from the heat of the blazing inferno of the town of West Bromwich.</p> <p>We had a wonderful Matron, Miss Thomas. She was a fine disciplinarian and instilled in all her staff a deep sense of duty which stood everybody in good stead during that dreadful night. Matron was awarded the George Medal.</p> <p>Each member of staff was given a Commendation as an appreciation of their devotion to duty on that dreadful night. The words of that Commendation are as follows:</p> <p>“West Bromwich and District General Hospital, 6<sup>th</sup> December 1940:</p> <p>At a full meeting of the Council of Management held on the 2<sup>nd</sup> December, 1940, it was unanimously resolved to place on record the feelings of profound admiration and pride with which the members had received the details of the magnificent courage, ability and team spirit shown by every single member of the Staff in dealing with the serious enemy air raid on the night of the 19<sup>th</sup> November 1940.</p> <p><b>The Council of Management fully realise that the evacuation of the 91 patients without loss of life, and the prevention of total demolition of the Hospital by fire, was entirely due to the almost incredible bravery, devotion and discipline of all concerned.</b></p> <p>President’.</p> |
| <p>Patrick Moren<br/>via WW2<br/>People’s War <sup>3</sup></p>                       | <p>‘We soon heard the familiar drone of the German engines and this time the incendiaries started to fall followed by the high explosives. The whine of falling bombs was a distinctive sound amongst the general noise.</p> <p>Peacocks warehouse (a retail chain store) was set alight, together with the Gas showrooms in the High Street, Hill and Long’s furniture storage, a typewriter factory in Victoria Street and many others. The high explosives caused many fatal casualties in nearby streets, and there were many acts of bravery. At Richard Street South a young boy bravely held his baby sister above the floodwater that had crept up the stairs in the cellar of his wrecked home. They were rescued after many hours. Broken mains water was a threat in bombed homes. <b>There was a direct hit on a fire engine near Edward Street, and the Edward Street hospital boiler unit was destroyed. Part of the boiler came through our roof and landed on my brother’s bed. We found an unexploded incendiary bomb in a roof gutter months later.</b></p> <p>As the light from the many fires increased my father suddenly made an extraordinary decision to get the family Standard saloon car out of the garage and drive us all out of the raid. The garage had a first floor storage area reached by a wooden step ladder on the wall. My father had to drive over a girder blown into our rear garage access alley. The drive through the raid is clear in my memory, with the many fires and the sound of the bombs and anti-aircraft guns near I think to Stone Cross’.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p>Ann Harrison via<br/>West Bromwich<br/>Local History<br/>Society <sup>4</sup></p> | <p>‘I worked at West Bromwich and District General Hospital, Edward Street, between October 1961 and May 1964, in the Group Secretariat Department on the first floor next door to the Board Room... <b>Across the road, on the corner of Lombard Street and Edward</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

<sup>3</sup> <https://www.bbc.co.uk/history/ww2peopleswar/stories/90/a2327690.shtml>

<sup>4</sup> <https://www.westbromwichhistory.com/people-places/hospital-stories-1/>



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|                                                                              | <p><b>Street, was the hospital laundry was bombed during the Second World War.</b> Behind that, there was the engineers department’.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p>Various accounts via West Bromwich Local History Society <sup>5</sup></p> | <p>‘On 19th November 1940, West Bromwich suffered its worst air raid of the war, which killed over 50 people. <b>The District hospital in Edward Street was badly hit.</b> The sirens in West Bromwich sirens sounded at 6.53pm. It was the 185th warning.</p> <p>Bill Markham, aged 14, had recently started work at PEL, part of Accles &amp; Pollock, earning ten shillings a week. He was diagnosed with pleurisy and admitted to the District hospital at lunchtime on 19th November. He was placed on one of the ‘round’ wards. <b>The incendiaries dropped by the planes caused widespread fires and heavy explosive bombs destroyed part of the hospital. All the windows were shattered. With large fires burning on two sides and the railway embankment blocking any exit at the rear of the building, single-handedly the Matron puts out incendiaries in one block. Despite the rubble strewn across the roads, incredibly the hospital was evacuated in less than 70 minutes.</b> One of 91 patients, Bill was taken away to safety at Hallam Hospital in a converted bus ambulance. The stretchers used were made of two steel tubes with a bracing piece between them and covered with a wire mattress. These very stretchers were made at his place of employment. He was later told that Hill &amp; Longs furniture warehouse, on the other side of the railway line, was hit and a piece of metal girder travelled through the air as far as the hospital, falling right through the roof of the very ward he was in. Once at Hallam he was put in the veranda outside the main ward. The ack-ack guns at Stone Cross and Hill Top golf course were firing constantly, creating a terrific noise. Pieces of shrapnel rained down with a rattling sound on the glass roof of the veranda.</p> <p><b>Dr William Walton, the Medical Officer of Health for the town, was standing with the 53-year-old Matron, Miss Evalyn Gertrude Thomas, in a corridor discussing the situation with the fires when three high explosive bombs hit. The blast threw the both of them in different directions. In front of him, the corridor caved in and debris fell all around. He later told a reporter, “The Matron was magnificent. Despite this gruelling experience she carried on unperturbed with her work and superintended the evacuation of the hospital with the greatest efficiency.”</b> Indeed, the Matron picked herself up and set about the evacuation. After they dealt with the patients, the staff then went back to into the blazing hospital to bring out bandages, dressings and drugs. Anything capable of being carried they took away to a place of safety. Only three nurses were wounded and three patients suffered minor injuries, two from fragments of glass. Miss Thomas returned to work in the morning and insisted that the Union Jack be raised above the shattered hospital. For their work that night the Dr. Walton and Miss Thomas were both awarded the George Medal, receiving their award from the King at Buckingham Palace on 17th June, 1941.</p> <p>Alma Broad was on messenger duty that night. “As the bombs came down they made a sort of whistling sound. We used to count to seven, when we got to seven we said, That one didn’t have our name on. Dorothy and me were going back to our post. <b>We were in the High Street on our way to Moor Street to get back to B9 when we heard this explosion, then another, these seemed to shake the earth; they were different to other bombs. We found out they were land mines. We went round to Lombard Street to help as we could see the devastation by the hospital and the wardens, nurses, doctors all working to evacuate the patients from the wards.</b> Matron was there, she was great; she spoke to us to tell us what to do. We actually thought she was a Sister as we had never seen a Matron before. I remember her going back to a ward upstairs and putting the Union Jack through the window. When we got back to our post and told the warden on duty, which was my Dad, about Matron, he said, I think that is something you will remember all your life”.’</p> |
| <p>John Day via West Bromwich</p>                                            | <p>‘Wednesday 19th November. <b>Worst air raids on West Bromwich of the war.</b> The alarm went off Code Red from around 1900 hrs. <b>Bombing on town centre, three bombs on Lombard Street, other on Gas Showrooms next to and above the War Rooms, Lombard Street and demolition of the Gala Baths and Laundry. Bratt Street, Paradise Street, Peacocks Store, Bromford Lane, and Victoria Street all hit and the surrounding areas on</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

<sup>5</sup> <https://www.westbromwichhistory.com/>



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|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local History Society <sup>6</sup>                                          | <b>fire. The General Hospital on Edward Street was evacuated during the height of these activities with patients taken to Hallam Hospital at Lyndon.</b> Staff returned for bandages, drugs, equipment and anything useful and transportable. (The Registrar Dr. William Stanley Walton and Sister Moore were awarded the George Medal on behalf of the staff and in 'recognition of the deeds done on this day').                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Various Accounts of Gala Bath bombing via Lostlidos.co.uk <sup>7</sup>      | <p><b>'The Gala Baths was adjacent to the original baths which were destroyed by enemy action, and rebuilt as the Gala Baths... Gala Baths West Bromwich was an opulent building. I was always fascinated by the boarded windows and iron railings adjacent to the entrance of the Gala Baths. This of course was the original bath bombed during the war.</b></p> <p>Eds note:</p> <p>This was the very first swimming pool I saw when I was three years old. I remember it vividly today. This huge, huge bath almost "as big as the sea," surrounded with high walls with people splashing about, and so very deep.</p> <p>The baths were an opulent building. The Gala Baths had two entrances – one from Lombard Street being the main entrance, but the one that was used generally was through a side entrance in Edward Street leading to the ticket office. This entrance also led to a Gala Suite used for banquets and weddings. Also a cafe and committee rooms.</p> <p>The Mens changing area were immediately to the left on entering the main bath hall. There were cubicles under the spectators gallery with stairs leading to more first floor cubicles. The Ladies approached the similar two tiered changing cubicles via a walk along the top end of the bath the opposite side.</p> <p>One passed the wonderful tiling that formed a dado and surrounded a doorway leading to a long wide warm marble floored corridor (more like a hallway) that led to the Learners Pool.</p> <p><b>As one walked down this corridor there was a doorway to the right (out of bounds) which if one ventured inside would lead to the bombed remains of the original bath – forbidden territory.'</b></p> |
| David Brown in the article <i>Bombing in West Bromwich in World War Two</i> | <p>'On the 19th November the Germans launched a nine-hour attack on the Midlands with wave after wave of bombers. In West Bromwich bombs hit, Richard Street, South, Lombard Street, Constance Avenue, Florence Road, Paradise Street, <b>the District Hospital in Edward Street</b>, the Corporation Gas Showrooms next to the Central Library, Oak Road and the Corporation Bus Garage and the Palace Cinema in the High Street.'</p> <p><b>'A further bomb totally smashed the laundry of the District Hospital in Edward Street and damaged parts of the hospital itself.</b> The town's Medical Officer, Dr. Walton, and hospital matron were blown in opposite directions whilst standing in a corridor. Dr. Walton reported, 'the corridor caving in front of me', nevertheless they both picked themselves up and got on with supervising the evacuation of 90 patients to Hallam Hospital. Both received the George Medal for their bravery.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

<sup>6</sup> <https://www.westbromwichhistory.com/people-places/john-days-story/>

<sup>7</sup> <https://www.lostlidos.co.uk/>



11.7. Surveys of Damage in Great Britain. Birmingham. History of Raids.

A report commissioned by the Ministry of Home Security Research and Experiments Department was consulted at The National Archives. The report provides general details of bombing raids in the greater Birmingham region, including West Bromwich, between 1940 and 1943. Whilst the report details the dates, types of bomb that fell and the damage caused, locations are often vague and simply confirm when bombs fell in the area.

| Surveys of Damage in Great Britain. Birmingham. History of Raids. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date Range                                                        | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 19 <sup>th</sup> /20 <sup>th</sup><br>November                    | <p>On November 19<sup>th</sup> the alert sounded at 18:49 hrs and half an hour later the attack commenced at Edgbaston, south of the city. Simultaneously, came reports of <b>incendiaries</b> dropped on the boundary of West Bromwich, which is the north-west of the city. There was a small interval after this first wave, until at 20:05 reports began to come in of incidents in the south-east followed by more reports from north-west. 38 HEs fell in the first half hour.</p> <p>So far the incidents reported had been in a semi-circle form south-east to north-west of the city.</p> <p><b>About 00:50 the West Bromwich and district hospital was hit, and surrounded by fires.</b> Altogether <b>53 HE's 56 IB's</b> and <b>1 UXB</b> fell in West Bromwich, but owing to all the telephones in the being out of operation, reports were not received until the next day. Seven public buildings and nine factories were damaged or destroyed, as well as much residential property. Group mutual aid sent them reinforcements.</p>                                                                                                                                                                                                                               |
|                                                                   | <p>23:45/20 Report of further damage at West Bromwich. <b>53 HE, 56 I.B, 1 UXB.</b></p> <p>Damage to public buildings:</p> <ol style="list-style-type: none"> <li><b>1. Wes Bromwich and District Hospital ... Extensive</b></li> <li>2. Corporation Gas Dep Showroom...Entirely destroyed</li> <li>3. Public Library.....Extensively damaged</li> <li>4. Town Hall and Offices....slightly damaged</li> <li>5. Public Baths.... Extensively by fire</li> <li>6. Hill Top Elementary School... Direct hit.</li> <li>7. Law Courts</li> </ol> <p>Damage to factories:</p> <ol style="list-style-type: none"> <li>1. Jensen Motors... Completely gutted</li> <li>2. Forward Oil Co.... Damaged by fire</li> <li>3. Hayes Spring Co. .... Damage by HE</li> <li>4. Midland Candle Factory...Gutted by fire</li> <li>5. Byfords Grice St.... Damaged by fire</li> <li>6. J. and T.....Foundry and roof shattered</li> <li>7. Masters and sons .... Buildings destroyed</li> <li>8. British Typewriters.... Completely gutted</li> </ol> <p>In addition, Woolworths and Marks and Spencer's were damaged by fire and Wn Wild's New Factory Grice St was completely burnt out, damage being caused to plant and machinery. Residential property suffered throughout the whole area.</p> |



**11.8. WWII-Era Aerial Photography**

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

| WWII-Era Aerial Photography                 |                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                    |
| 26/04/48 - National Monuments Record Office | The structures on site appear to be intact although this photography is not the highest resolution. Some of the roofs appear to be a bit lighter in places which would indicate that they have been repaired.<br><br>Repairs appear to have been undertaken at the public baths to the north of the site, with possible damage/clearance to the north-east across Edward Street and to the immediate east too. |
| 1946 - Britain from Above                   | Oblique photography shows the site from the south east of the site. Most of the roofs of the various buildings are lighter in places which would suggest that repairs were undertaken following bomb/ fire damage.<br><br>A house to the east of the site appears to be damaged. The roof the public baths is missing-possibly blown off by bombing.                                                           |
| 1946 - Britain from Above                   | Oblique photography shows the site from the east. Again many of the roofs show that repairs appears to have been undertaken across all the buildings. Some of the windows look like they may still be damaged. Repairs can be seen to be underway on a house to the east of the site.                                                                                                                          |

**11.9. 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.

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



### 11.10. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) 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, Geo Environmental Group will be advised.

