SMALL SITES × SMALL BUILDERS

CABLE STREET

TECHNICAL INFORMATION

LAND AT CABLE STREET & ROYAL MINT STREET, E1 8LG

Navigate this pack using the links below or the pdf bookmarks

Aerial and OS maps

Planning Statement

Site Investigation Summary Report

Topographical and Buried Services Survey

Ecology Survey

Arboricultural Survey

Archaeological Desktop Review

Geotechnical and Geo-Environmental Desk Study and Preliminary Investigation

Unexploded Ordnance Desk Study and Risk Assessment

Transport for London

TfL Operational Property
Commercial Development
Windsor House
42-50 Victoria Street
SW1H 0TL

Site for Disposal

Retained Land

Site ID 2363

N

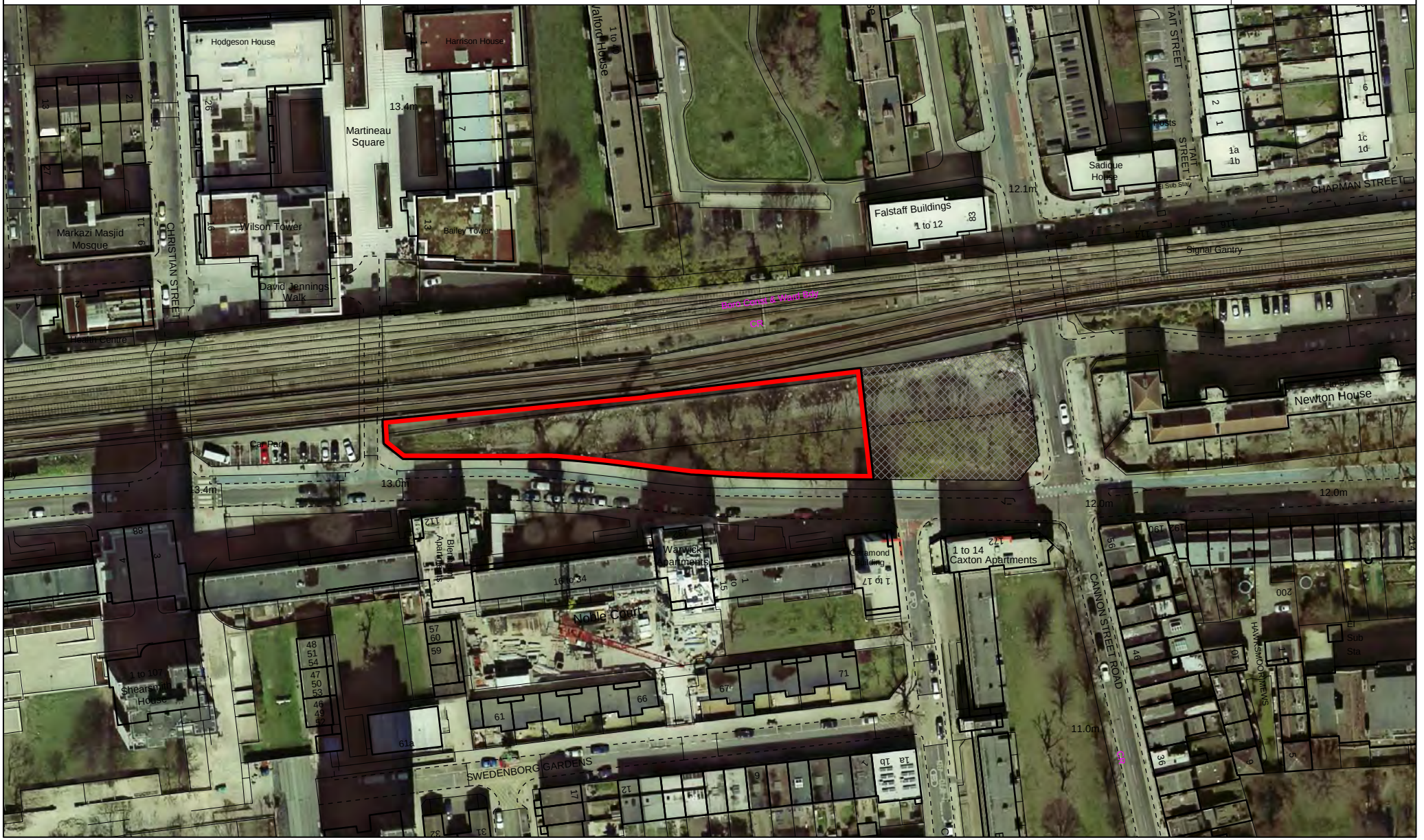
A4 Landscape

Date : Aug 2017

Initial : REM

File : PAR

Scale : 1/1250 at A4



Mayor of London

Transport for London

TfL Operational Property
Commercial Development
Windsor House
42-50 Victoria Street
SW1H 0TL

Site for Disposal

Retained Land

Site ID 2363

N

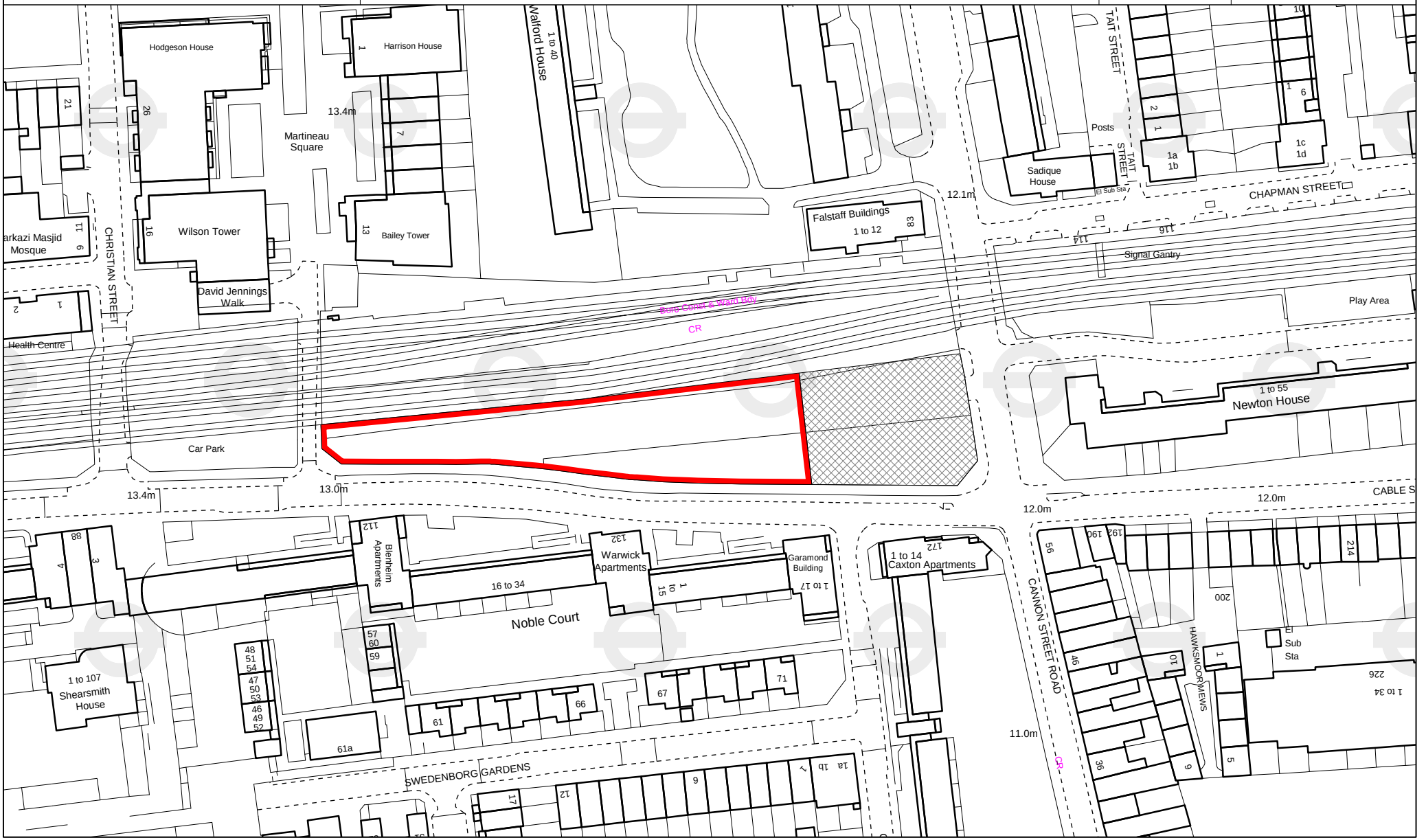
A4 Landscape

Date : Aug 2017

Initial : REM

File : PAR

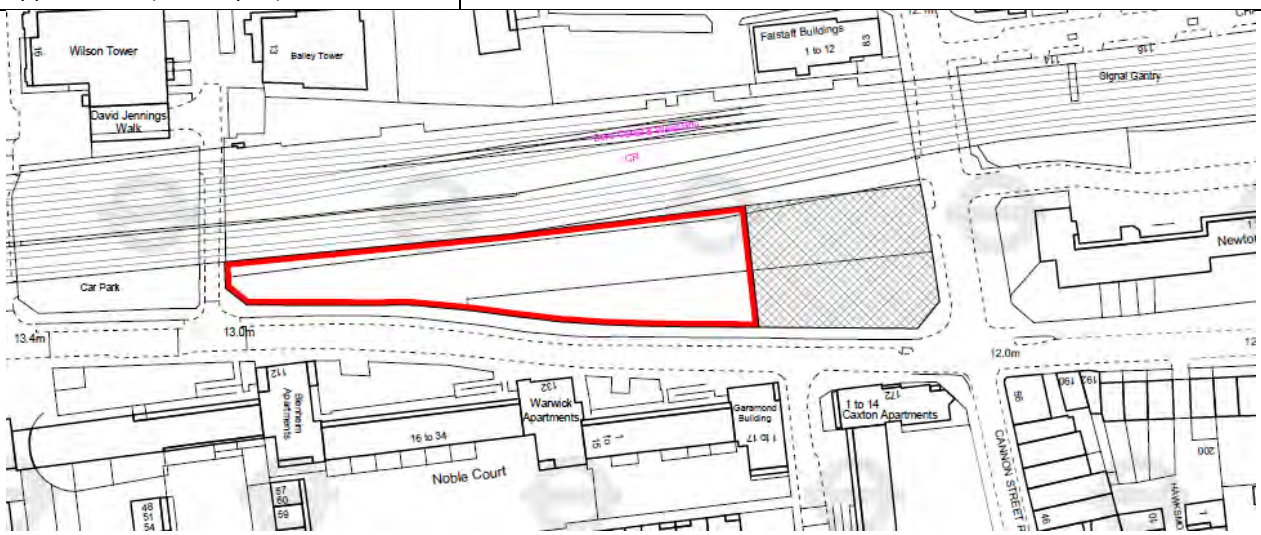
Scale : 1/1250 at A4



Mayor of London

1. PROPERTY DETAILS	
Site Name & Address	Land at Cable Street, Shadwell, E1 8HX
Unique Ref (PAR)	2363
Borough	Tower Hamlets
Zone (TfL)	2
Site Area (acres)	Approx. 0.51 (2048 sq. m)

Location and Site Plan



Existing Use	- The site is a crane lifting point for the DLR on this route and is reserved for response teams. It has been used as a compound for works in the past. The last known use of the site is as a depot. The site to the east will be retained for operational requirements.

2. TOWN PLANNING	
Planning Policy Documents	- Adopted: London Plan (consolidated with changes 2016), Core Strategy (2010); Managing Development Document & Policies Map (2013). - Emerging: New Local Plan (Regulation 18 consultation in late 2016)
Site Allocations	- No site specific allocations
Housing zone or Opportunity Area	- Yes, City Fringe Opportunity Area
Heritage Designations	- Yes, Archaeological Priority Area and opposite (to the NW of) a Conservation Area (St George in the East)
Flood Zone	- No
Ecological Designations	- None
PTAL	- 6a/6b
Tall buildings permitted	- The site does not fall within an area suitable for tall buildings outlined within the Tower Hamlets Core Strategy and DMD. However, the site falls within an opportunity area, with an excellent PTAL rating and the surrounding context is primarily mid rise (5-9 storeys) so there may be scope for a taller building at this location.
Car parking standards	- Car free development is promoted in sites with high PTAL in existing and emerging planning policy.

<table>
<tr><td>LPA affordable housing target</td><td>
Existing:
<table>
<tr><th>Threshold</th><th>Affordable Housing target (unit)</th><th>Affordable Housing Tenure Split</th><th>Provision Requirement</th></tr>
<tr><td>10 units, or more than 1,000 sq m gross internal area</td><td>35%-50% subject to viability</td><td>70% Social Rented and 30% Intermediate</td><td>On site preferred</td></tr>
<tr><td>9 units, or 999 sq m or less of gross internal area</td><td>n/a</td><td>n/a</td><td>No policy requirement</td></tr>
</table>
Proposed:
<table>
<tr><th>Threshold</th><th>Affordable Housing target (unit)</th><th>Affordable Housing Tenure Split</th><th>Provision Requirement</th></tr>
<tr><td>10 units, or more than 1,000 sq m gross internal area</td><td>35%-50% subject to viability</td><td>70% Social Rented and 30% Intermediate</td><td>On site preferred</td></tr>
<tr><td>9 units, or 999 sq m or less of gross internal area</td><td>n/a</td><td>n/a</td><td>Contributions required</td></tr>
</table>
</td></tr>
<tr><td>Other</td><td>- A number of large mature trees occupy the southern boundary of the site.
- The site is to the south of a number of railway arches.
- Underutilised space in a high density area with excellent PTAL, in close proximity to the shops and facilities in Shadwell. The site falls within an Opportunity Area and the surrounding area is primarily mid height (5-9 storeys).
- The site is in close proximity to raised tracks so future residents' amenity would need to be protected</td></tr>
<tr><td>Planning Policy Overview</td><td>- The site has good potential for a higher density residential development. Any development would need to be of high quality design and in keeping with the existing surrounding context (SP12, DM24).
- Development will need to ensure that there is adequate daylight and sunlight provision and no unacceptable loss of privacy for the adjacent and proposed development (DM25).</td></tr>
<tr><td>Planning History</td><td>- No relevant planning history</td></tr>
<tr><td>Local Planning Authority Feedback
Email feedback from Paul Buckenham, Development Manager at Tower Hamlets following a meeting. Feedback received on the 05/06/2017</td><td>- Principle of development: The principal of residential development on this site is considered acceptable, subject to an assessment of detailed design against development plan policies.
- Preferred use: Residential
- Design: The relationship with existing residential development opposite, including the effect on daylight, sunlight, sense of enclosure and privacy will influence the siting and form of buildings and the amount of development. Building heights should be informed by an appropriate response to local townscape context. The site includes a row of mature London plane trees that make a positive contribution to visual amenity. Detailed scheme design should, wherever possible, seek to retain these trees, and where it is not possible ensure suitable mitigation or replanting is provided.</td></tr>
</table>

ARCADIS Design & Consultancy for natural and built assets

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE
LAND TO THE NORTH SIDE OF ROYAL MINT STREET AND CABLE STREET, TOWER HAMLETS, E1 8LG

Site Ref. 2363

Summary Report

SEPTEMBER 2017

Incorporating
EC HARRIS BUILT ASSET CONSULTANCY
Hyder

Land to the North Side of Royal Mint Street and Cable Street, Tower Hamlets, E1 8LG

Summary Report

Author	Various
Checker	Alison Pugh 
Approver	Angela Mulgrew 
Report No	1105-UA009686-UP32R-02
Date	SEPTEMBER 2017

VERSION CONTROL

Version	Date	Author	Changes
01	Sept 2017		First Issue
02	Sept 2017		Final Issue

CONTENTS

1 INTRODUCTION 1

2 TOPOGRAPHICAL AND BURIED SERVICES SURVEY 2

3 ECOLOGY SURVEY 3

4 ARBORICULTURAL SURVEY 4

5 ARCHAEOLOGICAL DESKTOP REVIEW 5

6 GEOTECHNICAL AND GEO-ENVIRONMENTAL DESK STUDY AND PRELIMINARY INVESTIGATION 6

7 REFERENCES 7

1 Introduction

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a number of technical surveys for a site known as Land to the North side of Royal Mint Street and Cable Street, Tower Hamlets, E1 8LG ('the Site'). This will be referred to as Cable Street.

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of the survey work is to provide robust and pragmatic advice associated with topography and buried services, ecology, arboriculture, archaeology and geotechnical and geo-environmental conditions. This report provides a summary of the technical surveys commissioned for the Site and reference should be made to the individual reports for further detailed information.

The Site is located immediately north of the B126 / Royal Mint Street / Cable Street and west of Cannon Street Road, in the London Borough of Tower Hamlets. The Site is centred at Grid Reference 534587, 180926 and is approximately 0.3 hectares in area. The Site is currently vacant with trees along the southern boundary. The Site includes land that is intended for disposal and land that will be retained by TfL/DLR.

The surveys undertaken at Cable Street include the following;

- Topographical and Buried Services Survey (Ref 1);
- Ecology Survey (Ref 2)
- Arboricultural Survey (Ref 3);
- Archaeological Desktop Review (Ref 4), and
- Geotechnical and Geo-Environmental Desk Study (Ref 5).

A summary of the findings of these surveys are detailed in the following sections.

2 Topographical and Buried Services Survey

The topographical survey indicates that the Site is generally flat with levels recorded between 12m OS and 13m OS.

Three manhole covers are indicated at the eastern and western end of the site. An asset assumed to be surface water drainage is shown crossing the site with associated manhole covers. Consideration will need to given to these services during development of the Site.

3 Ecology Survey

The ecological assessment comprised a desk-based study using publicly available information and an ecological constraints survey to identify potential constraints present on Site.

Ecology is not considered to present a significant constraint to the development of the Site.

No Statutory or non-statutory designated sites (including ancient woodlands or woodlands listed on the Ancient Woodland Inventory (AWI)) were identified within the vicinity of the Site to have the potential to be significantly impacted by development on the Site.

The Site supported a limited range of habitats. The northern and western sections of the site supported a mosaic of tall ruderal and ephemeral/short perennial vegetation with occasional low-lying scrub, grasses and tree saplings. A line of mature deciduous trees was located along part of the southern boundary of the Site.

Although the habitats on Site are generally of poor quality due to the lack of positive management, these habitats are valuable in terms of general green infrastructure, likely performing important ecosystem services (such as water quality and volume attenuation, air quality attenuation etc.).

Within the Site, there was limited potential for protected or notable species. Nesting birds are likely to be utilising the mature deciduous trees on the Site, including potentially species listed on the London Biodiversity Action Plan (BAP) as Priority Species, such as bullfinch and dunnock. Removal of vegetation on the Site will need to be conducted outside of the bird nesting season (March – August inclusive) or under an ecological watching brief.

A mature Purple Leaved Sycamore (*Acer pseudoplatanus purpureum*) tree located in the south-east section of the Site (within the area to be retained by DLR) supported two cavities, each of which were assessed as having a low potential to support roosting/hibernating bats. Suitable foraging and commuting habitat for bats in the wider landscape is limited. If the Purple Leaved Sycamore tree is to be affected by new development (i.e. require removal), it is recommended that the cavities are inspected with an endoscope by a licenced bat worker to confirm the status of the tree with regards to roosting bats.

A squirrel drey was recorded in the south-east section of the Site. Although grey squirrel is regarded as an invasive non-native species included on Schedule 9 Wildlife and Countryside Act, they are protected against inhumane killing under the Wild Mammal (Protection) Act 1996. The Act protects mammals against being inhumanly killed or harmed. Typically, there are two main breeding seasons when young are in the drey (February to August inclusive). Reasonable avoidance includes soft felling the tree, pest control methods (e.g. live trapping and poisoning).

Should tree removal be required trees should ideally be re-provisioned on the Site within any development, if on-Site re-provisioning is not possible off-Site mitigation should be considered. These should be of a suitable species, preferably native species of local origin. In addition, consideration to biodiversity roofs, rain gardens and other green infrastructure should be included in any development.

There will be some ecological benefit from the removal of non-native and invasive species listed on the LISI (London Invasive Species Initiative) list which are present on the site including Butterfly-bush. There is no legal obligation to control or remove these species however it is good practice to do so. Removal of the vegetation from the site to facilitate the development would likely adequately eradicate the majority of the LISI species from the site.

4 Arboricultural Survey

An arboricultural survey was conducted in accordance with British Standard 5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations.

The Site is not within a Conservation Area and none of the trees surveyed are protected by Tree Preservation Orders.

A total of 31 arboricultural items were recorded within the study area (the Site and its immediate surroundings). These were all recorded as individual on-site trees of which 18 have been identified as Category B (trees of moderate quality) and should be considered for retention where possible, 13 have been identified as Category C (trees of low quality). These trees should not place a constraint on the development layout but should be considered for replacement should they be removed. The dominant tree species within the Site is the Norway maple (*Acer platanoides*). The location of these trees shields the flats adjacent to Cable Street's view of the rail tracks and are likely to contribute to reduction in noise and light levels. This should be considered during development proposals.

While unlikely to prevent development, tree protection for trees to be retained and tree re-provisioning for any trees lost due to development are a material consideration for planning determination. If trees cannot be replaced on-Site due to development, off-Site options for tree re-provisioning to ensure no net loss should be considered. Individual Local Planning Authorities may ask for re-provisioning in excess of 1 to 1 for trees of Category A or B.

Should any future development proposal require the removal of trees or incursions into the Root Protection Areas (RPAs) of any trees, an Arboricultural Impact Assessment (AIA) would be required in support of any planning application.

A bespoke AMS may be required post planning and when the construction details are known by the local planning authority (LPA) to protect the retained trees within and adjoining the Site.

All new tree planting should be in accordance with British Standard 8545: Trees: From Nursery to Independence in the Landscape – Recommendations, 2014; and all tree works must be carried out by a qualified contractor in accordance with BS3998:2010: Tree Work – Recommendations.

5 Archaeological Desktop Review

An archaeology desktop review for a site on the north side of Mint Street and Cable Street, Tower Hamlets has been carried out. This was a rapid information-gathering exercise on the Site and a 500m study area using information from publicly held sources. A brief assessment of potential heritage/archaeological constraints and opportunities at the Site has been made.

The Site lies within an archaeologically rich area and the review has assessed that there is a medium potential for buried archaeological remains to be present. The Site lies within the western part of the Tower Hamlets Archaeology Priority Area (APA) due to being within the Roman 'Eastern Cemetery'. It lies to the north of a Roman road (The Highway) which was a principal route leading eastwards from the Roman city walls. There are also medieval occupation and industrial remains along Cable Street and the Highway and to the west, along Dock Street. Although the Site has potential for buried archaeological remains to exist, these heritage assets are not considered likely to be a barrier to development on the Site.

There are no Scheduled Monuments within the study area. There are 43 Listed Buildings (one Grade I, one Grade II*, the rest Grade II) within the study area but none within the Site boundary. There are nine Locally Listed Buildings, or rows of buildings, within the study area but none within the Site boundary. The Site does not lie within a Conservation Area, however it is adjacent to the St George in the East Conservation Area.

For any future planning application, the potential for below ground remains need to be fully evaluated. The Greater London Archaeological Advisory Service (GLAAS) who advise the local planning authority are likely to recommend a full archaeological desk-based assessment (DBA) for the Site as well as an evaluation to be undertaken prior to planning permission being determined. The DBA would include a specific archaeology Site walkover, a visit to the record office to gather historic maps and relevant documentary evidence, a map regression exercise as well as preparation of distribution maps showing designated and un-designated heritage assets. The evaluation would likely consist of a programme of trial trenching and subsequent reporting. If heritage assets of significance are encountered during the evaluation stage, there may be a requirement for further recording in the form of an excavation or watching brief. This may be delivered through a post-determination condition.

6 Geotechnical and Geo-Environmental Desk Study and Preliminary Investigation

The geo-environmental and geotechnical desk study comprised a review of existing historical and current information on the Site. The Site is a vacant parcel of land currently overgrown with grass and trees in the south. The Site is located within a largely residential area (predominantly apartments) with local amenities and commercial uses. The Docklands Light Railway is located to the north of the Site on a viaduct parallel to the site. The history indicates developments within the Site including residential / possibly commercial properties which were later demolished and a coal depot was recorded.

A preliminary site investigation was undertaken comprising two cable percussive boreholes to investigate ground conditions and to provide an indication of the levels of contaminants in the Site.

Potential risks to human health, controlled waters and the built environment have been identified from on-Site Made Ground and hydrocarbons and vapours are possible risks to human health from the off-Site sources such as works, tanks and garages. The proposals for the Site are unknown and, therefore, a conservative assumption of residential housing with private gardens has been used for the assessment. Gross contamination was not encountered during the preliminary ground investigation, however, concentrations of contaminants (lead and asbestos) within the Made Ground were recorded in excess of applicable guideline values.

Further development-specific ground investigation will be required to confirm any mitigation requirements. Workstreams may include (but not limited to):

- Confirming concrete design for sulphate resistance for foundations and services;
- Determining the extent and depth of buried obstructions within the Site;
- Further gas monitoring and assessment of the potential risk of ground gases to receptors, and determining whether gas protection measures would be required for future development;
- Consideration of shrinkage and swelling, trees, potential for relict shear slip surfaces and buried services may need to be considered during the design; and
- UXO mitigation.

Based on the findings of the desk study and investigation report, and assuming that the Site will be developed for residential use, it is anticipated that some remediation (off-site disposal, clean cover, gas membrane, basic asbestos monitoring and pipe upgrade but excluding foundation) may be required.

Material re-used on-site would need to be assessed in terms of its chemical and geotechnical suitability for reuse as engineering or landscaping fill. If off-site disposal is required, a waste assessment for the Made Ground and shallow soil materials would need to be undertaken to determine whether they are classified as hazardous or non-hazardous waste. Based on a preliminary assessment, Made Ground associated with the structures in the west of the Site may be hazardous due to elevated lead concentrations, and other Made Ground material may be hazardous depending on the quantity of asbestos present.

The western part of the Site is classified as ‘moderate’ potential of encountering unexploded ordnance (UXO) and UXO mitigation will be required where excavations or piling / boreholes are proposed. The remainder of the site is classified as low UXO risk.

7 References

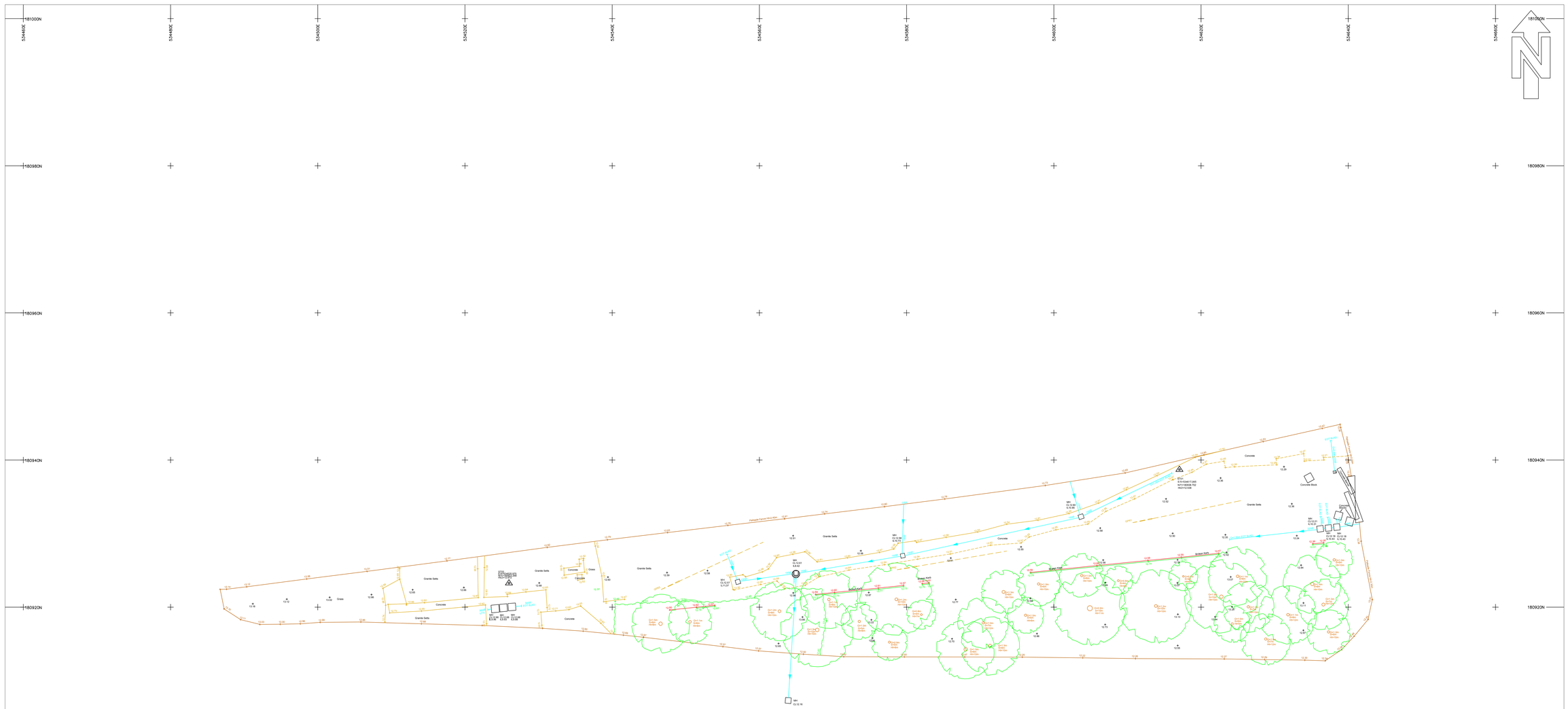
1. 40Seven (August 2017) Topographical Survey.
2. Arcadis Consulting (UK) Limited (September 2017) Land to The North Side Of Royal Mint Street And Cable Street, Tower Hamlets, E1 8LG. Ecology Assessment (Report Number 1102-UA009686-UE21R-01)
3. Arcadis Consulting (UK) Limited (September 2017) Land to The North Side Of Royal Mint Street And Cable Street, Tower Hamlets, E1 8LG Preliminary BS5837 :2012 Tree Survey (Report 1103-UA009686-UE21R-01)
4. Arcadis Consulting (UK) Limited (July 2017) Land to The North Side Of Royal Mint Street And Cable Street, Tower Hamlets, E1 8LG Archaeology Desktop Review (Report 1104-UA009686-UE21R-01)
5. Arcadis Consulting (UK) Limited (September 2017) Land to The North Side Of Royal Mint Street And Cable Street, Tower Hamlets, E1 8LG. Geotechnical and Geo Environmental Desk Study (Report Number 1601-UA009686-UP32R-01)

Arcadis Consulting (UK) Limited

Arcadis House
34 York Way
London N1 9AB
United Kingdom

T: +44 (0)20 7812 2000

arcadis.com



UTILITY LEGEND

- Foul Drainage
- Surface Drainage
- Combined Drainage
- Electricity
- Overhead Electricity
- Traffic Light System
- Gas
- Water
- Telecommunications
- Cable Television
- Close Circuit Television
- British Telecom
- Overhead Telecom
- Fibre Optics
- Unknown
- Unknown Route Located By GPR
- Ducting
- Transport for London
- Scar
- GPR Image Position
- Survey Extents
- Photo Position

*** Please Note:**
Utility routes shown in dark grey & with line type (!) are from existing records.
Examples: ——— !!! ——— !!! ——— !!!

ABBREVIATIONS

AC	Asbestos Cement	NM	Note Marker
AD	Assumed Drainage	NP	No Parking
AG	Assumed Gas Main	NPV	No Pipes Visible
AR	Assumed Route	OSA	Off Survey Area
BB	Bollard	P	Pole
BB	Bellmouth Beacon	PBM	Permanent Bench Mark
BD	Back Drop	PE	Polyethylene
BHL	Bed Level	PGM	Permanent Ground Mark
BK	Brick Kerb	PI	Pillar
Bk	Brick	PL	Plastic
BL	Basement Light	PL	Palisade Fence
BO	Bollard	PM	Parking Meter
BR	Barrier	PR	Post & Rail Fence
BS	Bus Stop	PU	Pump
BT	British Telecom Cover	PVC	Polyvinylchloride
BTB	British Telecom Box	PW	Post & Wire Fence
BW	Brick Wall	PZ	Piezometer
BWF	Barbed Wire Fence	RE	Rodding Eye
CA	Cable Duct	RF	Refuge
CAT	Catenary Level	RL	Rail Level
CB	Close Bonded Fence	RP	Reflector Post
CC	Concrete Cover	RSP	Rising Sprinkler
CH	Chainage	RWP	Rain Water Pipe
CNL	Channel Level	RW	Retaining Wall
CO	Clean Out	S	Screw
CI	Corrugated Iron Fence	SA	Survey Abandoned
CL	Cover Level	SA	Soakaway
CLF	Chain Link Fence	SB	Stop Cock Marker
Co	Concrete	SF	Safety Fence
CP	Catch Pit	SI	Spun Iron
CR	Concrete Road	SL	Sign Level
CJB	Crash Barrier	SP	Sign Post
CTV	Cable TV	Spr	Spring
CW	Chain Wire	SR	Security Railings
CW	Concrete Wall	SS	Structure Support
DI	Ductile Iron	ST	Stop Tap
DL	Down Pipe	SV	Scour Valve
dis	Disused	SV	Sluice Valve
D/S	Downstream	SVP	Soil Vent Pipe
EB	Electricity Board	TA	Traffic Arrow
EB	Electricity Box	TaL	Tactile Paving
EC	Electricity Cover	TBM	Temporary Bench Mark
EL	Electricity Line	TC	Telecom Cover
EOT	End of Trace	TCB	Telephone Call Box
EP	Electricity Pole	TCP	Telephone Call Post
ER	Earth Rod	TFR	Taken From Records
FC	Fuel Cover	TH	Trial Hole / Pit
FCL	Finished Floor Level	TL	Telephone Level
FH	Fire Hydrant	Tk	Tank
FO	Fibre Optic Cover	TOW	Top Of Wall
FP	Flood Pipe	TP	Traffic Signal Pole
G	Gully	TS	Traffic Signals
GPR	Ground Penetrating Radar Anomaly	U/S	Upstream
GV	Gas Valve	UCA	Underground Cabin Access
H/R	Hand Rail	UTL	Unable to Locate
HC	Hydrant Chamber Cover	UTR	Unable to Raise
IL	Invert Level	UTT	Unable to Trace
IR	Iron Rail Fence	VC	Vitrified Clay
LB	Letter Box	VCP	Vehicle Protector Pads
LB	Letter Box	VP	Vent Pipe
LC	Lighting Column	VR	Vapour Recovery
LP	Lamp Post	W	Water Meter
LOR	Loss Of Reflection	W	Water Cover
LOS	Loss Of Signal	WL	Water Level
M	Manhole Cover	WM	Water Meter
M/C	Multiple Cables	WM	Wire Mesh Fence
MH	Manhole Cover	WO	Water Wash Out
MP	Marker Post	WP	Water Pumpable
MP	Mile Post/Stone	WV	Wheel Valve
NFI	No Further Information		

DISCLAIMER

Unless otherwise stated, all services shown on this plan have been surveyed using electronic detectors and the connections between manholes, if not traced, are assumed to be direct.
No guarantee can be given that all services have been shown.
In ideal conditions the depth accuracies for the underground utilities located is +/- 10% of depth.
Where services are shown as 'Taken From Records' on the drawing we are not liable for any loss that may arise due to a lack of accuracy in that plotted information.
Due to BT's policy we are not permitted to lift their inspection chamber covers.
Reference should be made to the methodology used on site as detailed within the latest version of 40SEVEN's Site Procedures for Utility Location Surveys.
It is the client's responsibility to verify all services shown are to be carried out with due diligence (Ref: HSG47).
The following text' is an extract from Surveys of Land, Buildings and Utility Surveys at scales of 1:500 and Larger issued by the Royal Institute of Chartered Surveyors February 1996:
"Electromagnetic locating is a reliable method of locating buried services. On heavy, built up sites 95% completeness is probably all that can be expected.
"Plan accuracies of the order of + or - 150mm may be achieved but this figure will depend greatly on the depth of the service below ground level. Where small services run in close proximity, separation may be impossible. Successful tracing of non-metallic pipes may be limited.
"Existing record information showing underground services is often incomplete and of doubtful accuracy. It should be regarded only as an indication and cannot be guaranteed.