### 11.11. Evaluation of German Aerial Delivered UXO Records

| Factors                                                                                                                                                                                                                                                                                                                                                                                                               | Conclusion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <p><b>Density of Bombing</b></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 situated within the County Borough of West Bromwich, which according to official Home Office bombing statistics sustained an overall low density bombing campaign, with an average of 22.7 items of ordnance dropped per 1,000 acres. Bombing in West Bromwich may be attributed to the proximity of Birmingham and various targets located within the area.</p> <p>Written records and bomb mapping show that the area was bombed by both incendiary and HE bombs. Indeed, various anecdotal sources and written records from the National Archives record that the hospital was bombed on the 19<sup>th</sup>/20<sup>th</sup> of November 1940. The exact number and locations of bombs are unclear, though at least three HE bombs are mentioned in one account from the West Bromwich Local History Society. A public bath to the north is also noted to have been bombed.</p>                                                                                                                                                                                                                           |
| <p><b>Damage</b></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>Various anecdotal accounts and a Surveys of Damage report by the Ministry of Home Security Research and Experiments Department record significant damage sustained to the hospital, with extensive damage noted to hospital wards and corridors and part of the boiler room/laundry destroyed completely, following the bombing raid on the 19<sup>th</sup>/20<sup>th</sup> of November 1940. Debris is also noted across the site area, although the prevention of total demolition of the Hospital by fire is noted to have been credited to those present at the time.</p> <p>However, a comparison of pre and post-war OS mapping and WWII-era aerial imagery indicates much of the hospital survived the war structurally intact. No significant damage, such as clearance or ruined buildings can be seen, though indicators of blast/repairs can be seen in the form of discoloured roofing. Additional repairs may also have been undertaken prior to photography being available.</p> <p>Significant damage may be seen across Edward Street, including at the location of the public bath, and to the east of the site.</p> |
| <p><b>Ground Cover</b></p> <p><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>                                                                                                                                                                                                                          | <p>The site was occupied by several multi-storied structures. Generally, these are thought to have obviously shown signs of damage following bombing, such as entry holes and unaccounted damage. Conditions may however have reduced following the bombing raid on the 19<sup>th</sup>/20<sup>th</sup> of November 1940, due to the damage and debris recorded across the site area until repairs were made.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |





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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Access Frequency</b><br><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> | The site was occupied by a hospital which was in use during WWII. However, it is known that during the heavy raid on the 19 <sup>th</sup> of November 1940, that the hospital staff and patients were evacuated into shelters in the hospital grounds and to other nearby hospitals. It's not known exactly how long this period of evacuation lasted. However, as the raid on the 19 <sup>th</sup> /20 <sup>th</sup> of November 1940 is the only raid specifically noted to have occurred on site, with no evidence found to subsequent raids, and the fact that the main hospital structures look intact within WWII-era imagery, its anticipated that post-raid checks and access would have resumed as soon as possible in order to keep the hospital functioning during wartime. |
| <b>Bomb Failure Rate</b>                                                                                                                                                                                                                                                                                                                                                    | 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Abandoned Bombs</b>                                                                                                                                                                                                                                                                                                                                                      | 1 <sup>st</sup> Line Defence holds no records of abandoned bombs at or within the site vicinity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Bombing Decoy sites</b>                                                                                                                                                                                                                                                                                                                                                  | 1 <sup>st</sup> Line Defence could find no evidence of bombing decoy sites within the site vicinity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Bomb Disposal Tasks</b>                                                                                                                                                                                                                                                                                                                                                  | 1 <sup>st</sup> Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



**12. Introduction to Allied Ordnance**

**12.1. General**

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

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

**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"> <li>• Anti-aircraft gun emplacements to engage enemy aircraft.</li> <li>• Fighter aircraft to act as interceptors.</li> <li>• Rockets and missiles were used later during WWII.</li> </ul> | <ul style="list-style-type: none"> <li>• Blackouts and camouflaging to hinder the identification of Luftwaffe targets.</li> <li>• Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas.</li> <li>• Barrage balloons forced enemy aircraft to greater altitudes.</li> <li>• Searchlights were often used to track and divert adversary bomber crews during night raids.</li> </ul> |

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 | <b>Gun type</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Calibre</b> | <b>Shell Weight</b> | <b>Shell Dimensions</b> |
|                                      | 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 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 **Appendix iv**.





### 13. The Likelihood of Contamination from Allied Ordnance

#### 13.1. Introduction

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

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

#### 13.2. Evaluation of Contamination Risk from Allied UXO

1<sup>st</sup> Line Defence has considered the following potential sources of Allied ordnance contamination:

| Sources of Allied UXO Contamination                                                                                                                                                                                                                                                                         | Conclusion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Military Camps</b><br/><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>1<sup>st</sup> Line Defence could find no evidence of a military camp within the site.</p>                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><b>Anti-Aircraft Defences</b><br/><i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i></p>                                                                                                           | <p>1<sup>st</sup> Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 3.2km east of the site. Despite this distance the maximum effective range of an AA 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><b>Home Guard Activity</b><br/><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>Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.</p>                                                                                         |
| <p><b>Defensive Positions</b><br/><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 pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.</p>                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Training or firing ranges</b><br/><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>No evidence of training or firing ranges could be found within the site or surrounding area.</p>                                                                                                                                                                                                                                                                                                                                                                                             |





|                                                                                                                                                                                                                                     |                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <p><b>Defensive Minefields</b></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><b>Ordnance Manufacture</b></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> |
| <p><b>Military Related Airfields</b></p> <p><i>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.</i></p> | <p>The site was not situated within the perimeters or vicinity of a military airfield.</p>                        |

#### 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               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Quality of the Historical Record</b> | <p>The research has evaluated pre- and post-WWII Ordnance Survey maps, early photography of the hospital, WWI mapping of air raids and naval bombardments, Luftwaffe reconnaissance imagery, Bomb Census mapping for the Handsworth area, Birmingham Bomb Census Reports, anecdotal accounts of bombing and aerial and oblique post-WWII photography.</p> <p>The record set is of limited quality. Available maps only cover a specific period of time, the written records do not always given specific locations and the aerial photography is not high resolution. However, the anecdotal sources covering the raid on the hospital on the 19<sup>th</sup> of November 1940 are very detailed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>German Aerial Delivered Ordnance</b> | <ul style="list-style-type: none"> <li>• During WWII, the site was located within the County Borough of West Bromwich. According to official Home Office bombing statistics, West Bromwich sustained an overall low density bombing campaign, with an average of 22.7 items of ordnance dropped per 1,000 acres. Bombing in West Bromwich may be attributed to the proximity of Birmingham and various targets located within the area.</li> <li>• Pre- and post WWII OS mapping indicates the site to comprise a <i>General Hospital on Edward Street</i>, consisting of several large hospital buildings and interspersed open land.</li> <li>• Available written and anecdotal accounts reference multiple HE bomb strikes and incendiary bombing at the hospital on site. This looks to have occurred on the 19<sup>th</sup>/20<sup>th</sup> of November 1940, as referenced by multiple accounts. The exact number and locations of bombs during this raid are unclear, though at least three HE bombs are mentioned in one account from the West Bromwich Local History Society. No further raids on the hospital were evidenced within available materials.</li> <li>• Following bombing on the 19<sup>th</sup>/20<sup>th</sup> November 1940, anecdotal accounts and a Surveys of Damage report by the Ministry of Home Security Research and Experiments Department record that damage was sustained to the hospital, including to some of the hospital wards and corridors, while part of the boiler room/laundry was destroyed completely. The exact locations of such damage is unclear. Debris is also noted across the site area, although the prevention of the demolition of the hospital by fire is noted to have been credited to those present at the time.</li> <li>• Despite such damage noted, a comparison of pre and post-war OS mapping and WWII-era aerial imagery indicates much of the hospital survived the war structurally intact. No significant damage, such as clearance or ruined buildings can be seen in 1948 imagery, though indicators of blast/repairs can be seen in the form of discoloured roofing. Further repairs are anticipated to have been undertaken prior to the photography available.</li> <li>• Several references were found to the hospital being completely evacuated during the bombing raid on site. Additionally, ground conditions noted subsequent to bombing, including damage, rubble and debris specifically noted within the boundary, are not thought to have been favourable to the detection of UXO indicators. However, as the raid on the 19<sup>th</sup>/20<sup>th</sup> of November 1940 is the only raid specifically noted to have occurred on site, with no evidence found to subsequent raids, as well as the fact that the main hospital structures look intact within WWII-era imagery, its anticipated that post-raid checks and access would have resumed relatively swiftly. It is understood that the hospital remained in</li> </ul> |



|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | <p>regular use for the duration of the war after the clear up from this incident, with repairs made as soon as possible in order to keep the hospital functioning during wartime.</p> <ul style="list-style-type: none"> <li>• In summary, multiple references to bombing and bomb damage within the proposed site during wartime were encountered, with the hospital subsequently being evacuated for a period. Such factors would typically be a cause for potential concern. However, the hospital looks to largely have remained structurally intact post-war, with no further raids evidenced following that on the 19<sup>th</sup>/20<sup>th</sup> of November 1940. As such, it is anticipated that repairs would have been made, and access resumed as soon as possible in order to keep the hospital functioning during wartime. The chance of a UXB going missing on site during this raid is therefore not considered to be significant, although it cannot be discounted entirely.</li> <li>• Whilst attempts are usually made by 1<sup>st</sup> Line Defence to isolate 'zone' specific areas of bombing or significant damage, it has not been possible to isolate such areas on site on this occasion owing to the limited nature of the records available. In this instant, it's not considered likely that any one area was damaged significantly enough to elevate any one particular area of the proposed site, as the site appears largely structurally intact post-war. Accordingly there is a <b>Low-Medium Risk</b> of items of German aerial delivered and anti-aircraft unexploded ordnance assessed across the whole site footprint</li> </ul> |
| <b>Allied Ordnance</b> | <ul style="list-style-type: none"> <li>• 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.</li> <li>• The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## **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**

1<sup>st</sup> Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1<sup>st</sup> 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**

Significant development has occurred on site. Pre-WWII buildings on site appear to have been cleared and new structures have since been constructed.

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



## **16. The Likelihood of UXO Encounter**

### **16.1. Introduction**

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

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

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

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

### **16.2. Encountering 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. 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:

| <b>UXB Initiation</b>         |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Direct Impact</b>          | 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.                                                                                                                                                                             |
| <b>Re- starting the Clock</b> | 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.                                                                    |
| <b>Friction Impact</b>        | 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. 1<sup>st</sup> 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

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

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

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

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



## 20. Proposed Risk Mitigation Methodology

### 20.1. General

The following risk mitigation measures are recommended to support the proposed works at Edward Street Hospital:

| Type of Work | Recommended Mitigation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All Works    | <ul style="list-style-type: none"> <li> <b>UXO Risk Management Plan</b><br/> 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 1<sup>st</sup> Line Defence for help/more information. </li> <li> <b>Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.</b><br/> 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. </li> </ul> |

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, 1<sup>st</sup> Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

**1<sup>st</sup> Line Defence Limited**

**12<sup>th</sup> November 2021**

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.