NOTES

Read in conjunction with existing records.
Utility routes and text shown in dark grey are from existing records.
Drainage routes with a pipe diameter of 300mm or greater are shown as the pipe width along with continuous line style.

REV.	DETAILS	BY	DATE

GRID: ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS

DATUM: ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS

Achilles THE SURVEY ASSOCIATION
Certificate Number: FS 11217
40SEVEN
LEEDS 08450 175000 LONDON 08450 175100
E-Mail: 40seven-info@40seven.com Web site: www.40seven.com

CLIENT:
ARCADIS CONSULTING (UK) LTD
ARCADIS HOUSE
34 YORK WAY
LONDON N1 9AB

PROJECT TITLE:

DRAWING TITLE:
TOPOGRAPHICAL SURVEY

SURVEYED BY:	DRAWN BY:	APPROVED BY:
DS	VK	JB

SCALE:	SURVEY DATE:
1:200 @ A2	AUGUST / 2017

DRAWING NUMBER: 1178_Cable_Street_P_3D

SHEET NUMBER: 1 of 1 A0 REV:

Arcadis TFL Sites (Cable Street)
Shadwell

Utility Mapping Survey
Site Report
Project No. 1178

Prepared by:
Tom Grimley
40SEVEN Limited

Unit E
Great Hollanden Business Centre
Underriver
Sevenoaks
Kent
TN15 0SQ
Tel: 08450 179 300

Commissioned by:
Tony Windsor
Arcadis Consulting (UK) Ltd

Aston Cross
Rocky Lane
Aston
Birmingham
B6 5RQ

Table of Contents

1 ..... Title Page
2 ..... Survey Details
2 ..... Specification Notes
3 ..... Existing Service Records
3 ..... Field Equipment
4 ..... Survey Results
6 ..... Site Photographs & GPR Scans
13 ..... Comments

Utility Surveyor: Tom Grimley, James Ephgrave

Topographical Surveyor: Daniel Smith

Date of Survey: July 2017

Drawings Number Issued to the Client: 1178 _P.dwg

Type of Survey: Underground Utility Location & Mapping Survey.

Survey Grid: ORDNANCE SURVEY - Related to the OS Active Network via GPS observations.

Survey Datum: ORDNANCE SURVEY - Related to the OS Active Network via GPS observations.

Accuracies: Depth by Electromagnetic Detection: +/- 10% of Depth.
Plan position by Electromagnetic Detection: +/- 10% of Depth.
Depth by GPR: +/- 10% of depth (in Normal Ground Conditions)
Plan position by GPR: +/- 10% of Depth.

Specification Notes:

1. All survey works carried out in the areas defined by Arcadis.
2. All drawings must be read in conjunction with record information.
3. Field distortions from any above ground metallic objects i.e. temporary heras fences, temporary safety barriers or parked vehicles can limit the locatable signal due to interference from above ground fields.
4. Statutory information available at the time of survey, provided by 40Seven.
5. All services have been surveyed robustly using a combination of Electromagnetic Detection & Ground Penetrating Radar (GPR). All utility positions were surveyed in using a Robotic Total Station.

Existing Service Records Provided to Field Surveyor

Service	Provider	Remarks
BT	Openreach	Map Reference : TQ3459080935
Water	Thames Water	No Map Reference Available
Electric	UKPN	Map Reference : TQ3480NW
CATV	Virgin Media	No Map Reference Available
Comms	Zayo	No Map Reference Available
		NOTE: No other existing statutory undertaker's records were available at the time of the survey or during the course of post processing.

Field Equipment

Type	Make	Model	Company I.D No.	Operator(s) Initials
Electrolocation Instrument	RD	8100	PDL011 TXT011	TG
Ground Radar	Mala	HDR Pro	ELP07	TG
Robotic Total Station	Trimble	S3	Rob 23	DS
GPS Receivers	Trimble	R8	Rover 20	DS

Utility Location & Mapping Survey Results

Service	Comment Number	Successes / Problems Differences between survey & "Stats"
Drainage	1	Surface water interceptor located in the far West end of the survey extents. This interceptor consists of three chambers located inside three Gattic manhole covers. Unable to locate the incoming 300mm pipe due to a blockage preventing location by sonde. Unable to locate the outgoing 300mm pipe as it is metallic and cannot be located using a sonde.
	2	Surface water interceptor located in the far East end of the survey extents near the site entrance. The outgoing route is a 225mm pipe which has been located using a sonde but only partially due to a blockage preventing further location.
	3	Several 150mm surface water drainage routes located throughout the survey extents. These routes have been located by sonde and by sound testing connectivity between manhole covers. The outgoing route exits site and enters a manhole cover in the carriageway of Cable Street.
	4	Surface water drainage gully located in the far East end of the survey extents near the site entrance. This route has been located using a sonde but only partially due to a blockage preventing further location.
	5	No foul sewer drainage routes located within the survey extents.
	6	No statutory information available at the time of survey.
Electric	1	No electric routes located within the survey extents.
	2	A full passive power sweep has been carried out across the survey area using electromagnetic location instrument.
	3	Statutory information available at the time of survey, provided by the client.
Gas	1	No gas routes located within the survey extents.
	2	No statutory information available at the time of survey.
Water	1	No water routes located within the survey extents.
	2	Statutory information available at the time of survey, provided by the client.
Telecom	1	No telecom routes located within the survey extents.
	2	Statutory information available at the time of survey, provided by the client.
CATV	1	No CATV routes located within the survey extents.
	2	Statutory information available at the time of survey, provided by the client.
Comms	1	No comms routes located within the survey extents.
	2	Statutory information available at the time of survey, provided by the client.

Service	Comment Number	Successes / Problems Differences between survey & "Stats"
GPR	1	The radar reflects changes in the electrical properties of materials in the sub-surface. The data prevents definition of unknown targets.
	2	A full GPR survey has been carried out across the site where possible.
	3	GPR scan positions (as shown on the survey drawing) relate to the GPR images shown within this report, and are not necessarily indicative of actual routes / anomolies detected.

Photos:

Photo 1

Description: General view of site.

Photo 2

Description: View of Interceptor manhole covers.

Photo 3

Description: General view of site.

Photo 4

Description: General view of site.

Photo 5

Description: General view of site.

Photo 6

Description: General view of site.

Photo 7

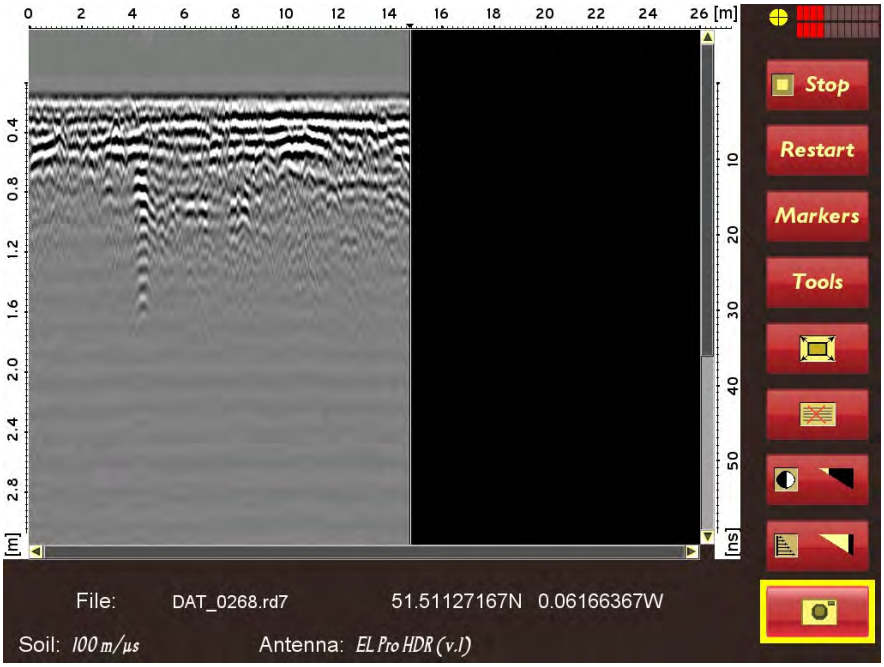
Description: General view of site.

Photo 8

Description: View of Interceptor manhole covers.

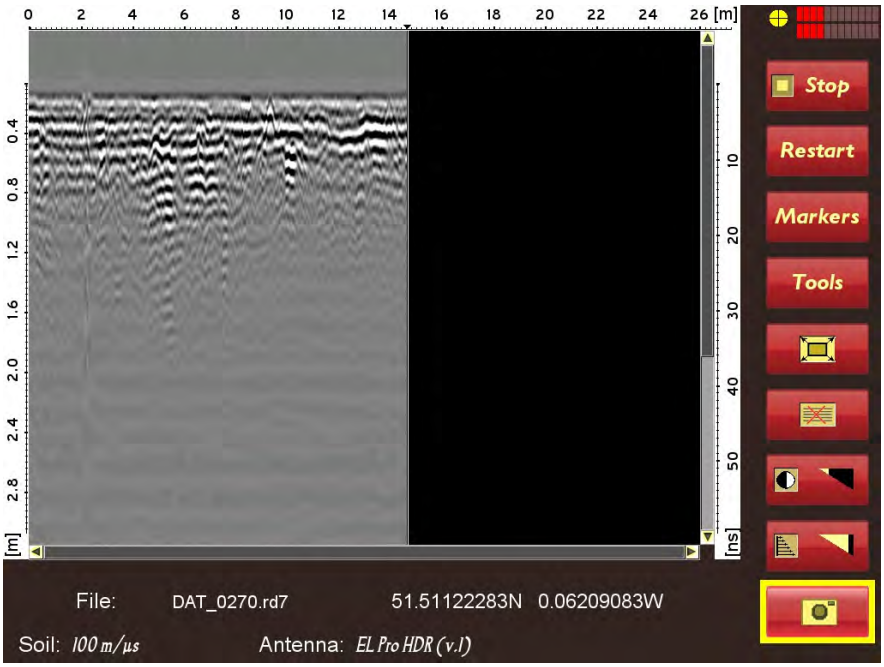
GPR Scans:

GPR 1



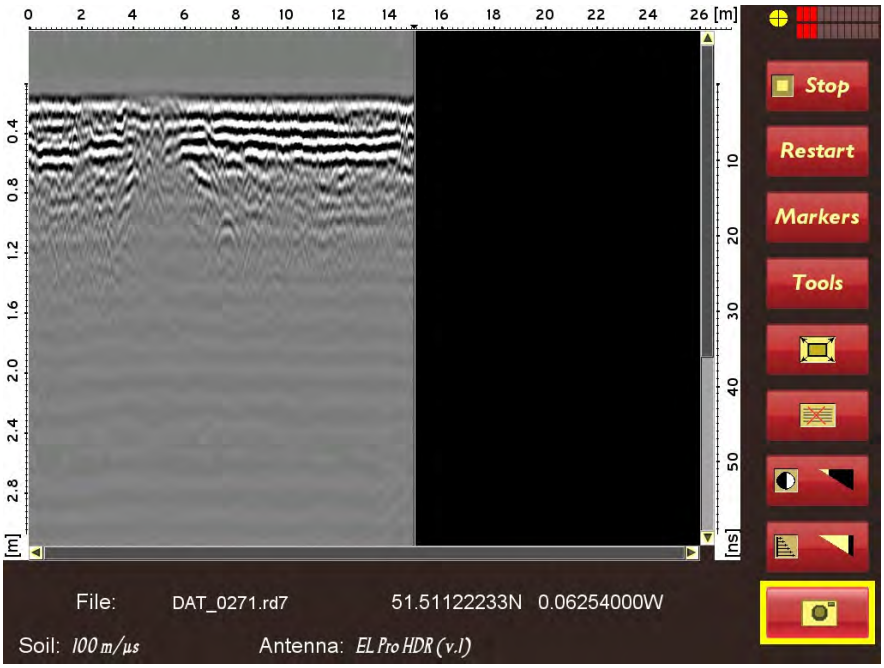
Description: Ground Penetrating Radar Scan 1.

GPR 2



Description: Ground Penetrating Radar Scan 2.

GPR 3



Description: Ground Penetrating Radar Scan 3.

Site Notes:

1. **Survey was undertaken in the areas defined by Arcadis Ltd.**
2. **Various utilities on site could not be proven or completed and the appropriate comments have been added to the drawing.**
3. **Services plotted outside survey extents should not be considered to be exhaustive.**
4. **Through non-intrusive surveying techniques it always remains possible that there are additional services within the survey boundary that we have not been able to detect. We recommend that care is taken on site and that all service providers records should be checked prior to any works being carried out.**
5. **Existing service provider's records were available during the site survey.**

CAD Operators Comments:

1. Survey work corresponds to Utility Surveyor's fieldwork.
2. Services shown outside the survey extents should not be considered to be exhaustive.

QA Managers Comments:

1. All procedures have been followed.
2. Checked that all topographical features have utilities connected, or if not are appropriately notated.
3. Services shown outside the survey extents should not be considered to be exhaustive.

Project Managers Comments:

1. A full electromagnetic and GPR survey carried out across the site.
2. GPR works by emitting electromagnetic signals into the ground and analysing signal returns. The use of GPR is strongly dependent upon local soil properties. Depth of penetration is limited by the presence of clays of other highly conductive materials. There must be a significant electrical contrast between the target and the host materials.
3. If the survey interacts with any above ground metallic features this may hinder the survey therefore caution should be taken within those areas while excavating.
4. It is recommended that statutory authority records are acquired and read in conjunction with this information, as no guarantee can be made for the completeness of this drawing.

ARCADIS Design & Consultancy for natural and built assets

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE

LAND TO THE NORTH SIDE OF ROYAL MINT ST. AND CABLE ST. TOWER HAMLETS, E1 8LG

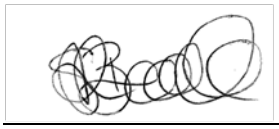
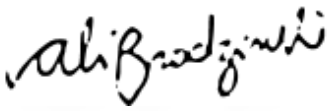
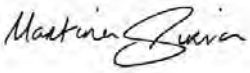
Site Ref: 2363
Ecological Assessment

OCTOBER 2017

Incorporating
EC HARRIS BUILT ASSET CONSULTANCY
Hyder

LAND TO THE NORTH SIDE OF ROYAL MINT ST. AND CABLE ST. TOWER HAMLETS, E1 8LG

Ecological Assessment Report

Author	Rebecca Beale	
Checker	Aline Brodzinski	
Approver	Martina Girvan	
Report No	1102-UA009686- UE21R-02	
Date	OCTOBER 2017	

VERSION CONTROL

Version	Date	Author	Changes
01	September 2017	Rebecca Beale	1st Issue
02	October 2017	Rebecca Beale	Final Issue

CONTENTS

1 INTRODUCTION 1

1.1 Background 1

1.2 Site Location & Setting 1

2 METHODOLOGY 2

2.1 Desk Study 2

2.2 Field Survey 2

2.3 Limitations and Expectations 2

3 SURVEY RESULTS 4

3.1 Reporting Outline 4

3.2 Desk Study Results 4

3.3 Site Overview 4

3.4 Habitats 4

3.5 Protected and Notable Species 5

3.6 Invasive Species 5

4 POTENTIAL ECOLOGICAL CONSTRAINTS 6

4.1 Habitats / Invasive Species 6

4.2 Protected and Notable Species 6

5 LEGISLATION AND KEY POLICY REQUIREMENTS 7

5.1 Relevant Legislation 7

5.2 Relevant Policy 7

5.3 Potential for Enhancement Within a Development 7

6 SUMMARY OF ECOLOGICAL CONSTRAINTS AND MITIGATION REQUIRED 8

7 CONCLUSIONS 10

SITE PHOTOGRAPHS 11

FIGURE 1: STATUTORY DESIGNATED SITES WITHIN 2KM OF THE SITE CENTRE 12

FIGURE 2: EXTENDED PHASE 1 HABITAT MAP (WITH DEDICATED SURVEY RESULTS AND TARGET NOTES) 13

APPENDIX A: DESK STUDY RESULTS 14

APPENDIX B: BAT HABITAT SUITABILITY AND LONDON POPULATION STATUS 20

APPENDIX C: SELECTED LEGISLATION, NATURE CONSERVATION STATUS AND POLICY 23

1 INTRODUCTION

1.1 Background

Arcadis (UK) Limited (Arcadis) was commissioned by Transport for London (TfL) to undertake an ecological assessment to support the feasibility for potential development at land to the north side of Royal Mint Street and Cable Street Site, Tower Hamlets, E1 8LG ; hereafter referred to as “the Site”.

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of the Small Sites Initiative is to provide robust and pragmatic advice that sensibly de-risks each of the sites such that unreasonable “abnormal” development costs are not included by developers.

The objective of this report is to identify potential ecological development constraints due to current ecological conditions on Site as based on the findings of a desk study and ecological constraints survey. The report outlines the ecological constraints associated with the Site with regards to biodiversity legislation and policy and provides advice on mitigation and enhancement opportunities, including requirement for any further assessment or licensing, if necessary.

1.2 Site Location & Setting

The Site is located immediately north of the B126/ Royal Mint Street and Cable Street and west of Cannon Street Road, in the London Borough of Tower Hamlets. The Site is centred at Grid Reference 534587, 180926 and is located within the postcode of E1 8LG.

The Site is approximately 0.3ha in area. The northern and western sections of the site supported a mosaic of tall ruderal and ephemeral/short perennial vegetation with occasional low-lying scrub, grasses and tree saplings. A line of mature deciduous trees was located along part of the southern boundary of the site.

The site is adjoined by industrial units and the London Docklands Railway line and to the north and east, the B126 / Cable Street to the south and the B108 / Cannon Street Road to the west. The surrounding area is characterised by multi-storey residential development.

The Site boundary used for this assessment is presented on Figure 2.

2 METHODOLOGY

2.1 Desk Study

Desk-based ecological information was collated from multiple sources.

The Multi-Agency Geographic Information for the Countryside (MAGIC) website[1] and other Natural England and Forestry Commission datasets were used to search for any statutory or non-statutory designated sites of nature conservation importance within a specific radius of the Site boundary, as follows:

- Special Protection Areas (SPAs) or Ramsar Sites designated for their bird interests (5km radius);
- Special Areas of Conservation (SACs) (5km radius);
- Sites of Special Scientific Interest (SSSIs) and all other statutory designated sites (2km radius);
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR); and
- Woodlands registered on the Ancient Woodland Inventory (AWI).

Records of protected or otherwise notable species of conservation concern (that the Site has the potential to support) located 1km of the Site boundary were obtained from the following sources:

- Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006) Species of Principle Importance in England[2];
- National Biodiversity Network Atlas[3]; and
- London Biodiversity Action Plan[4].

In addition, the Local Plan for the London Borough of Tower Hamlets[5] was reviewed for the locations and citations of any non-statutory designated sites located within a 1km radius of the Site. Referred to as Sites of Importance for Nature Conservation (SINCs) they are categorised into three sub designations:

- Sites of Metropolitan Importance for Nature Conservation (SMINCs);
- Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II; and
- Sites of Local Importance for Nature Conservation (SLINCs).

Waterbodies located within 500m of the Site identified from OS mapping were assessed with regards to their connectivity to the Site and their potential suitability for supporting a population of breeding great crested newts (*Triturus cristatus*).

2.2 Field Survey

This survey was conducted by Rebecca Beale in August 2017 (BSC, MSc, MCIEEM). Habitats were classified according to their JNCC Phase 1 habitat categories (JNCC 2010)[6] and plants named after Stace (1997)[7] and are presented on Figure 2.

2.3 Limitations and Expectations

This report has been prepared for TfL in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by

[1] MAGIC (2002). MAGIC Map Search. [online] Available at http://magic.defra.gov.uk [Accessed August 2017]
[2] NERC Act (2006) Section 41 Species http://www.nhm.ac.uk/our-science/data/uk-species/checklists/NHMSYS0020515439/index.html
[3] National Biodiversity Network https://nbn.org.uk/ [Accessed August 2017]
[4] London BAP (Reviewed 2007) http://www.gigl.org.uk/london-bap-priority-species/ [Accessed August 2017]
[5] London Borough of Tower Hamlets Proposals Map http://democracy.towerhamlets.gov.uk/mgConvert2PDF.aspx?ID=6262 and http://www.towerhabitats.org/docs/SINCcitationsApril2017.pdf [Accessed August 2017]
[6] Joint Nature Conservation Committee (2010), *Handbook for Phase 1 habitat survey - a technique for environmental audit*
[7] Stace, C. (1997). *New Flora of the British Isles Second Edition*. Cambridge University Press

This report has been compiled from a number of sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

3 SURVEY RESULTS

3.1 Reporting Outline

The results of the desk study and ecological constraints survey are described below, with Sites or features of particular nature conservation interest detailed as appropriate.

Supporting information enclosed within this report to be read in conjunction with the results and subsequent discussion are as follows:

- Figure 1: Designated Sites within 2km of the Site centre;
- Figure 2: Extended Phase 1 Habitat Map (with dedicated survey results and target notes);
- Table 1: Ecological Constraints and Mitigation Summary Table; and
- Table 2: Site photographs.

Only information potentially relevant to the development of the Sites is included within the report other information is appended as follows:

- Appendix A: Desk Study Results;
- Appendix B: Bat Habitat Suitability Assessment and London Bat Population Status; and
- Appendix C: Selected Legislation, Nature Conservation Status and Policy.

3.2 Desk Study Results

Only desk study results that are potentially relevant to the Site will be presented within the report. Detailed status and protections conferred by the relevant designations below are presented in Appendix A and Figure 1. The relevant Site information is summarised below.

- There is one hedgehog (*Erinaceus europaeus*) record from 2006 approximately 0.7km from the Site;
- There are five fox (*Vulpes vulpes*) records from 1995-2012 with the closest record approximately 0.7km from the Site;
- There were no relevant records of protected or notable amphibians, reptiles, bats and badger within 1km of the Site; and
- No statutory or non-statutory designated sites (including ancient woodlands or woodlands listed on the Ancient Woodland Inventory (AWI)) were identified within the vicinity of the Site which were considered to have the potential to be significantly impacted by development on the Site.

3.3 Site Overview

Vegetation on the Site had established through degrading hard-standing. Several small rubble piles were observed across the Site. The Site supported a limited range of habitats and was comprised of comprised of ephemeral short perennial and scattered tall ruderal vegetation with low-lying scrub. A line of mature deciduous trees was located along the southern boundary of the site.

3.4 Habitats

Phase 1 habitat categories and descriptions of these habitats are presented below and the locations of these habitats are presented in Figure 2.

- **Scattered Trees:** A line of mature deciduous trees were recorded along part of southern boundary of the Site, dominated by Norway Maple (*Acer platanoides*) with occasional Purple Leaved Sycamore (*Acer pseudoplatanus purpureum*), Elder (*Sambucus nigra*) and Ash (*Fraxinus excelsior*). Ash and Sycamore (*Acer pseudoplatanus*) saplings were observed throughout the Site. The ground layer supported Common Ivy (*Hedera helix*), Wood Avens (*Geum urbanum*) Ground Ivy (*Glechoma hederacea*) and Annual Mercury (*Mercurialis annua*).

- **Scrub:** Occasional stands of low-lying Bramble (*Rubus fruticosus* agg.) scrub were recorded on the Site. Occasional stands of Butterfly-bush (*Buddleja davidii*), listed on the London Invasive Species Initiative (LISI) list, were also recorded.
- **Ephemeral/short perennial and tall ruderal**: The northern and western sections of the Site supported a mosaic of tall ruderal and ephemeral/short perennial vegetation with occasional low-lying scrub, grasses and tree saplings. Vegetation on the Site included Common Nettle (*Urtica dioica*), Melilot spp. (*Melilotus spp.*), Canadian Fleabane (*Conyza canadensis*), Mugwort (*Artemesia vulgaris*), Perennial Wall-rocket (*Diplotaxis tenuifolia*), Thistle species (*Cirsium* sp.), Yarrow (*Achillea millefolium*), Hogweed (*Heracleum sphondylium*), Sow-thistle species (*Sonchus* sp.), Red Dead-nettle (*Lamium purpureum*), White Dead-nettle (*Lamium album*), Ribwort Plantain (*Plantago lanceolata*), Red Clover (*Trifolium pratense*), and Broad-leaved Dock (*Rumex obtusifolius*). Common Chickweed (*Stellaria media*), Common Poppy (*Papaver rhoeas*), Herb-Robert (*Geranium robertianum*) and Common Toadflax (*Linaria vulgaris*). Occasional Pendulous Sedge (*Carex pendula*) was also observed.
- **Species-poor semi-improved grassland**: the western tip of the Site supported a small area of species-poor unmanaged grassland dominated by False Oat-grass (*Arrhenatherum elatius*).

3.5 Protected and Notable Species

The following protected or notable species have the potential to be present on / adjacent to the Site:

- **Roosting / Hibernating Bats:** A mature Purple Leaved Sycamore tree (Target Note 2 on Figure 2) located in the south-east section of the site exhibited a split trunk (with burnt marks on its bark). A scar on each split trunk had not fully occluded and each supported a cavity (located approximately 2m above the ground) leading-up into the trunk. The potential of this feature to support roosting/hibernating bats was categorised as 'low' based on BCT guidance[8]. This was owing to the Site being well lit from street lighting, which reduces its suitability for use by bats with little suitable connecting foraging and commuting habitat.
- **Nesting Birds:** There is potential for nesting birds to be utilising the trees and scrub on the Site, including species listed on the London BAP such as house sparrow (*Passer domesticus*). House sparrow and blackbird (*Turdus merula*) were observed on Site during the survey.
- **Squirrel:** A squirrel drey was recorded in the south-east section of the Site (Target Note 1 on Figure 2).

The Site offered no suitable habitat for reptiles. No suitable ponds were present within 500m of the Site with connectivity to the Site, so the presence of great crested newts is extremely unlikely. Strong smell of fox on site was observed. It is likely that the species uses the Site regularly as foraging grounds. Overall, within the Site, there was limited potential for protected or notable species.

3.6 Invasive Species

On Site, no invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) were recorded during the survey.

Butterfly-bush listed on the LISI (London Invasive Species List) was recorded on Site.

[8] Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

4 POTENTIAL ECOLOGICAL CONSTRAINTS

The potential ecological constraints and associated further works including mitigation is briefly presented below, further detail is presented in Table 1.

4.1 Habitats / Invasive Species

The habitats on Site are likely to be considered as 'less than local' value according the CIEEMs *Guidelines for Ecological Impact Assessment* (CIEEM 2016)[9]. However, these habitats have value as green infrastructure, likely performing important ecosystem services (such as drainage, air quality etc.).

There will be some ecological benefit from the removal of non-native invasive species listed on the LISI list. There is no legal obligation to control or remove these species recorded but it is good practice to do so. Removal of the vegetation from the Site to facilitate the development would likely adequately eradicate the majority of the LISI species from the Site.

For any loss of trees, trees should be re-provisioned on the Site, of a suitable species, preferably native species of local origin appropriate to the sylvan culture of the area. An ecologist and arboriculturist should contribute to the evolution of the development and landscaping design to minimise biodiversity loss and to maximise the replacement green infrastructure with regards to biodiversity.

4.2 Protected and Notable Species

The following notable or protected species have the potential to be impacted by future development:

- **Roosting / Hibernating Bats:** Two cavities identified on a mature Purple Leaved Sycamore tree located in the south-east section were categorised as having a low potential to support roosting/hibernating bats. Should this tree require removal to facilitate new development it is recommended that the cavities are inspected with an endoscope by a licenced bat worker to confirm the status of the tree with regards to roosting bats.
- **Nesting birds:** It is likely that nesting birds will utilise the Site. Clearance of vegetation should be avoided during the nesting bird season (March to August inclusive). Replacement nesting opportunities should be provided within any future development.
- **Squirrel:** A squirrel drey was recorded in the south-east section of the Site. Although grey squirrel is regarded as an invasive non-native species included on Schedule 9 Wildlife and Countryside Act, they are protected against in humane killing under the Wild Mammal (Protection) Act 1996. Th Act protects mammals against being inhumanly killed or harmed. Typically there are two main breeding seasons when young are in the drey (February to August inclusive). Reasonable avoidance includes soft felling the tree and pest control methods (e.g. live trapping and poisoning).

[9] CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater and Coastal.

5 LEGISLATION AND KEY POLICY REQUIREMENTS

Potentially relevant Legislation and Policy are presented in Appendix C and further detail with regards to surveys and mitigation required are presented in Table 1.

5.1 Relevant Legislation

Development of the Site will require surveys and or mitigation to fulfil legislative requirements for the following protected species:

- All bat species are afforded full protection under UK and European legislation, including the Wildlife and Countryside Act 1981 (as amended)[10], the Countryside and Rights of Way Act (2000)[11] and the Conservation (Natural habitats &c.) Regulations 2010 (as amended)[12].
- The Wildlife and Countryside Act 1981 (as amended) for nesting birds: works will need to be timed to avoid the nesting bird season (March to August inclusive) or supervised to prevent impacts to nesting birds.
- All mammals are protected under The Wild Mammal (Protection) Act 1996.

Full details of subsequent works required are included within Section 6, Table 1 below.

5.2 Relevant Policy

Elements of national and London policies and plans have the potential to be applicable to any development of the Site, these relate to:

- The safeguarding and replacement of trees to be lost to development;
- Creation and enhancement of biodiversity where possible:
- Material consideration of those species listed under Section 41 (S41) of the 2006 Natural Environment and Rural Communities (NERC) Act[13] which may to utilise the Site including, bullfinch starling, and yellow wagtail; and
- There was a plant recorded listed on LISI (London Invasive Species List), Butterfly-bush. There is no legal requirement to remove or control this species. However, it would be appropriate and beneficial to remove them as part of a future development.

An ecology report addressing the required design and construction mitigation for any proposed development will be required in support of planning.

5.3 Potential for Enhancement Within a Development

In addition to the recommended further works, enhancements should be considered within any development. For example, biodiversity roofs, rain gardens and other green infrastructure should be considered and the soft landscaping should be designed to maximise the biodiversity potential.

There are also opportunities for enhancements for London BAP species. Bird boxes for sparrows would be a valuable enhancement, along with bat roosting boxes.

[10] Anon (1981) Wildlife and Countryside Act. HMSO, London.
[11] Anon (2000) Countryside and Rights of Way Act. HMSO, London.
[12] Anon (2010). The Conservation (Natural Habitats, & c) Regulations 2010. HMSO, London.
[13] Anon (2006) The Natural Environment and Rural Communities Act HMSO, London.

6 SUMMARY OF ECOLOGICAL CONSTRAINTS AND MITIGATION REQUIRED

Table 1: Ecological Constraints and Mitigation Summary Table

Key Issues	Legislation/Policy	Assumption	Further Survey / input?	Seasonal Timing	Mitigation Required	Seasonal Timing	Programme Delay Risk	Survey/ Mitigation Cost Estimate*	Risk Rating
Roosting / hibernating bats									
A mature Purple Leaved Sycamore tree located in the south-east section of the site exhibited two cavities categorised as having a low potential to support roosting/hibernating bats.	Schedule 5 of the of the WCA, 1981, as amended The Conservation of Habitats and Species Regulations 2010	Assumption is that the trees are to be felled for development	It is recommended that the cavities are inspected with an endoscope by a licenced bat worker to confirm the status of the tree with regards to roosting bats.	N/A	Inspection of the cavities with an endoscope by a licenced bat worker to confirm the status of the tree with regards to roosting bats Should the surveys confirm the presence of roosting bats in a feature to be removed, it is likely that a EPS mitigation licence would be required for the works to proceed. This would require the provision of a method statement for the works and suitable mitigation measures to be put in place.	Felling following the inspection of the cavities with an endoscope by a licenced bat worker to confirm the status of the tree with regards to roosting bats November to February inclusive	N/A	Mitigation Potentially £500 Inspection of the cavity	Low
Nesting Birds									
All green infrastructure listed below is suitable for nesting birds. These are likely to be removed for development. • Individual trees.	WCA, 1981, as amended	Removed for development / site investigation.	No (but see mitigation recommendations)	Vegetation clearance ideally undertaken between September to February (inclusive), outside of the bird nesting season.	Vegetation clearance undertaken outside of the core bird nesting season (March to August inclusive). If this is not possible, then it is recommended that a check for breeding birds is undertaken by a suitably experienced ecologist prior (within 48 hours) to works commencing. If an active nest (including nests in the process of being constructed) is found, a suitable stand-off area should be maintained until the young have fledged. The extent of this area would be determined by an ecologist and demarcated on site using suitable fencing.	September to February remove woody vegetation.	If vegetation removal is required during the nesting bird season and breeding birds are found by the ecological watching brief, a delay of 6 weeks is likely to be required until chicks have fledged.	Mitigation £500 - £1000 per day for ecological supervision / nesting bird check. Design and replacement of green infrastructure not costed.	Low

Key Issues	Legislation/Policy	Assumption	Further Survey / input?	Seasonal Timing	Mitigation Required	Seasonal Timing	Programme Delay Risk	Survey/ Mitigation Cost Estimate*	Risk Rating
					A toolbox talk should be given by the ecologist to the contractors to ensure the nest is not disturbed.				
Green Infrastructure/ Trees									
A number of trees may be felled for development	Potential TPOs (although unlikely) although removal will be granted with planning permission national and local policy on no net loss	Trees will be removed or damaged due to development	Yes: BS 3857 2012 Tree survey	Removal of trees affected by bird nesting season see above.	Protection of trees replacement of trees and green infrastructure	As above.	N/A	Survey: £1,900 Mitigation: £1,000 demarcation and Arboricultural Method Statement. Replacement of green infrastructure.	Low
Non-native Invasive species									
Butterfly-bush	London Invasive Species Index	Development could cause these species to spread	No	N/A	It would be good practice to remove this species during subsequent development and to implement mitigation to ensure it does not spread	N/A	N/A	Can be undertaken with vegetation clearance for development.	Low
Squirrels									
Field Maple tree contains squirrel drey. This tree is likely to be felled prior to development causing loss of habitat and potential harm to squirrels.	Wild Mammals Protection Act 1996	Closed for development	No	N/A	Dreys should be removed when juvenile squirrels are unlikely to be present Avoidance of the 2 main breeding seasons when young are in the drey (February to October inclusive) is recommended.	Fell the tree in winter (November to January inclusive)	None	Mitigation £500 site supervision dulling felling	Low

* Cost estimates only, actual costs would depend on the design and programme of any subsequent development and do not include costs for reports in support of planning application

7 CONCLUSIONS

There are no likely significant ecological constraints with regards to the development of this Site. No statutory or non-statutory designated sites were considered to have the potential to be significantly impacted by development on the Site.