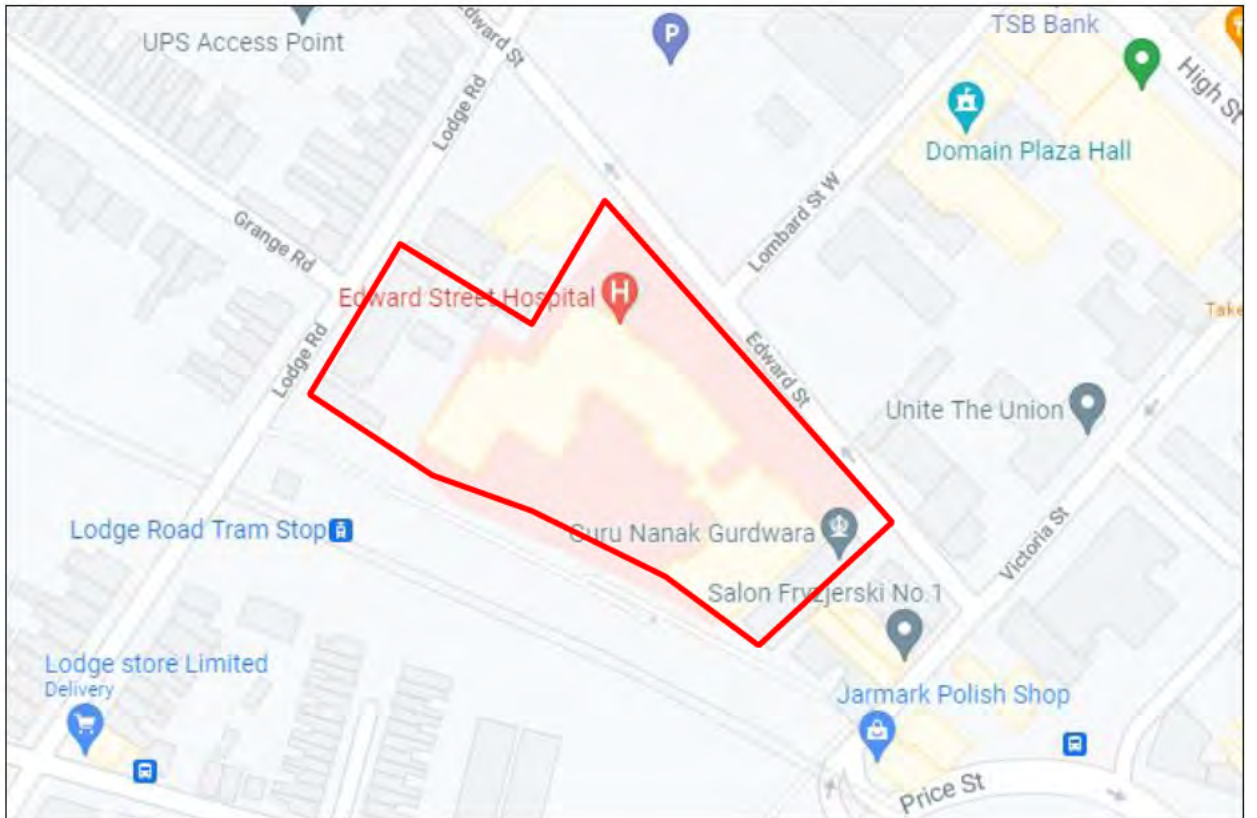
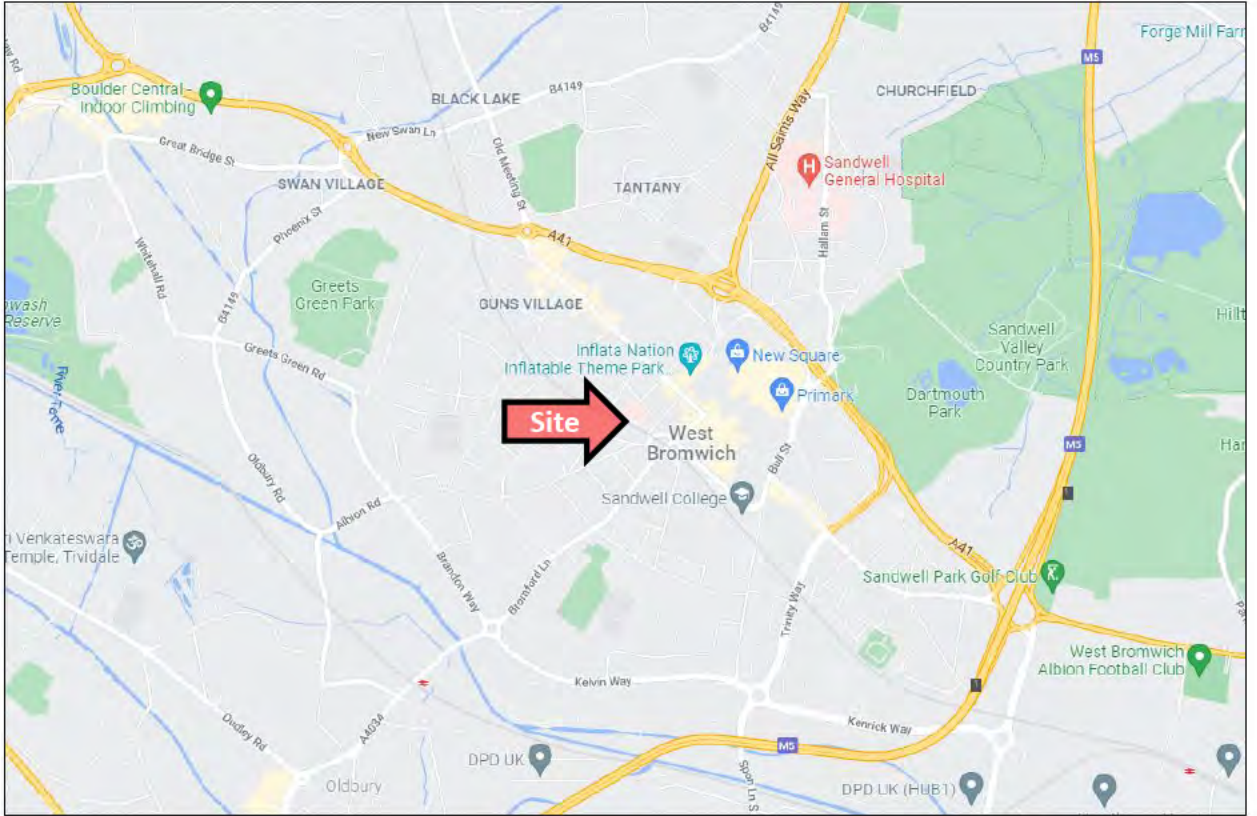
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Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: Google Maps

 **Approximate site boundary**








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Source: Google Earth™ Mapping Services





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Client: **Geo Environmental Group**

**—** Approximate site boundary

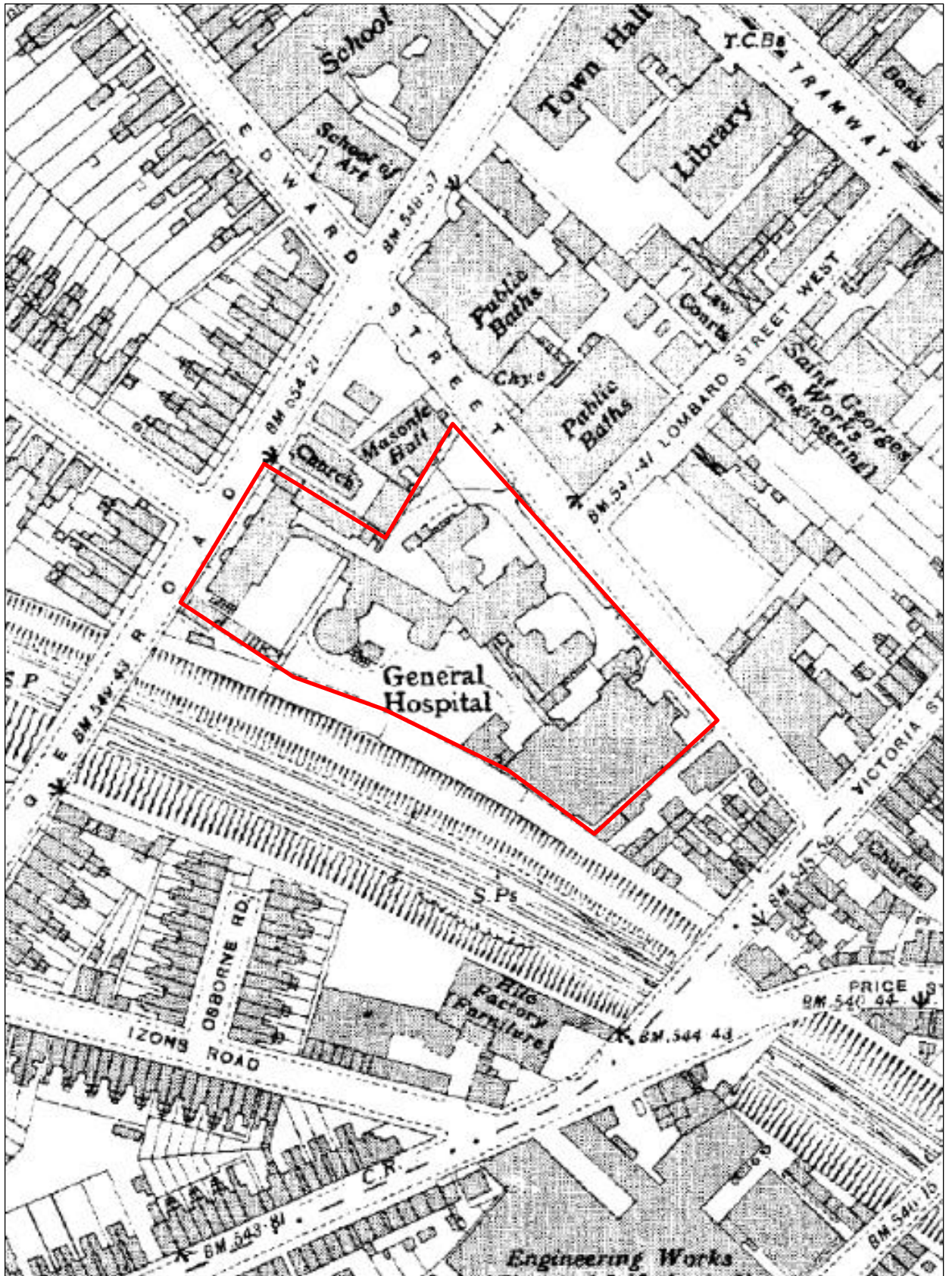
Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: Geo Environmental Group







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Tel: +44 (0)1992 245 020

Client: **Geo Environmental Group**

 **Approximate site boundary**

Project: **Edward Street Hospital, West Bromwich**



Ref: **DA14372-00**

Source: **Landmark Maps**





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Client: **Geo Environmental Group**

 **Approximate site boundary**

Project: **Edward Street Hospital, West Bromwich**



Ref: **DA14372-00**

Source: Landmark Maps



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Client: **Geo Environmental Group**

 **Approximate site boundary**

Project: **Edward Street Hospital, West Bromwich**



Ref: **DA14372-00**

Source: Landmark Maps



Edward Street hospital, previously known as the District General Hospital was founded in 1869. The red brick hospital was built between 1869 and 1871 to the design of Martin & Chamberlain of Birmingham. The hospital was funded by penny subscriptions of local people in the town. Additions were made in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries.



West Bromwich District Hospital, Edward Street, shortly after building in 1870 (Sandwell Archives).



West Bromwich District Hospital staff, 1870 (Sandwell Archives).



View of Edward Street Hospital, 1935 (Sandwell Archives).



West Bromwich District Hospital, men's ward, 1940.



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Client: **Geo Environmental Group**

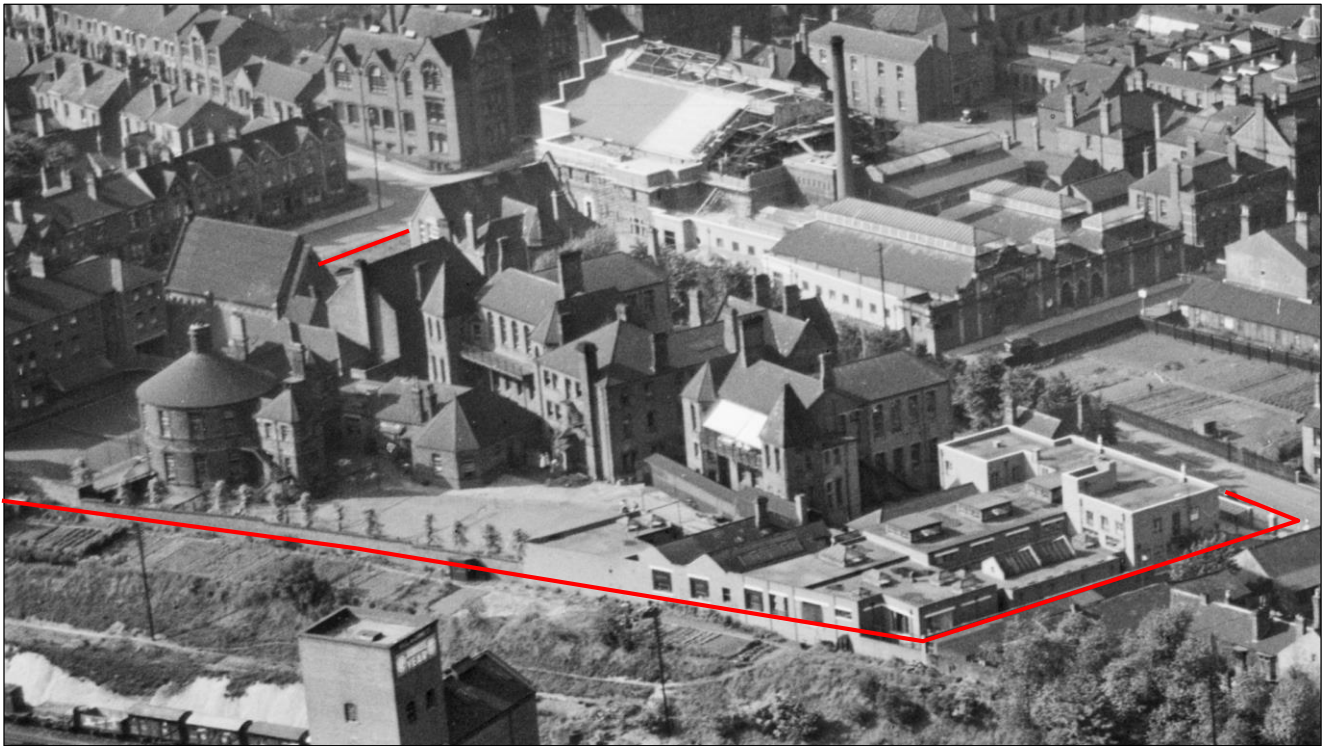
Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: West Bromwich Local History Society

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The E.M.B. Co Electrical and Mechanical Engineering Works, Hill & Long Ltd Furniture Factory and the General Hospital, West Bromwich, 1937:



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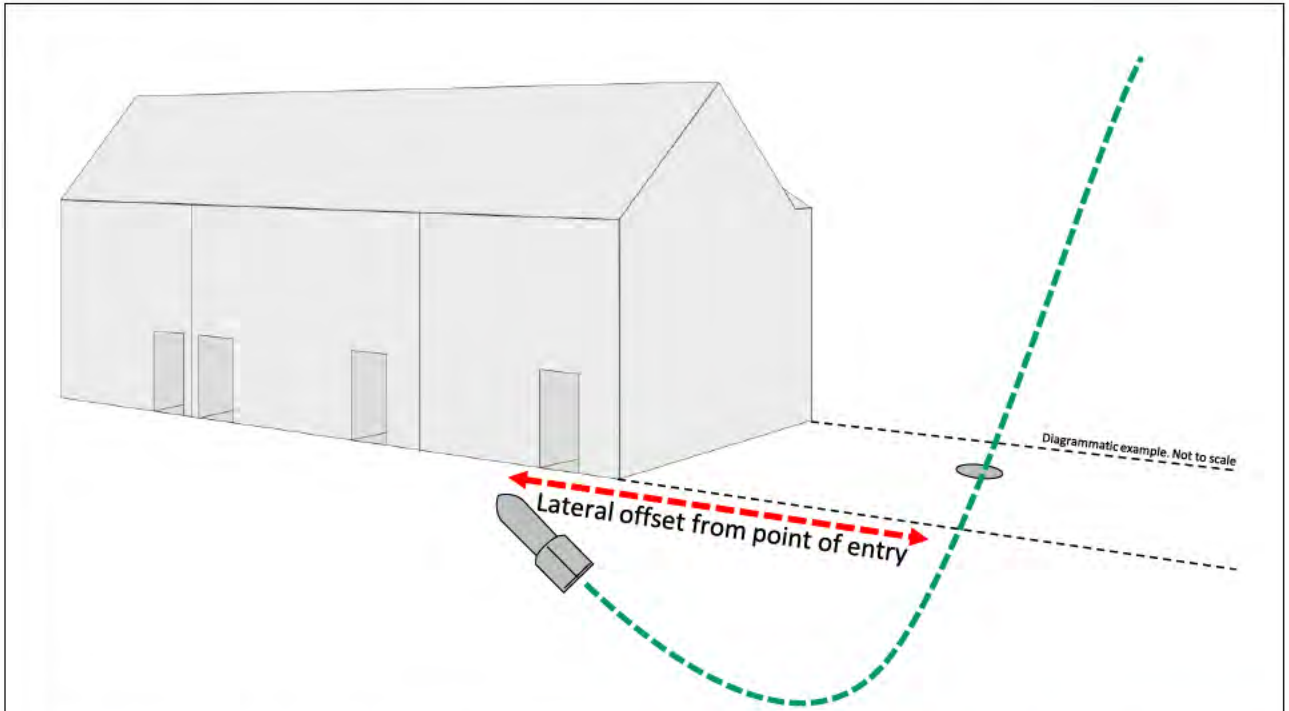
Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

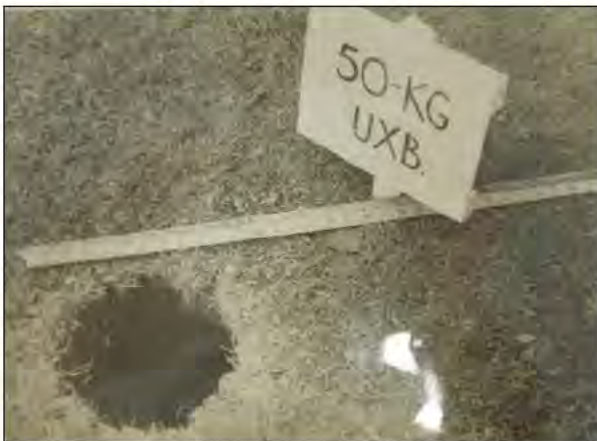
Source: Britain from Above







**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**).

**BBC**

**NEWS**

**Bermondsey bomb: World War Two device safely removed**



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

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

March 2015

**BBC**

**NEWS**

**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

**BBC**

**NEWS**

**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

**BBC**

**NEWS**

**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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Source: BBC News

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

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



### BASF Provides Some Details

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

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

1<sup>st</sup> March 2013

## WWII bomb injures 17 at Hattingen construction site



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

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

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

19<sup>th</sup> 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.

2<sup>nd</sup> 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.

23<sup>rd</sup> October 2006



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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 (2)

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.

Related Stories

- Police as dog nearly thrown grenade
- WW2 bomb found at wind farm exploded
- WWII bomb found in kitchen exploded

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.

### 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 2016



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: 09:51:12 January 2016

338 shares

10 Voted comments

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@thetmgroop.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.

Six a mid December: the Royal Navy's Southern Dive Unit has recovered 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, the legacy of that conflict lingers on in form of old battleships 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.

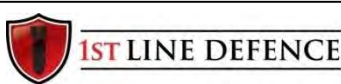
In areas of responsibility stretches the some 23000 (1,400 miles), it begins from the highest peak in Hull and proceeds seaward to the territorial limit, and then turns clockwise around the British Isles - including the Isle of Wight, Channel Islands, and Isles of Scilly - to finish in Liverpool.

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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Client: **Geo Environmental Group**

Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00** Source: Various news sources



# Watch: Army explode 'Second World War bomb' in Black Country woodland

CENTRAL | ENVIRONMENT | Tuesday 2 March 2021, 3:34pm



*Willow Avenue, Bearwood  
Credit: Max Such*

The army has exploded a 'Second World War bomb' in woodland after it was found in a garden - sending a huge blast across surrounding areas.

Bomb experts were drafted in to prepare for the controlled detonation at around 1.30pm on (March 1st).

Those living in Willow Avenue, Bearwood were asked to evacuate after the alarming discovery.

Shortly after the device was destroyed at Warley Woods.



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Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: **ITV News**

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Above: The Swan Lane Gas Works, identified as a target within this image, was located approximately 1km north-west of the site



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Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: Unknown

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19<sup>th</sup>/20<sup>th</sup> November 1940:



Unknown Date:



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Source: The National Archives, Kew

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 **Approximate site boundary**



Project: **Edward Street Hospital, West Bromwich**

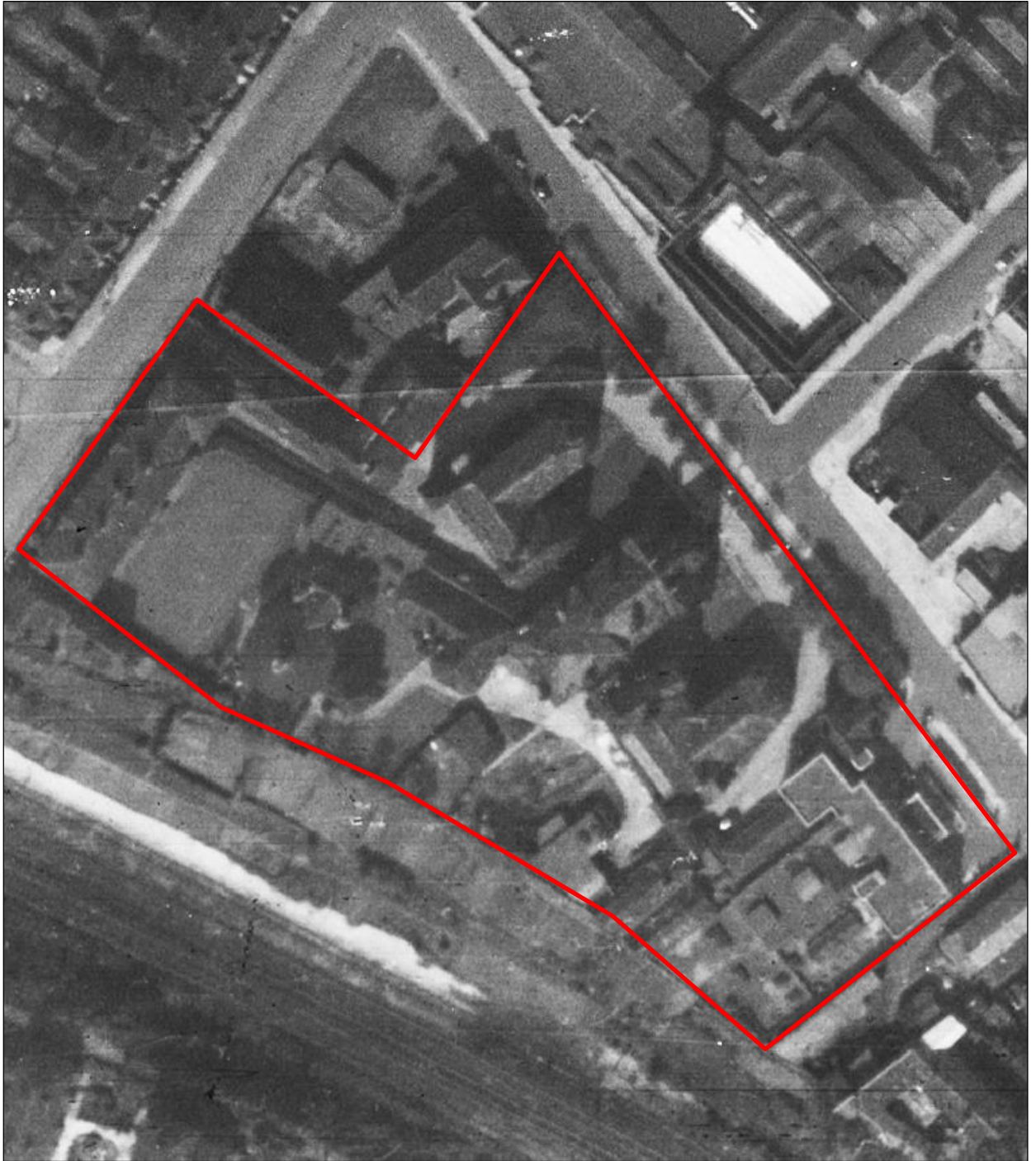
Ref: **DA14372-00**

Source: **National Monuments Record Office (Historic England)**

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Enlarged view of the site:



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 **Approximate site boundary**



Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: National Monuments Record Office (Historic England)

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The E.M.B. Co Ltd (Electro-Mechanical Engineering) Works on Moor Street and environs, West Bromwich, 1946:



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 partial site boundary

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Source:



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| SC 50kg          |                                                                                                                                           |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight      | 40-54kg (110-119lb)                                                                                                                       |
| Explosive Weight | c25kg (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         |                                                                                                                                                          |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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). |

| SC 500kg         |                                                                                                                                                              |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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, trialene. Bombs recovered with Trialene filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming |

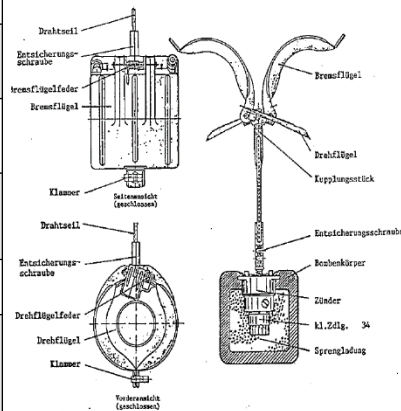
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|-------------------------------------------------------|-------------------------|
| Client: <b>Geo Environmental Group</b>                |                         |
| Project: <b>Edward Street Hospital, West Bromwich</b> |                         |
| Ref: <b>DA14372-00</b>                                | Source: Various sources |

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| SD2 Butterfly Bomb |                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight        | 2kg (4.41lb)                                                                                                                                                                         |
| Explosive Weight   | 7.5oz (212.6 grams ) of TNT surrounded by a layer of bituminous composition.                                                                                                         |
| Fuze Type          | 41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)                                                                                                    |
| Bomb Dimensions    | Length 240 mm<br>Width 140 mm<br>Height 310 mm                                                                                                                                       |
| Body Diameter      | 3in (7.62 cm) diameter, 3.1in (7.874) long                                                                                                                                           |
| Use                | It was designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers that opened at a predetermined height, thus scattering the bombs. |
| Remarks            | The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.                                                                              |