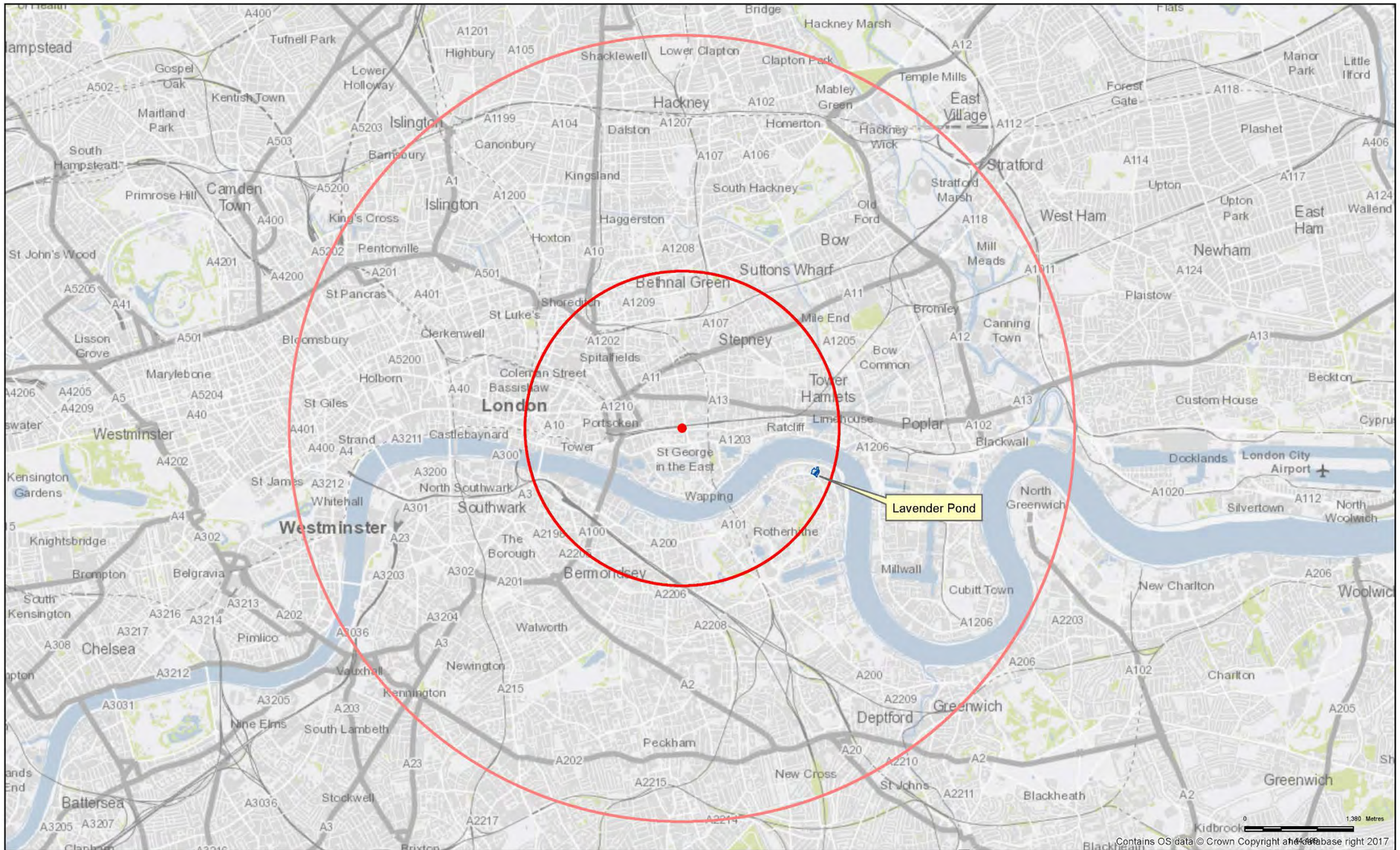
Potential constraints requiring mitigation and recommendations for enhancement are listed below:

- The Site supported a limited range of habitats and comprised of a mosaic of tall ruderal and ephemeral/short perennial vegetation with occasional low-lying scrub, grasses and tree saplings. A line of mature deciduous trees was located along part of the southern boundary of the site. The habitats on Site were generally of poor quality and with limited potential for protected or notable species due to the small area and limited value of the habitats. However, these habitats have value in terms of green infrastructure, likely performing important ecosystem services (such as water quality and volume attenuation and air quality attenuation etc.). Habitat retention, replacement and/or enhancement should be included within the design of any future development.
- A mature Purple Leaved Sycamore tree located in the south-east section of the site supported two cavities, each of which were assessed as having a low potential to support roosting/hibernating bats. Should this tree be removed, section felling under precautionary method of works would be required. The section containing the cavity will be left in situ for a minimum of 24 hours before being removed from the Site.
- There is potential for nesting birds to be utilising the trees on the Site, including species listed on the London BAP such as house sparrow. Removal of all trees and scrub vegetation on the Site will need to be conducted outside of the bird nesting season (March – August inclusive) or under an ecological watching brief.
- A squirrel drey was recorded in the south-east section of the Site. They are protected against inhumane killing under the Wild Mammal (Protection) Act 1996. Typically, there are two main breeding seasons when young are in the drey (February to August inclusive). Reasonable avoidance includes soft felling the tree, pest control methods (e.g. live trapping and poisoning).
- There will be some ecological benefit from the removal of non-native invasive species on the LISI, which is likely to occur when the site is cleared for any construction. There is no legal obligation to control any of the LISI species recorded on the Site or to remove of them as controlled but it is good practice to remove them and to avoid their spread.
- Trees and other vegetation should be replaced within any proposed soft landscaping and these designs should be evolved in liaison with an ecologist and arboriculturist. In addition, rain gardens, biodiversity roofs and other green infrastructure should be considered within any development.
- There are also opportunities for enhancements for London BAP species. Bird boxes for sparrows would be a valuable enhancement, along with bat roosting boxes.

SITE PHOTOGRAPHS

Table 1: Site photographs

Site photographs	
	
Photograph 1: Mosaic of Habitats on Site	Photograph 2: Tree Cavity with Low Bat Potential



N.B. Non statutory designated sites not shown

Legend

- Site centre point selection
- 2km buffer (national statutory designated sites)
- 5km buffer (international statutory designated sites)
- Local nature reserve (within 2km)

REV	Date	Description	Drawn	Check	Approv
01	10/07/17	Designated Sites Map	EP	AB	MG

Client: Transport For London

Client: Transport for London, Palestra House, 197 Blackfriars Rd, London, SE1 8AZ, www.tfl.gov.uk

Suitability Description:	FINAL		
Designed	E. POPPLETON	Date 10/07/17	Signed
Drawn	E. POPPLETON	Date 10/07/17	Signed
Checked	A. BRODZINSKI	Date 10/07/17	Signed
Approved	M. GRIVAN	Date 10/07/17	Signed
Scale:	As Shown	Datum:	AOD
Original Size:	A3	Grid:	
Suitability Code:	Sx	Project Number:	UA009686

PROJECT: TFL - Small Sites Project Due Diligence

TITLE: Site Ref 2363 Cable Street International and National Statutory Designated Sites

ARCADIS Design & Consultancy for natural and built assets

Registered office: Arcadis House, 34 York Way, London, N1 9AB, www.arcadis.com

Drawing Number: 2402-UE21-UA009686 | Revision: 02

© Copyright reserved

FIGURE 1: STATUTORY DESIGNATED SITES WITHIN 2KM OF THE SITE CENTRE

FIGURE 2: EXTENDED PHASE 1 HABITAT MAP (WITH DEDICATED SURVEY RESULTS AND TARGET NOTES)

Appendix A: Desk Study Results

Statutory Designated Sites

The desk study found one Statutory designated sites within 5km of the Site.

Site Name	Designation	Size (Ha)	Distance (km)	Direction	Description
Lavender Pond	Local Nature Reserve (LNR)		1.7	south-east	The site is designated for supporting a pond with marginal vegetation and wet Alder (*Alnus glutinosa*) woodland

Non-Statutory Designated Sites

The desk study found ten non-statutory designated sites within 1km of the Site.

Sites of Metropolitan Importance for Nature Conservation (SMINCs)

- River Thames and Bow Creek SMINC

Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II

- Pinchin Street Disused Railway SBINC (Grade II)
- Shadwell Basin, Wapping Wood and Wapping Canals SBINC (Grade II)
- Cable Street Community Garden SBINC (Grade II)
- London Wall and the wall of the Tower of London SBINC (Grade II)

Sites of Local Importance for Nature Conservation (SLINCs)

- Swedenborg Gardens SLINC
- St George-in-the-East Church Gardens SLINC
- St Katharine's Dock SLINC
- Hermitage Basin SLINC
- King Edward Memorial Park SLINC

Non-Statutory Designated Sites

Table A:2: Non-Statutory Designated Sites

Site Name	Designation	Size (Ha)	Distance (m)	Direction	Description
Swedenborg Gardens SLINC	SLINC		100m	south-west	The SLINC is comprised of native and ornamental trees and shrubs, a small area of acid grassland which supports several locally scarce plants and an orchard;
St George-in-the-East Church Gardens SLINC	SLINC		130m	south-east	The SLINC is comprised of scattered trees, ornamental shrubs and tall ruderal vegetation and is designated for supporting grassland habitats and invertebrates

Site Name	Designation	Size (Ha)	Distance (m)	Direction	Description
					including Essex skipper (*Thymelicus lineola*).
Shadwell Basin, Wapping Wood and Wapping Canals SBINC (Grade II)	SBINC		400m (at its closest point)	south	The SBINC is designated for supporting a variety of habitat types including a canal, pond, secondary woodland and semi-improved neutral grassland;
St Katharine's Dock SLINC	SLINC		550m	south-west	The SLINC is comprised of several docks and is designated for supporting wintering birds and Jersey Cudweed (*Gnaphalium luteoalbum*);
Hermitage Basin SLINC	SLINC		655m	south-west	The SLINC is comprised of a small dock and is designated for supporting aquatic plants and breeding birds;
Cable Street Community Garden SBINC (Grade II)	SBINC (Grade II)		765m	east	The SBINC is comprised of allotments and includes numerous small ponds. It is designated for supporting amphibians and a variety of breeding birds
London Wall and the wall of the Tower of London	SBINC (Grade II)		840m	south-west	The SBINC is designated for supporting perhaps the only remaining long-established population of London-rocket (*Sisymbrium irio*);
River Thames and Bow Creek	SMINC		850m	south	The SMINC includes the River Thames across London and the tidal sections of creeks and rivers which flow into it. The SMINC is designated for functioning as a 'green corridor' and supporting reedbed and intertidal habitats and a diversity of marine invertebrates, fish and wintering birds
King Edward Memorial Park SLINC	SLINC		860m	south-east	The Site is designated for supporting a mosaic of habitat types including a pond, wildflower meadow and scrub and common frog (*Rana temporaria*) and a large colony of the nationally-

Site Name	Designation	Size (Ha)	Distance (m)	Direction	Description
					rare Daisy Earthstar fungus (*Geastrum floriforme*)

Overview of Protected, Notable and Invasive Species in London

This section of this report outlines the status of protected and notable species in London. The status of these species on the Site is fully discussed in section 3. Relevant conservation status and legislation is presented in Appendix D and E.

Non-native invasive species in Greater London

London is an extremely urbanised area and is a major international port for both people and goods, this in addition to its climate and major levels of construction has encouraged the spread of a number of non-native invasive species that are becoming pests. Therefore, in addition to those species listed on Schedule 9 of the Wildlife and Countryside Act (WCA) **Error! Bookmark not defined.** (1981, as amended) there is a London Invasive Species Initiative (LISI)[Error! Bookmark not defined.] managed by the London Biodiversity Partnership, which lists non-native invasive species that should be controlled in London. Species potentially relevant to the Site include those presented in Table A3..

Table A:3: *Potential Schedule 9 (WCA 1981, as amended) or LISI species*

Common Name	English Name	Status
Japanese Knotweed	*Fallopia japonica*	Schedule 9 and LISI
Cotoneaster (numerous)	*Cotoneaster* spp.	Schedule 9 and LISI
Rhododendron	*Rhododendron ponticum*	Schedule 9 and LISI
Indian (or Himalayan balsalm)	*Impatiens glandulifera*	Schedule 9 and LISI
Virginia creeper	*Parthenocissus quinquefolia*	Schedule 9
Montbretia	*Crocosmia x crocosmiiflora*	LISI
Cherry Laurel	*Prunus laurocerasus*	LISI
False acacia	*Robinia pseudoacacia*	LISI
Green alkanet	*Pentaglottis sempervirens*	LISI
Butterfly-bush	*Buddleia davidii*	LISI
Snowberry	*Symphoricarpos albus*	LISI
Tree of heaven	*Ailanthus altissima*	LISI
Holm oak	*Quercus ilex*	LISI
Passion flower	*Passiflora caerulea*	LISI
Spanish bluebell	*Hyacinthoides hispanica & H. x massartiana*	LISI
Holm oak	*Quercus ilex*	LISI

Bats in Greater London

From previous Arcadis work in London and from data from the London Bat Group the most likely bats species to be present are common and soprano pipistrelle (*Pipistrellus pipistrellus* and *P. pygmaeus*) which are by far the more frequent, followed by Daubenton's (*Myotis daubentoni* in the vicinity of open water) noctule (*Nyctalus noctula*) and brown long-eared (*Plecotus auritus*). These are all London BAP species and S41 species with the exception of Daubenton's and common pipistrelle. Full details of the conservation status of these species and the results from the London Bat Group Species Action Plan Audit are presented in Appendix B Table B2.

In general, every borough will have bats present, as even in the inner boroughs there are usually some areas of suitable habitat that can provide feeding habitat for small numbers of common and light tolerant bat species such as soprano and common pipistrelles. In general, the outer boroughs with larger areas of more suitable habitat should be expected to have higher numbers of bats and a greater diversity of species.

Birds in Greater London

There are a number of bird species that although relatively common are in decline and have been highlighted section 41 or London Priority BAP species and/or birds of conservation concern that have the potential to be present (Table A4).

TableA:4*:* *Birds of conservation concern associated with London*

Common Name	English Name	Status	Typical London habitats
Black redstart	*Phoenicurus ochrurus*	L	Traditionally found on brownfield sites around the built environment in proximity to standing or tidal Thames water
Dunnock	*Prunella modularis*	S41:L:	Associated with dense scrub and trees in private gardens and pocket parks
Grey heron	*Ardea cinerea*	L	associated with tidal Thames and standing water
House sparrow	*Passer domesticus*	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks traditionally a species associated with nesting in buildings
Peregrine	*Falco peregrinus*	L	Tidal Thames and the built environment using tall buildings for roosting and nesting and foraging on other birds particularly pigeons
Song thrush	*Turdus philomelos*	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks
Starling	*Sturnus vulgaris*	S41:L:R	Built environment
Tree sparrow	*Passer montanus*	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks

Section 41 = S41: London BAP = L: R = Birds of Conservation Concern Red List

Reptiles in Greater London

Records from SARG (Surrey Amphibian and Reptile Group) and the London Biodiversity Action Plan show that the presence of European Protected Species of reptile in the London area is generally very unlikely. Common lizard (*Zootoca vivipara*) and Slow worm (*Anguis fragilis*) are the most likely reptiles to be present followed by Grass snake (*Natrix natrix*) with Adder (*Vipera berus*) being unlikely to be present these are all Section 41 and London BAP species.

Badger in Greater London

Badger is a London BAP species and can be found using private gardens, woodlands and parklands across London.

Amphibians including Great Crested Newts (GCN) in Greater London

GCN are Section 41 and London BAP species, that while uncommon are found breeding in ponds associated with private gardens, from data available from Froglife (2012), 71 Sites across Greater London were surveyed where historical GCN records were identified, of none of these sites were located within the London Borough of Barnet [14]. Of the other amphibians that are London BAP species Common frog (*Rana temporaria*), palmate newt (*Triturus helveticus*) and Common toad (*Bufo bufo*), common toad is also a Section 41 species

Other Potentially Relevant S41 and London BAP species

There are a number of other species that have the potential to be relevant to the Site:

- Black poplar (*Populus nigra*);
- Mistletoe (*Viscum album*);
- Hedgehog (*Erinaceus europaeus*); and
- Stag beetle (*Lucanus cervus*), there was an NBN record within 500m of the Site.

Table A:5: *Designated sites descriptions*

Designation	Description
Special Areas of Conservation (SAC) Special Protected Areas (SPAs)	Sites designated under European law and are the most important sites for wildlife in the UK, along with Special Protected Areas (SPAs). SACs are designated under the European Habitats Directive (Council Directive 92/43/EEC). Both the Habitats and Birds Directives provide for the creation of a network of protected areas across the EU, to be known as 'Natura 2000'. The designations aim to conserve important or threatened species and habitats and provide them with increased protection and management
National Nature Reserve (NNR)	Statutory reserves established for the nation under the Wildlife and Countryside Act, 1981. NNRs may be owned by a relevant national body, e.g. Natural England, or by established agreement; a few are owned and managed by non-statutory bodies. NNRs cover a selection of the most important sites for nature conservation in the UK.
Sites of Special Scientific Interest (SSSI)	Are areas notified under the Wildlife and Countryside Act 1981 by Natural England as being of special interest for nature conservation. SSSI notification forms the statutory bedrock for site protection. Biological SSSIs form a national network of wildlife sites, with each site being of national significance for its nature conservation value. Consultation and some form of agreement with the national statutory conservation agency is mandatory before any listed, potentially damaging development or change in land use can be carried out
Local nature reserves (LNR)	These are land owned, leased or managed by Local Authorities and designated under the National Parks and Access to the Countryside Act. These are sites of some nature conservation value managed for educational objectives. In some cases it is managed by a non-statutory body (e.g. the London Wildlife Trust). Local Authorities have the power to pass bylaws controlling (e.g.) access, special protection measures.

[14] Capital Great Crested Newts Revisited (2012). Project report – Public Web Edition

Designation	Description
Sites of Metropolitan Importance for Nature Conservation (SMINCs)	These are sites that contain the best examples of London's habitats. These sites are of strategic significance and are therefore of the highest priority against damage or loss
Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II	Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II are important in the context of the borough. The nature conservation quality of these sites varies and so these sites are graded as I or II in relation to their nature conservation potential.
Sites of Local Importance for Nature Conservation (SINCs)	These are sites of particular importance to people nearby (such as residents and schools). Local sites are particularly important in areas otherwise deficient in nearby wildlife sites.

Appendix B: Bat Habitat Suitability and London Population Status

Table B: 1 BCT (2016) – Habitat Suitability Criteria

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[a] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree- lined watercourses and grazed parkland. Site is close to and connected to known roosts.

Table B: 2 *Bat species status in London from the London Bat Species Action Plan Audit*

Common Name	Latin Name	UK Status	London Status	Notes
Greater horseshoe bat	*Rhinolophus ferrumequinum*	Endangered BAP Priority	Extinct	Last Greater London record from Oxleas Wood in 1953.
Lesser horseshoe bat	*Rhinolophus hipposideros*	Endangered BAP Priority	Extinct	Last Greater London record from Abbey Wood (Woolwich) in 1952-3.
Whiskered bat	*Myotis mystacinus*	Vulnerable	Rare	
Brandt's bat	*Myotis brandtii*	Vulnerable	Rare	
Natterer's bat	*Myotis nattereri*	Vulnerable	Scarce	Still relatively few records in Greater London. Most central locations are Highgate Wood and Hampstead Heath, otherwise Richmond and Hounslow and occasionally other outer London Boroughs. 8 current known roosts (mostly winter).
Daubenton's bat	*Myotis daubentoni*	Not Threatened	Locally frequent but declining	Relatively widespread and strongly associated with ponds, lakes & rivers. Occasional summer roosts have been found in trees on Wimbledon Common and in Ruislip Woods. Contrary to the national trend, this species is apparently declining in London and its sensitivity to increasing ambient light levels is a possible reason. 4 current known winter roosts.
Serotine	*Eptesicus serotinus*	Vulnerable	Rare; has declined	Serotines are found in outer London Boroughs, especially Bromley, Havering, Sutton and Richmond. 2 current known summer roosts, in Bromley and Teddington.
Noctule	*Nyctalus noctula*	Vulnerable; declining BAP Priority	Widespread but declining	The status of this large, wide-ranging bat is difficult to assess, but the past two decades have seen a rapid decline in the species and this mirrors the national trend. An exclusively tree-roosting bat; current known roosts number <10 London-wide.
Leisler's bat	*Nyctalus leisleri*	Vulnerable	Scarce	Leisler's bat has been recorded infrequently in London area, yet sightings have doubled in the last three years. New foraging sites for the species include the Barnes area, Wandsworth Common and Brent Reservoir. 3 current known roosts (Haringey, Bromley and Bexley).

Common Name	Latin Name	UK Status	London Status	Notes
Common pipistrelle	*Pipistrellus pipistrellus*	Not Threatened	Common	A widespread species, the common pipistrelle is believed to occur in all London boroughs. Roosts are still discovered relatively infrequently, however.
Soprano pipistrelle	*Pipistrellus pygmaeus*	BAP Priority	Common	Also widespread and probably London's commonest bat. Apparently more associated with wetland habitats than its close relative, *P. pipistrellus*. Known roosts currently number 15-25?, but many more pass undetected.
Nathusius's pipistrelle	*Pipistrellus nathusii*	Rare	Rare	Only recently confirmed as a UK breeding species. Detector records from an increasing list of sites include Lesnes Abbey Woods, Chislehurst Ponds and the Wetland Centre at Barnes. 1 known current roost site in bat boxes in Hounslow.
Brown long-eared bat	*Plecotus auritus*	Declining BAP Priority	Scarce	Brown long-eared bats are fairly secretive and may be under-recorded in Greater London, although reasons for the national decline are also likely to affect London's population. Roosts have been found in Bexley, Bromley, Hillingdon, Wandsworth, Kensington & Chelsea, Barnet, and Richmond.

NB: This audit is based on data from the London Bat Project collected in the mid-1980s, as well as that collected since by the London Bat Group and is therefore not systematic. This audit is the best possible understanding of the status of bats in London that can currently be realised by the London Bat Group.

Appendix C: Selected Legislation, Nature Conservation Status and Policy

Legislation

Table C: 1 Legislation Summary

Receptor	Legislation
Nesting Birds	The legislation relevant to the potential ecological constraints on Site associated with nesting birds. All wild birds, their nests and eggs are protected under the Wildlife and Countryside Act 1981 (as amended)**Error! Bookmark not defined.**. Section 1 of the Act makes it an offence to: • intentionally kill, injure or take any wild bird; • intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built; or • intentionally take or destroy an egg of any wild bird. It is also an offence to: • intentionally disturb any wild bird included in Schedule 1 of the Act while it is building a nest or is in, on or near a nest containing eggs or young; or • disturb dependent young of such a bird. • Species listed on Schedule 1 include the black redstart, barn owl (*Tyto alba*), Cetti's warbler (*Cettia cetti*) and kingfisher (*Alcedo atthis*). There is no potential for Schedule 1 birds to be nesting on Site, the legislation regarding common nesting birds will be complied with due to the precautionary mitigation previously stated.
Badgers	Badgers are protected from inhumane killing or injury under the Badgers Act (1992)[15] this also protects their setts from damage and prohibits blocking access to their setts.
Bats	The legislation relevant to the constraint identified associated with bats. Bats are protected under the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2010 (as amended).. Bats are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and are subject to the provisions of Section 9 of the Act, which make it an offence to: • intentionally or recklessly disturb a wild animal listed on Schedule 5 whilst it is occupying a structure or place which it uses for shelter or protection; • intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a wild animal listed on Schedule 5; • sell, offer or expose for sale, or to possess or transport for sale alive or dead wild animal listed on Schedule 5 or any part of or anything derived from a wild animal listed on Schedule 5. Bats are also listed on Schedule 2 (European protected species of animals) of the Conservation of Habitats and Species Regulations 2010 (as amended) and are subject to the provisions of Regulation 41 which makes it an offence to: • deliberately capture, injure or kill any wild animal of a European protected species; • deliberately disturb wild animals of any such species (where disturbance is likely to impair their ability to survive, breed or reproduce, rear or nurture their young; or to

[15] Protection of Badgers Act 1992 (as amended)

Receptor	Legislation
	hibernate or migrate; or to affect significantly the local distribution or abundance of the species); • damage or destroy a breeding site or resting place of such an animal; or • be in possession of, control, transport, sell or exchange, or offer for sale or exchange any live or dead animal of such a species or any part of a wild animal or anything derived from an animal or any part of an animal of such a species.
Great Crested Newts	Great crested newts are a European Protected Species (EPS), listed on Annex II and IV of the EEC Directive on the Conservation of Natural Habitats and Wild Fauna and Flora, receiving protection under The Conservation of Habitats and Species Regulations 2010. This species is also afforded full protection under the Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) (WCA 1981). Under such legislation it is an offence to: • Intentionally or recklessly kill, injure or take a great crested newt; • Possess or control any live or dead specimen or anything derived from a great crested newt; • Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a great crested newt; and • Intentionally or recklessly disturb a great crested newt while it is occupying a structure or place which it uses for that purpose.
Reptiles	The relevant legislation relevant to the constraint identified associated with reptiles All native British reptile species are protected under the Wildlife and Countryside Act 1981 (as amended). Reptiles are listed under Schedule 5 of the Act. The four more widespread species including common lizard, slow worm, adder and grass snake are subject to some of the provisions of Section 9 of the Act, which make it an offence to: * • intentionally kill or injure a reptile; or * sell, offer or expose for sale, or • to possess or transport for sale alive or dead reptile or any part of, or anything derived from, a reptile.
Other Mammals	Other mammals not protected by their own legislation are protected by the Mammal Act (1996). The Act makes provision for the protection of wild mammals from certain cruel acts. An offence is committed if any person mutilates, kicks, beats, nails, or otherwise impales, stabs, burns, stones, crushes, drowns, drags, or asphyxiates any wild mammal with intent to inflict unnecessary suffering.
Non Native Invasive Species	Numerous species are listed on Schedule 9 (of the Wildlife and Countryside Act 1981, as amended) whereby it is an offence to grow or to cause this species to grow in the wild. A species on Schedule 9 that commonly occurs in London is Japanese Knotweed (*Fallopia japonica*) which is also covered by the Environmental Protection Act (EPA) 1990 which designates this as a controlled waste.

Nature Conservation Status

- **Birds of Conservation Concern (BOCC) (2015)**

The UK's leading bird conservation organisations worked together to produce The Population Status of Birds in the UK: Birds of Conservation Concern Four (BoCC).

Commonly referred to as the UK Red List for birds, this is the fourth review of the status of birds in the UK, Channel Islands and Isle of Man, and updates the last assessment in 2009. Using standardised criteria, 244 species with breeding, passage or wintering populations in the UK were assessed by experts from a range of bird NGOs and assigned to the Red, Amber or Green lists of conservation concern.

Table C: 2 Bird Population Status Criteria for Birds of Conservation Concern in the UK

Criteria	Status
Red list criteria	Globally threatened Historical population decline in UK during 1800–1995 Rapid (> or =50%) decline in UK breeding population over last 25 years Rapid (> or =50%) contraction of UK breeding range over last 25 years
Amber list criteria	Historical population decline during 1800–1995, but recovering; population size has more than doubled over last 25 years Moderate (25-49%) decline in UK breeding population over last 25 years Moderate (25-49%) contraction of UK breeding range over last 25 years Moderate (25-49%) decline in UK non-breeding population over last 25 years Species with unfavourable conservation status in Europe, termed Species of European Conservation Concern (SPEC) Five-year mean of 1–300 breeding pairs in UK > or =50% of UK breeding population in 10 or fewer sites, but not rare breeders > or =50% of UK non-breeding population in 10 or fewer sites > or =20% of European breeding population in UK > or =20% of northwest European (wildfowl), East Atlantic Flyway (waders) or European (others) non-breeding populations in UK
Green list	No identified threat to the population's status

Relevant Policy

National

The Site survey, assessment and recommended mitigation ensure compliance with the following policies, any additional enhancement measures would further comply with these policies:

- **The National Planning Policy Framework** (NPPF 2012)[16] sets out how the planning system should protect and enhance nature conservation interests. Section 11 is concerned with conserving and enhancing the natural environment Opportunities to enhance biodiversity are also encouraged.
- **The Natural Environment and Rural Communities** (NERC) Act 2006[17] places a duty upon public bodies to consider Section 41 lists flora, fauna and habitats (previously UK BAP habitats and species) as a material consideration in planning and to consider enhancement of biodiversity.
- **Biodiversity 2020**: A strategy for England's Wildlife and Ecosystem Services[18] includes a list of Habitats of Principal Importance in England (HPIEs) and Species of Principal Importance in England (SPIEs). These were previously included as Priority Habitats and Priority Species in the UK BAP.

London

- **London Invasive Species Initiative (LISI)[19]**: Managed by the London Biodiversity Partnership, LISI lists non-native invasive species that should be controlled in London. Species relevant to the Scheme include Japanese Knotweed and Butterfly-bush.
- **London Biodiversity Action Plan (BAP)[20]:** Managed by the London Biodiversity Partnership (2006), the London BAP sets out priority habitats and species for the city. London BAP habitats relevant to the Scheme include reed beds, standing water and wasteland.
- **The London Plan (2011) Strategic Policy 7.19 Biodiversity and Access to Nature and Policy 7.21 Trees and woodlands) (updated with the Minor Alterations to the London Plan 2016)[21]:** Regional planning policy for London is presented in the London Plan: Spatial Development Strategy for Greater London. It contains various policies with regard to nature conservation in London, which include commitments to protect, enhance, create, promote, expand and manage the extent and quality of green infrastructure and biodiversity and to increase access to nature, the following elements of SP 7 are as follows:
    - **Strategic Policy 7.19 Biodiversity and Access to Nature and Policy:**
        - A) The Mayor will work with all relevant partners to ensure a proactive approach to the protection, enhancement, creation, promotion and management of biodiversity in support of the Mayor's Biodiversity Strategy.
        - B) Any proposals promoted or brought forward by the London Plan will not adversely affect the integrity of any European site of nature conservation importance.
        - C) Development Proposals should:
            - a) wherever possible, make a positive contribution to the protection, enhancement, creation and management of biodiversity
            - b) prioritise assisting in achieving targets in biodiversity action plans (BAPs), set out in Table 7.3, and/or improving access to nature in areas deficient in accessible wildlife sites
            - c) not adversely affect the integrity of European sites and be resisted where they have significant adverse impact on European or nationally designated sites or on the population or conservation status of a protected species or a priority species or habitat identified in a UK, London or appropriate regional BAP or borough BAP.

[16] Anon (2012) The National Planning Policy Framework HMSO, London
[17] Anon (2006) The Natural Environment and Rural Communities Act HMSO, London
[18] Department for Environment, Food and Rural Affairs (2011) *Biodiversity 2020: A strategy for England's Wildlife and Ecosystem Services*
[19] London Invasive Species Plan (2012). Legislative and Information Exchange Framework. [online] Available at http://www.londonisi.org.uk/tackling-inns/lisp/. [Available June 2016]
[20] City of London (2009). *London Biodiversity Action Plan 2010 – 2015*
[21] Greater London Authority (2011) *The London Plan Strategic Policy 7.19 Biodiversity and Access to Nature and Policy 7.21 Trees and woodlands) (updated with the Minor Alterations to the London Plan 2016)*

- D) On Sites of Importance for Nature Conservation development proposals should:
  - a) give the highest protection to sites with existing or proposed international designations1 (SACs, SPAs, Ramsar sites) and national designations (SSSIs, NNRs) in line with the relevant EU and UK guidance and regulations
  - b) give strong protection to sites of metropolitan importance for nature conservation (SMIs). These are sites jointly identified by the Mayor and boroughs as having strategic nature conservation importance
  - c) give sites of borough and local importance for nature conservation the level of protection commensurate with their importance.
- E) When considering proposals that would affect directly, indirectly or cumulatively a site of recognised nature conservation interest, the following hierarchy will apply:
  - 1 avoid adverse impact to the biodiversity interest
  - 2 minimize impact and seek mitigation
  - 3 only in exceptional cases where the benefits of the proposal clearly outweigh the biodiversity impacts, seek appropriate compensation.
- F) In their LDFs, Boroughs should:
  - a use the procedures in the Mayor's Biodiversity Strategy to identify and secure the appropriate management of sites of borough and local importance for nature conservation in consultation with the London Wildlife Sites Board.
  - b identify areas deficient in accessible wildlife sites and seek opportunities to address them
  - c include policies and proposals for the protection of protected/priority species and habitats and the enhancement of their populations and their extent via appropriate BAP targets
  - d ensure sites of European or National Nature Conservation Importance are clearly identified
  - e identify and protect and enhance corridors of movement, such as green corridors, that are of strategic importance in enabling species to colonise, re-colonise and move between sites.

- **Strategic Policy 7.21 Trees and Woodlands:**
  - A) Trees and woodlands should be protected, maintained and enhanced, following the guidance of the London Tree and Woodland Framework (or any successor strategy). In collaboration with the Forestry Commission the Mayor has produced supplementary guidance on Tree Strategies to guide each borough's production of a Tree Strategy covering the audit, protection, planting and management of trees and woodland. This should be linked to a green infrastructure strategy.
  - B) Existing trees of value should be retained and any loss as the result of development should be replaced following the principle of 'right place, right tree. Wherever appropriate, the planting of additional trees should be included in new developments, particularly large-canopied species.
  - C) Boroughs should follow the advice of paragraph 118 of the NPPF to protect 'veteran' trees and ancient woodland where these are not already part of a protected site.
  - D) Boroughs should develop appropriate policies to implement their borough tree strategy.

- **The London Plan (2011) , Housing Supplementary Planning Guidance (March 2016)[22]:** With regards to housing, recently a dedicated supplementary planning guidance has been produced, the relevant elements of which are presented below
  - Standard 40 and Policy 7.19 "Biodiversity and access to nature promotes a proactive approach to the protection, promotion and management of biodiversity across the capital" and that "Proposals for development should give full consideration to their direct

[22] Greater London Authority (2016) *London Plan 2016 Implementation Housing Supplementary Planning Guidance adopted in March 2016*

and indirect effects on ecology. Ecological improvements can be achieved as part of Sustainable Urban Drainage Systems and incorporated into green or brown roofs, green walls and soft landscaping."

- Policies 7.19 and 7.21 "supporting biodiversity, protecting London's trees, 'green corridors and networks".
- Development proposals should also enhance provision of green infrastructure in the public realm, helping to mitigate and adapt to climate change (Policy 5.10 Urban Greening), extend tree cover (Policy 7.21), improve biodiversity (Policy 7.19).
- Public, communal and private open spaces should be protected and enhanced, and where possible new open spaces should be created. This is supported by Policy 2.18 Green Infrastructure, Policy 7.18 Protecting open space, Policy 7.19 Biodiversity and Policy 7.21 Trees and Woodlands.

- **The Mayor's Biodiversity Strategy (2002)[23]:** Connecting with London's Nature: The Mayor's Biodiversity Strategy provides a statutory framework for the delivery of biodiversity policies in London. It seeks to ensure that there is no overall loss of wildlife habitats in London.
- **The London Plan (2011), Sustainable Design and Construction Supplementary Planning Guidance (April 2014)[24]:**
  - Mayor's Priority - Developments should contribute to the Mayor's target to increase tree cover across London by 5% by 2025.
  - Mayor's Priority - There is no net loss in the quality and quantity of biodiversity.
  - Mayor's Priority - Developers make a contribution to biodiversity on their development site.
  - Mayor's Priority - Any loss of a tree/s resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of providing the same canopy cover as that provided by the original tree/s.

Local

Tower of hamlets - Managing Development: Development Plan Document (Adopted 2013).

- **DM10: Delivering open space [25]**

  Development will be required to provide or contribute to the delivery of an improved network of open spaces in accordance with the Council's Green Grid Strategy and Open Space Strategy;

- **DM11: Living buildings & biodiversity**

  Development will be required to provide elements of a 'living building';

  Existing elements of biodiversity value should be protected or replaced within the development and additional habitat provision made to increase biodiversity value.

- **DM13: Sustainable Drainage**

  Development will be required to show how it reduces the amount of water usage, runoff and discharge from the site, through the use of appropriate water reuse and Sustainable Urban Drainage (SUD) techniques.

[23] Greater London Authority (2002), *Connecting with Nature: The Mayor's Biodiversity Strategy adopted in 2002*
[24] Greater London Authority (2011), The London Plan *Sustainable Design and Construction Supplementary Planning Guidance adopted in April 2014*
[25] http://www.towerhamlets.gov.uk/Documents/Planning-and-building-control/Strategic-Planning/Neighbourhood-Planning/Managing-Development-Document-April-2013.pdf.

Arcadis (UK) Limited

Arcadis House,
34 York Way,
London, N1 9AB
United Kingdom

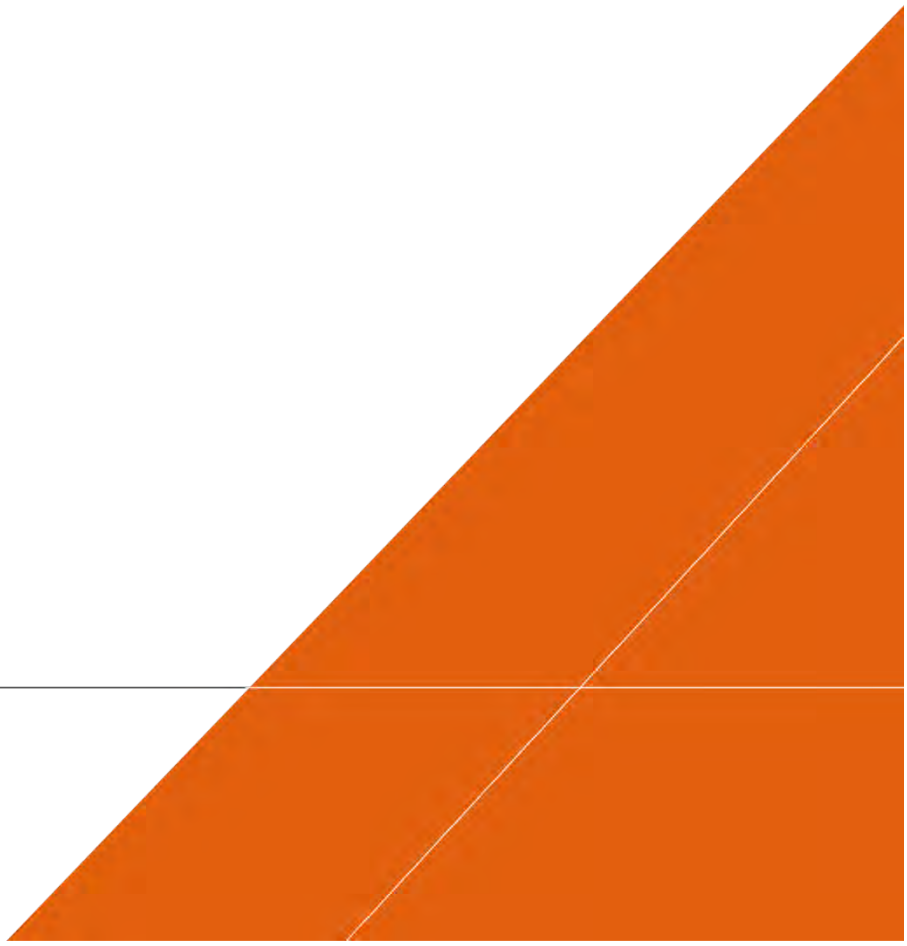
www.arcadis.com

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE
LAND TO THE NORTH SIDE OF ROYAL MINT STREET AND CABLE STREET, TOWER HAMLETS, E1 8LG

Site Ref: 2363

Preliminary BS5837:2012 Tree Survey Report

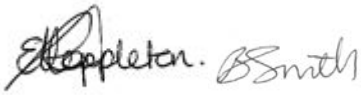
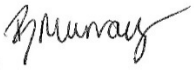
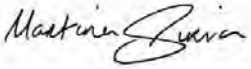
OCTOBER 2017



Incorporating
EC HARRIS BUILT ASSET CONSULTANCY
Hyder

LAND TO THE NORTH SIDE OF ROYAL MINT STREET AND CABLE STREET, TOWER HAMLETS, E1 8LG

Preliminary BS5837:2012 Tree Survey Report

Author	Ellen Poppleton/Beverly Smith	
Checker	Brandon Murray	
Approver	Martina Girvan	
Report No	1103-UA009686-UE21R-02	
Date	OCTOBER 2017	

VERSION CONTROL

Version	Date	Author	Changes
01	September 2017	Ellen Poppleton Beverly Smith	1st Issue
02	October 2017	Ellen Poppleton Beverly Smith	Final Issue

CONTENTS

1 INTRODUCTION 1
1.1 Overview 1
1.2 Site Location and Setting 1

2 METHODOLOGY 2
2.1 Tree Survey Methodology 2
2.2 Individual Trees and General Data Capture 2
2.3 Categorisation 2
2.4 Root Protection Area 2
2.5 Survey Limitations 2
2.6 Statutory Tree Protection 3

3 TREE SURVEY RESULTS 4
3.1 Tree Assessment and Categorisation 4
3.2 Tree Species Diversity 4
3.3 Age Diversity 5
3.4 Root Protection Area 5

4 CONCLUSIONS 6

5 FURTHER WORK 7

6 REFERENCES 8

FIGURE 1. TREE CONSTRAINTS PLAN 9

APPENDIX A. EXPLANATION OF TERMS 10

APPENDIX B. TREE SCHEDULES 12

APPENDIX C. PRELIMINARY ARBORICULTURAL METHOD STATEMENT 19

APPENDIX D. PHOTOGRAPHS 24

1 Introduction

1.1 Overview

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a number of technical surveys for Land to the North side of Royal Mint Street and Cable Street, Tower Hamlets, E1 8LG ('the Site').

TfL is aiming to divest a number of small Sites to enable prospective regeneration. The objective of the Small Sites Initiative is to provide robust and pragmatic advice that sensibly de-risks each of the sites such that unreasonable "abnormal" development costs are not included by developers.

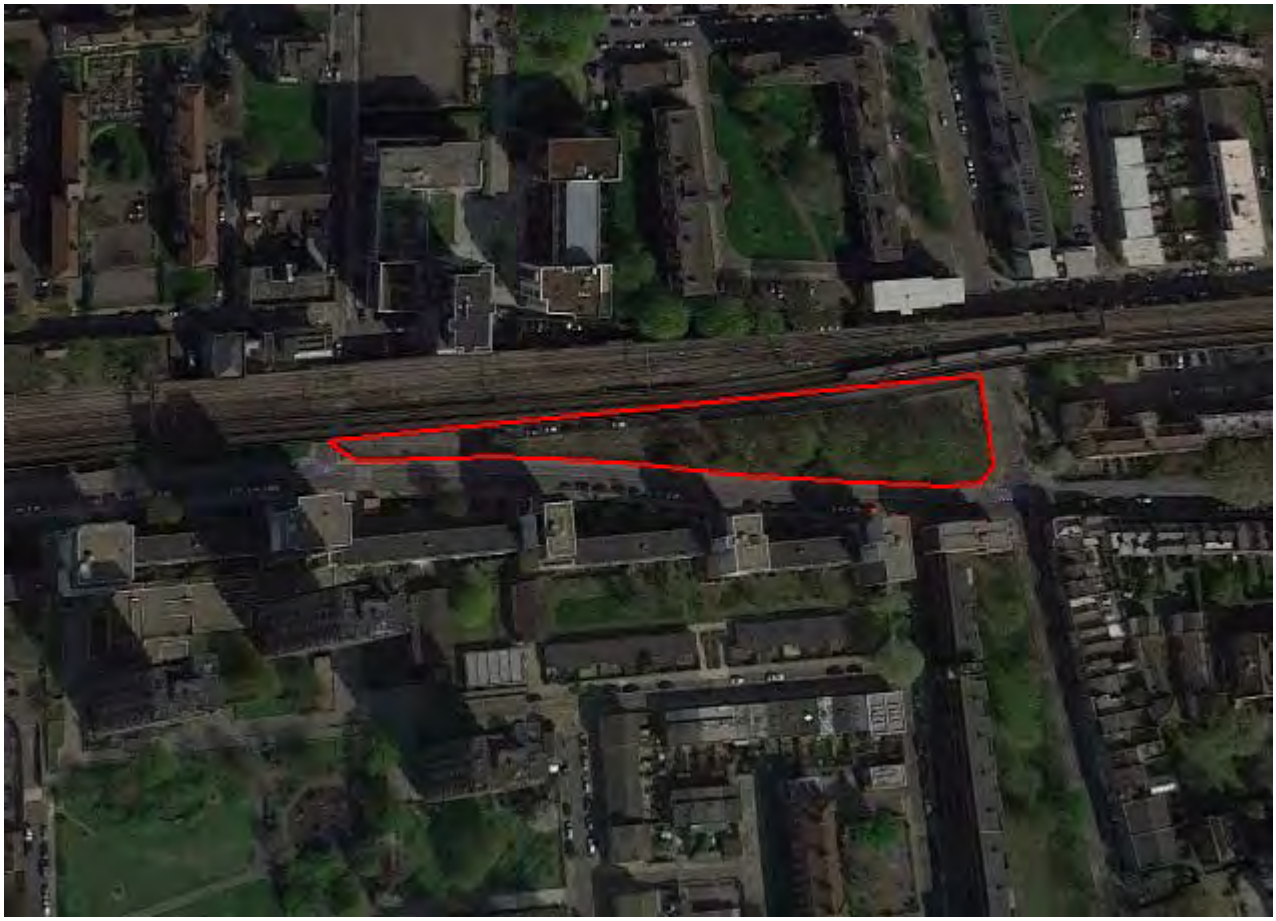
The objective of this assessment is to present the potential constraints and future survey requirements with regards to trees and any proposed future development.

1.2 Site Location and Setting

The Site is located immediately north of the B126/ Royal Mint Street / Cable Street and west of Cannon Street Road, in the London Borough of Tower Hamlets. The Site is centred around the postcode of E1 8LG. The site is adjoined by industrial units and the London Docklands Railway line and to the north and east, the B126 / Cable Street to the south and the B108 / Cannon Street Road to the west. It is comprised of a mosaic of tall ruderal and ephemeral/short perennial vegetation with occasional low-lying scrub, grasses and tree saplings with a line of mature deciduous trees located along part of the southern boundary of the site. The Site is approximately 0.3 hectares in area.

An aerial screen shot illustrating the Site boundary is presented in Image 1-1. Photographs of the Site and trees can be found in Appendix D - Photographs.

Image 1-1 Site Location Plan



2 Methodology

2.1 Tree Survey Methodology

An Arboricultural Survey was undertaken by Beverley Smith, FDSc. Tech.Arbor.A on 17th August 2017 in accordance with BS 5837:2012.

Observations were conducted from ground level, utilising the "Visual Tree Assessment" (VTA) system as outlined in The Body Language of Trees, A Handbook for Failure Analysis Research for Amenity Trees No.4 (Department of the Environment, 1994) with the aid of binoculars.

The Site and its immediate surroundings were surveyed, this area is referred to as the study area.

2.2 Individual Trees and General Data Capture

For reference, individual trees are identified with the letter T and associated unique number on the Tree Schedules and Tree Constraints Plan. The stem diameter of the trees on site was recorded using a rounded-down diameter tape at 1.5m above ground level. Measurements were taken in millimetres. The height of the subject trees was estimated to the nearest metre using a digital clinometer.

The maximum crown spread of each tree was measured from the centre of the trunk to the tips of the live lateral branches taken at four compass points (N-E-S-W) using a ground tape. Crown spread measurements were taken in metres.

Tree age was estimated from visual indicators (such as tree size and appearance of bark) which were taken as a provisional guide. Age estimates often need to be modified based on further information such as historical records and local knowledge.

Where direct access to the tree was not possible, estimations from appropriate vantage points were taken; any limitations or estimations are presented within the survey limitations section and noted in the associated Tree Schedules.

2.3 Categorisation

In compliance with Table 1 of BS 5837: 2012 the trees surveyed have been categorised according to their arboricultural quality and value. A glossary of survey terms can be found in Appendix A - Explanation of Terms.

2.4 Root Protection Area

The Root Protection Areas (RPA) of the trees were calculated in accordance with Section 4.6.1 in BS: 5837:2012. This is calculated from the measurement of the stem diameter at 1.5m above ground level or at ground level if the tree is multi-stemmed. These are recorded in Table B2 in the appendix and form the initial Construction Exclusion Zone (CEZ) to protect the trees within and adjoining the Site. The RPA is represented by pink-shaded areas. The shape and size of RPAs can be amended in accordance with Section 4.6.3 in BS: 5837:2012.

Within Section 5.3.1 in BS: 5837:2012 it is stated the default position is that proposed development should not be within the RPA of retained trees. However, where there is an overriding need for construction and associated activity with the RPA of trees arboricultural mitigation should take place to protect the trees.

2.5 Survey Limitations

Topographical base mapping was provided. For the purposes of BS 5837: 2012, only trees with a stem diameter greater than 75mm, (measured at 1.5m above ground level), have been included within the survey. However, it should be noted that a number of individual trees and shrubs with a stem diameter of less than 75mm were present within the study area.

Only trees within the study area as defined above were assessed. The RPAs are based on a given tree stem diameter taken at 1.5m above ground level with each RPA (see Appendix B - Tree Schedules) being calculated from the above ground portions of the tree. It should be recognised that the RPA may not entirely encompass all of the tree's rooting material.

Trees are living organisms and as such their health and condition are naturally subject to change over time. Unforeseen future circumstances such as neglect, wilful damage or severe/extreme weather conditions may affect the future health and condition of the trees included in this report.

2.6 Statutory Tree Protection

According to the Tower Hamlets Council Website http://towerhamlets.maps.arcgis.com , the Site is not located within a Conservation Area (CA). The Site is located 15m away from St George in the East Conservation Area (designated in 1969) but given that none of the trees surveyed fall within this designation it is not considered a constraint to development.

None of the trees surveyed are protected by Tree Preservation Orders (TPO) and there are no Planning Application Conditions protecting the trees.

3 Tree Survey Results

3.1 Tree Assessment and Categorisation

A total of 31 arboricultural items were recorded within the study area. All of these items are on Site. Full details of the survey data are presented within the Tree Schedules in Appendix B and Figure 1 Tree Constraints Plan.

Each arboricultural item was assigned to one of four categories, as listed below:

- Category A individual trees, groups of trees: No arboricultural items were graded as Category A (trees of high quality) as part of this survey;
- Category B individual trees, groups of trees: 18 individual trees were graded as Category B (trees of moderate quality) as part of this survey;
- Category C individual trees, groups of trees: 13 individual trees have been identified as Category C (trees of low quality) as part of this survey due to poor form or inappropriate past management;
- Category U individual trees, groups of trees: No trees have been identified as Category U (trees of poor quality unsuitable for retention) as part of this survey due to poor structural and physiological condition.

3.2 Tree Species Diversity

Three different tree species and cultivars were recorded during the survey and are represented throughout the study area. A summary of the species surveyed can be found within the Tree Schedule in Appendix B and also provided in Table 1 .

Table 1 Tree Species Recorded

Tree Species	Number of Individual Stems	Approximate Percentage
Norway maple (*Acer platanoides*)	24	77.4%
Purple sycamore (*Acer pseudoplatanus* 'Purpureum')	6	19.4%
Ash (*Fraxinus excelsior*)	1	3.2%
Totals	**31**	**100%**

3.3 Age Diversity

Analysis of the data identified that the majority of the trees within the study area were within the semi-mature age classification set by BS 5837: 2012 with an estimated useful life expectancy of over 10 years, as illustrated in Table 2.

Table 2 Age Diversity

Age Class	Number of Individual Stems	Approximate Percentage
Young	0	0%
Early-mature	8	8%
Semi-mature	13	41.9%
Mature	10	32.3%
Over-mature	0	0%
Totals	**31**	**100%**

3.4 Root Protection Area

The RPAs are presented in Figure 1 Tree Constraints Plan.

4 Conclusions

A total of 31 arboricultural items were recorded during the survey. All of these trees were recorded as on Site individual trees. Of these, 18 individual trees have been identified as Category B (trees of moderate quality) and should be considered for retention where possible and 13 individual trees have been identified as Category C (trees of low quality). These trees should not place a constraint on the development layout but should be considered for replacement should they be removed.

There is currently no proposed design layout and therefore it is not possible to say whether the trees would need to be removed and if there is space for any new trees to be re-provisioned on the site. This can be determined once designs are developed.

The dominant tree species within the Site is Norway maple (*Acer platanoides*). Purple sycamore (*Acer pseudoplatanus* 'Purpureum') was the second most commonly found species on site.

While the Site is not within a CA nor are any of the trees covered by a TPO, the location of the on-Site trees shields the flats adjacent to Cable Street's view of the rail tracks and are likely to contribute to noise and light level reduction. This should be considered during development proposals.

While unlikely to prevent development, tree protection for trees to be retained and tree re-provisioning for any trees lost due to development are a material consideration for planning determination. If trees cannot be replaced on-Site due to development, off-Site options for tree re-provisioning to ensure no net loss should be considered. Individual Local Planning Authorities may ask for re-provisioning in excess of 1 to 1 for trees of Category B grade.

5 Further Work

Should any future proposed development require tree removals or RPA incursions within RPA's of the retained trees an Arboricultural Impact Assessment (AIA) will be required by the Local Planning Authority (LPA), London Borough of Tower Hamlets, in support of a planning application.

The AIA should include a tree schedule, although one is provided within this report, a review of any proposed development should be undertaken to ensure that there are no additional trees within the zone of influence of the development. For example, parking requirements often extend the zone of influence.

The AIA should state the trees to be removed due to the design and access requirements and any proposed tree facilitation pruning works. This should also be accompanied by an assessment of the likely impacts due to construction activity on the trees to be retained. Indicative arboricultural mitigation measures should be provided which would include recommendations for tree re-provisioning. The AIA should be accompanied by an updated Tree Constraints Plan and a Tree Impact and Protection Plan based on the proposed design.

The AIA should also include a Tree Replacement Strategy which should take into consideration the landscape character, local treescape and biodiversity features of the immediate and adjoining areas. The species, number, size, type of stock, location and planting aids for the compensating planting should be chosen for landscape, wildlife and arboriculture values. To ensure that appropriate and sustainable planting is achieved advice should be sought from an ecologist and arboriculturist. Furthermore, liaison with the LPA Tree Officer will be necessary during the planning process to agree an approved tree compensation and or landscape scheme plan.

All new tree planting should be in accordance with British Standard 8545: Trees: From Nursery to Independence in the Landscape – Recommendations, 2014 and all tree works must be carried out by a qualified contractor in accordance with BS3998:2010: Tree Work – Recommendations.

This document encloses a Preliminary Arboricultural Method Statement (AMS) outlining tree protection measures. However following planning determination and when full construction measures are known a bespoke AMS may be required to ensure protection of the trees to be retained on and adjoining the Site.

6 References

British Standards Institution (2010) BS 3998:2010, Tree Work Recommendations.

British Standards Institution (2012) BS 5837: 2012 Trees in relation to design, demolition and construction – Recommendations.

British Standards Institution (2014) BS 8545: Trees: From nursery to Independence in the Landscape – Recommendations.

Mattheck, C. and Broeler, H. DETR (1994) The Body Language of Trees: A Handbook for Failure Analysis Research for Amenity Trees No.4.

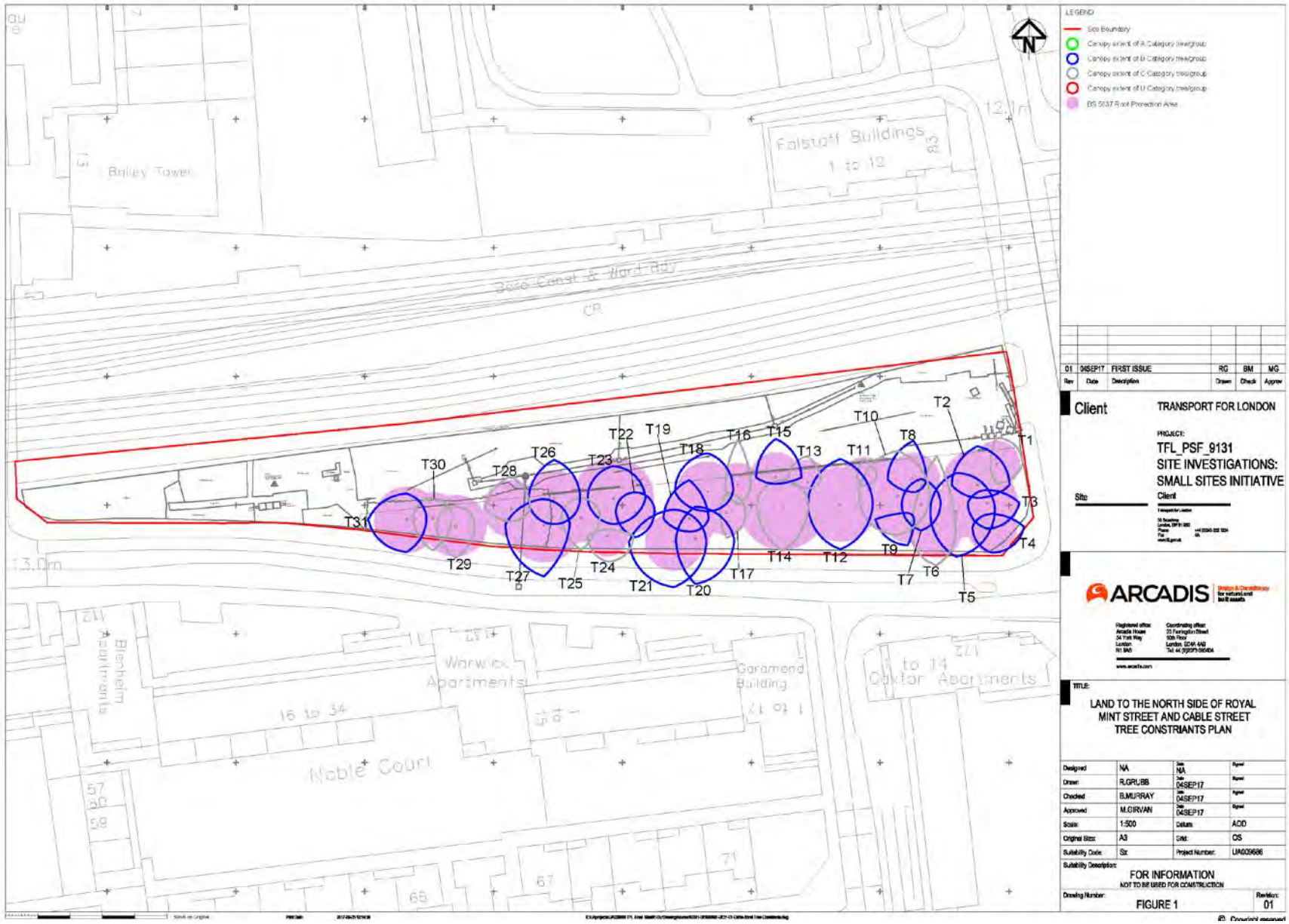


FIGURE 1. Tree Constraints Plan

APPENDIX A. Explanation of Terms

Age Class

Young – Trees in the first fifth of full life expectancy

Semi-mature – Trees in the second fifth of full life expectancy

Early-mature – Trees in the third fifth of full life expectancy

Mature – Trees in the fourth fifth of full life expectancy

Over Mature – Trees having reached full life expectancy and trees in natural decline

Veteran – Trees of interest biologically, culturally and aesthetically because of their age

Stem Diameter

The diameter of the stem measured in millimetres (mm) at a height of 1.5m above ground level

Crown Spread

Average measured in metres using a ground tape where possible

Physiological Condition

Good – Healthy tree with no signs of ill health and signs of good extension growth for species

Fair – Trees with signs of disease, minor defects and decreased life expectancy due to physical damage

Poor – Trees with significant disease, significantly reduced life expectancy and/or under major physiological stress

Dead – Dead tree or trees with over 70% crown dieback

Structural Condition

Good – Trees with no significant defects

Fair – Trees with remedial defects which require minor tree surgery works

Poor – Trees with remedial defects which require significant tree surgery works or felling

Dead – Trees which require felling

BS 5837 Retention Category

Each tree, group of trees or hedge is assigned to a retention category where:

Table A1 Categorisation of trees

Category	Description
A	Trees of high quality and value, retention is highly desirable
B	Trees of moderate quality and value where retention is desirable
C	Trees of low quality and value, or young trees with a stem diameter <150mm. Category C trees may be retained, replaced or in the case of younger trees, relocated
U	Trees of poor quality and value, unsuitable for retention or trees which should be removed

In addition, each tree, group of trees or hedge is assigned to a retention sub-category where categorisation is for:

Table A2 Reasons for Categorisation

Sub-category	Reason for Categorisation
1	Mainly arboricultural qualities
2	Mainly landscape qualities
3	Mainly cultural values, including conservation

APPENDIX B. Tree Schedules

Client: **Transport for London (TfL)**
Street, Tower Hamlets, E1 8LG
Survey date**: 17th August 2017**

Project: **Land to the North side of Royal Mint Street and Cable**

Surveyor**: Beverly Smith FDSc. Tech.Arbor.A**

Table B1 Tree Schedule

Tree reference number	Species	Height (m)	Stem diameter (mm)	Branch spread (m)				Height of crown clearance (m)	Age class	Physiological condition	Structural condition	Additional Information	Estimated remaining contribution (years)	Category grading
				N	E	S	W							
T1	Norway maple *(Acer platanoides)*	12	300	4	4	3	1	2.5	Semi-mature	Good	Fair	Wound around stem N - S. Also a wound on west from ground level to 2.5m. Deadwood in lower crown.	10-20	C1
T2	Norway maple *(Acer platanoides)*	14	455	6	5	2	4	2	Mature	Good	Good	None	20-40	B1
T3	Norway maple *(Acer platanoides)*	14	400	2	5	4	3	3	Mature	Good	Good	Deadwood in crown.	20-40	B1
T4	Norway maple *(Acer platanoides)*	14	325	2	5	4	3	4	Semi-mature	Good	Good	None	20-40	B1
T5	Norway maple *(Acer platanoides)*	14	350	6	6	7	4	4	Early-Mature	Good	Good	None	20-40	B1
T6	Norway maple *(Acer platanoides)*	12	315	12	3	5	4	4	Semi-mature	Good	Fair	Wound on N from ground level to 1m. Exposed sapwood sound. Wound on limbs on W and S at 6m. Minor deadwood in lower crown on W.	10-20	C1
T7	Norway maple *(Acer platanoides)*	14	310	4	3	4	3	2	Semi-mature	Good	Good	None	20-40	B1
T8	Norway maple *(Acer platanoides)*	13	345	6	2	2	4	2.5	Early-Mature	Good	Good	Bark wounds on W at 1.5m.	20-40	B1
T9	Norway maple *(Acer platanoides)*	12	300	1	1	4	5	1	Semi-mature	Fair	Fair	50% dieback in crown. Deadwood. Reduce crown by 30%.	10-20	B1
T10	Norway maple *(Acer platanoides)*	14	490	7	5	6	6	2	Mature	Good	Fair	Wound at base on east to 1.2m. Hollow sound at base following percussive test. Recommend reduce crown by 30%.	10-20	C1
T11	Norway maple *(Acer platanoides)*	18	285	3	2	1	1	2	Semi-mature	Good	Fair	Bark wound on W from ground level to 3m.	10-20	C1

Tree reference number	Species	Height (m)	Stem diameter (mm)	Branch spread (m)				Height of crown clearance (m)	Age class	Physiological condition	Structural condition	Additional Information	Estimated remaining contribution (years)	Category grading
				N	E	S	W							
T12	Norway maple *(Acer platanoides)*	15	485	7	5	7	5	0	Mature	Good	Good	None	20-40	B1
T13	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	12	280	4	2	1	3	2	Semi-mature	Good	Fair	Wound at base on N to 0.5m. Deadwood in south of crown. Recommend remove deadwood.	10-20	C1
T14	Purple sycamore *(Acer pseudoplatanus* 'Purpureum'*)*	16	420, 385	4	4	7	4	2.5	Mature	Good	Fair	Twin-stemmed at 1.5m. Fire damage to stem. Each stem has cavity from union point to 0.5m with decay.	10-20	C1
T15	Norway maple *(Acer platanoides)*	14	325	6	4	1	3	2	Semi-mature	Good	Good	Crown suppressed on south.	20-40	B1
T16	Norway maple *(Acer platanoides)*	13	285	7	2	3	2	4	Semi-mature	Good	Fair	Number of bark wounds on stem, no cavities.	10-20	C1
T17	Norway maple *(Acer platanoides)*	14	290	3	3	4	1	1	Semi-mature	Good	Fair	Snapped hanging branch on N. Number of bark wounds on stem. Bulge in stem at base on N.	10-20	C1
T18	Norway maple *(Acer platanoides)*	14	390	6	4	3	5	3	Early-Mature	Good	Good	None	20-40	B1
T19	Norway maple *(Acer platanoides)*	16	360	6	3	2	4	2	Early-Mature	Good	Good	Twin-stemmed at 2m. Rocks piled around base of stem to 30cm height. Recommend remove rocks.	20-40	B1
T20	Purple sycamore *(Acer pseudoplatanus* 'Purpureum'*)*	16	375	5	6	7	3	2.5	Early-Mature	Good	Good	None	20-40	B1
T21	Norway maple *(Acer platanoides)*	16	470	5	5	7	7	3	Mature	Good	Good	Deadwood in crown over highway. 30% dieback. Recommend to Remove deadwood.	20-40	B1
T22	Norway maple *(Acer platanoides)*	15	260	3	3	4	3	4	Semi-mature	Good	Good	Minor deadwood.	20-40	B1
T23	Norway maple *(Acer platanoides)*	16	525	5	5	4	4	1.5	Mature	Good	Good	None	20-40	B1
T24	Norway maple *(Acer platanoides)*	11	265	1	4	4	3	2	Semi-mature	Good	Good	30% dieback in crown on north.	10-20	C1
T25	Norway maple *(Acer platanoides)*	14	320	3	3	5	3	2.5	Early-Mature	Good	Fair	Dieback on north. Minor bark wounds on stem.	10-20	C1

Tree reference number	Species	Height (m)	Stem diameter (mm)	Branch spread (m)				Height of crown clearance (m)	Age class	Physiological condition	Structural condition	Additional Information	Estimated remaining contribution (years)	Category grading
				N	E	S	W							
T26	Norway maple *(Acer platanoides)*	16	370	6	4	4	4	2	Early-Mature	Good	Good	Exposed on north with decay. Not an issue at present.	20-40	B1
T27	Ash *(Fraxinus excelsior)*	17	480	4	4	8	6	3	Mature	Good	Good	Crown suppressed on north. Deadwood in crown. Recommend to remove deadwood.	20-40	B1
T28	Norway maple *(Acer platanoides)*	14	370	5	3	2	4	1.5	Early-Mature	Good	Fair	40% dieback in crown. Deadwood. Recommend to remove deadwood.	10-20	C1
T29	Purple sycamore *(Acer pseudoplatanus* 'Purpureum')	14	400	3	3	5	3	2	Mature	Good	Fair	Dieback in crown on east. Elder growing at base.	10-20	C1
T30	Purple sycamore *(Acer pseudoplatanus* 'Purpureum')	14	330	3	3	5	3	2	Semi-mature	Fair	Fair	Dieback in crown on south.	10-20	C1
T31	Purple sycamore *(Acer pseudoplatanus* 'Purpureum')	14	425	4	3	5	6	1.5	Mature	Good	Good	Minor deadwood.	20-40	B1

Table B2 Root Protection Area

Tree reference number	Species	Stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)
T1	Norway maple *(Acer platanoides)*	300	3.6	40.72
T2	Norway maple *(Acer platanoides)*	455	5.5	93.66
T3	Norway maple *(Acer platanoides)*	400	4.8	72.38
T4	Norway maple *(Acer platanoides)*	325	3.9	47.78
T5	Norway maple *(Acer platanoides)*	350	4.2	55.42
T6	Norway maple *(Acer platanoides)*	315	3.8	44.89
T7	Norway maple *(Acer platanoides)*	310	3.7	43.47
T8	Norway maple *(Acer platanoides)*	345	4.1	53.85
T9	Norway maple *(Acer platanoides)*	300	3.6	40.72
T10	Norway maple *(Acer platanoides)*	490	5.9	108.62
T11	Norway maple *(Acer platanoides)*	285	3.4	36.75
T12	Norway maple *(Acer platanoides)*	485	5.8	106.41
T13	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	280	3.4	35.47
T14	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	420, 385	6.8	146.86

Tree reference number	Species	Stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)
T15	Norway maple *(Acer platanoides)*	325	3.9	47.78
T16	Norway maple *(Acer platanoides)*	285	3.4	36.75
T17	Norway maple *(Acer platanoides)*	290	3.5	38.05
T18	Norway maple *(Acer platanoides)*	390	4.7	68.81
T19	Norway maple *(Acer platanoides)*	360	4.3	58.63
T20	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	375	2.2	14.66
T21	Norway maple *(Acer platanoides)*	470	4.5	63.62
T22	Norway maple *(Acer platanoides)*	260	3.1	30.58
T23	Norway maple *(Acer platanoides)*	525	6.3	124.69
T24	Norway maple *(Acer platanoides)*	265	3.2	31.77
T25	Norway maple *(Acer platanoides)*	320	3.8	46.32
T26	Norway maple *(Acer platanoides)*	370	4.4	61.93
T27	Ash *(Fraxinus excelsior)*	480	5.8	104.23
T28	Norway maple *(Acer platanoides)*	370	4.4	61.93
T29	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	400	4.8	72.38

Tree reference number	Species	Stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)
T30	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	330	4.0	49.27
T31	Purple sycamore *(Acer pseudoplatanus 'Purpureum')*	425	5.1	81.71

Table B3 Key to Categories

Tree Reference Number	Category
T/GXX	Category A
T/GXX	Category B
T/GXX	Category C
T/GXX	Category U

APPENDIX C. Preliminary Arboricultural Method Statement

Overview

This Preliminary Arboricultural Method Statement provides generic best practice measures to be adopted in order to protect retained trees during the development process. It has been prepared in order to inform the planning and the construction/ development process.