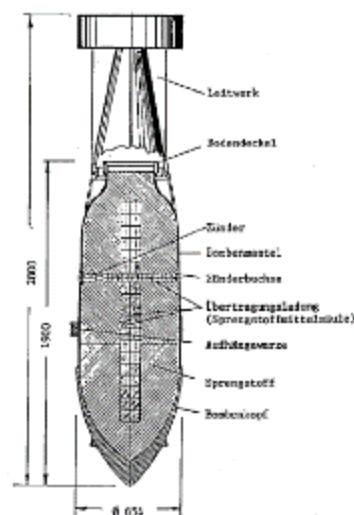
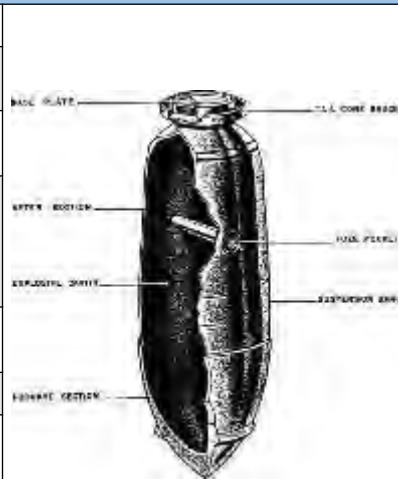
## Parachute Mine (Luftmine B / LMB)

|                  |                                                                                                                                                                         |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight      | 987 017kg (2176lb)                                                                                                                                                      |
| Explosive Weight | 125-130kg (276-287lb)                                                                                                                                                   |
| Fuze Type        | Impact/ Time delay / hydrostatic pressure fuze                                                                                                                          |
| Bomb Dimensions  | 1640 x 512mm (64.57 x 20.16in)                                                                                                                                          |
| Body Diameter    | 368mm (14.5in)                                                                                                                                                          |
| Use              | Against civilian, military and industrial targets. Designed to detonate above ground level to maximise damage to a wider area.                                          |
| Remarks          | Parachute Mines were normally carried by HE 115 (Naval operations), HE 111 and JU 88 aircraft types. Deployed a parachute when dropped in order to control its descent. |



## SC 1000kg

|                  |                                                                                                                                                                                                       |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight      | 996-1061kg (1,058-1,146lb)                                                                                                                                                                            |
| Explosive Weight | 530-620kg (551-573lb)                                                                                                                                                                                 |
| Fuze Type        | Electrical impact/mechanical time delay fuze.                                                                                                                                                         |
| Filling          | Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.                                     |
| Bomb Dimensions  | 2800 x 654mm (77 x 25.2in)                                                                                                                                                                            |
| 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 |



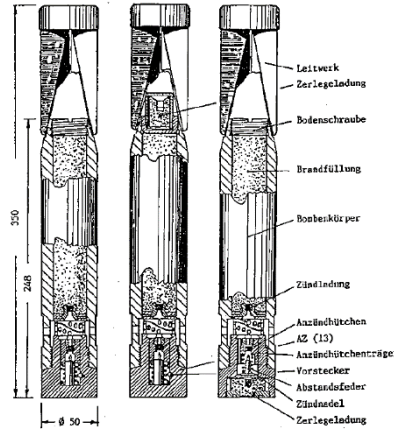
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|                                                                                                                               |                         |
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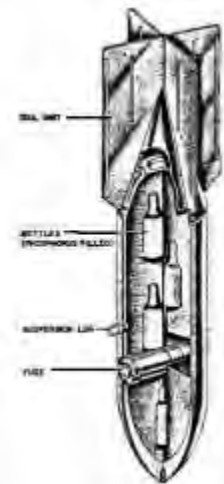
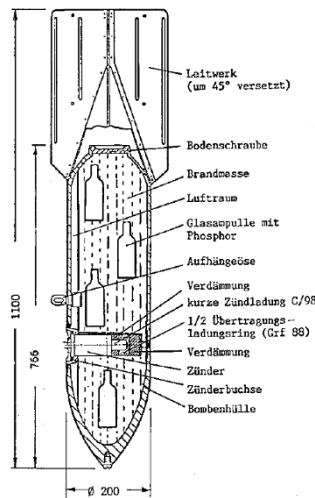
## 1kg Incendiary Bomb

|                  |                                                                                                                                                                                 |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight      | 1.0 and 1.3kg (2.2 and 2.87lb)                                                                                                                                                  |
| Explosive Weight | 680gm (1.3lb) Thermitite                                                                                                                                                        |
| 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 against 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. |



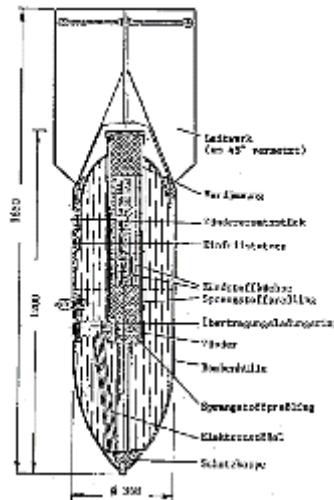
## C50 A Incendiary Bomb

|                    |                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------|
| Bomb Weight        | c41kg (90.4lb)                                                                                                   |
| Explosive Weight   | 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 all targets where an incendiary effect is to be expected                                                 |
| Remarks            | Early fill was a phosphorous/carbon disulphide incendiary mixture                                                |



## Flam C-250 Oil Bomb

|                  |                                                                                                                                                           |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bomb Weight      | 125kg (276lb)                                                                                                                                             |
| Explosive Weight | 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 living targets, against troop barracks and industrial installations. Thin casing – not designed for ground penetration |



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Client: **Geo Environmental Group**

Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: Various sources



# Examples of Anti-Aircraft Projectiles

## QF 3.7 Inch WWII 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               | High Explosive Anti-Aircraft projectile. 4.5in projectiles were also used in this role. |
| Ceiling           | 30,000ft to 59,000ft                                                                    |



## 40mm Bofors Projectile

|                       |                                    |
|-----------------------|------------------------------------|
| Projectile Weight     | 1.96lb (0.86kg)                    |
| Explosive Weight      | 300g (0.6lb)                       |
| Fuze Type             | Proximity and Mechanical Time Fuze |
| Rate of Fire          | 120 rounds per minute              |
| Projectile Dimensions | 40mm x 310mm (1.6in x 12.2in)      |
| Ceiling               | 23,000ft (7000m)                   |



## Unrotated Projectile (UP) – Z Battery

|                   |                                                                                                                                                                                                                                                             |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Projectile Weight | 84lb (24.5kg)                                                                                                                                                                                                                                               |
| Warhead Weight    | 4.28lb (1.94kg)                                                                                                                                                                                                                                             |
| Warhead           | Aerial Mine with a No. 700 / 720 fuze                                                                                                                                                                                                                       |
| Filling           | High Explosive                                                                                                                                                                                                                                              |
| Dimensions        | 1930mm x 82.6mm (76 x 3.25in)                                                                                                                                                                                                                               |
| Use               | 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. |



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Client: **Geo Environmental Group**

Project: **Edward Street Hospital, West Bromwich**

Ref: **DA14372-00**

Source: Various sources

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## **APPENDIX F**

### **EXPLORATORY HOLE LOGS**





# Borehole Log

Borehole No.

**WS01**

Sheet 1 of 1

|               |                                                               |             |            |          |                   |           |      |
|---------------|---------------------------------------------------------------|-------------|------------|----------|-------------------|-----------|------|
| Project Name: | Edward Street Hospital, West Bromwich                         | Project No. | GEG-21-706 | Co-ords: | 400196E - 291208N | Hole Type | WS   |
| Location:     | Edward Street Hospital, Edward street, West Bromwich, B70 8NL |             |            | Level:   | 167.30 m AOD      | Scale     | 1:31 |
| Client:       | VINCI                                                         |             |            | Dates:   | 08/11/2021        | Logged By | AT   |

| Well | Water Strikes    | Sample and In Situ Testing |          |                                | Depth (m) | Level (m) | Legend                    | Stratum Description                                                                                                                           |     |
|------|------------------|----------------------------|----------|--------------------------------|-----------|-----------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----|
|      |                  | Depth (m)                  | Type     | Results                        |           |           |                           |                                                                                                                                               |     |
| Well | Water<br>Strikes | 0.00                       |          |                                | 0.00      |           |                           | MADE GROUND - Soft dark brown silty CLAY.                                                                                                     |     |
|      |                  | 0.20                       | ES       |                                | 0.20      | 167.30    |                           | MADE GROUND - Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded quartzite and brick. | 0.5 |
|      |                  | 1.00                       | SPT      | N=4 (1,1/1,1,1,1)              | 1.10      | 167.10    |                           | Medium dense reddish brown fine to medium SAND. (ALVELEY MEMBER)                                                                              | 1.0 |
|      |                  | 1.50                       | D        |                                |           |           |                           |                                                                                                                                               | 1.5 |
|      |                  | 2.00 - 3.00<br>2.00        | B<br>SPT | N=14 (1,3/3,4,4,3)             |           |           |                           |                                                                                                                                               | 2.0 |
|      |                  | 3.00                       | SPT      | 50 (25 for 135mm/50 for 125mm) | 2.90      | 166.20    |                           | Very dense red fine to coarse SAND. (ALVELEY MEMBER)                                                                                          | 3.0 |
|      |                  |                            | 3.26     | 164.40                         |           |           | End of Borehole at 3.260m | 3.5                                                                                                                                           |     |
|      |                  |                            |          |                                |           |           |                           | 4.0                                                                                                                                           |     |
|      |                  |                            |          |                                |           |           |                           | 4.5                                                                                                                                           |     |
|      |                  |                            |          |                                |           |           |                           | 5.0                                                                                                                                           |     |
|      |                  |                            |          |                                |           |           |                           | 5.5                                                                                                                                           |     |

Remarks  
 1. No groundwater encountered. 2. N = SPT/CPT 'N' Value. 3. Equipment: Premier 110 windowless/ dynamic sampling rig. 4. Borehole refused on very dense sand at 3.26m. 5. Upon completion backfilled with arisings.





# Borehole Log

Borehole No.

**WS02**

Sheet 1 of 1

|               |                                                               |             |            |          |                   |           |      |
|---------------|---------------------------------------------------------------|-------------|------------|----------|-------------------|-----------|------|
| Project Name: | Edward Street Hospital, West Bromwich                         | Project No. | GEG-21-706 | Co-ords: | 400173E - 291217N | Hole Type | WS   |
| Location:     | Edward Street Hospital, Edward street, West Bromwich, B70 8NL |             |            | Level:   | 167.58 m AOD      | Scale     | 1:31 |
| Client:       | VINCI                                                         |             |            | Dates:   | 08/11/2021        | Logged By | AT   |

| Well | Water Strikes | Sample and In Situ Testing |          |                         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                              |                           |
|------|---------------|----------------------------|----------|-------------------------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|      |               | Depth (m)                  | Type     | Results                 |           |           |        |                                                                                                                                  |                           |
|      |               |                            |          |                         | 0 00      |           |        | MADE GROUND - Soft brown slightly sandy silty CLAY.                                                                              |                           |
|      |               | 0.40                       | ES       |                         | 0 30      | 167.58    |        | MADE GROUND - Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular quartzite, brick and ceramic.   | 0.5                       |
|      |               | 1.20                       | SPT      | N=7 (2,1/2,2,1,2)       | 1 00      | 167.28    |        | MADE GROUND - Loose reddish brown clayey slightly gravelly SAND. Gravel is fine to coarse sub-rounded to well rounded quartzite. | 1.0                       |
|      |               | 2.00<br>2.00               | D<br>SPT | N=20 (3,3/3,4,5,8)      | 1.70      | 166.58    |        | S iff reddish brown slightly sandy CLAY. (ALVELEY MEMBER)                                                                        | 1.5                       |
|      |               | 3.00                       | SPT      | N=20 (2,1/2,4,6,8)      | 2.60      | 165.88    |        | Medium dense reddish brown clayey SAND. (ALVELEY MEMBER)                                                                         | 2.0                       |
|      |               | 4.00                       | SPT      | 50 (11,13/50 for 180mm) | 3 20      | 164.98    |        | S iff reddish brown very sandy CLAY. (ALVELEY MEMBER)                                                                            | 2.5                       |
|      |               |                            |          |                         |           |           |        | 4.00-4.33m becoming very stiff.                                                                                                  | 3.0                       |
|      |               |                            |          |                         |           | 4 33      | 164.38 |                                                                                                                                  | End of Borehole at 4.330m |
|      |               |                            |          |                         |           |           |        | 4.0                                                                                                                              |                           |
|      |               |                            |          |                         |           |           |        | 4.5                                                                                                                              |                           |
|      |               |                            |          |                         |           |           |        | 5.0                                                                                                                              |                           |
|      |               |                            |          |                         |           |           |        | 5.5                                                                                                                              |                           |

Remarks  
 1. No groundwater encountered. 2. N = SPT/CPT 'N' Value. 3. Equipment: Premier 110 windowless/ dynamic sampling rig. 4. Borehole refused on very stiff sandy clay at 4.33m. 5. Upon completion backfilled with arisings.





# Borehole Log

Borehole No.