Protective Fencing

The purpose of this fencing is to provide protection to the RPA of retained trees/groups and to protect trees and hedgerows prior to their translocation. The type of fencing used shall be appropriate to the level of adjacent construction activity and shall be agreed with the Local Authority tree officer. Weather-proof notices shall be attached to any protective fencing located adjacent to retained trees displaying the words "Construction Exclusion Zone" and listing restrictions which apply. All personnel must be made aware of these restrictions.

It is anticipated that three specifications for fencing would be employed during construction.

Low-use areas

The system illustrated in Figure C1 is adequate to define areas of protected vegetation and exclude traffic, and comprises Cleft Chestnut Pale Fence in accordance with *BS 1722 Part 4: Specification for cleft chestnut pale fences (British Standards Institution, 1991)* supported by 150mm wooden stakes. Assembled with galvanized 14-gauge (2 mm) wire, four strands per row, peeled and pointed one end. Approximate spacing of pales 75 mm.

Figure C1 Tree Protection fencing example for low use areas

Medium-use areas

This system comprises anti-climb weldmesh panels connected by clamps and supported by rubber or concrete bases and bracing struts. The system is illustrated in Figure C2 and is based on *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations (British Standards Institution, 2012)* guidelines. This kind of system is robust enough to withstand occasional knocks by plant machinery.

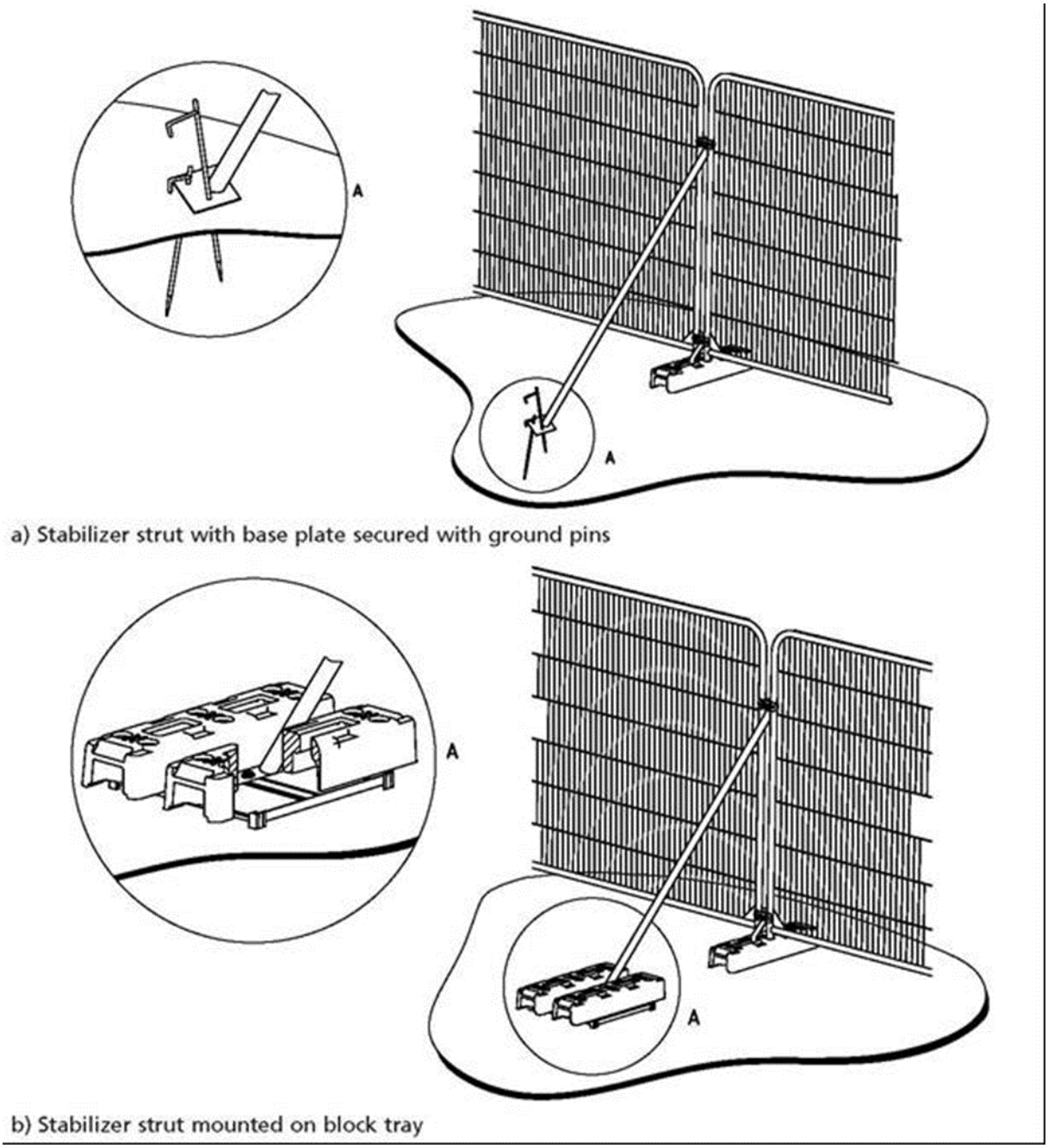
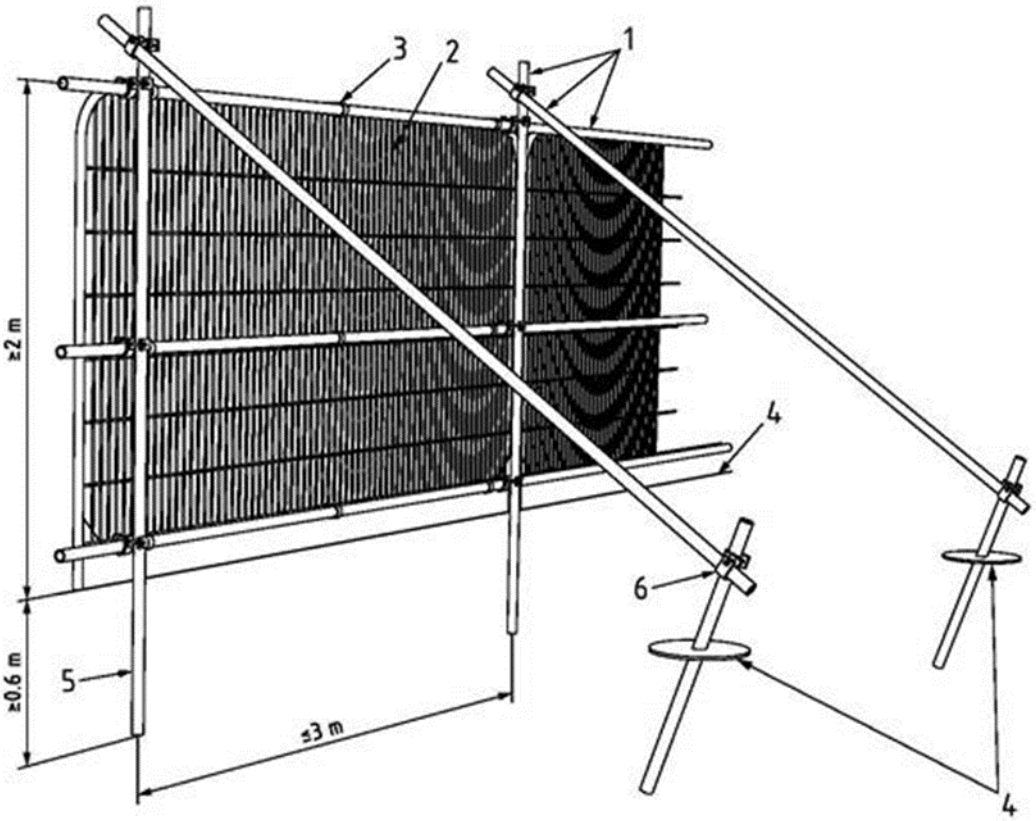


Figure C2 Tree Protection Fencing s*pecification (extract from BS 5837)*

High-use areas

This system involves driving scaffold poles into the ground, onto which are affixed horizontal scaffold poles and diagonal bracing struts. Anti-climb weldmesh panels are secured to this scaffold framework using standard scaffold clips or wire. The system is illustrated in diagram Figure. C3 and is based on *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations (British Standards Institution, 2012)* guidelines. This kind of system provides the highest level of security.



Key

1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps

Figure C3 Tree Protection Fencing specification (extract from BS5837)

Construction Exclusion Zone (CEZ)

The Construction Exclusion Zone (CEZ) is the area identified by an arboriculturist to be protected during development, including Site clearance and construction work, through the use of barriers and/or ground protection fit-for-purpose to ensure the successful long-term retention of a tree. The area within the construction exclusion zone is to be regarded as sacrosanct and the fencing shall not be taken down or relocated at any time.
All areas excluded by protective tree fencing shall be treated as CEZs, and the following restrictions shall apply:

- No construction activity whatsoever must occur within these areas.
- No tree works, without the written consent from the Local Authority.
- No alterations of ground levels or conditions.
- No chemicals or cement washings.
- No excavation.
- No temporary structures. *
- No storage of soil, rubble or other materials.
- No vehicles or machinery to be used or parked without appropriate ground protection measures as per BS5837 recommendations. This will require the use of a proprietary system of reinforced concrete slabs/steel road plates on a compressible layer, or side butting scaffold boards/ 18mm plywood sheets on a compressible layer. The type of ground protection used shall be appropriate for the likely loading applied.
- No fixtures (lighting, signs etc.) to be attached to trees.
- No fires within 10 metres of the canopies of any tree or hedgerow.

1

**Sales Cabins or Site huts, provided they are of the Jack Leg type, can be sited to act as ground protection for the duration of the construction.*

General construction activity

Since the canopies of retained trees may be in close proximity to areas of crane operation, the following restrictions will apply:

- All cranes will be sited outside the defined RPAs of retained trees / groups, and the appointed contractor will ensure all relevant personnel shall be made aware of the location of branches and the need to avoid causing damage to them.
- Prior to the implementation of lifting operations, a representative from the equipment supply company shall visit the Site and ensure all operations can be completed without causing damage to retained trees. A lifting plan will be prepared and submitted for approval prior to all lifting operations. The lifting plan will make provision for the potential for damage of retained trees.
- All lifting operations will be completed under the close direction of a qualified banksman, who will be briefed by the appointed contractor as to the need to avoid damage the stems and branches of retained trees.
- Should additional tree removal or pruning be required the Local Authority Tree Officer shall be contacted and the scope of works agreed in writing.
- All materials will be stored within designated areas and no materials shall be stored within any RPA.

Hazardous materials

Any mixing of cement-based materials is to take place outside the RPAs of all trees. Provision shall be made to ensure that the mixing area is contained so that no water runoff enters the RPAs of any trees. All mixers and barrows shall be cleaned within this dedicated mixing area.
All other chemicals hazardous to tree health, including petrol and diesel, are to be stored in suitable containers as specified by the Control of Substances Hazardous to Health (COSHH) Regulations (2002), and kept away from the RPAs.

Example of Protective Fencing Signs

APPENDIX D. Photographs

Tree No.	Description	Photograph
N/A - multiple	View of the trees at the south of the site viewed from the east to the west	
N/A - multiple	Tree line on site viewed from the north	

Arcadis (UK) Limited

Arcadis House,
34 York Way,
London, N1 9AB
United Kingdom

www.arcadis.com

ARCADIS Design & Consultancy for natural and built assets

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE
LAND TO THE NORTH SIDE OF ROYAL MINT STREET AND CABLE STREET, TOWER HAMLETS, E1 8LG

Site Ref. 2363

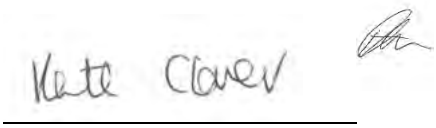
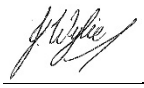
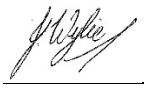
Archaeology Desktop Review

OCTOBER 2017

Incorporating
EC HARRIS BUILT ASSET CONSULTANCY
Hyder

Land to the North Side of Mint Street and Cable Street, Tower Hamlets, E1 8LG

Archaeology Desktop Review

Author	Alexandra Latham and Kate Clover	
Checker	Jenny Wylie	
Approver	Jenny Wylie	
Report No	1104- UA009686-UE21R-03	
Date	OCTOBER 2017	

VERSION CONTROL

Version	Date	Author	Changes
001	20/07/2017	Alexandra Latham and Kate Clover	1st Issue
002	06/08/2017	Kate Clover	Issue to TfL
003	02/10/2017	Kate Clover	Final issue

CONTENTS

1 INTRODUCTION 1
1.1 Background 1
1.2 Scope of Works 1
1.3 Limitations 1
2 SITE OVERVIEW 2
3 DATA SOURCES 2
4 BASELINE CONDITIONS 3
4.1 Designated Heritage Assets 3
4.2 Non-designated Heritage Assets 3
5 CONCLUSIONS 20

FIGURES

Figure 1: Designated and Non-Designated Heritage Assets within the Study Area 21

1 INTRODUCTION

1.1 Background

Arcadis Consulting (UK) Limited (Arcadis) have been commissioned by Transport for London ("TfL") 'the Client' to undertake a number of technical surveys for a Site north of Mint Street and Cable Street, Tower Hamlets ('the Site').

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of this archaeology desktop review is to identify potential abnormal development costs / development constraints due to the presence of below ground archaeological remains and above ground heritage assets on Site.

1.2 Scope of Works

The scope of the review is to carry out a desk-top search of publicly available information on designated and un-designated heritage assets within a study area of 500m of the Site boundary. Using this information, a brief assessment of potential heritage/archaeological constraints and opportunities at the Site has been made, focusing on key constraints. The desktop review also highlights when a Site should be subject to further detailed assessment (i.e. additional scope) to support a planning application for any future development.

1.3 Limitations

This report has been prepared for TfL in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by any third party. The copyright of this document, including the electronic format shall remain the property of Arcadis.

This report has been compiled from a number of sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

2 SITE OVERVIEW

The Site is located to the north of Mint Street and Cable Street, in the London Borough of Tower Hamlets (NGR 534587, 180926). The sub-triangular piece of land measures 0.2 hectares in area and is bounded on all sides by a metal fence. The southern part of the Site is formed of a long linear ridge, covered by grass and trees that is raised above the street level to the south. The north side of the Site is flat and partially covered by hardstanding and partially by rough grass. Access is from Cannon Street Road to the east where the entrance gate is blocked by concrete blocks (as viewed on Google Earth 2017). To the north of the Site is the line of the Docklands Light Railway which is raised above street level.

The Site lies on bedrock of London Clay Formation consisting of clay, silt and sand. Superficial deposits are formed of the clay and silt of the Langley Silt Member formed by wind blown deposits. More specific information gathered from borehole data from the Site reveals alluvium 1.3m thick in some areas of the Site which in turn overlies gravel. London Clay was encountered at between 7.3m and 8.6m below ground level in these boreholes.

3 DATA SOURCES

Records for the Site and a 500m study area were examined. Data was obtained for designated heritage assets from the Heritage List for England on 3rd July 2017 and for non-designated heritage assets and Archaeology Priority Areas (APA) from the Greater London Historic Environment Record (GLHER) on the 3rd July 2017. Information of Conservation Areas and Locally Listed Buildings was obtained from Tower Hamlets Borough Council's website:

(http://www.towerhamlets.gov.uk/lgnl/environment_and_planning/conservation/conservation_areas/character_appraisals.aspx) and details on other designations was obtained from the Defra's MAGIC website (http://www.magic.gov.uk/MagicMap.aspx).

Numbers in brackets in the text are unique identifiers assigned to heritage assets for the purposes of this report. Listed Buildings are prefixed LB (LB1 etc) and undesignated sites are not prefixed. A list of all heritage assets including relevant archaeological events can be found on Tables 1 and 2. All heritage assets and APAs are shown (un-numbered) on GL Figure 1.

4 BASELINE CONDITIONS

4.1 Designated Heritage Assets

There are no scheduled monuments within the Site or study area. There are 43 Listed Buildings (one Grade I, one Grade II* and the remainder Grade II) within the study area but none within the Site boundary (Table 1). All Listed buildings are 18th or 19th century apart from the war memorial (LB35) which is dated 1924 and the former Berner Street Special School (LB42) which was built in 1924. The Listed Buildings include Wilton's Music Hall (LB7), which is the oldest music hall in London to survive in its original form, and The Church of St George in the East (LB34) which dates from 1729 and was designed by Nicholas Hawksmoor.

There are no Registered Parks and Gardens within the study area. There is one Conservation Area within the study area - St George in the East Conservation Area - which lies just to the south of Cable Street and surrounds the church of that name. Many of the Listed Buildings closest to the Site are located within this Conservation Area, along Cannon Street Road and the south side of Cable Street. The Site does not lie within the Conservation Area but is only 30m away from it.

The Site lies within the Tower Hamlets APA. This APA is currently not tiered and not divided up into separate named areas. A little information on this APA is available online in the Council's Heritage Resource document (http://www.towerhamlets.gov.uk/Documents/Planning-and-building-control/Development-control/Conservation-areas/4-Tower-Hamlets-Heritage-Resource.pdf) which states that the area has been assigned due to being in an area of Roman cemeteries, not far from a Roman Road (The Highway).

Whilst APAs do not receive statutory protection, they have been identified in the Borough's Heritage Resource Document as areas where potential for below-ground archaeological remains to survive is high and where archaeological investigations are therefore likely to be required. Historic England's website provides more information about APAs and the differing levels of sensitivity to development (https://www.historicengland.org.uk/services-skills/our-planning-services/greater-london-archaeology-advisory-service/greater-london-archaeological-priority-areas/).

There are nine Locally Listed Buildings, or rows of buildings, within the study area but none within the Site boundary. These are buildings that do not receive statutory protection but are considered by the Borough to be of historic or architectural interest. Those closest to Site may be affected by future development, however the remainder will be screened by adjacent residential tower blocks (http://towerhamlets.maps.arcgis.com/apps/webappviewer/index.html?id=b0448c3d9f254bf683e200174fc3f729).

4.2 Non-designated Heritage Assets

There are a large number of non-designated heritage assets recorded within the study area (195 in total). Monuments including features and findspots are tabulated on Table 2. The 'events' are archaeological investigations including excavations and trial trench evaluations and are also tabulated on Table 2.

Prehistoric

The evidence suggests that the area to the south of Site could be important for quaternary remains, being located on a Thames gravel terrace (98). The study area has only produced three prehistoric features or land surfaces (40, 74 and 98). These are not specifically dated but the presence of worked flint and burnt flint in all of them suggests Neolithic or Bronze Age activity. All these are recorded from the area of The Highway to the south of the Site and (74) and (98) were found within alluvial deposits.

Roman

Within the study area there are 34 known monuments (i.e. archaeological features and findspots) of Roman date (AD43-AD410). The Site is located east of the Roman city of Londinium and part of the Roman city walls still survive close to where the Tower of London now stands. The Site is located 180m north of the principal Roman road leading eastwards from the Roman city which is now followed by the line of The Highway. Roman cemeteries are located outside the city walls alongside the principal routeways out of the city and the Site is located within London's Eastern Cemetery. This cemetery has

been excavated in part and covers a large area of land, perhaps 12 hectares in total, although the exact extent of the cemetery is not known. Burials are known to extend up to 150m away from the road on either side and continue for at least 600m along its line. Estimates of the total number of burials within the cemetery vary between 50,000 – 100,000 based on assumptions about burial density within this area.

Burials from this Roman cemetery (5) were found 150m to the south-east of the Site, within the grounds and park of St George in the East Church (Cannon Street) and a Roman urn (27) was found at 41 Cannon Street, only 50m south-east of the Site boundary. Slightly further away from the Site, Roman cremations and inhumations were discovered on the Highway (16 and 71). To the west of the Site further Roman burials were found south of Hooper Street (13) along with part of a Roman road or trackway (12) and a ditch (36). To the north-west a Roman tombstone was found at Back Church Lane (17). The evidence indicates that the Site lies within the boundary of the cemetery although no burials have been recorded within the Site itself.

According to the HER; The Highway area contained a possible Roman fort with watch tower (37), palisade (38), signal station (31), numerous ditches (39,41,69,75) and buildings (68,114), most interesting of all was a recently excavated large bath house (101) at no. 172-176 The Highway, in Shadwell. Cannon Street has revealed several other findspots apart from the Roman burials including a coin (26) and a jar (28). Back Church Lane also contains evidence of Roman life including a structure (11) and a quarry pit (77). The Site therefore has a medium potential for below ground archaeological remains of this date to be present.

Anglo-Saxon
During the Anglo-Saxon/early medieval period (AD410-AD1066), there appears to have been a village (24) where St George in the East Church and gardens now stand. The original name of settlement is believed to have been 'Waeppa's People' which later evolved into the place name Wapping. The extent of the village is unknown but it is believed to have been located on high ground. An alternative meaning for the name 'Wapping' may be 'Wap-ing' meaning meadow by the river or 'Wapol Marsh' (2) signifying that the area to the south of the Site, by the Thames, was periodically waterlogged in this period.

Medieval
What remains from the medieval period (AD1066-AD1540) illustrates the land use in this period i.e. soil cultivation recorded on the Highway (108), land reclamation in the general area (22), wharves to the south near the former river frontage (35) and quarrying to the north of the Site on Umberston Street (103). A small amount of occupation evidence from this period has also survived in the form of a cess pit and refuse pit (89), a ditch (88), pottery and moulds (134) and a well (97) all found to the west of the Site on Dock Street and Wellclose Square as well as a find of a stylus (34, writing tool) and a cess pit (42) on the Highway. This evidence illustrates a history of land reclamation throughout the period in order to make land available for cultivation and habitation.

Post-medieval and modern
Much more prominent in the archaeological record is evidence from the post-medieval and modern period. Several buildings survive from the 18th and 19th centuries such as the hydraulic pump house on Hooper Street and associated structures (59,60,61,62,63). Many of the features relate to industry in the area i.e. the glass works (25), warehouse (18) and dockyard (19). Occupation features from this period include a cess pit and well (80) along Cable Street as well as occupation debris found in landfill (78) and in various dumped layers for example on Cable Street (79 and 87). The study area also features numerous post-medieval cemeteries (54, 57, 72, 133 and 136-142). Civil War (mid 17th century) siegeworks (1,10) have been recorded along the Highway and it is possible that Cannon Street Road derives its name from this period. Also of interest is the Site of a gallows (4) on Canon Street Road that was used from the medieval period up until 1900.

Historic mapping shows that between 1851 and 1896 the Site itself contained residential housing and from 1896 until 1968 it was used as a coal depot. From 1968 until present the Site has remained largely unchanged.

Table 1: Designated Heritage Assets (Listed Buildings)

ID Number	Grade	Asset Name	NGR	GLHER Number
LB1	II	Brown Bear Public House	534110 180971	DLO27746
LB 2	II	Sarcophagus dated 1740 approximately 7 meters east of St George Rectory	534719 180810	DLO27633
LB3	II	1 Nelson Street	534689 181394	DLO27688
LB4	II	Grenfell School (Southern Building)	534512 181410	DLO27725
LB5	II	9 Nelson Street	534689 171394	DLO27731
LB6	II	Hydraulic Pumping Station	534141 181006	DLO27738
LB7	II*	Wilton's Music Hall	534244 180857	DLO27771
LB8	II	74 Back Church Lane (Wool House)	534250 181009	DLO27784
LB9	II	Monastery Bonded Tea Warehouse	534158 180693	DLO27811
LB10	II	Gate Piers to St George in the East Garden	534846 180909	DLO27841
LB11	II	St George's Rectory	534710 180808	DLO27854
LB12	II	Pier, Gates, railed Wall to North Side of Church of St George in the East	534747 180824	DLO27855
LB13	II	Churchyard and Rectory Wall at Church of St George in the East	534732 180846	DLO27856
LB14	II	224 Cable Street	534757 180902	DLO27885
LB15	II	Pennington Street Warehouse (including former canteen and vaults below)	534519 180634	DLO28003
LB16	I	A Warehouse (skin floor) including Vaults Extending Under Wapping Lane	534699 180601	DLO28005
LB17	II	44 Cannon Street	534675 180867	DLO28034
LB18	II	Monument to a Wyllie in south west Corner of St Georges Garden	534780 180794	DLO28035

ID Number	Grade	Asset Name	NGR	GLHER Number
LB19	II	40 Back Church Lane (Chandlery House)	534213 181135	DLO28059
LB20	II	192 Cable Street	534982 180902	DLO28071
LB21	II	Gate Piers to Church of St George in the East	534685 180787	DLO28073
LB22	II	St George's Gardens Raine Memorial	534785 180808	DLO28074
LB23	II	St Georges Garden Wall	534767 180846	DLO28075
LB24	II	128 Cannon Street	534619 181167	DLO28076
LB25	II	141 Lemon Street	534136 180925	DLO28111
LB26	II	Steps, Terraced House, Railings, Terraced House	534584 181392	DLO28150
LB27	II	St Georges Town Hall	534831 108897	DLO28195
LB28	II	St Pauls Mission Room and Infant Nursery	534308 180828	DLO28209
LB29	II	St Pauls Church (Church of England)	534168 180793	DLO28324
LB30	II	St Pauls Church of England Primary School	534314 180780	DLO28328
LB31	II	Group of Bollards on Pavement Edge in Front of Site of former Brunswick theatre from North Corner of Sailor's Home Southwards to Control Doorway of D T Merchant Marine Office	534199 180826	DLO28353
LB32	II	Offices for the Cooperative Wholesale Society	534094 181017	DLO28363
LB33	II	101 Back Church Lane (New Loom House)	534213 181121	DLO28388
LB34	II	Church of St George in the East. Designed 1729 by Nicholas Hawksmoor	534751 180798	DLO28400
LB35	II	St George's Gardens War Memorial	534766 180828	DLO28401
LB36	II	118 Cannon Street	534623 181143	DLO28402

ID Number	Grade	Asset Name	NGR	GLHER Number
LB37	II	Area railings at no.11 and St Paul's Vicarage	534160 180806	DLO28421
LB38	II	230 Cable Street	534794 180905	DLO28436
LB39	II	1 Nelson Street. Shop front	534579 181375	DLO28462
LB40	II	Area railings at no.15 to 21	534570 181370	DLO28482
LB41	II	Darul Ummah Community Centre (former lower Chapman Street School)	534828 181078	DLO33668
LB42	II	Former Berner Street Combined Special School (now Harry Gosling Primary School, Henriques St)	534326 181241	DLO35217
LB43	II	137 Lemon Street	534110 180971	DLO27745

Table 2: Non-designated Heritage Assets: Monuments

ID Number	Asset Name	NGR	Description	GLHER Number
1	The Highway	534875 180735	Battery, Fort, Siegework, Post Medieval	MLO10355
2	Wapping	534505 189505	An alternative source of the name 'Wapping' may be 'Wap-ing' meaning meadow by the river or 'Wapol Marsh'	MLO11201
3	Back Church Lane	534225 181125	Roman ear Pick	MLO11212
4	Cannon Street Road	534645 181005	Execution Site, medieval to 19th Century. Marked as 'Hangman's Acre' on historic maps	MLO11239
5	Cannon Street Road	534755 189805	Roman cemetery	MLO12933
6	Hooper Street, Whitechapel	534123 181011	Cannon Bollard, 18th Century to Modern. The Bollard on corner of Hooper Street, beside the British Railways Warehouse II, is a 19th century cast iron cannon bollard.	MLO93048
7	7 m East of St George's Rectory	534721 180812	Sarcophagus, 18th Century	MLO92662
8	The Highway	534875 180735	Post Medieval gravel pit	MLO14422
9	Graces Alley (Wiltons Music Hall)	534250 180855	Post Medieval well	MLO18800
10	Alignment of Civil War Parliamentary Linear Fortification	534800 180750	Siegework, 17th Century	MLO4157
11	Back Church Lane and Gowers Walk (Junction of)	534205 181055	Roman structure	MLO19230
12	Hooper Street	534205 180955	Roman road/trackway	MLO19233
13	Hooper Street	534205 180955	Roman cemetery	MLO19481
14	The Highway/Prioress Street, Shadwell/Bermondsey,	534800 180750	Post-medieval siegework	MLO54506
15	Back Church Lane, Spitalfields	534227 181075	A medieval bone and iron stylus	MLO3801
16	The Highway	534905 180735	Roman Cremation and inhumation cemetery consisting of 5 cremation burials and 13 other burials including inumations found during excavations	MLO2171
17	Back Church Lane near Cable St	534205	Roman tombstone	MLO23050

ID Number	Asset Name	NGR	Description	GLHER Number
		180955		
18	Dock St	534150 180705	Post-medieval warehoouse	MLO25307
19	Thomas More St	534405 180605	Post-medieval dockyard	MLO25332
20	2-6 Fairclough St	534255 181145	Post Medieval gravel pit	MLO25636
21	Wapping	534505 180505	15th Century to 16th Century land reclamation	MLO29045
22	Wapping	534505 180505	Medieval land reclamation	MLO29046
23	The Highway	534875 180735	Roman drain and water tank	MLO30265
24	St George in the East	534505 180705	Early Medieval/Anglo Saxon village of Wapping	MLO3200
25	Ensign St	534205 180755	Post Medieval glass works and mound	MLO3275
26	Cannon St Rd	534890 181250	Roman coin	MLO3805
27	41 Cannon St Rd	534655 180865	Roman burial urn	MLO3809
28	41 Cannon St Rd	534655 180865	Roman jar and vessel	MLO3810
29	The Highway	534875 180735	Post Medieval hearth, pit and water tank	MLO38130
30	The Highway	534905 180755	Roman brooch	MLO3814
31	The Highway	534875 180735	Roman signal station	MLO3815
32	The Highway	534875 180735	Roman barrack building	MLO38591
33	The' Highwaye of Wapping Lane'	534875 180735	Possible surface of Roman road. Unclear GLHER reference	MLO3914
34	Martha street [The Highway]	535050 181000	Medieval needle	MLO3983
35	Suffrance Wharf, Wapping	534550 180450	Medieval to 19th Century wharf	MLO4390
36	Hooper St	534205	Roman ditch	MLO48544

ID Number	Asset Name	NGR	Description	GLHER Number
		180955		
37	The Highway	534875 180735	Roman watch tower	MLO53664
38	The Highway	534875 180735	Roman palisade	MLO56416
39	The Highway	534875 180735	Roman ditch	MLO56418
40	77-101 The Highway	534460 180722	Prehistoric pit containing fire cracked flint	MLO58073
41	77-101 The Highway	534460 180722	Roman ditch	MLO58074
42	77-101 The Highway	534455 180715	Medieval cess pit	MLO58077
43	77-101 The Highway	534460 180722	Post Medieval quarry	MLO58078
44	77-101 The Highway	534460 180722	Post Medieval garden and yard	MLO58081
45	Rampart St	534525 181305	15th century to 16th century Gravel pit	MLO59108
46	Rampart St	534525 181305	Post medieval find unclassified	MLO59109
47	62-64 Royal Mint St	534105 180835	Post medieval dump	MLO62745
48	Cable St	534515 180835	Post medieval dump	MLO63385
49	36-44 Gowers Walk	534175 181165	Post medieval garden	MLO63395
50	36-44 Gowers Walk	534175 181165	Post medieval pit	MLO63396
51	36-44 Gowers Walk	534175 181165	Post medieval basement	MLO63399
52	36-44 Gowers Walk	534175 181165	Post medieval well	MLO63400
53	36-44 Gowers Walk	534175 181165	Post medieval cess pit	MLO63401
54	36-44 Gowers Walk	534175 181165	Post medieval cemetery	MLO63403
55	109-153 Backchurch Lane	534215	Post medieval building	MLO64326

ID Number	Asset Name	NGR	Description	GLHER Number
		181245		
56	109-153 Backchurch Lane	534215 181245	Post medieval pit	MLO64332
57	109-153 Backchurch Lane	534215 181245	Post medieval cemetery	MLO64333
58	109-153 Backchurch Lane	534215 181245	Post-medieval cultivation soil	MLO64334
59	Hooper St	534105 181005	Post-medieval hydraulic pumping station	MLO64613
60	Hooper St	534105 181005	Post-medieval boiler house	MLO64614
61	Hooper St	534105 181005	Post medieval engine house	MLO64615
62	Hooper St	534105 181005	Post-medieval hydraulic accumulator tower	MLO64616
63	Hooper St	534105 181005	Post medieval industrial site	MLO64617
64	Fairclough St	534305 181205	Garage	MLO65818
65	172-176 The Highway	534835 180745	Roman surface	MLO65918
66	172-176 The Highway	534835 180745	Post-medieval building	MLO65919
67	Lowood Street, Tower Hamlets	535041 180909	Post Medieval road surfaces and layers recorded during a watching brief in 2006-7	MLO98906
68	The Highway	534905 180605	Roman building	MLO66616
69	The Highway	534905 180605	Roman ditch	MLO66617
70	The Highway	534905 180605	Roman floor	MLO66618
71	The Highway	534905 180605	Roman cremation burial	MLO66619
72	Wellclose Square	534405	Post medieval cemetery	MLO70846
73	2-6 Fairclough St	534255 181145	Post medieval dump	MLO70886

ID Number	Asset Name	NGR	Description	GLHER Number
74	The Highway (Nos 130-162, [Tobacco Dock]	534764 180711	Alluvial deposits produced burnt and worked flint which probably indicate a buried land surface.	MLO71704
75	130-162 The Highway	534764 180711	Roman ditch	MLO71705
76	130-162 The Highway	534764 180711	Post medieval dump	MLO71709
77	Backchurch Lane	534205 181205	Roman quarry pit	MLO72142
78	Wapping Basin	534705 180505	Post medieval landfill site	MLO72843
79	228 Cable St	534785 180880	Post medieval dump	MLO72983
80	228 Cable St	534785 180880	Post medieval well	MLO72985
81	228 Cable St	534785 180880	Post medieval cess pit	MLO72986
82	228 Cable St	534785 180880	Post medieval terraced ground	MLO72987
83	Victoria Mills	534305	Post medieval ditch	MLO73124
84	St Georges Methodist Church	534865 181105	Find unclassified (medieval), find unclassified (15th century to 16th century), find unclassified (post medieval)	MLO73344
85	St Georges Methodist Church	534865 180905	Post medieval deposit	MLO73345
86	St Georges Methodist Church	534865 180905	Post medieval surface and building material	MLO73346
87	St Georges Methodist Church	534865 180905	Post medieval dump	MLO73347
88	38-40 Dock St	534145 180725	Medieval ditch	MLO74343
89	38-40 Dock St	534145 180725	Medieval rubbish pit	MLO74344
90	38-40 Dock St	534145 180725	Post medieval yard	MLO74345
91	38-40 Dock St	534145 180725	Post medieval drain and gully	MLO74346
92	38-40 Dock St	534145 180725	Post medieval rubbish pit	MLO74347