**WS03**

Sheet 1 of 1

|               |                                                               |             |              |          |                   |           |    |
|---------------|---------------------------------------------------------------|-------------|--------------|----------|-------------------|-----------|----|
| Project Name: | Edward Street Hospital, West Bromwich                         | Project No. | GEG-21-706   | Co-ords: | 400180E - 291225N | Hole Type | WS |
| Location:     | Edward Street Hospital, Edward street, West Bromwich, B70 8NL | Level:      | 167.55 m AOD | Scale    | 1:31              | Logged By | AT |
| Client:       | VINCI                                                         | Dates:      | 08/11/2021   |          |                   |           |    |

| Well | Water Strikes | Sample and In Situ Testing |      |                        | Depth (m) | Level (m) | Legend                                                              | Stratum Description |  |
|------|---------------|----------------------------|------|------------------------|-----------|-----------|---------------------------------------------------------------------|---------------------|--|
|      |               | Depth (m)                  | Type | Results                |           |           |                                                                     |                     |  |
|      |               |                            |      |                        | 0.00      |           | MADE GROUND - Soft brown silty CLAY. (REWORKED)                     | 0.5                 |  |
|      |               |                            |      |                        | 0.80      | 167.55    | Medium dense fine to medium reddish brown SAND. (ALVELEY MEMBER)    | 1.0                 |  |
|      |               | 1.20                       | SPT  | N=7 (2,1/2,2,1,2)      |           |           | <i>1.20-2.00m becoming loose.</i>                                   | 1.5                 |  |
|      |               | 2.00                       | SPT  | N=11 (1,1/2,2,3,4)     |           |           | <i>2.00-2.80m becoming medium dense.</i>                            | 2.0                 |  |
|      |               | 2.70                       | SPT  | 50 (12,13/50 for 60mm) | 2.80      | 166.75    | Very dense dark reddish brown fine to medium SAND. (ALVELEY MEMBER) | 2.5                 |  |
|      |               |                            |      |                        | 2.91      | 164.75    | End of Borehole at 2.910m                                           | 3.0                 |  |
|      |               |                            |      |                        |           |           |                                                                     | 3.5                 |  |
|      |               |                            |      |                        |           |           |                                                                     | 4.0                 |  |
|      |               |                            |      |                        |           |           |                                                                     | 4.5                 |  |
|      |               |                            |      |                        |           |           |                                                                     | 5.0                 |  |
|      |               |                            |      |                        |           |           |                                                                     | 5.5                 |  |

Remarks  
 1. No groundwater encountered. 2. N = SPT/CPT 'N' Value. 3. Equipment: Premier 110 windowless/ dynamic sampling rig. 4. 50mm Standpipe installed at 2.80m, response zone 1.00-2.80m, bentonite seal 0.10-1.00m, concrete flush cover 0.00-0.10m. 5. Borehole refused on very stiff sandy clay at 2.91m.







# Borehole Log

Borehole No.

**WS04**

Sheet 1 of 1

|               |                                                               |             |              |          |                   |           |    |
|---------------|---------------------------------------------------------------|-------------|--------------|----------|-------------------|-----------|----|
| Project Name: | Edward Street Hospital, West Bromwich                         | Project No. | GEG-21-706   | Co-ords: | 400215E - 291222N | Hole Type | WS |
| Location:     | Edward Street Hospital, Edward street, West Bromwich, B70 8NL | Level:      | 166.90 m AOD | Scale    | 1:31              | Logged By | AT |
| Client:       | VINCI                                                         | Dates:      | 08/11/2021   |          |                   |           |    |

| Well | Water Strikes | Sample and In Situ Testing |      |                         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                  |     |
|------|---------------|----------------------------|------|-------------------------|-----------|-----------|--------|------------------------------------------------------------------------------------------------------|-----|
|      |               | Depth (m)                  | Type | Results                 |           |           |        |                                                                                                      |     |
|      |               |                            |      |                         | 0.00      | 166.90    |        | BRICK PAVING                                                                                         |     |
|      |               |                            |      |                         | 0.05      |           |        | MADE GROUND - Medium dense light reddish brown sandy GRAVEL of fine to coarse sub-angular quartzite. | 0.5 |
|      |               |                            |      |                         | 0.70      | 166.85    |        | Medium dense reddish brown fine to medium SAND. (ALVELEY MEMBER)                                     | 1.0 |
|      |               | 1.20                       | SPT  | N=13 (1,1/1,4,4,4)      |           |           |        |                                                                                                      | 1.5 |
|      |               | 2.00                       | SPT  | N=22 (1,2/3,4,6,9)      |           |           |        |                                                                                                      | 2.0 |
|      |               | 2.80                       | SPT  | 50 (10,13/50 for 135mm) |           |           |        |                                                                                                      | 2.5 |
|      |               |                            |      |                         |           |           |        | <i>2.80-3.09m becoming very dense.</i>                                                               | 3.0 |
|      |               |                            |      |                         | 3.09      | 166.20    |        | End of Borehole at 3.090m                                                                            | 3.5 |
|      |               |                            |      |                         |           |           |        |                                                                                                      | 4.0 |
|      |               |                            |      |                         |           |           |        |                                                                                                      | 4.5 |
|      |               |                            |      |                         |           |           |        |                                                                                                      | 5.0 |
|      |               |                            |      |                         |           |           |        |                                                                                                      | 5.5 |

Remarks  
 1. No groundwater encountered. 2. N = SPT/CPT 'N' Value. 3. Equipment: Premier 110 windowless/ dynamic sampling rig. 4. 50mm Standpipe installed at 2.90m, response zone 1.00-2.90m, bentonite seal 0.10-1.00m, concrete flush cover 0.00-0.10m. 5. Borehole refused on very dense sand at 3.09m.





# Borehole Log

Borehole No.

**WS05**

Sheet 1 of 1

|               |                                                               |             |              |          |                   |           |    |
|---------------|---------------------------------------------------------------|-------------|--------------|----------|-------------------|-----------|----|
| Project Name: | Edward Street Hospital, West Bromwich                         | Project No. | GEG-21-706   | Co-ords: | 400217E - 291244N | Hole Type | WS |
| Location:     | Edward Street Hospital, Edward street, West Bromwich, B70 8NL | Level:      | 168.90 m AOD | Scale    | 1:31              | Logged By | AT |
| Client:       | VINCI                                                         | Dates:      | 08/11/2021   |          |                   |           |    |

| Well | Water Strikes | Sample and In Situ Testing |      |                         | Depth (m) | Level (m) | Legend                                                                                                                           | Stratum Description |  |
|------|---------------|----------------------------|------|-------------------------|-----------|-----------|----------------------------------------------------------------------------------------------------------------------------------|---------------------|--|
|      |               | Depth (m)                  | Type | Results                 |           |           |                                                                                                                                  |                     |  |
|      |               |                            |      |                         | 0.00      |           | MADE GROUND - Soft brown silty CLAY.                                                                                             |                     |  |
|      |               |                            |      |                         | 0.30      | 168.90    | MADE GROUND - Firm brown sandy gravelly CLAY. Gravel is fine to cobble sub-angular to sub-rounded brick, concrete and quartzite. | 0.5                 |  |
|      |               | 1.20                       | SPT  | N=50 (5,6/50 for 285mm) | 1.00      | 168.60    | Dense light reddish brown fine to medium SAND. (ALVELEY MEMBER)<br><u>1.20-1.64m becoming very dense.</u>                        | 1.0                 |  |
|      |               |                            |      |                         | 1.64      | 167.90    | End of Borehole at 1.640m                                                                                                        | 1.5                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 2.0                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 2.5                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 3.0                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 3.5                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 4.0                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 4.5                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 5.0                 |  |
|      |               |                            |      |                         |           |           |                                                                                                                                  | 5.5                 |  |

Remarks  
 1. No groundwater encountered. 2. N = SPT/CPT 'N' Value. 3. Equipment: Premier 110 windowless/ dynamic sampling rig. 4. 50mm Standpipe installed at 1.00m, response zone 0.50-1.00m, bentonite seal 0.10-0.50m, concrete flush cover 0.00-0.10m. 5. Borehole refused on very dense sand at 1.64m.

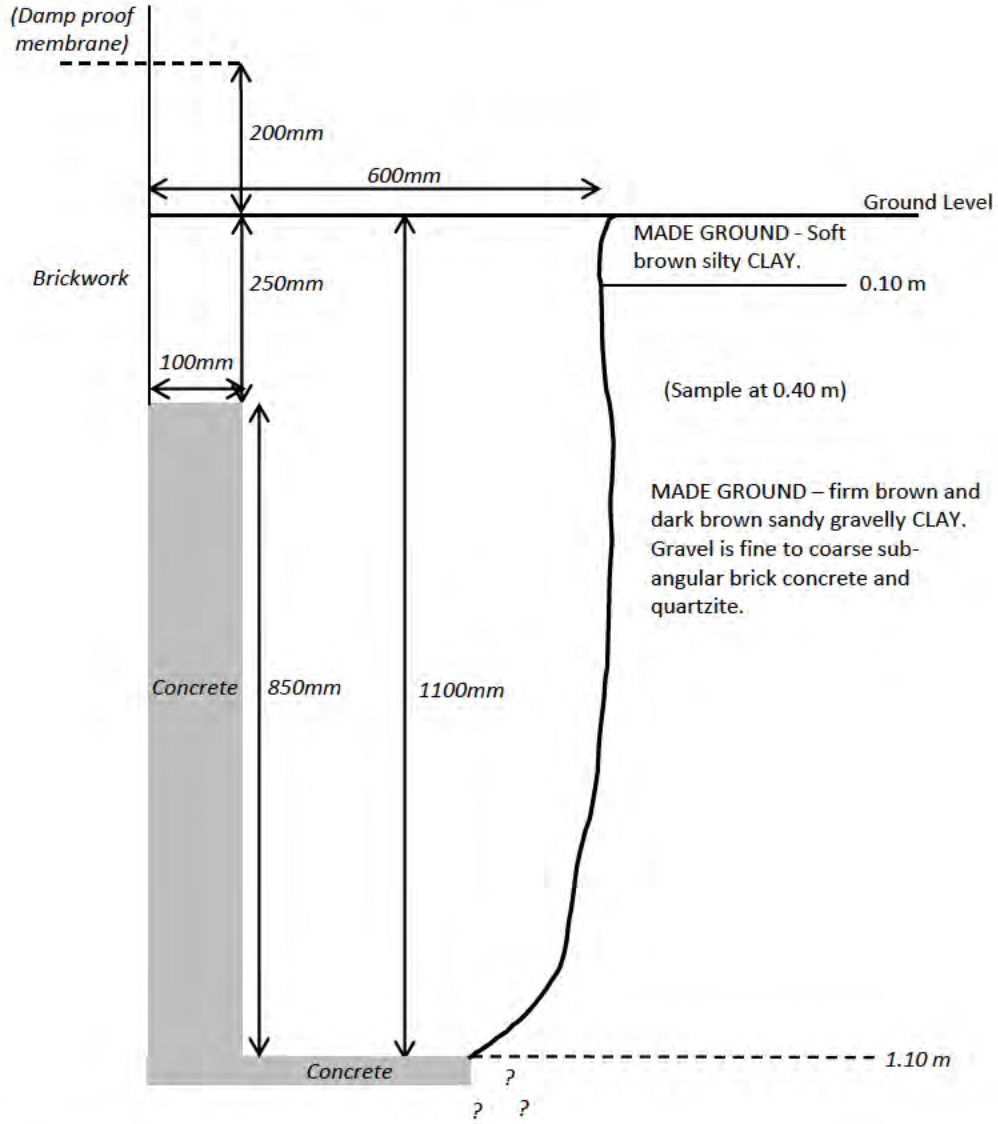


# FOUNDATION PIT TP01

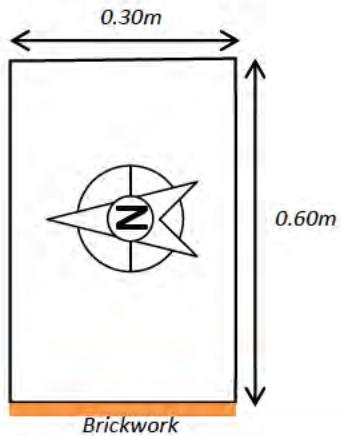
## SKETCH VIEW

Date Excavated: 8/11/2021

Method: Hand Excavated



## PLAN VIEW



|                                                       |                                   |                             |                                                                                                           |
|-------------------------------------------------------|-----------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b><br>FOUNDATION PIT DRAWING (TP01)        | <b>CLIENT:</b><br>VINCI           | <b>DRAWN/CHECKED:</b><br>EB | GEG House<br>17 Graham Road, Malvern, WR14 2HR<br>Tel. 01684 212526<br>admin@g-eg.co.uk<br>www.g-eg.co.uk |
| <b>SITE:</b> EDWARD STREET HOSPITAL,<br>WEST BROMWICH | <b>PROJECT No.:</b><br>GEG-21-706 | <b>SCALE:</b><br>NTS        | <b>DATE:</b><br>08/11/2021                                                                                |