ID Number	Asset Name	NGR	Description	GLHER Number
93	57-60 Royal Mint St	534855 180855	Post medieval quarry pit	MLO75132
94	Cable Street	534300 180900	Post medieval wall and floor	MLO75414
95	2 Artichoke Hill	534505 180665	18th century dump	MLO75422
96	Sir John Falstaff Public House, Cannon Street Road	534620 180974	17th century to 19th century quarry	MLO76177
97	Wellclose Square	534315 180795	Medieval to 19th century well	MLO7749
98	130-162 The Highway	534767 180702	A palaeo-channel with a well-defined environmental sequence of late Quaternary date was identified during archaeological excavations. Limited evidence for prehistoric land use comprising a probable post hole and pit cut and some residual burnt flint and lithics was uncovered	MLO77555
99	130-162 The Highway,	534764 180711	Post medieval dump, structure and pit	MLO77619
100	Salt Petre Bank Glasshouse	534195 180755	17th century to 19th century glasshouse	MLO77740
101	172-176 The Highway	534836 180702	Roman pit, bath house, building	MLO77896
102	St George's Gardens	534790 180810	Post medieval dump and burial	MLO77949
103	12-16 and 18-26 Umberston Street	534470 181256	Medieval quarry pit	MLO77960
104	172-176 The Highway	534835 180705	Post medieval cultivation soil, cess pit, occupation debris	MLO78200
105	12-16 and 18-26 Umberston Street	534475 181255	Post medieval pit, linear feature, dump, demolition layer	MLO78201
106	130-162 The Highway	534766 180702	Roman terrace, building, ditch	MLO78206
107	130-162 The Highway	534766 180702	17th century to 19th century building, sewer	MLO78207
108	'The Highwaye of Wapping Lane'	534875 180735	Medieval cultivation soil	MLO8184
109	141-143 Leman Street	534150	17th century to 18th century brickearth pit	MLO98343

ID Number	Asset Name	NGR	Description	GLHER Number
		180920	Jar and, tobacco pipe	
110	Wapping Lane	534777 180716	A watching brief recorded a made ground deposit below a previous cobbled road surface. 18th century	MLO98909
111	Leman Street (Nos 55-73, 75 & 99) [Goodmans Fields], Whitechapel	534130 181047	Roman cinerary urn and pottery recovered from post medieval quarry pits during an evaluation in 2003	MLO77541
112	130-162 The Highway,	534764 180711	Roman deposit	MLO76361
113	130-162 The Highway	534764 180711	Roman structure	MLO71706
114	130-162 The Highway	534764 180711	Roman pit	MLO71707
115	130-162 The Highway	534764 180711	Roman dump	MLO71708
116	The Highway	534875 180735	Post Medieval yard	MLO10301
117	Pennington Street	534772 180675	Post Medieval road surfaces and layers recorded during a watching brief in 2006-7	MLO98907
118	Bewley Street	534987 180884	Post Medieval road layers and surfaces recorded during a watching brief in 2006-7	MLO98903
119	Royal Mint Street, No 66, Whitechapel	534115 180852	late 18th/early 19th century tobacco warehouse	MLO98908
120	Wapping Lane, No 21, Shadwell, Tower Hamlet	534877 180474	A 17th to 18th century soil, 18th to 19th century demolition layers and 19th century wall foundation were recorded during a watching brief and evaluation in 2007.	MLO98922
121	Christian Street, [Bishop Challoner School], Whitechapel	534448 181092	The basements and foundations of Victorian period buildings were recorded during an evaluation in 2008. 19th/20th century dump layers were also recorded	MLO99474
122	Dock Street, No 20, Whitechapel	534137 180783	Late 19th century spice warehouse, dump layer, gravel pit and mill	MLO98910
123	Bewleys, south of Cable Street, Shadwell	534998 180859	site of Shadwell workhouse, 19th century	MLO98897
124	Dock Street, No 22, Whitechapel	534141 180768	The Pepper Pot public house, late 19th century	MLO98911
125	Cable Street	535071 180919	Post Medieval road layers and a wooden pipe found during a watching brief	MLO98904

ID Number	Asset Name	NGR	Description	GLHER Number
126	Christian Street, [Bishop Challoner School], Whitechapel	534457 181039	Made ground site of Victorian period buildings were recorded during an evaluation in 2008. 19th/20th century dump layers were also recorded	MLO99474
127	Dock Street, Nos 10, 12 & 14, Whitechapel	534129 180822	Terrace of 18th century buildings, heavily altered and formally an orphanage	MLO77962
128	Christian Street, [Bishop Challoner School], Whitechapel	534459 180956	Site of 19th century sugar refinery and dumping layers found in 2006	MLO99473
129	Dock Street, Nos 16 & 18, Whitechapel	534125 180810	possible remains of 18th-19th century terraced houses. Dump layer	MLO98899
130	Garnet Street, Tower Hamlets	534963 180559	{site of Eastern Dock, part of London Docks built 1824-28. Dump layers	MLO98920
131	Dock Street, No 15, Tower Hamlets	534193 180706	19th century house	MLO98934
132	Watney Street/Cable Street, Shadwell	534948 180970	Shadwell underground station and former ticket hall. 1876	MLO101116
133	The Highway [Ebenezer Chapel Burial-Ground] Ratcliffe	534893 180817	18th/19th century burial ground, last described in 1839 and deserted by 1896.	MLO104098
134	Dock Street, (No 15)	534197 180713	Roman pottery. Medieval pottery and mould. Post-medieval pottery, crucibles and kiln from a 17th/18th century glass working site	MLO98935
135	St George's-in-the-East Church, Cannon Street Road/The Highway	534651 180801	18th Church designed by Nicholas Hawksmoor. The chuchyard occupies an area known as The Gun Field.	MLO104207
136	Cannon Street Road [St George's Gardens Nature Study Centre & Museum] Shadwell	534820 180804	18th c. mortuary, 19th c. museum	MLO104097
137	St George's Gardens, Cannon Street Road Shadwell	534785 180819	18th century churchyard/burial ground, 19th century garden	MLO70772
138	Swedenborg Gardens [Swedish Burial Ground] Shadwell,	534491 180790	18th Century Swedish cemetery and chapel. Chapel now demolished	MLO70084
139	Wellclose Square [Danish Burial Ground] Shadwell	534312 180798	18th century Danish cemetery and church. Church now demolished	MLO11267
140	Commercial Road, (52-8) [Sheen's Burial Ground], Whitechapel	534200 181245	18th century burial ground known to have been part of Sheen's Burial Ground	MLO98404
141	Cannon Street Road [Trinity Episcopal	534660 181044	17/18th century chapel/burial ground	MLO70016

ID Number	Asset Name	NGR	Description	GLHER Number
	Chapel-yard], Shadwell			
142	Leman Street (Nos 55-73, 75 & 99) [Goodmans Fields], Whitechapel	534129 181056	18th century quarrying. Quarry pits, dumps, walls, wells and cess pits were identified during an evaluation in 2003	MLO78204
143	Commercial Road (Nos 227-233) [Cheviot House], Whitechapel	534789 181337	1930s textile showroom	MLO107842
Events				
144	Cable Street/ Backchurch Lane/ Christian Street	534302 180900	Archaeological Evaluation	ELO1043
145	Nos 2-6 the Highway, Tobacco Dock	534503 180701	Archaeological Evaluation	ELO2347
146	2-6 Fairclough Street	534255 181145	Archaeological Evaluation	ELO3266
147	Nos 2-6 Fairclough Street	534255 181145	Watching Brief	ELO3275
148	Nos 57-60 Royal Mint Street	534255 180855	Archaeological Evaluation	ELO4424
149	Nos 172-176 The Highway	534836 180702	Archaeological Evaluation	ELO2434
150	St Georges Gardens	534790 180810	Archaeological Evaluation	ELO2518
151	12-16 and 18-26 Umberston Street	534470 181256	Archaeological Evaluation	ELO2536
152	Back Church LA and Gowers Walk (junction of)	534205 181055	Archaeological Evaluation	ELO2748
153	Cable Street, St George's Methodist Church	534865 180905	Archaeological Evaluation	ELO2948
154	No. 228 Cable Street	534785 180880	Archaeological Evaluation	ELO2946
155	Cable Street	534515 180835	Watching Brief	ELO3098
156	Nos 62-64 Royal Mint and Nos 4-10 Dock Street	534105 180835	Archaeological Evaluation	ELO3162
157	Nos 38-40 Dock Street	534145 180725	Watching Brief	ELO3180
158	Nos 130-162 The Highway, Wapping	534764	Archaeological Evaluation	ELO89

ID Number	Asset Name	NGR	Description	GLHER Number
		180711		
159	Nos 130-162 The Highway, Tobacco Docks, Wapping	534764 180711	Archaeological Evaluation	ELO3133
160	The Highway of Wapping Lane	534875 180735	Archaeological Excavation	ELO3596
161	Nos 172-176 the Highway and No.9 Wapping Lane	534835 180735	Watching Brief	ELO3597
162	Hooper Street	534205 180955	Archaeological Excavation	ELO3642
163	The Highway, East of Wapping Lane	534875 180735	Archaeological Evaluation	ELO3846
164	The Highway	534890 180735	Archaeological Excavation	ELO3847
165	Victoria Mills	534305 181105	Watching brief	ELO4821
166	Nos 141-143 Lemon Street	534150 180920	Archaeological Evaluation	ELO6808
167	Sir John Falstaff Public House, Cannon Street Road	534620 180974	Archaeological Evaluation	ELO714
168	London Dock	534450 180575	Geoarchaeological Watching Brief	ELO1328
169	London Dock, St George in the East	534450 180575	Geoarchaeological Watching Brief	ELO1327
170	No. 228 Cable Street	534781 180879	Archaeological Watching Brief	ELO1418
171	London Dock, St George in the East, Wapping	534450 180575	Archaeological Evaluation	ELO14259
172	No. 228 Cable Street	534783 180899	Archaeological Evaluation	ELO1447
173	No. 2 Artichoke Hill	534505 180660	Archaeological Geotechnical Monitoring	ELO14329
174	St George Estate, Cable Street	534406 180849	Archaeological Watching Brief	ELO1467
175	East London Line Extension Project [Central Section And Southern Extension],Southwark, E1-SE8 And SE16:	534850 180072 (c)	Building Survey of the central and southern sections of the East London Line Extension Project was carried out by MOLAS IN 2007-9	ELO1115

ID Number	Asset Name	NGR	Description	GLHER Number
176	No. 2 Artichoke Hill	534505 180665	Watching Brief	ELO1050
177	Nos 10-20 Dock Street	534137 180804	Archaeological Evaluation	ELO7361
178	No. 15 Dock Street	534197 180713	Archaeological Evaluation	ELO8086
179	Chapmen Street/ Tait Street/ Walburgh Street	534692 181022	Watching Brief	ELO1354
180	Nos 4-10 Dock Street/ Nos 62-63 Royal Mint Street	534112 180828	Borehole Survey	ELO1355
181	Nos 10-20 Dock Street	534137 180782	Historic Building Survey and Watching Brief	ELO1193
182	No 21 Wapping Lane	534883 180480	Watching Brief	ELO7762
183	Cable Street	534470 180850	Archaeological Evaluation	ELO1120
184	Pennington Street	534949 180743	Archaeological Watching Brief	ELO7714
185	The Highway	534291 180735	Archaeological Assessment	ELO1361
186	The Highway	534292 180729	Watching Brief	ELO1361
187	Nos 109-153 Back Church lane	534236 181239	Archaeological Evaluation	ELO1354
188	Bishop Challoner school, Christian Street	534764 180711	Geotechnical Monitoring	ELO8770
189	Bishop Challoner school, Christian Street	534835 180735	Archaeological Evaluation	ELO8769
190	Allie Street/ Goodman Stile/ Gower's Walk/ Lemon Street	534093 181193	Watching Brief	ELO1300
191	No 28 Ensign Street	534211 180713	Archaeological Evaluation	ELO1371
192	Nos 36-44 Gowers Walk	534183 181192	Archaeological Evaluation	ELO3492
193	Nos 55-73, 75 and 99, Lemon Street, Goodmans Field	534129 181052	Archaeological Evaluation	ELO2321
194	No. 21 Wapping Lane	534879	Archaeological Impact Assessment	ELO1389

ID Number	Asset Name	NGR	Description	GLHER Number
		180481		
195	No. 60 Commercial Road	534236 181289	Watching Brief	ELO1602

5 CONCLUSIONS

An archaeology desktop review for a Site on the north side of Mint Street and Cable Street, Tower Hamlets has been carried out. This is a rapid information-gathering exercise on the Site and a 500m study area using information from publicly held sources. A brief assessment of potential heritage/archaeological constraints and opportunities at the Site has been made.

Although the Site has potential for buried archaeological remains to exist, these heritage assets are not considered likely to be a barrier to development on the Site.

The Site lies within an archaeologically rich area and the review has assessed that the Site has a medium potential for buried archaeological remains to be present. The Site lies within the western part of the Tower Hamlets APA due to being within the Roman 'Eastern Cemetery'. It lies to north of a Roman road (The Highway) which was a principal route leading eastwards from the Roman city walls. There are also medieval occupation and industrial remains along Cable Street and the Highway and to the west, along Dock Street.

The Site, although now devoid of buildings, was built on in the 19th century (or earlier) and it is not clear what damage these buildings have had on any below-ground archaeological remains. Borehole data from the Site reveals up to 4.9m of modern made ground containing brick and ash which may indicate that there has been some truncation of the former ground surface.

There are no Scheduled Monuments within the study area. There are 43 Listed Buildings (one Grade I, one Grade II*, the rest Grade II) within the study area but none within the Site. There are nine Locally Listed Buildings, or rows of buildings, within the study area but none within the Site boundary. The Site does not lie within a Conservation Area, however it is adjacent to the St George in the East Conservation Area.

The Greater London Archaeological Advisory Service (GLAAS) who advise the local planning authority are likely to recommend a full archaeological desk-based assessment (DBA) for the Site as well as an evaluation to be undertaken prior to planning permission being determined. It is recommended that GLAAS are consulted at the earliest opportunity in order clarify if any field investigations such as trial trenching are required.

The DBA would include a specific archaeology Site walkover, a visit to the record office to gather historic maps and relevant documentary evidence, a map regression exercise as well as preparation of distribution maps showing designated and undesignated heritage assets. The evaluation would likely consist of a programme of trial trenching and subsequent reporting. If heritage assets of significance are encountered during the evaluation stage, there may be a requirement for further recording in the form of an excavation or watching brief. This may be delivered through a post-determination condition.

FIGURES

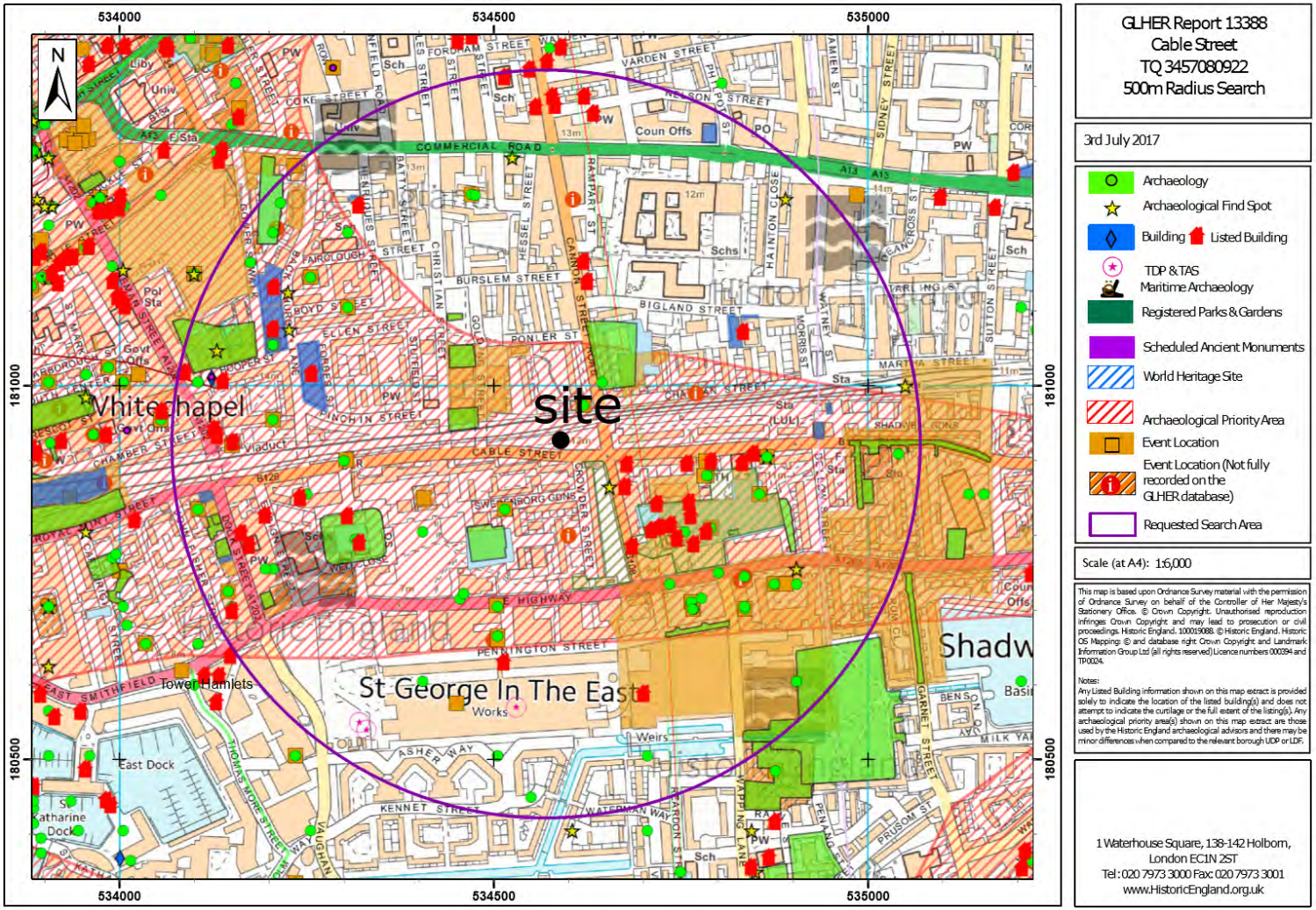


Figure 1: Designated and Non-Designated Heritage Assets within the Study Area

Arcadis Consulting (UK) Limited

Arcadis House
34 York Way
London
N1 9AB
T: +44 (0)20 7812 2000

arcadis.com

ARCADIS Design & Consultancy for natural and built assets

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE
LAND TO THE NORTH SIDE OF ROYAL MINT STREET AND CABLE STREET, TOWER HAMLETS, E1 8LG

Site Ref. 2363

Preliminary Geotechnical and Geo-Environmental Report

NOVEMBER 2017

Incorporating
EC HARRIS BUILT ASSET CONSULTANCY
Hyder

Land to the North side of Royal Mint Street and Cable Street, Tower Hamlets, E1 8LG

Preliminary Geotechnical and Geo-Environmental Report

Author	Rojalin Mishra	pp
Checker	Tukhanh Agapakis	
Approver	Tony Windsor	
Report No	1101-UA009686-UP32R-02	
Date	NOVEMBER 2017	

VERSION CONTROL

Version	Date	Author	Changes
01	15/09/2017	JR	Draft for client comment
02	07/11/17		Final Issue

CONTENTS

1 INTRODUCTION 4
1.1 Terms of Reference 4
1.2 Sources of Information 5
1.3 Limitations and Expectations 5

2 SITE SETTING AND HISTORY 6
2.1 Site Location 6
2.2 Site History 6
2.3 Unexploded Ordnance 8

3 PHYSICAL AND ENVIRONMENTAL SETTING 9
3.1 Published Geology, Hydrogeology and Hydrology 9
3.2 Environmental Public Registers 10

4 PRELIMINARY CONCEPTUAL SITE MODEL 12
4.1 Potential Contaminant Sources 12
4.2 Potential Receptors 12
4.2.1 Human Health 12
4.2.2 Controlled Waters 13
4.2.3 Buildings 13
4.3 Potential Pathways 13
4.4 Summary 13

5 PRELIMINARY GROUND INVESTIGATION 15
5.1 Scope and Rationale of Investigation 15
5.1.1 Rationale 15
5.1.2 Scope 15
5.2 Ground Conditions Encountered 15
5.3 Geotechnical Laboratory and Field Testing 16
5.3.1 Made Ground 16
5.3.2 Langley Silt Member 16
5.3.3 Taplow Gravel 16
5.3.4 London Clay 16

6 PRELIMINARY QUALITATIVE RISK ASSESSMENT 18
6.1 Human Health Screening 18
6.2 Soil Waste Assessment 18
6.3 Ground Gas Assessment 19
6.4 Refined Conceptual Site Model 20
7 WASTE MANAGEMENT AND POTENTIAL DEVELOPMENT CONSTRAINTS 21
7.1 Waste Management 21
7.2 Potential Development Constraints 21
8 GEOTECHNICAL CONSIDERATIONS 22
9 CONCLUSIONS AND RECOMMENDATIONS 23
9.1 Design Considerations 23
9.2 Construction Considerations 23
10 REFERENCES 24

APPENDICES

APPENDIX A
Historical Maps

APPENDIX B
Environmental Data Sheets

APPENDIX C
Zetica Desk Study and Risk Assessment Report

APPENDIX D
Site Investigation Data

1 Introduction

1.1 Terms of Reference

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a Geotechnical and Environmental desk study report and limited Site investigation for land north of Cable Street, Tower Hamlet, London E1 8LG ('the Site').

TfL is aiming to divest a number of small Sites to enable positive regeneration. The objective of this review is to identify any potential abnormal development costs due to geotechnical and geo-environmental conditions on Site.

The objectives of this review are to:

- Review geo-environmental information regarding the Site and its surrounding area;
- Undertake a limited Site investigation to obtain preliminary information relating to ground conditions with limited testing to inform the assessment of contamination issues and foundation constraints;
- Provide outline information on potential geo-environmental and geotechnical constraints which may impact on the land value or redevelopment potential for the Site; and
- Identify potential development constraints due to geotechnical and geo-environmental conditions on Site.

The Site location is shown in Figure 1 below.

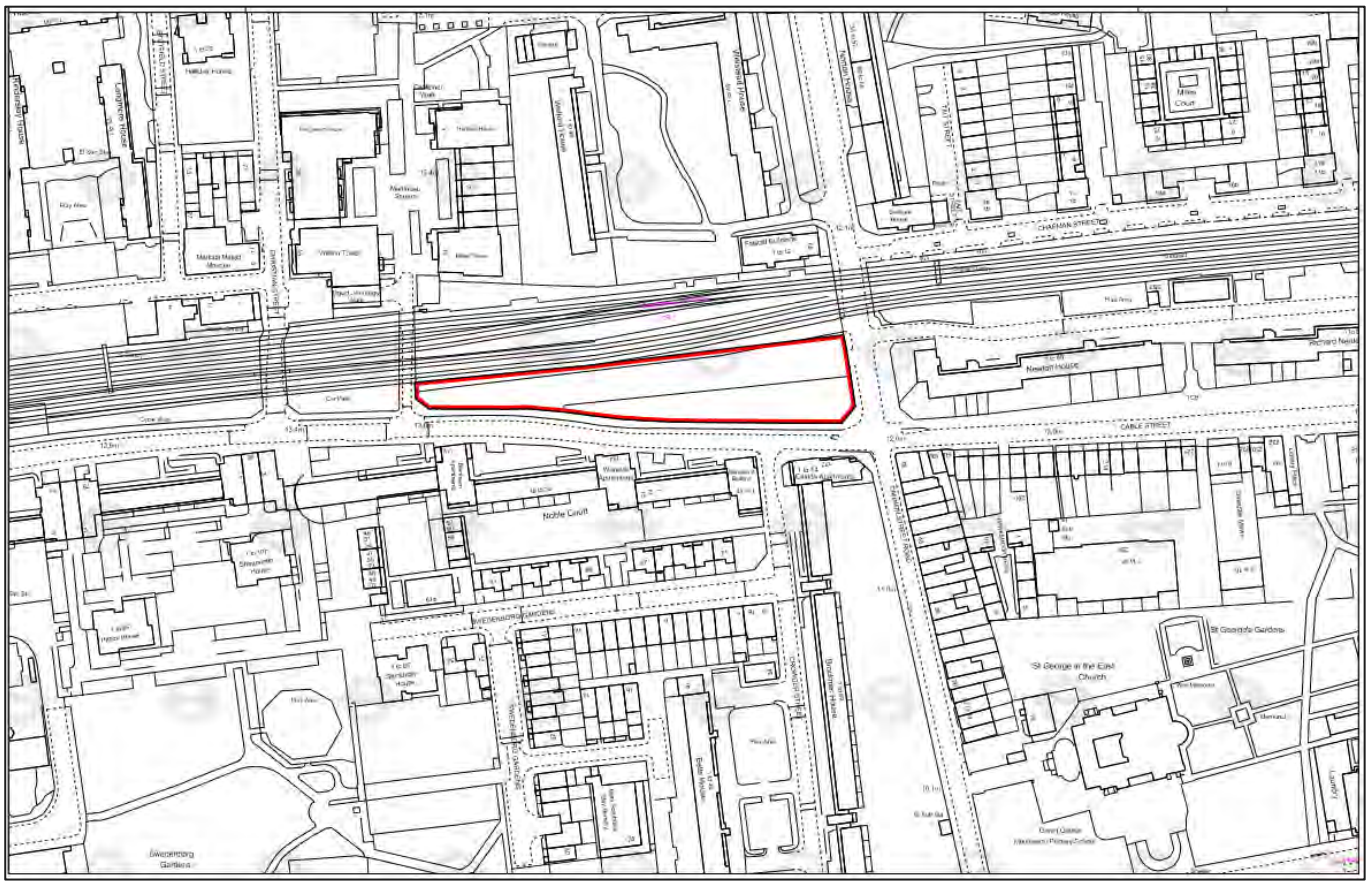


Figure 1: Site Location Plan provided by TfL

1.2 Sources of Information

As part of this report various sources of information have been used and are detailed below:

- The on-line British Geological Survey (BGS) 1:50 000 scale geological map comprising the Site (Ref. 1);
- Historical borehole records available through BGS website;
- Historical Ordnance Survey maps (included in Appendix A);
- Groundsure Environmental Data Reports (Appendix B);
- The Environment Agency (EA) What's in Your Backyard website (Ref. 2);
- The Bomb Sight Project http://bombsight.org/; and
- Zetica Regional Unexploded Ordnance (UXO) Map and UXO Desk Study and Risk assessment report (Ref. 3) (Appendix C).

1.3 Limitations and Expectations

This report has been prepared for the Client in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by any third party. The copyright of this document, including the electronic format shall remain the property of Arcadis.

This report has been compiled from a number of sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

Ground conditions can only be inferred between test locations and as such localised conditions on Site may vary. Furthermore, observations made at the time of investigations and during the monitoring visit may be subject to variation due to atmospheric, seasonal or other effects.

This report is based on a preliminary ground investigation and the purpose of which is to provide an initial indication of ground conditions and potential ground abnormals and enable an assessment of contamination issues and foundation constraints. Further development-specific ground investigation and risk assessment will be required.

2 Site Setting and History

2.1 Site Location

Table 2.1 Details relating to Site Location

Site Location / Address	Land to the North of Cable Street, Tower Hamlet, E1 8LG
National Grid Reference	534587, 180926 Site
Approximate Site Area	The Site covers an area of approximately 0.3 hectares.
Description of Site	The Site is roughly triangular in shape. The southern part of the Site is formed of a long linear ridge, covered by grass and trees that is raised above Cable Street to the south. The northern half of the Site is flat and partially covered by granite cobbles and concrete. It is bounded on all sides by a metal fence. Access is from Cannon Street Road to the east where there is secured gated access. To the north of the Site is the Docklands Light Railway which is raised on a viaduct above street level.
Topography	Site is generally flat and level. The surrounding area generally slopes down to the east. The Site lies approximately 13m Above Ordnance Datum (AOD).
Surrounding Area	The Site is located in an urban area which is predominantly residential housing. Local amenities such as schools, churches with some commercial uses are located near the Site. Cable Street runs along the southern border of the Site beyond which are five to eight-storey residential blocks. Docklands Light Railway runs parallel to Cable Street on a bridge along the northern boundary with commercial properties occupying the railway arches. There are further residential apartments beyond. Cannon Street Road borders the eastern boundary where it extends below the Docklands Light Railway in the north-east. East of Cannon Street Road there are five-storey residential blocks. To the west of the Site is an access road (Golding Street) with B & Y Car Park area beyond.

2.2 Site History

A review of the available historical Ordnance Survey maps (Appendix A) has been undertaken to assess the historical development of the Site and surrounding areas.

It is not the intention of this report to provide a full history, but to identify those past uses on and within the vicinity of the Site that could have resulted in contamination of the soils and/or waters. Significant changes to the land use of the Site and surrounding areas are summarised in Table 2.2 below.

Table 2.2 History of Site and Surrounding Area

Date	Historical Development (Site and Surrounding Area)
1875	The map shows the Site occupied with buildings of various sizes, these appear to be formed of a mix of terraced properties and commercial units or larger properties; which are shown in the centre and encroaching into the Site from the north. Wellclose Place and a public House

Date	Historical Development (Site and Surrounding Area)
	are recorded in the west. The Site fronts onto a Cable Street with Cannon Street Road to the east. Approximately 20m north is the London and Blackwall Railway (L&BR), running parallel to the northern boundary. The area surrounding the Site is a mix of residential / industrial with a charcoal works, sugar refinery and some warehouses, including stable, recorded between 50m and 100m north-west. Warehouses, stables, and a further sugar refinery are shown approximately 75m south of the Site.
1880	No significant changes are noted within the Site or surrounding area. The 1880 map shows the Site encroaching onto Cable Street, but this is likely to be mapping error. Further away, Swedish Chapel and St. George Church with graveyard are shown approximately 120m south and south-east of the Site. During this time St George Street is first shown to be mapped approximately 200m south of the Site.
1896	The map shows all the buildings within the Site had been demolished and replaced with a coal depot. By this time, the charcoal works, sugar refinery and warehouses are no longer mapped to the north-west, west and south-west of the Site, the majority of which, having been replaced by residential properties. The railway line had expanded with a further branchline approximately 150m west of the Site.
1916	No significant changes are noted on-site or in the immediate vicinity. Further away, a school developed in the area of the former sugar refinery (50m north-west).
1948	The maps show the majority of the buildings had been demolished with the exception of a few small structures near the perimeter of the Site; although it is still referred to as a coal depot. There is a large rectangular building off-site along the north-western boundary. In the surrounding area, a number of changes are noted. There are areas of residential properties having been demolished, with ruins noted, suggesting WWII bombing. Some areas are occupied by new developments including coach building works, warehouses, a sweet factory and electricity sub-station along the southern side of Cable Street and within 100m towards south and south-west direction of the Site. There are also areas which remain vacant.
1951-1971	No significant changes are noted on-site or in the immediate vicinity. The Site is referred to as a depot by 1952 and by 1963 map shows a garage on the western side of Golding Street and new residential flats east of Cannon Street Road. The 1963 map shows the site and immediate area to the north as vacant land.
1973-1978 1981-1994	The map shows the Site as open space with trees in the south.

Date	Historical Development (Site and Surrounding Area)
	Some changes to the railway were also noted by the 1970s. The works to the south had been replaced by open space and much of the surrounding areas were residential with local amenities such as schools. The residential area continued to develop into the 1980s and 1990s.

A number of uses have been recorded in the Site, initially comprising a mix of residential and potentially commercial uses. When these were demolished, the Site operated as a coal depot with the majority of the buildings cleared during the 1940s. The surrounding area was similarly a mix of residential and commercial / industrial with a railway line to the north and a former garage to the west. These are considered to be potential sources of on-site and off-site sources of contamination. It is noteworthy that a number of ruined buildings were noted in the surrounding area during the 1940s, suggesting potential impacts from WWII.

2.3 Unexploded Ordnance

With reference to the Zetica Regional Unexploded Bomb Risk of London, the Site is designated as lying within an area denoted as “low to medium” bomb risk area. The Bombsite website (Ref. 4) indicates that no bombs are recorded as having been dropped within the Site. However, the closest high explosive bombs are recorded as having been dropped near to locations approximately 70m north, 90m west and 100m north-east and north-west of the Site on Cable Street, Cannon Street Road and Ponler Street.

A further UXO desk study and risk assessment was therefore commissioned by a specialist consultant (Zetica) prior to the commencement of the site works. The report is presented in Appendix C and is summarised below:

- *A number of high explosive bombs were recorded within 100m of the Site.*
- *Records have been found indicating that buildings adjacent to the western boundary of the site were demolished by 1No. HE bomb during WWII. It is considered that this may have masked the impact of a UXB, which may have offset beneath the western end of the Site and remain in situ. Consequently, the western end of the Site is assigned a **Moderate** UXO hazard level.*
- *No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the remainder of the Site. The central and eastern parts of the site are assigned a **Low** UXO hazard level.*

For areas of moderate risk, UXO mitigation measures for excavations include raising awareness, a non-intrusive UXO detection survey and intrusive investigation of identified targets, where detection is not feasible, a specialist engineer should supervise the excavations works.

For boreholes or piling, clearance certification is considered essential which can be archived by advancing a magnetometer ahead of boreholes or piling to detect ferrous metal targets such as UXB. Reference should be made to Appendix C for further detailed information.

3 Physical and Environmental Setting

3.1 Published Geology, Hydrogeology and Hydrology

With reference to the sources of information detailed in Section 0, the following information has been obtained.

Table 3.1 Information regarding geology, hydrogeology and hydrology

Geology (Aquifer Status)	**Superficial Deposits:** Langley Silt Member described as clay and silt (Unproductive Strata). The Taplow Gravel is indicated within the surrounding area (within 400-500m) and may therefore be present within the Site. These are classified as Secondary A Aquifer. **Solid Geology:** London Clay Formation described as clay, silt and sand (Unproductive Strata).
BGS Boreholes (within 100m of the Site)	A number of BGS borehole logs are recorded within the surrounding area. The following summarises the three recorded within the Site for Docklands Light Railway. TQ38SW3813 – (on-site in the north-east) reveals tarmacadam and cobble surfacing with Made Ground comprising medium dense, brick, ash, timber, slate, bones, gravel and silty sand to 2.40m and a band of loose brown very silty sand with gravel and brick between 2.40m to 3.35m. Very loose brown gravelly silty sand was encountered between 3.35m to 4.20m followed by medium dense to very dense orange-brown coarse sand and flint gravel to depth of 7.65m (this was referred to as *Plateau Gravel* – Taplow Gravel), followed by firm to stiff silty clay becoming stiff to very stiff brown grey silty clay with sand partings/pockets to the termination of the hole at 30m. TQ38SW2209 – (on-site centre) reveals Topsoil over Made Ground up to 4.90m which was described as medium dense to dense very silty sand with gravel and brick. This was underlain by a thin layer of sand with gravel (5.3m bgl) and in turn by Alluvium (although this is likely to be the Langley Silt Member) described as dark grey silty fine sand with plant remains to 6.9m. Plateau Gravels were encountered to 8.6m (medium dense to dense sandy flint gravel). This was underlain by stiff silty clay becoming very stiff fissured silty clay with sand partings/pockets (London Clay) to the termination of the borehole at 30m. TQ38SW3812 – (on-site north-west) reveals tarmacadam and cobble surfacing over Made Ground comprising dense silty sand, ash, brick and gravel to a depth of 3.80m, this was underlain by a layer of possible fill described as silty clayey fine sand with flint to 4.8m. Plateau Gravels described as sandy flint gravel were recorded to 6.9m. Firm to stiff silty sand becoming very stiff fissured silty clay with sand partings/pockets and claystones was encountered to the termination of the borehole at 30m.
Within a Source Protection Zone	N/A
Licensed Groundwater Abstraction Points	There are now active abstraction licenses within 500m of the Site. There were 2 historical abstractions from groundwater approximately 460m south-east for canal and a second recorded approximately 490m west registered to NATWEST bank for drinking, cooking, sanitary and washing.
Surface Water Feature	Wapping Canal, a secondary river is located approximately 430m to the south of the Site. The River Thames is also located approximately within 1km south of the Site.

Likely Groundwater Flow Direction	Based on the proximity of the Site to the Wapping Canal and River Thames, it is inferred that groundwater flow will be in a southerly direction towards the canal and the river.

A preliminary ground investigation has been undertaken which comprised 2 cable percussion boreholes which are discussed in Section 5.2.

3.2 Environmental Public Registers

Public register information from available environmental datasets (Appendix B) for the Site and the surrounding area has been summarised in Table 3.2 below.

It is not the purpose of this section to provide a comprehensive account of the environmental data but only to detail those factors that are or could impact the Site.

Table 3.2. Environmental Data

Data type	Description	Distance (m) and Direction
Radon	The Site is not in a radon affected area, as less than 1% of properties are above the action level. Protection is not considered necessary within new properties.	N/A
Landfill sites	None identified within 1km of the Site	N/A
Fuel Storage and Retail	Four identified within 500m of the Site: Tower Hamlets and City Garages (Obsolete); Status - Obsolete Co-Op St Katherines (Texaco); Status - Open Tower Connect (BP); Status – Open Hamlet Service Station (Obsolete); Status - Obsolete	 152m NW 191m S 202m S 412m NE
Local Authority Pollution Prevention and Controls	Six identified within 500m of the Site: Star Service Stations Ltd, 77-101 The Highway – Unloading of Petrol into Storage at Service Stations (Historical permit) Star Service Stations Ltd, 102-106 The Highway – Unloading of Petrol into Storage at Service Stations (Historical permit) Texaco, The Highway – Petrol Vapour Recovery Process (Historical Permit) BP Service Stations Ltd, 102-106 The Highway – Unloading of Petrol into Storage at Service Stations (Current permit) Dry Cleaning by Sandringham, 21 Watney Market – Dry Cleaning (Historical Permit) Diamond Tailors & Dry Cleaners, 21 Watney Market – Dry Cleaning (Current Permit)	 187m S 209m S 212m S 215m S 406m NE 407m NE

Data type	Description	Distance (m) and Direction
Contemporary Trade Directory Entries	33 identified within 250m of the Site, including:	
	A distribution and haulage, suppliers, vehicle repairs, substations, jewellery supplier, textile / machinery,	Between 4m and 100m of the Site
	Vehicle sales and repairs, substations, petrol stations, record studio and media services, leather products, clothing supplier, published goods, electrical equipment and works	Between 100m and 250m

The Site and immediate surrounding area have been subject to various phases of demolition and redevelopment into housing, roads and industrial works (including coal depot). Made Ground is likely to be present within and immediately adjacent to the Site associated with these activities. This is discussed further in Section 4.

4 Preliminary Conceptual Site Model

Geo-environmental assessments are required in accordance with current regulatory guidance to consider the significance of potential contamination in terms of plausible source-pathway-receptor contaminant linkages. As part of this process, it is necessary to develop a conceptual model of these potential contaminant linkages by identifying the potential contamination sources, sensitive receptors and any potential exposure pathways. A risk assessment is then undertaken to determine the likelihood and significance of these potential contaminant linkages.

4.1 Potential Contaminant Sources

Based on the information obtained from the existing data and information obtained from historical and environmental research and the Site walkover, there are a number of potential contaminative sources identified on and off-site. These are detailed in Table 4.1 below.

It should be noted that it is considered unlikely that all these substances would be present at significant concentrations across the Site.

Table 4.1: Potential Sources of Contamination on Site

Source	Potential Contaminants
On Site	
Made Ground associated with demolition and redevelopment of residential properties.	Metals, polyaromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), asbestos, ground gas and vapours.
Coal depot	Metals, PAH, TPH, asbestos, sulphates, ground gas and vapours.
London Clay	Sulphates (potential aggressive ground conditions for concrete)
Off Site	
Made Ground associated with demolition and redevelopments adjacent to the Site	Metals, PAH, TPH, asbestos, ground gas and vapours
Historical industrial uses within 100m – works, refinery, railway, tanks, garages	Spills and leakage from garage and vehicle servicing, PAH, TPH, VOCs
Electricity substation	Leakage of oils potentially containing PCBs from transformers

4.2 Potential Receptors

The proposed land use is currently unknown. Based on the Site's current setting and location, it has been assumed that residential properties without gardens (such as flats / apartments) with limited areas of soft landscaping are likely. However, as a precautionary approach, the residential end-use scenario with gardens, which is more conservative, has been used for this initial assessment.

4.2.1 Human Health

- Site Users (residents, visitors, maintenance workers and contractors).

Contamination risks to construction workers are not appraised by chronic (long term) exposure human health risk assessments. There are no appropriate published criteria applicable to assessment of potential risks to construction workers. The potential risks should be addressed by a Site-specific construction workers risk

assessment and implementation of appropriate health and safety measures, to adequately mitigate any potential risks. All works should be conducted in accordance with the CDM Regulations (2015) or any other relevant guidance. Constructions workers are not considered further in this assessment.

4.2.2 Controlled Waters

- Groundwater in the Taplow Gravel although given the Unproductive Strata classification of the underlying Langley Silt Member and London Clay; these will not be considered further.
- Surface water features are not considered further given the distance to the nearest water course (Wapping Canal) is approximately 430m south of the Site.
- The Site is not within 500m of a groundwater Source Protection Zone.

4.2.3 Buildings

- Underground /structures/services (water pipes, concrete, foundations).
- Proposed buildings.

4.3 Potential Pathways

Potential pathways are the routes that link the receptor to the contamination source. The potential pathways for this Site are summarised in Table 4.2.

Table 4.2: Potential Contaminant Pathways

Receptor	Description
Human Health (residents, visitors, maintenance workers and contractors)	Accidental ingestion of contaminants within soil, water and dust Ingestion of contamination in home-grown produce Inhalation of dust, vapours and ground gases Dermal contact with contaminants within soil, water and dust
Controlled Waters (Secondary (A Aquifer – Taplow Gravels)	Leaching of potential contaminants in soil or Made Ground into groundwater. Vertical and lateral migration of soluble contaminants through the unsaturated zone into groundwater beneath the Site.
Buildings	Direct contact of building services or foundations with contaminants in the soil and Made Ground, including sulphate attack Gas accumulation in confined and poorly ventilated spaces Sulphate attack on buried concrete

4.4 Summary

Historical and current on-site and off-site potential sources of contamination have been recorded. Made Ground is likely to be present which could be a source of contamination including asbestos. Human exposure could occur in future gardens or soft landscaped areas, especially if soils are disturbed by activities such as digging / gardening. Ground gas / vapours could be generated by the Made Ground which could accumulate in confined spaces and pose risk to future site users.

The Site is underlain by an Unproductive Strata (Langley Silt Member and London Clay) although if present the Taplow Gravels would be classified as a Secondary A Aquifer. The London Clay is a source of naturally occurring sulphates, which could impact buried concrete.

Near surface investigation comprising cable percussion boreholes completed by Arcadis to assess the chemical properties of the existing near surface soils and to characterise the underlying subsurface soils is discussed in the following sections.

5 Preliminary Ground Investigation

5.1 Scope and Rationale of Investigation

A preliminary ground investigation was undertaken on 30th and 31st August 2017 to assess the shallow ground conditions at two locations within the Site. An exploratory hole location plan is included within Appendix D.

5.1.1 Rationale

The development of the preliminary CSM highlighted possible pollutant linkages with respect to the proposed future development. The ground investigation was designed to provide a better understanding of these potential pollutant linkages to facilitate a preliminary contamination and foundation assessment and to provide further recommendations, as necessary. The objectives of the investigation were therefore to:

- Characterise the Made Ground, Langley Silt Member and London Clay;
- Establish a preliminary understanding of the geo-environmental regime (soil only);
- Establish the preliminary groundwater conditions (groundwater levels) beneath the Site;
- Establish the preliminary soil borne gas regime;
- Preliminary waste classification based on the *Hazwaste Online* tool; and
- Identify the geotechnical properties of the natural soils.

It should be noted that as part of the preliminary nature of the investigation, testing comprised a general suite of contaminants which were used within the preliminary assessment. No Volatile Organic Compounds (VOCs) or PCBs were tested as no olfactory evidence of contamination was noted during the works and, in addition, no asbestos quantification testing, leachates or groundwater testing was included.

5.1.2 Scope

The ground investigation comprised:

- 2 cable percussive boreholes placed to provide general coverage within the Site;
- Chemical testing – 6 soil samples were tested for the following suite; arsenic, boron, cadmium, chromium (total), chromium (vi), copper, lead, mercury, nickel, selenium, zinc, PAH (16 speciated), pH, and asbestos.
- 3 soil samples were analysed for moisture content and Atterberg limits, 3 samples were tested for particle size distribution (wet sieve);
- Gas and groundwater monitoring standpipes were installed into two of the boreholes upon completion with response zones targeting the Head Deposits and one return monitoring visit for ground gas concentrations and groundwater level monitoring.

An exploratory hole location plan, exploratory hole logs, and chemical and geotechnical laboratory test results are presented within Appendix D.

5.2 Ground Conditions Encountered

The boreholes were positioned in the east and in the centre of the Site to provide general coverage, the logs, which are presented within Appendix D revealed:

- The surfacing at both locations were described as comprising granite cobbles to 0.16m (BH01) and 0.20m (BH02). These were underlain by base layers of brick and concrete to 0.45m (BH01) and 0.5m (BH02).
- The underlying Made Ground was recorded to depths of 3.8m (BH02) and 4.8m (BH01) and was variable described as comprising bands of dark brownish grey slightly gravelly sand, clay or silt in BH01 but as a sandy gravelly clay in BH02 with fragments of brick, flint, ceramics, concrete, slag and roots. There was no recovery between 2.3m and 3m in BH01 possibly due to the soft band.

- The Langley Silt Member (LSM) was encountered underlying the Made Ground to 4.9m (BH02) where it is described as soft greyish brown, slightly sandy, slightly silty clay with gravels of flint.
- Taplow Gravels underlie the LSM to 7.40m in BH01 but was not proven beyond 6.45m in BH02 where it was terminated. It is described as generally brown, orange brown slightly silty gravelly sand or sand and gravel. Gravel is quartz.
- The surface of the London Clay was encountered underlying the Taplow Gravel in BH01 at 7.40m (on cobbles / gravel) but not proven beyond 10.45m. It is described as stiff yellow brown mottled light brown clay where weathered (7.4-7.8m) becoming stiff extremely closely fissured dark grey / brown clay.
- Groundwater was not encountered in either boreholes.
- No visual or olfactory evidence of contamination was encountered during the investigation.

5.3 Geotechnical Laboratory and Field Testing

5.3.1 Made Ground

Seven in-situ Standard Penetration Tests (SPT) were undertaken within the Made Ground. N-values ranged between 4 (very loose) and 2 to 20 (very soft to stiff).

Two particle size distribution test was undertaken on sample of the Made Ground (BH01 0.5-1m) where is it described as a grey brown clayey very gravelly sand. In BH02 (1.2-1.7m) the sample is described as a clayey/silty very gravelly sand.

One Atterberg Limit was undertaken on the Made Ground (BH02 1.2-1.7m) as summarised below. The results indicates the sample is a clay of intermediate plasticity with a calculated modified plasticity index of 10 indicating a low volume change potential.

- Liquid Limit 43%
- Plastic Limit 24%
- Plasticity Index 19%
- Moisture Content 21%
- % Passing 425µm sieve 53%

5.3.2 Langley Silt Member

One SPT was undertaken within the LSM in BH02, the N-value recorded was 14 indicating the material tested was firm although was described by the logging engineer as soft.

One Atterberg Limit was undertaken on the LSM (BH02 4-4.5m) as summarised below.

- Liquid Limit 27%
- Plastic Limit - not plastic as the sample was described as a clayey sand by the laboratory technician
- Plasticity Index - N/A
- Moisture Content 7.3%
- % Passing 425µm sieve 60%

5.3.3 Taplow Gravel

Four SPTs were undertaken within the Taplow Gravel, N-values recorded ranged between 29 (medium dense) and >50 (dense) however it should be noted that cobbles are recorded in the Taplow Gravels which may have impacted the tests.

One particle size distribution test was undertaken on sample (BH01 5-5.5m) indicates the sample tested comprises yellow brown gravelly clayey sand is it described as a grey brown clayey very gravelly sand; this confirms the engineer's description.

5.3.4 London Clay

Three SPTs were undertaken within the London Clay in BH01, N-values ranged between 17 and 19 (stiff).

One Atterberg Limit was undertaken on the London Clay (8-8.5m) as summarised below and indicates the sample is a clay of extremely high plasticity with a calculated modified plasticity index of 60.4 indicating a high volume change potential.

- Liquid Limit 91%
- Plastic Limit 30%
- Plasticity Index 61%
- Moisture Content 30%
- % Passing 425µm sieve 99%

6 Preliminary Qualitative Risk Assessment

6.1 Human Health Screening

The proposed use is not currently known and therefore, as a preliminary assessment, the chemical test results have been screened against the LQM / CIEH S4ULs (Ref. 6) for a residential with plant uptake scenario. This is considered to be suitably conservative and representative of, for example, residential housing with private gardens. Exceedances are summarised in Table 6.1.

Asbestos fragments or fibres were not visually identified during the investigation however, asbestos loose fibres (Amosite) was detected by the laboratory in sample BH01 (5-5.5m bgl); however reference to the exploratory hole log reveals the sample is of the Taplow Gravel therefore at the time of reporting, we have requested clarification from the testing laboratory.

Table 6.1. Exceedances of the human health screening criteria in soils

Determinant	Location	Screening Criteria (mg/kg) Residential with plant uptake	Concentration (mg/kg)
Asbestos	BH01 5.00m bgl	N/A	Amosite- Loose Fibres
Lead	BH01 0.40m bgl	220	300
	BH01 1.00m bgl		920
	BH02 0.60m bgl		550
	BH02 3.00m bgl		1300

Lead exceeded the screening criteria for a residential with plant uptake land use in four of the samples of Made Ground tested (BH01 & BH02). Asbestos, described as loose fibres of amosite, was detected within BH01.

Whilst the development proposals are unknown, it is likely that to facilitate the development the Made Ground or part of it will be removed. The source removal/reduction and the non-volatile nature of the contaminants will sever the identified potential exposure pathways and, therefore, may mitigate the risk to future human health receptors where buildings or hardstanding is proposed. In areas of gardens or soft landscaping, a clean cover system may be required., although this is based on the limited testing available and further testing should be undertaken to confirm the most appropriate mitigation measures to support the development design.

6.2 Soil Waste Assessment

The chemical testing results from the 6 samples of Made Ground and soil collected during the ground investigation were screened using *HazWaste Online* software to determine the likely classification of excavated materials that may require off site disposal. The *HazWaste* assessment is presented in Appendix D.

The List of Wastes Code used in the assessment for non hazardous material is 17.06.04; soils and stones other than those mentioned in 17.05.03, whilst the code applicable for hazardous material is 17.05.03.

The concentration threshold for HP7 Carcinogenic was exceeded in BH02 3.0-3.5 due to the concentration of lead (1300 mg/kg). This sample is classified as **Hazardous**. Waste acceptance Criteria (WAC) testing should be undertaken of the material to be disposed of prior to removal off-site to inform the potential disposal options.

Asbestos (loose amosite fibres) was identified in BH01 5.0-5.5. Asbestos quantification analysis has not undertaken at this stage. For the waste to be classified as Hazardous with regard to asbestos, greater than 0.1% loose asbestos fibres would need to be identified. Therefore, until quantification has been undertaken,

the samples have been classified as **potentially hazardous.** WAC testing and asbestos quantification analysis of the actual material to be disposed of should be undertaken prior to removal offsite to inform the potential disposal options.

The initial screen of the results indicated that the concentration of sum TPH BH01 1.0 – 1.1 (12 mg/kg) was potentially hazardous with regard to HP3: Flammable. However, this assessment has been revised to **non hazardous** because the concentration of TPH required to be flammable in soil is greater than 1000 mg/kg, and no evidence of liquid phase free product was identified on the exploratory borehole logs.

BH01 0.4-0.45, BH01 1.0-1.1, BH02 0.6-0.7 and BH02 4.0-4.5 are classified as **non-hazardous** based on the determinants analysed. Arisings represented by these samples are likely to be suitable for disposal at either an inert or non hazardous waste landfill site, subject to the results of WAC testing.

It should be noted that to secure disposal at a landfill site, a waste management facility may require testing of the actual material that is to be disposed of offsite prior to acceptance, and that there is no obligation on a landfill operator to accept the waste.

The developer has a statutory responsibility under the Duty of Care Regulations to abide by the Environmental Protection Act 1990 to ensure that contaminated soils and waste are disposed of offsite to a suitably licenced waste management facility in a safe and approved manner. To comply with the Duty of Care all wastes taken off site must be handled by a registered waste carrier and be accompanied by a consignment note that describes the waste.

Any imported soil proposed for fill or landscaping should be suitable for its intended use (i.e. not present an environmental risk) and its condition validated as necessary. The results of the *HazWaste* assessment are attached in Appendix D.

6.3 Ground Gas Assessment

One monitoring visit was carried out on the 8th September 2017 for monitoring standpipes installed in the boreholes targeting the Made Ground. The results are summarised below.

Table 6.2. Ground Gas and Groundwater Monitoring Results

Parameter	Unit	BH01	BH02
Gas flow rate	l/h	ND	ND
Methane (CH_4)	% v/v	ND	ND
Carbon Dioxide (CO_2)	% v/v	3.2	5.3
Oxygen (O_2)	% v/v	16.1	14.1
Carbon Monoxide (CO)	ppm	0	0
Hydrogen Sulphide (H_2S)	ppm	0	0
Volatile Organic Compounds (VOC)	ppm	2	0.4
Depth to groundwater	m bgl	DRY	DRY

Note: Ground gas concentrations monitored for a minimum of 90 seconds or until stabilised. Maximum readings are given for all parameters except oxygen for which the minimum value is shown.

The gas monitoring revealed concentrations of carbon dioxide to a maximum of 5.3% v/v. Concentrations of methane, hydrogen sulphide, carbon monoxide, gas flow and VOCs were either not detected or recorded at low concentrations.

An initial assessment was carried out in accordance with CIRIA C665 (Ref. 7). This indicated that the highest gas concentration (carbon dioxide) of 5.3 % and maximum flow (taken as the detection limit of <0.1 l/hr)

result in a gas screening value (GSV) of 0.0053 l/hr for carbon dioxide, potentially, placing the Site within 'Characteristic Gas Situation 1 / 2' owing to the levels of carbon dioxide (very low risk to low risk) based upon modified Wilson and Card methodology (Ref. 7) or Amber in accordance with NHBC guidance (Ref. 8).

For preliminary assessment purposes and based on the development of private housing type buildings and CS1/2 and Amber 1 classification, gas protection measures is likely to be required subject to further monitoring and assessment.

6.4 Refined Conceptual Site Model

Exceedances of the screening values have been recorded in the soils tested including lead and PAHs, and asbestos-containing materials were identified in samples of the Made Ground. The following refined CSM has been prepared based on the available information.

Table 6.3 Refined Conceptual Site Model

Source	Pathway	Receptor
On-Site Made Ground, lead and asbestos	Accidental ingestion of contaminants within soil, water and dust	Human Health (residents, visitors, maintenance workers and contractors)
	Ingestion of contamination in home-grown produce	Human Health (residents)
	Inhalation of dust	Human Health (residents, visitors, maintenance workers and contractors)
	Dermal contact with contaminants within soil, water and dust	
	Direct contact of building services or foundations with contaminants in the soil and Made Ground.	Buildings
	Migration	Groundwater (Secondary A aquifer)
Sulphates in London Clay	Direct contact with sulphates leading to concrete degradation.	Buildings
Made Ground	Gas accumulation in confined and poorly ventilated spaces.	Buildings (CS1/2 or Amber 1) Human Health (residents, visitors, maintenance workers and contractors)

7 Waste Management and Potential Development Constraints

7.1 Waste Management

Consideration should be given to disposal of waste soils / Made Ground generated by the development. Chemical testing of soils / Made Ground is likely to be required to inform a waste classification assessment and determine the potential disposal options. It should be noted that the waste contractor may require testing of the actual material to be disposed prior to acceptance, and that there is no obligation on a landfill operator to accept the waste.

Soils suspected of being contaminated should be segregated from soils which appear to be 'clean' and should not be used elsewhere on the Site as fill or landscaping unless they can be proven to be fit for purpose.

Imported topsoil for landscaped areas should be clean, fit for purpose and validated as necessary.

The preliminary waste assessment carried out indicates that one sample of the Made Ground (BH02 3-3.5m) and the material containing asbestos may be classed as hazardous based on the presence of asbestos and elevated lead concentrations. The remainder of the Made Ground is classified as non-hazardous, and would likely be suitable for disposal as inert waste, subject to the results of Waste Acceptance Criteria (WAC) testing.

7.2 Potential Development Constraints

The Site is located between Dockland Light Railway and Cable Street in the Tower Hamlets area of London. The Site is located within a largely residential area with local amenities and companies nearby. The historical review reveals former uses of the Site included a number of residential properties and possibly commercial properties, which were demolished during the 1940s and the Site operated as a coal depot until it was finally cleared in the early 1970s. Current and historical off-site sources have been recorded (industrial works, factories, depots, petrol filling stations, garages, motor vehicle service stations). A preliminary ground investigation has been carried out and gross contamination was not encountered, although elevated concentrations of lead and asbestos were recorded associated with the Made Ground.

Subsurface obstructions (possible brick and concrete fragments) were encountered in WS101 to WS105 throughout the Site, possibly associated with the original early 19th Century terraced housing or coal depot recorded within the Site.

It should be noted that whilst significant contamination was not encountered during the works, this assessment has been based on a preliminary ground investigation which comprised 2 boreholes and contamination elsewhere in the Site cannot be discounted.

The following potential environmental and geotechnical conditions have been identified that will warrant further consideration and/or implementation:

- Buried obstructions (foundations and services) associated with the former buildings are present in the southwest and may be elsewhere on Site and may require removal prior to redevelopment.
- Buried services may require removal, protection, diversion or chasing and plugging at the boundary;
- Gross contamination is not anticipated however, provisions should be allowed for the potential for unforeseen contamination (this can be a planning requirement);
- Asbestos has been identified within one of the six Made Ground samples tested and further testing and assessment including quantification testing will be required;
- Gas protection measures are likely to be required, but this should be confirmed following further monitoring and discussions with Building Control are recommended;
- Sulphate resistant concrete is not expected to be required based on a preliminary assessment of two samples, however this should be confirmed during a development-specific ground investigation;
- Contaminant resistant water supply pipes may be required;
- Provision of clean cover system in landscaped areas are likely to be required;
- Design specific ground investigation and consultancy advice to support planning obligations will be required; and
- UXO mitigation measures.

8 Geotechnical Considerations

Ground conditions encountered within the two boreholes revealed Made Ground extended to 4.8m, this was underlain by a 1.1m thick layer of Langley Silt Member (LSM) in BH02. The LSM may have been removed or was reworked in BH01. The underlying Taplow Gravel is recorded to a maximum depth 7.4m (BH01), although the base of the Taplow Gravel was not proven in BH02. The underlying London Clay was weathered at the surface at BH01 and was not proven beyond 10.45m where it is described as stiff sandy clay.

No groundwater strikes were encountered. The proposals for the Site including structure layouts and loadings are unknown therefore the following has been provided for indicative purposes only.

Potential founding solutions will be dependent on the thickness of Made Ground and the geotechnical properties of the natural deposits. The Made Ground is generally considered unsuitable for foundations due to its variable composition and its potential for high total and differential settlement. The ground investigation has confirmed that where present, the Langley Silt Member which extended to 4.9m is described as soft/firm. Therefore, conventional shallow foundations or trench fill foundations are unlikely to be suitable. Depending on the final proposals for the Site a piled solution bearing onto the London Clay is likely to be required.

Possible brick and concrete were encountered as a buried obstruction in the exploratory holes within the Site. Further obstructions may also be present elsewhere. Ground disturbance caused by the removal of historical structures may increase the thickness of Made Ground already present beneath the Site locally.

There are currently several mature trees on Site. Consideration will need to be given to trees that may have been removed or the planting of future trees when considering the depths of the foundations (Ref. 9). The fine-grained materials of the Head Deposits and London Clay include very high plasticity clay which have a high potential for shrinkage and swelling.

Sulphates within the London Clay can cause sulphate attack on concrete structures and sulphate resistant concrete may therefore be required.

The potential for relict shear slip surfaces within the London Clay should also be considered during further investigation / design.

Consultation with external stakeholders (e.g. highways) may be required during design.

Buried services were not detected on Site, however, the potential for live or abandoned services on Site cannot be discounted.

9 Conclusions and Recommendations

The Site is a vacant parcel of land currently overgrown with grass and trees in the south. The Site is located north of Cable Street within a largely residential area (predominantly apartments) with local amenities and commercial uses. The Docklands Light Railway is located to the north of the Site on a viaduct parallel to the site. The history indicates developments within the Site included residential / possibly commercial properties before a coal depot was recorded within the Site. Potential off-site sources have also been identified.

A preliminary site investigation was undertaken comprising two cable percussive boreholes to investigate ground conditions and to provide an indication of the levels of contaminants in the Site.

9.1 Design Considerations

Potential risks to human health, controlled waters and the built environment have been identified from on-Site Made Ground and hydrocarbons and vapours are possible risks to human health from the off-Site sources. Gross contamination was not encountered during the preliminary ground investigation, however, concentrations of contaminants (lead and asbestos) within the Made Ground were recorded in excess of applicable guideline values. The proposals for the Site are unknown and, therefore, a conservative assumption of residential housing with private gardens has been used for the assessment. A clean cover system may be required in gardens or areas of soft landscaping, subject to confirmation by additional testing of near-surface soil in these areas, once a design layout is known.

Further development-specific ground investigation will be required to confirm the requirements for (but not limited to):

- Confirm concrete design for sulphate resistance for foundations and services;
- Determine the extent and depth of buried obstructions within the Site;
- Further gas monitoring and assessment of the potential risk of ground gases to receptors, and to determine whether gas protection measures would be required for future development;
- Consideration of shrinkage and swelling, trees, potential for relict shear slip surfaces and buried services may need to be considered during the design; and
- UXO mitigation.

9.2 Construction Considerations

During construction, a watching brief should be undertaken to identify the presence of any unforeseen contamination. If contamination is encountered, all works should cease until the advice of a suitably qualified professional can be sought.

Construction / demolition workers should use appropriate PPE and follow the site-specific contractors risk assessment which should include risks to human health from potential contamination. Due to the historic phases of development and demolition (and identification of asbestos containing materials in the preliminary ground investigation) consideration should be given to the presence of asbestos within the Made Ground.

Good site management practices should be adopted during the construction phase such as covering stockpiles to minimise surface runoff/dust creation.

The western part of the Site is classified as ‘moderate’ potential of encountering unexploded ordnance (UXO) and UXO mitigation will be required where excavations or piling / boreholes are proposed. The remainder of the site is classified as low risk. Further detailed information is presented in Appendix C.

Material re-used on-site would need to be assessed in terms of its chemical and geotechnical suitability for reuse as engineering or landscaping fill. If off-site disposal is required, a waste assessment for the Made Ground and shallow soil materials would need to be undertaken to determine whether they are classified as hazardous or non-hazardous waste. Based on a preliminary assessment, Made Ground associated with the structures in the west of the Site may be hazardous due to elevated lead concentrations, and other Made Ground material may be hazardous depending on the quantity of asbestos present.

10 References

1. British Geological Survey (BGS) Online Viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html
2. Environment Agency (EA) What's in your backyard website http://maps.environment-agency.gov.uk/wiyby/
3. Zetica Regional Unexploded Ordnance (UXO) Map
4. The Bomb Sight Project http://bombsight.org/
5. BRE (2005) Special Digest 1 -- Concrete in aggressive ground
6. LQM / CIEH LQM / CIEH (2015) The LQM / CIEH S4ULs for Human Health Risk Assessment

   "Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3223. All rights reserved"
7. CIRIA C665. (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings
8. NHBC (2007) Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Report Edition No.: 04, March 2007
9. NHBC (2017) NHBC Standards 2017 Chapter 4.2 Building Near Trees, HB2894 01/16

APPENDIX A

Historical Maps

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: 1056 Scale Town Plan

Map date: **1873-1875**

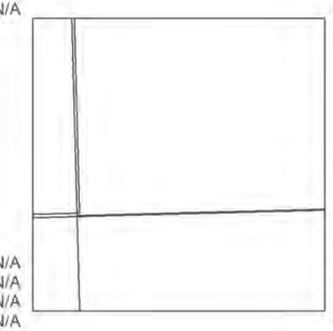
Scale: 1:1,056

Printed at: 1:1,056

N
W E
S

Surveyed 1873
Revised N/A
Edition 1875
Copyright N/A
Levelled N/A

Surveyed 1873
Revised N/A
Edition 1875
Copyright N/A
Levelled N/A



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: 1056 Scale Town Plan

Map date: **1875**

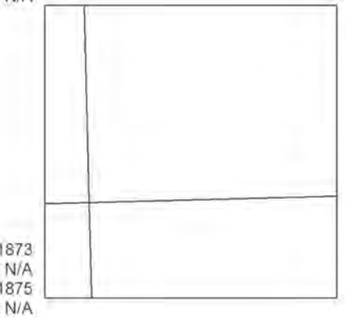
Scale: 1:1,056

Printed at: 1:1,056

N
W E
S

Surveyed 1873
Revised N/A
Edition 1875
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1875
Levelled N/A



Surveyed 1873
Revised N/A
Edition 1875
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: County Series

Map date: **1880**

Scale: 1:2,500

Printed at: 1:2,500

N W E S

Surveyed 1873
Revised N/A
Edition 1880
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

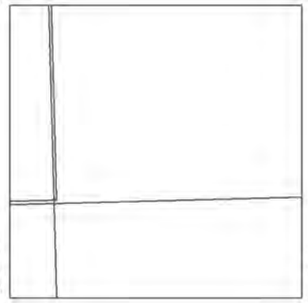
Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: 1056 Scale Town Plan
Map date: **1896**
Scale: 1:1,056
Printed at: 1:1,056

N
W E
S

Surveyed 1894
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A



Surveyed 1894
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A

Surveyed 1894
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A

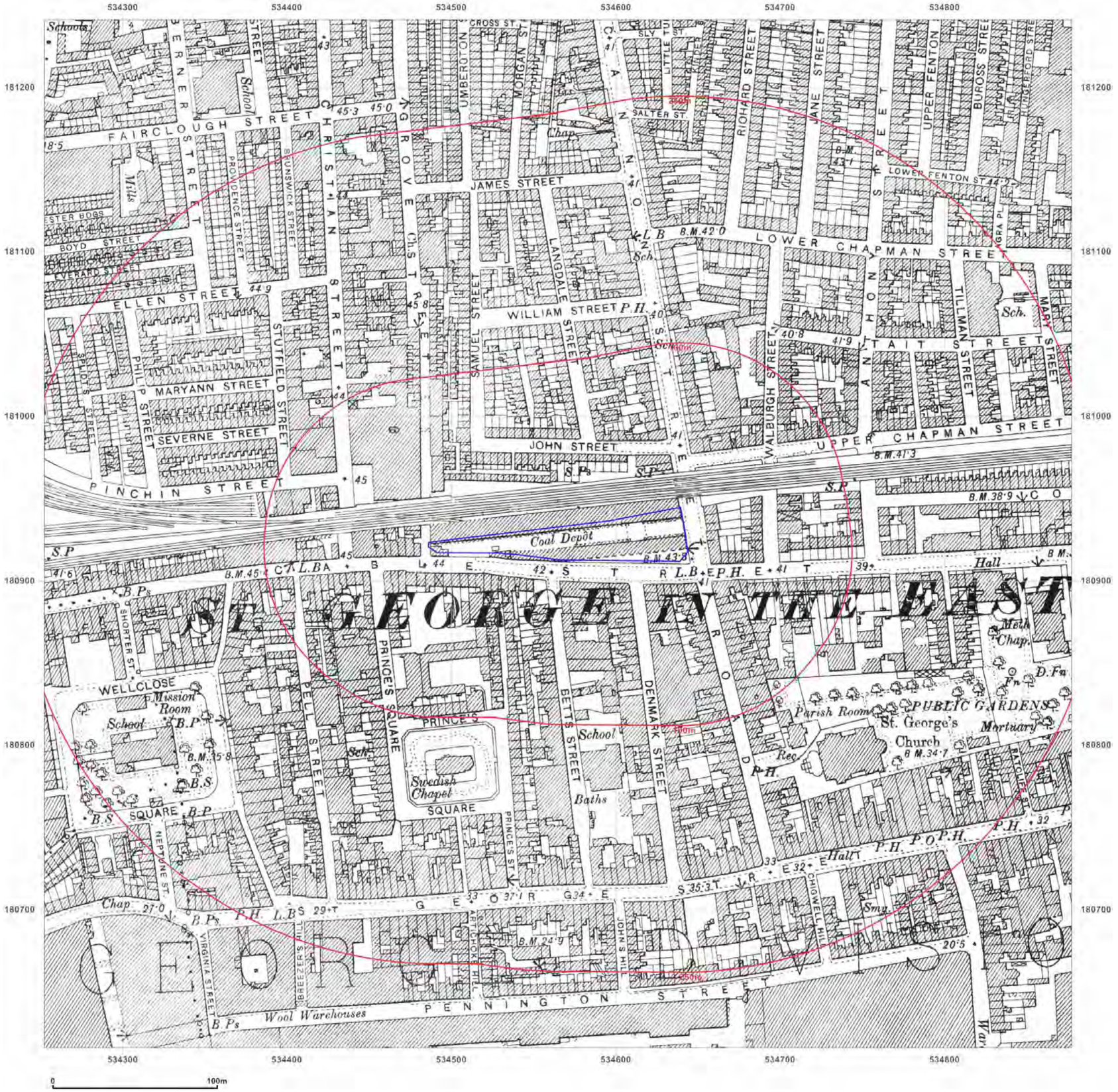
Surveyed 1894
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: County Series

Map date: **1896**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed 1896
Revised 1896
Edition N/A
Copyright N/A
Levelled N/A