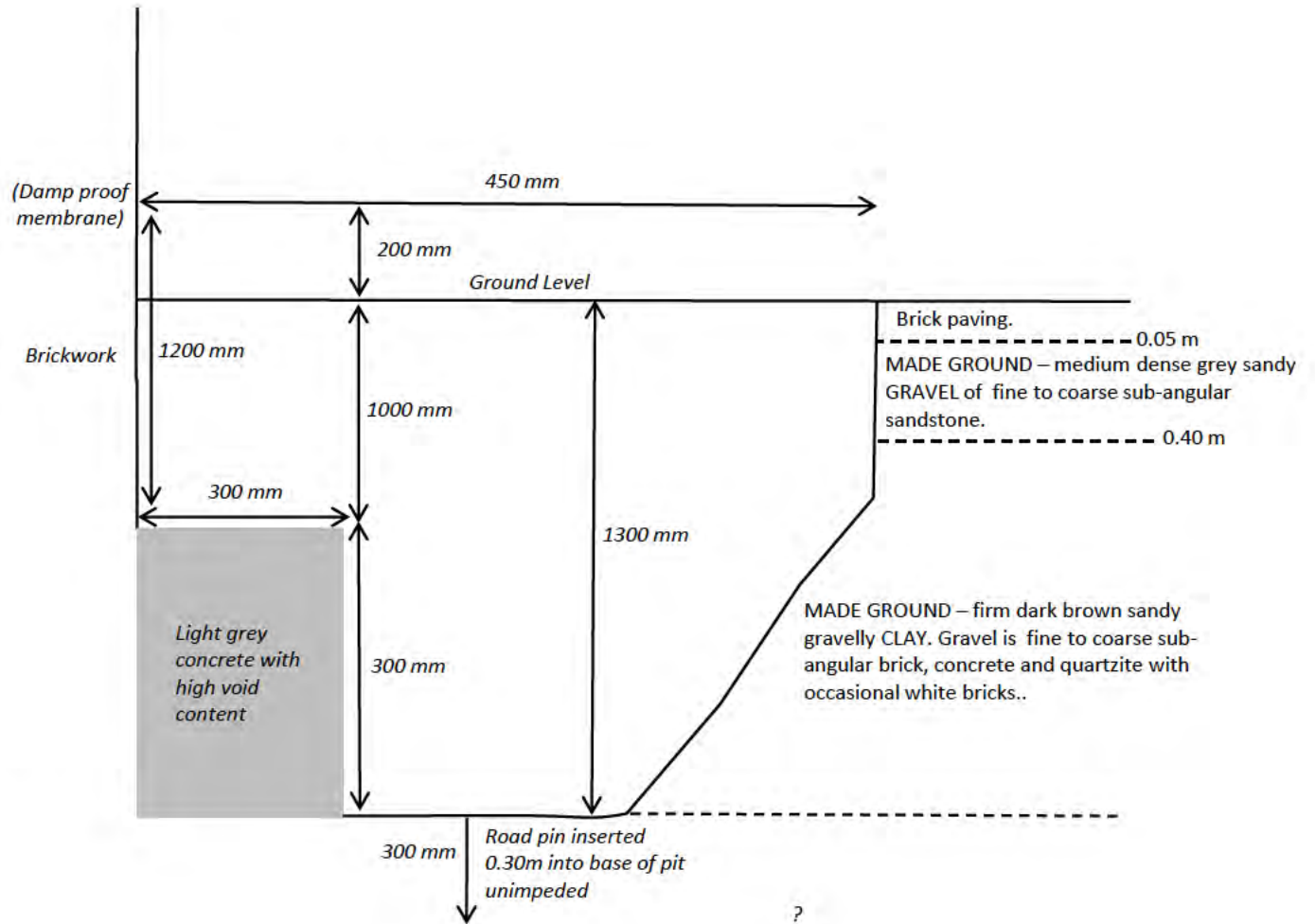


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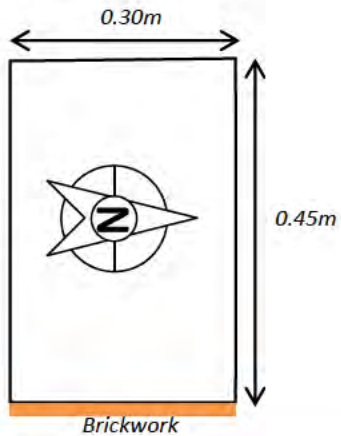
## SKETCH VIEW

Date Excavated: 8/11/2021

Method: Hand Excavated



## PLAN VIEW



|                                                       |                                   |                             |                                                                                                           |
|-------------------------------------------------------|-----------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b><br>FOUNDATION PIT DRAWING (TP02)        | <b>CLIENT:</b><br>VINCI           | <b>DRAWN/CHECKED:</b><br>EB | GEG House<br>17 Graham Road, Malvern, WR14 2HR<br>Tel. 01684 212526<br>admin@g-eg.co.uk<br>www.g-eg.co.uk |
| <b>SITE:</b> EDWARD STREET HOSPITAL,<br>WEST BROMWICH | <b>PROJECT No.:</b><br>GEG-21-706 | <b>SCALE:</b><br>NTS        | <b>DATE:</b><br>08/11/2021                                                                                |

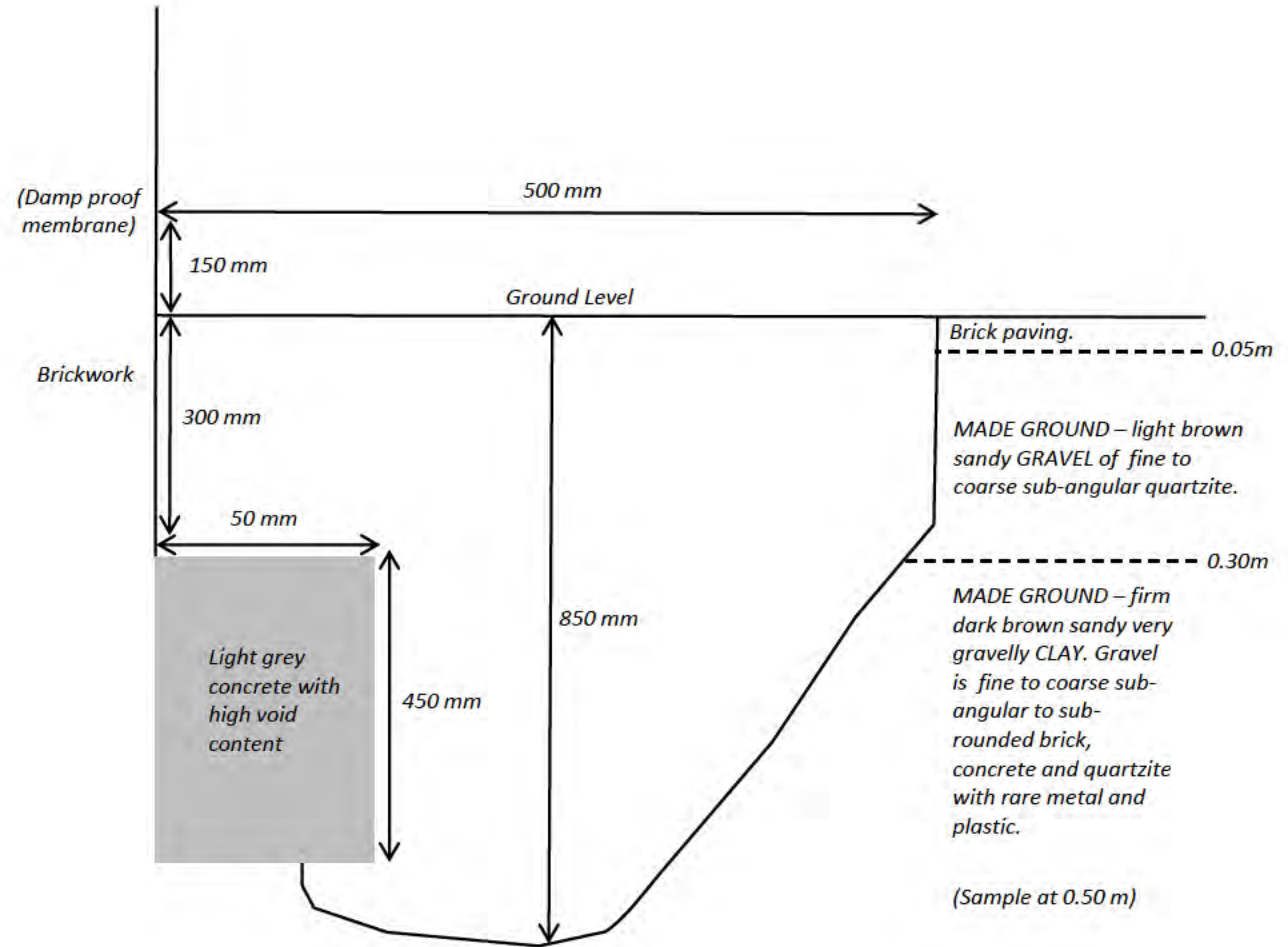


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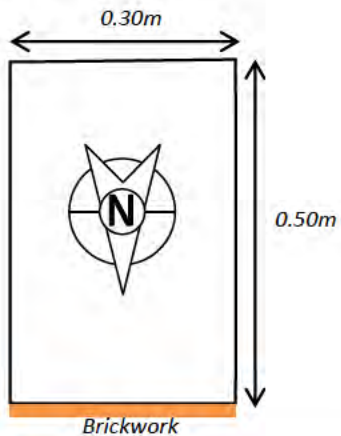
## SKETCH VIEW

Date Excavated: 8/11/2021

Method: Hand Excavated



## PLAN VIEW



|                                                       |                                   |                             |                                                                                                           |
|-------------------------------------------------------|-----------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b><br>FOUNDATION PIT DRAWING (TP03)        | <b>CLIENT:</b><br>VINCI           | <b>DRAWN/CHECKED:</b><br>EB | GEG House<br>17 Graham Road, Malvern, WR14 2HR<br>Tel. 01684 212526<br>admin@g-eg.co.uk<br>www.g-eg.co.uk |
| <b>SITE:</b> EDWARD STREET HOSPITAL,<br>WEST BROMWICH | <b>PROJECT No.:</b><br>GEG-21-706 | <b>SCALE:</b><br>NTS        |                                                                                                           |

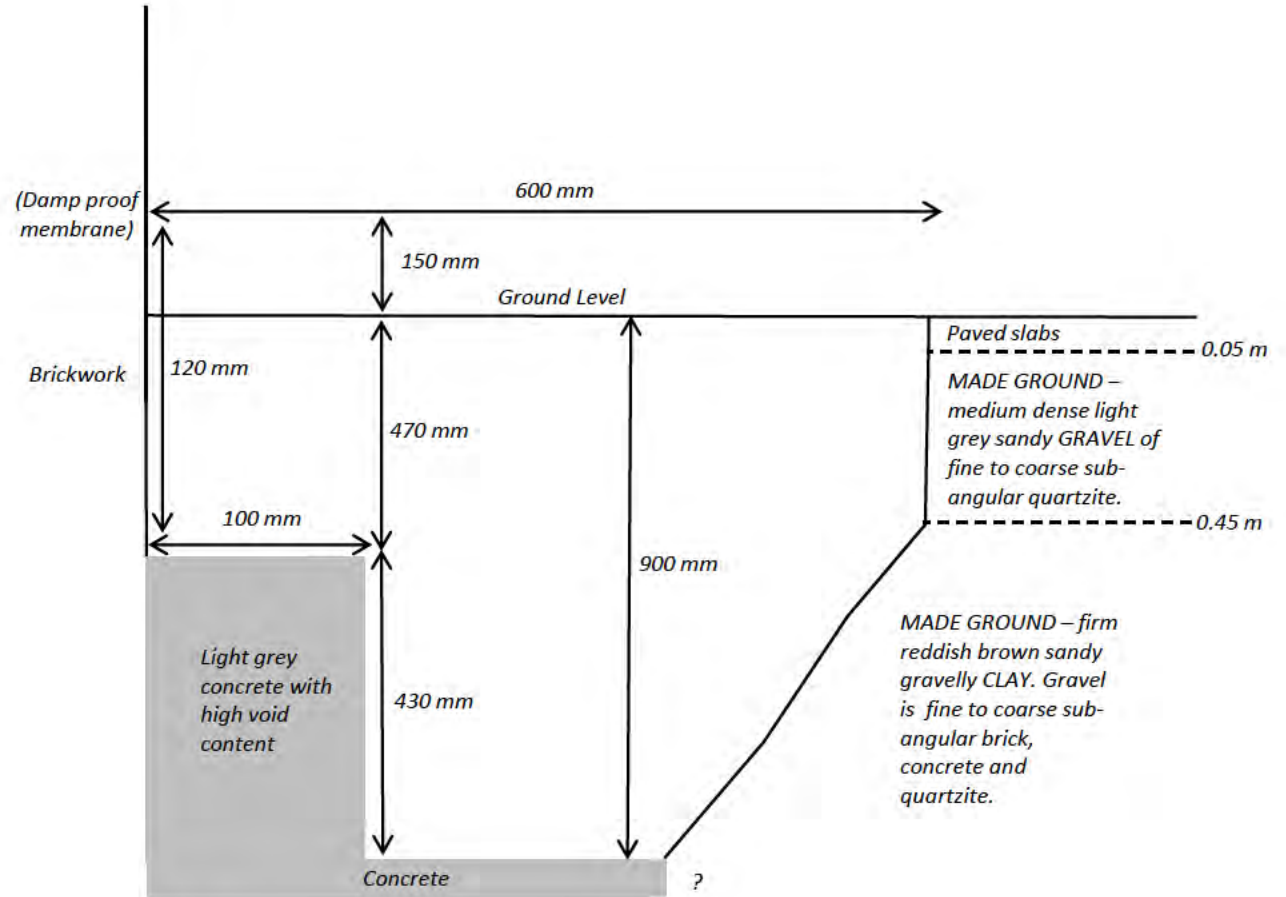


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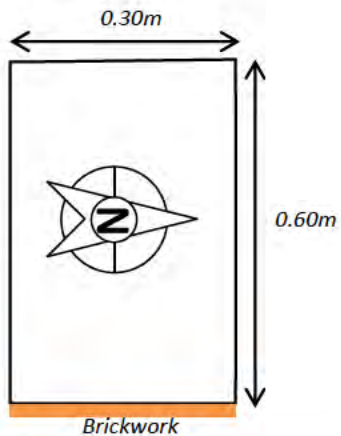
## SKETCH VIEW

Date Excavated: 8/11/2021

Method: Hand Excavated



## PLAN VIEW



|                                                       |                                   |                             |                                                                                                           |
|-------------------------------------------------------|-----------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b><br>FOUNDATION PIT DRAWING (TP05)        | <b>CLIENT:</b><br>VINCI           | <b>DRAWN/CHECKED:</b><br>EB | GEG House<br>17 Graham Road, Malvern, WR14 2HR<br>Tel. 01684 212526<br>admin@g-eg.co.uk<br>www.g-eg.co.uk |
| <b>SITE:</b> EDWARD STREET HOSPITAL,<br>WEST BROMWICH | <b>PROJECT No.:</b><br>GEG-21-706 | <b>SCALE:</b><br>NTS        | <b>DATE:</b><br>08/11/2021                                                                                |







## **APPENDIX G**

### **GEOTECHNICAL TESTING**



## Contract Number: 56696

Client Ref: **GEG-21-706**

Report Date: **27-11-2021**

Client PO: **4177**

Client **GEG Limited**  
**17 Graham Road**  
**Malvern**  
**Worcestershire**  
**WR14 2HR**

Contract Title: **Edward Street Hospital**  
For the attention of: **Alan Taylor**

Date Received: **11-11-2021**

Date Completed: **27-11-2021**

| Test Description                                                                              | Qty |
|-----------------------------------------------------------------------------------------------|-----|
| <b>Moisture Content</b><br>BS 1377:1990 - Part 2 : 3.2 - * UKAS                               | 2   |
| <b>4 Point Liquid &amp; Plastic Limit</b><br>BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS       | 2   |
| <b>PSD Wet Sieve method</b><br>BS 1377:1990 - Part 2 : 9.2 - * UKAS                           | 1   |
| <b>Water Soluble Sulphate 2:1 extract</b><br>Sub-contracted Test - @ Non Accredited Test      | 3   |
| <b>pH value of soil</b><br>Sub-contracted Test - @ Non Accredited Test                        | 3   |
| <b>Determination of Water Soluble Chloride</b><br>Sub-contracted Test - @ Non Accredited Test | 3   |
| <b>Samples Received</b><br>- @ Non Accredited Test                                            | 3   |
| <b>Disposal of samples for job</b>                                                            | 1   |

Notes: Observations and Interpretations are outside the UKAS Accreditation  
\* - denotes test included in laboratory scope of accreditation  
# - denotes test carried out by approved contractor  
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

#### Approved Signatories:

Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)









**PARTICLE SIZE DISTRIBUTION  
BS 1377 Part 2:1990  
Wet Sieve, Clause 9.2**

Contract Number 56696

Borehole/Pit No. WS01

Site Name Edward Street Hospital

Sample No.

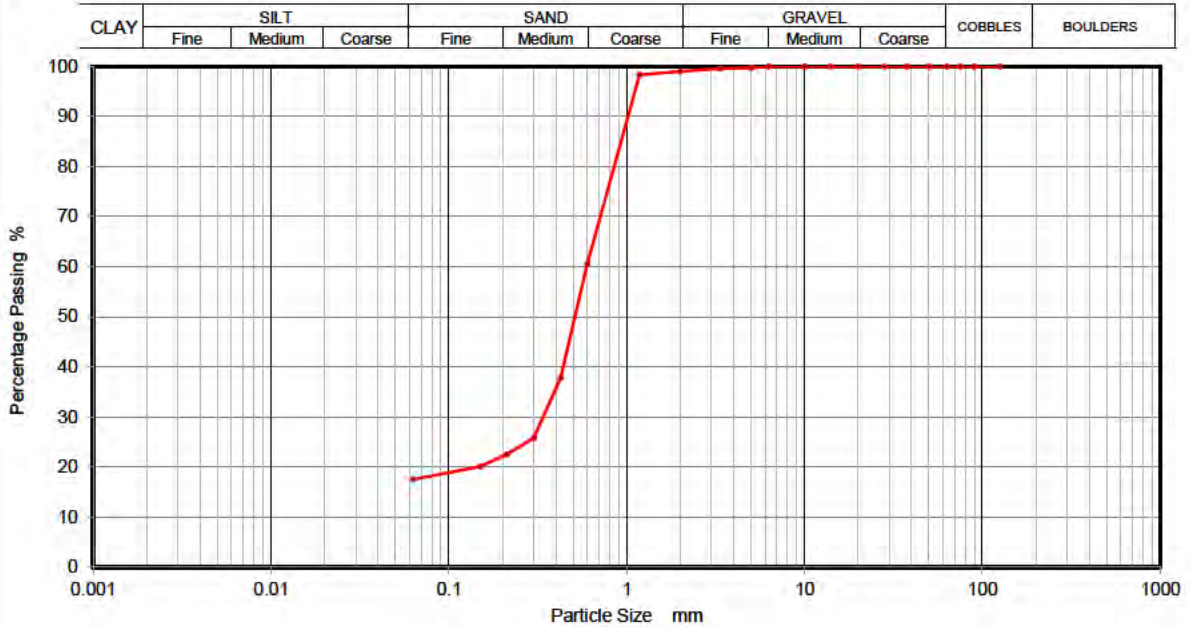
Soil Description Brown slightly fine gravelly clayey/silty fine to coarse SAND

Depth Top 2.00

Depth Base 3.00

Date Tested 25/11/2021

Sample Type B



| Sieving          |           | Sedimentation    |           |
|------------------|-----------|------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125              | 100       |                  |           |
| 90               | 100       |                  |           |
| 75               | 100       |                  |           |
| 63               | 100       |                  |           |
| 50               | 100       |                  |           |
| 37.5             | 100       |                  |           |
| 28               | 100       |                  |           |
| 20               | 100       |                  |           |
| 14               | 100       |                  |           |
| 10               | 100       |                  |           |
| 6.3              | 100       |                  |           |
| 5                | 100       |                  |           |
| 3.35             | 100       |                  |           |
| 2                | 99        |                  |           |
| 1.18             | 98        |                  |           |
| 0.6              | 61        |                  |           |
| 0.425            | 38        |                  |           |
| 0.3              | 26        |                  |           |
| 0.212            | 23        |                  |           |
| 0.15             | 20        |                  |           |
| 0.063            | 18        |                  |           |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Cobbles            | 0          |
| Gravel             | 1          |
| Sand               | 81         |
| Silt and Clay      | 18         |
|                    |            |
|                    |            |

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

|          |          |            |              |
|----------|----------|------------|--------------|
| Operator | Checked  | 26/11/2021 | Richard John |
| David    | Approved | 27/11/2021 | Paul Evans   |





## ANALYTICAL TEST REPORT

Contract no: 102774

Contract name: Edward Street Hospital

Client reference: GEG-21-706

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur  
Dafen Industrial Estate, Dafen  
Llanelli, Carmarthenshire  
SA14 8QN

Samples received: 17 November 2021

Analysis started: 17 November 2021

Analysis completed: 24 November 2021

Report issued: 24 November 2021

Key

- U UKAS accredited test
- M MCERTS & UKAS accredited test
- \$ Test carried out by an approved subcontractor
- I/S Insufficient sample to carry out test
- N/S Sample not suitable for testing

Approved by:



Rachael Burton  
Reporting Team Lead



# Chemtech Environmental Limited

## SOILS

| Lab number                   |                    |                      | 102774-1 | 102774-2  | 102774-3 |
|------------------------------|--------------------|----------------------|----------|-----------|----------|
| Sample id                    |                    |                      | WS01     | WS01      | WS02     |
| Depth (m)                    |                    |                      | 1.50     | 2.00-3.00 | 2.00     |
| Date sampled                 |                    |                      | -        | -         | -        |
| Test                         | Method             | Units                |          |           |          |
| pH                           | CE004 <sup>u</sup> | un ts                | 8.6      | 8.2       | 8.3      |
| Chloride (2:1 water soluble) | CE049 <sup>u</sup> | mg/l Cl              | 2.0      | 3.0       | 2.6      |
| Sulphate (2:1 water soluble) | CE061 <sup>u</sup> | mg/l SO <sub>4</sub> | 25       | <10       | <10      |

# Chemtech Environmental Limited

## METHOD DETAILS

| METHOD | SOILS                        | METHOD SUMMARY              | SAMPLE      | STATUS | LOD | UNITS                |
|--------|------------------------------|-----------------------------|-------------|--------|-----|----------------------|
| CE004  | pH                           | Based on BS 1377, pH Meter  | As received | U      | -   | units                |
| CE049  | Chloride (2:1 water soluble) | Aqueous extraction, IC-COND | Dry         | U      | 1   | mg/l Cl              |
| CE061  | Sulphate (2:1 water soluble) | Aqueous extraction, ICP-OES | Dry         | U      | 10  | mg/l SO <sub>4</sub> |

# Chemtech Environmental Limited

## DEVIATING SAMPLE INFORMATION

### Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

### Key

|     |                                                 |
|-----|-------------------------------------------------|
| N   | No (not deviating sample)                       |
| Y   | Yes (deviating sample)                          |
| NSD | Sampling date not provided                      |
| NST | Sampling time not provided (waters only)        |
| EHT | Sample exceeded holding time(s)                 |
| IC  | Sample not received in appropriate containers   |
| HP  | Headspace present in sample container           |
| NCF | Sample not chemically fixed (where appropriate) |
| OR  | Other (specify)                                 |

| Lab ref  | Sample id | Depth (m) | Deviating | Tests (Reason for deviation) |
|----------|-----------|-----------|-----------|------------------------------|
| 102774-1 | WS01      | 1.50      | Y         | All (NSD)                    |
| 102774-2 | WS01      | 2.00-3.00 | Y         | All (NSD)                    |
| 102774-3 | WS02      | 2.00      | Y         | All (NSD)                    |



# Chemtech Environmental Limited

## Additional Information

### Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

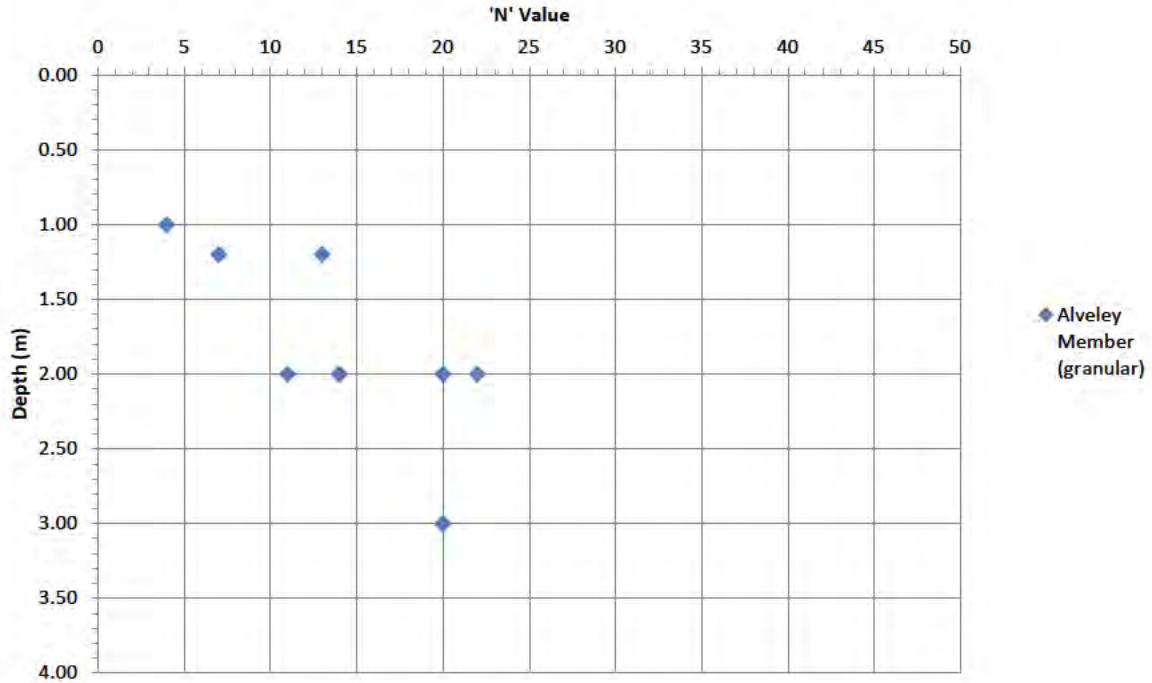
Standard Penetration Tests (SPT) 'N' Values

Project No.: GEG-21-706

Project: Edward street Hospital, West Bromwich



Graph 1. SPT 'N' Value vs Depth



Standard Penetration Tests (SPT) 'N' Values

Project No.: GEG-21-706

Project: Edward Street Hospital, West Bromwich