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: County Series

Map date: **1916**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

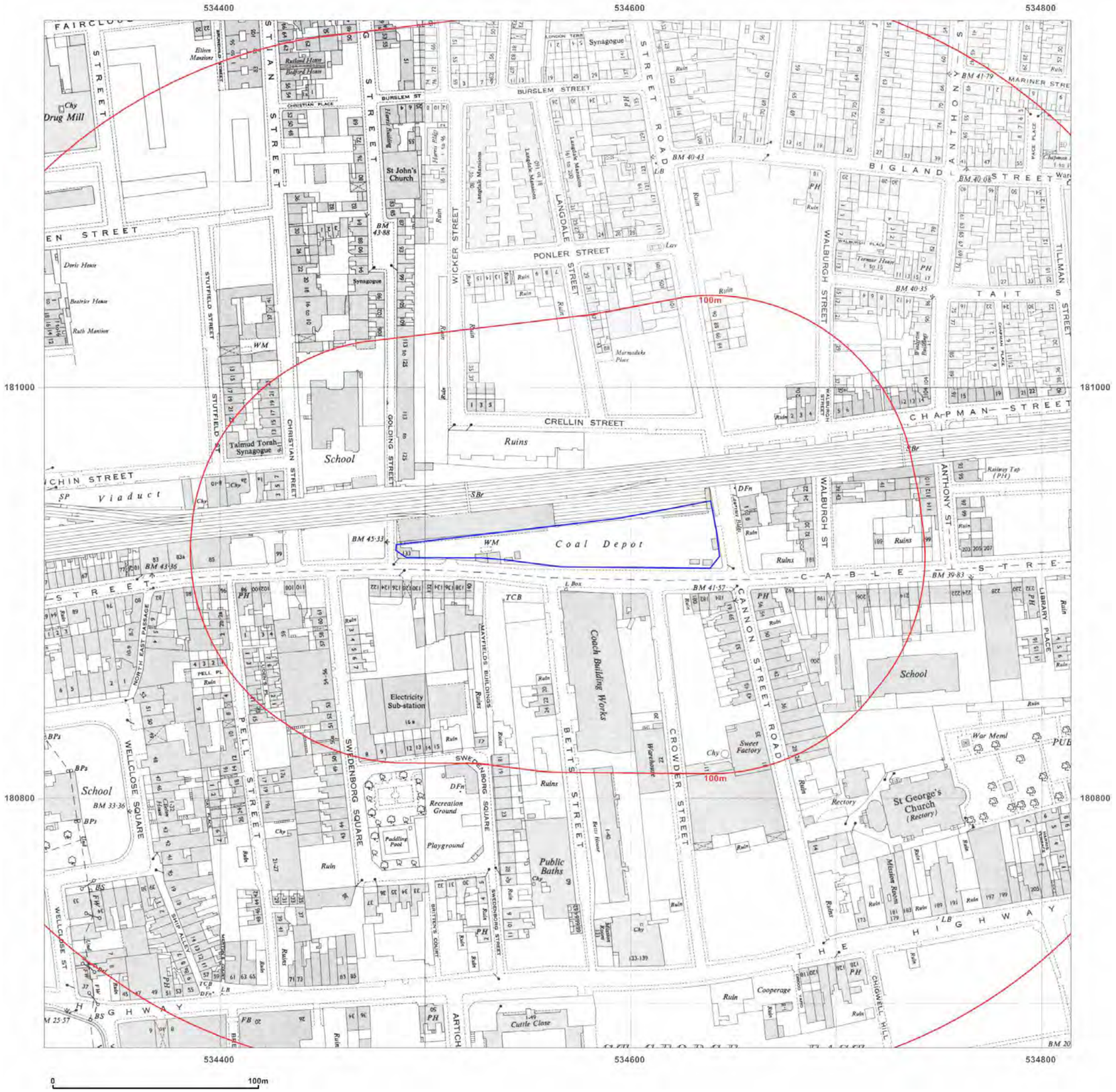
Surveyed 1916
Revised 1916
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1948**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934

Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934

Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934

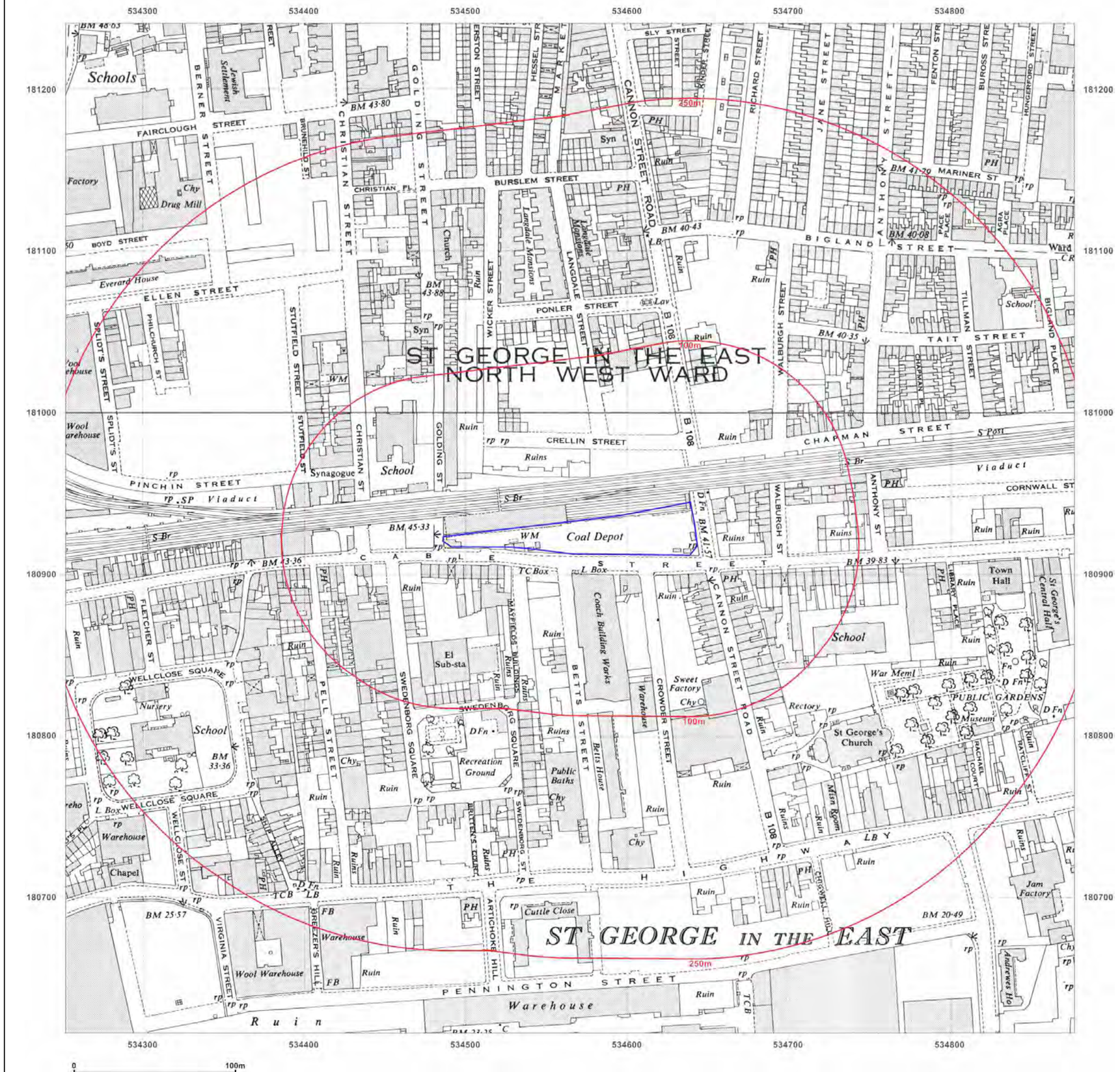
Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

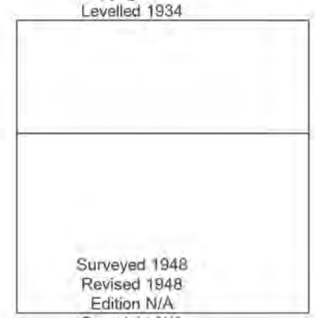
Map date: **1948**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934



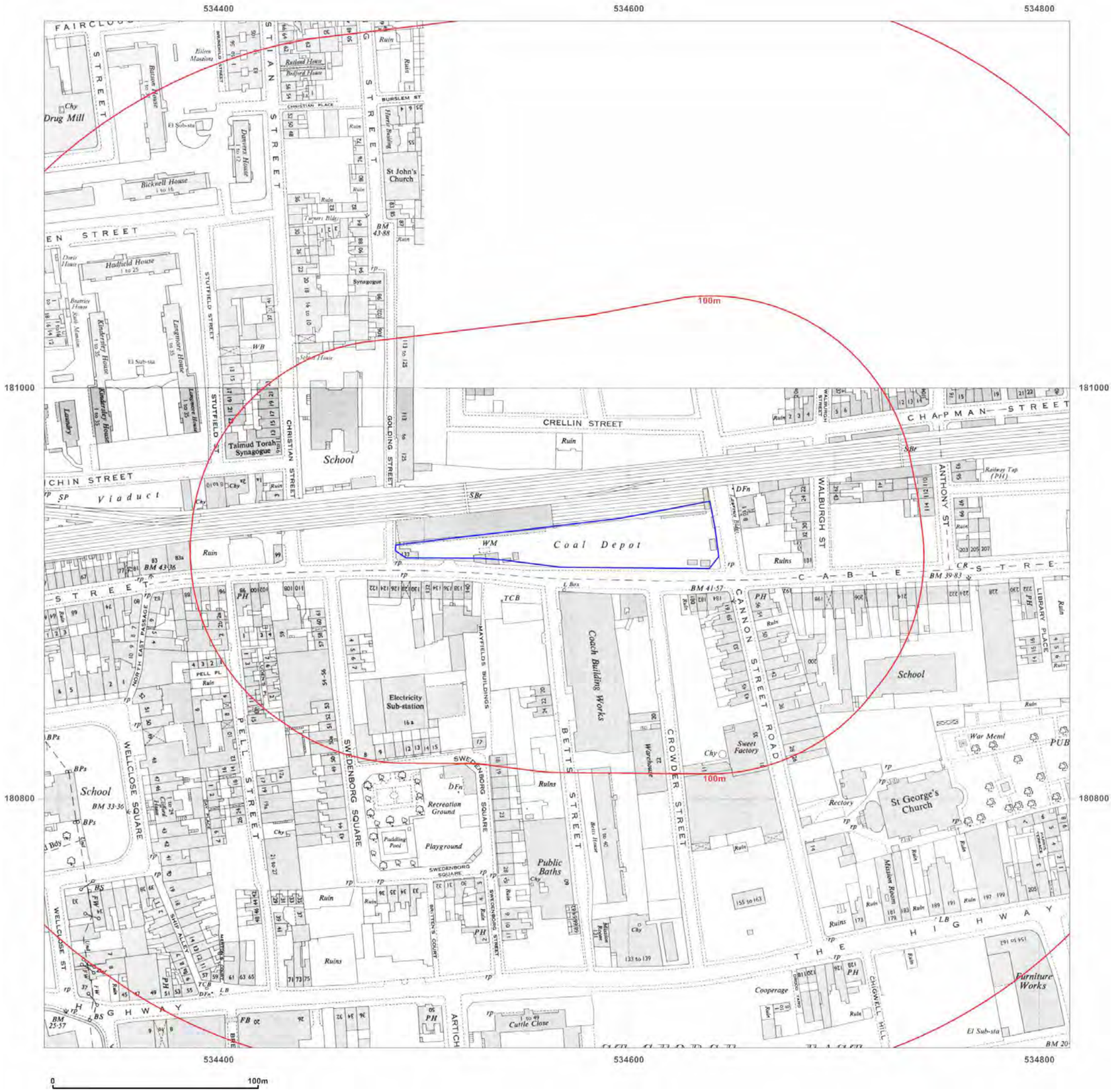
Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled 1934

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

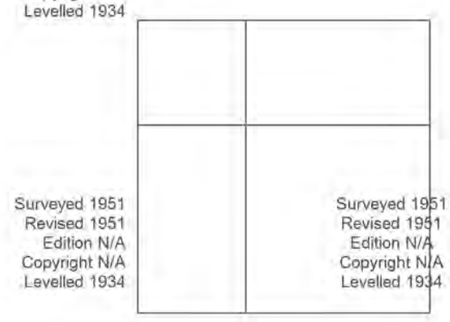
Map date: **1951**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1951
Revised 1951
Edition N/A
Copyright N/A
Levelled 1934



Surveyed 1951
Revised 1951
Edition N/A
Copyright N/A
Levelled 1934

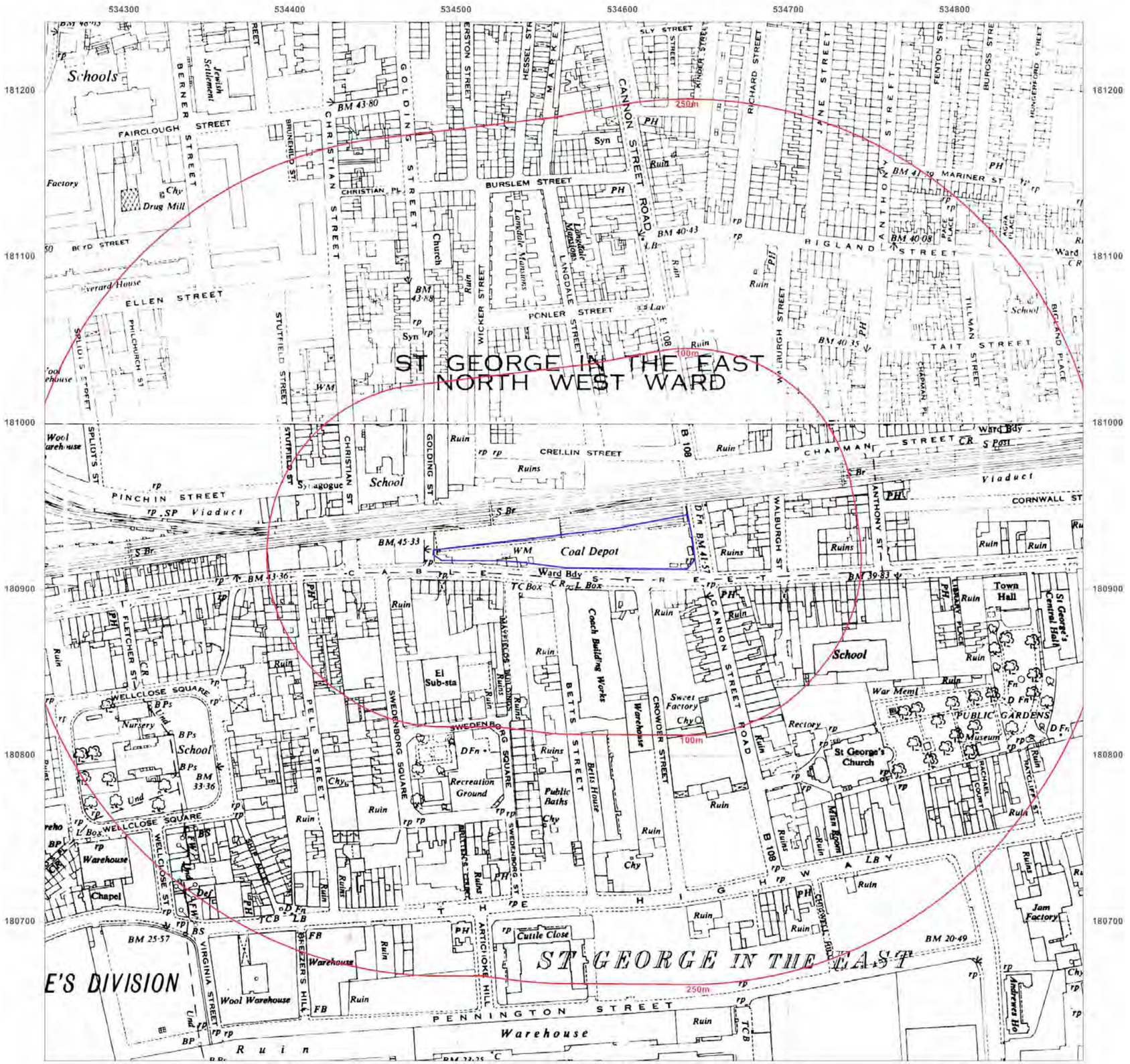
Surveyed 1951
Revised 1951
Edition N/A
Copyright N/A
Levelled 1934

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1951**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition 1951
Copyright N/A
Levelled 1934

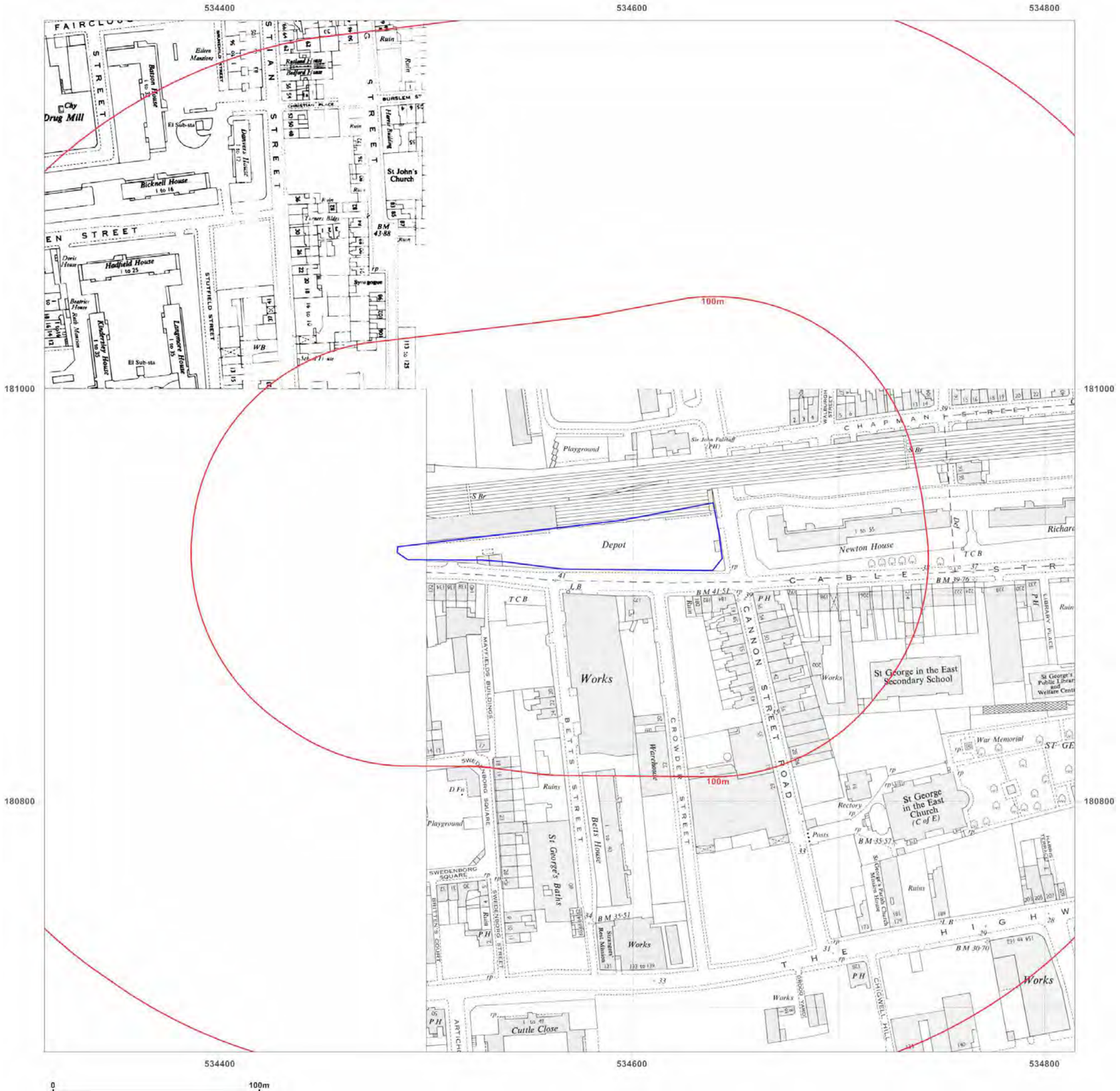
Surveyed N/A
Revised N/A
Edition N/A
Copyright 1951
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

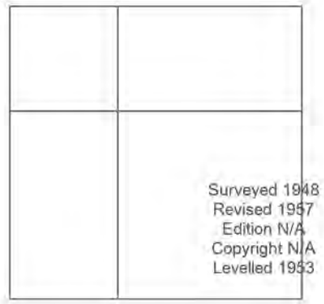
Map date: **1952-1957**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised 1951
Edition 1952
Copyright N/A
Levelled 1934

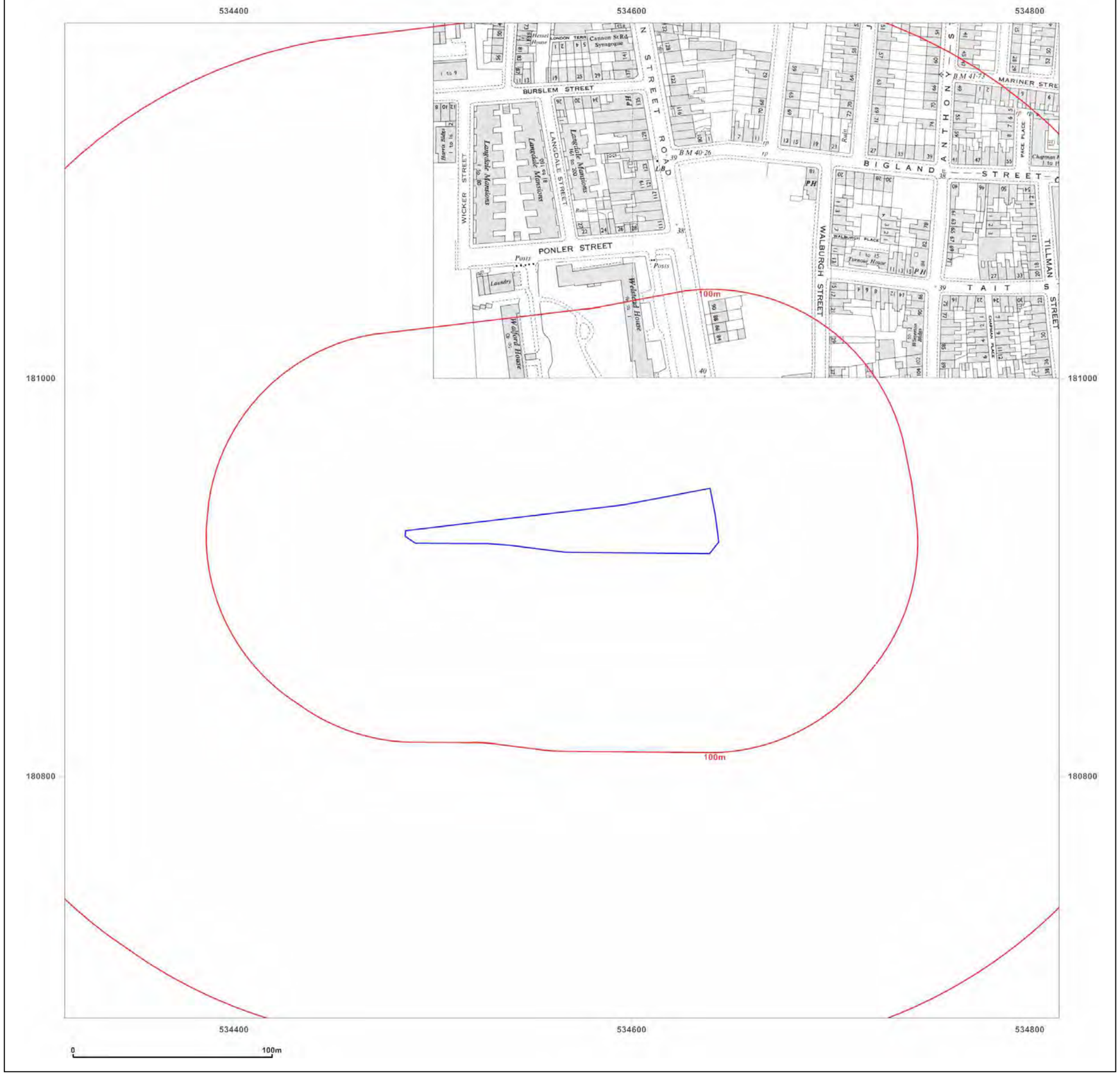


Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1958**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1958-1963**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1948
Revised 1961
Edition N/A
Copyright 1962
Levelled 1954

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1948
Revised 1963
Edition N/A
Copyright 1963
Levelled 1953

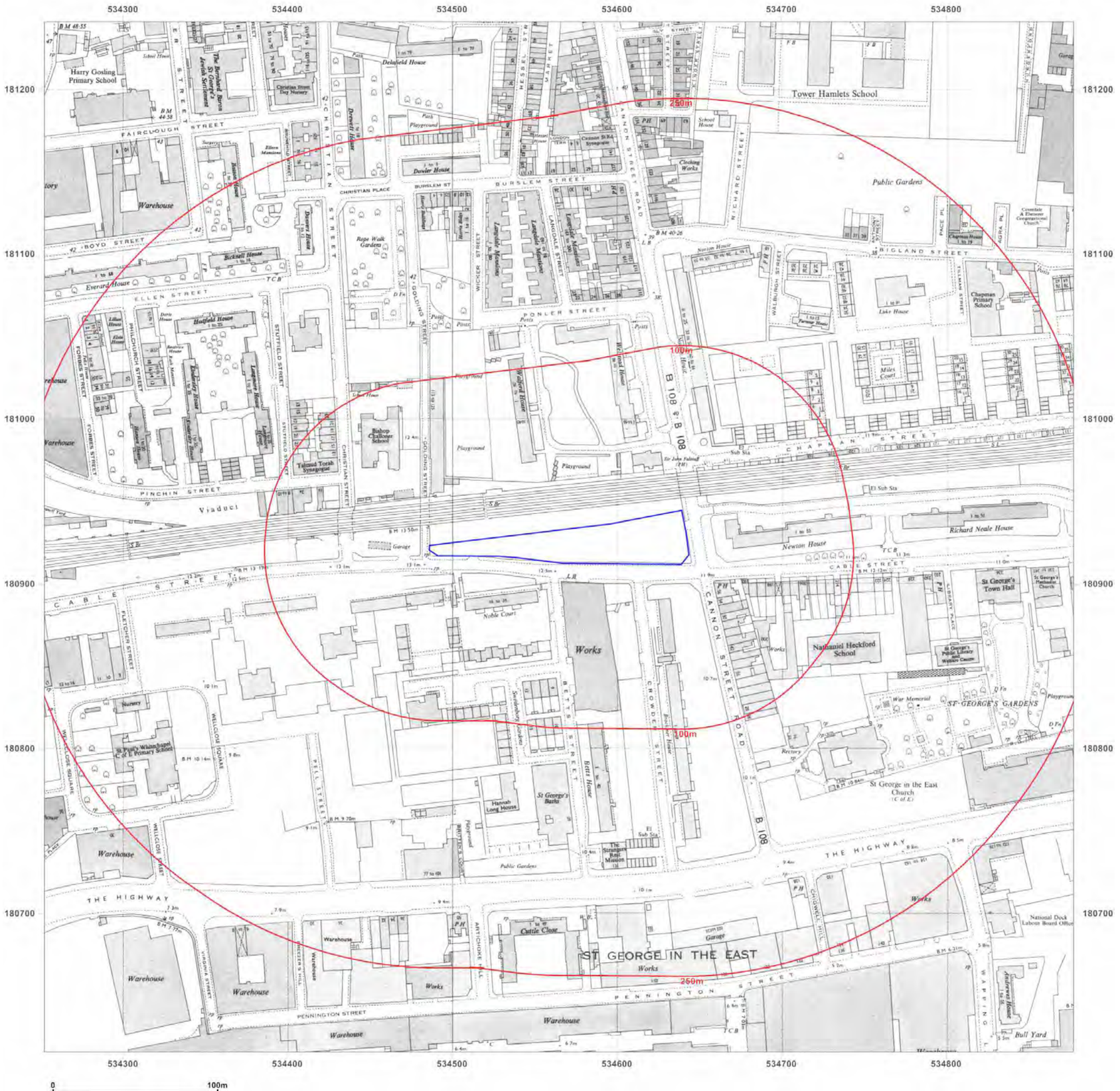
Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1965-1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed 1965
Revised 1965
Edition N/A
Copyright 1968
Levelled 1956

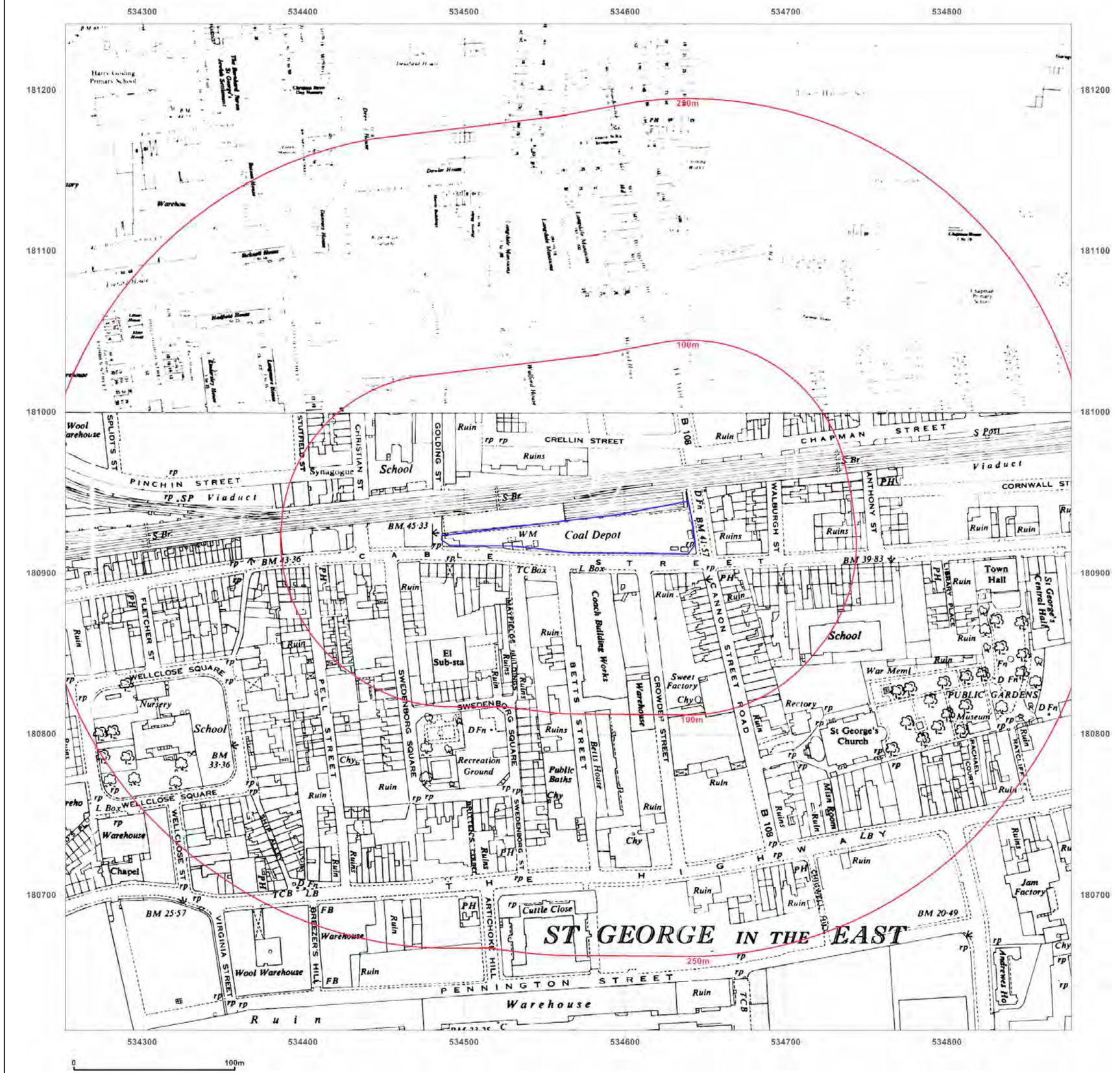
Surveyed 1949
Revised 1970
Edition N/A
Copyright 1971
Levelled 1953

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1965-1968**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

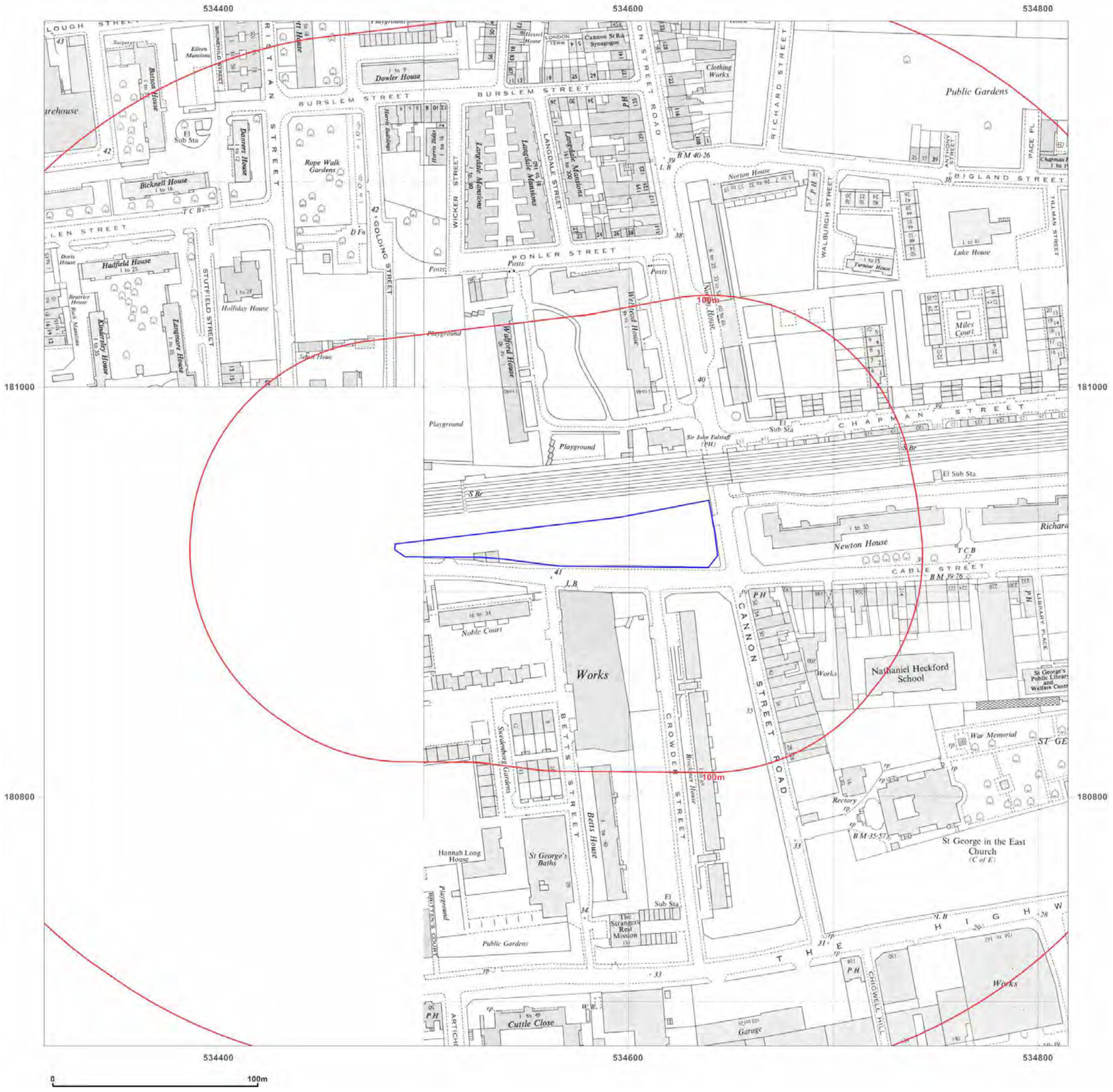
Surveyed N/A
Revised 1965
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1966-1969**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1968
Revised 1968
Edition N/A
Copyright 1969
Levelled 1956

Surveyed 1965
Revised 1965
Edition N/A
Copyright 1966
Levelled 1956

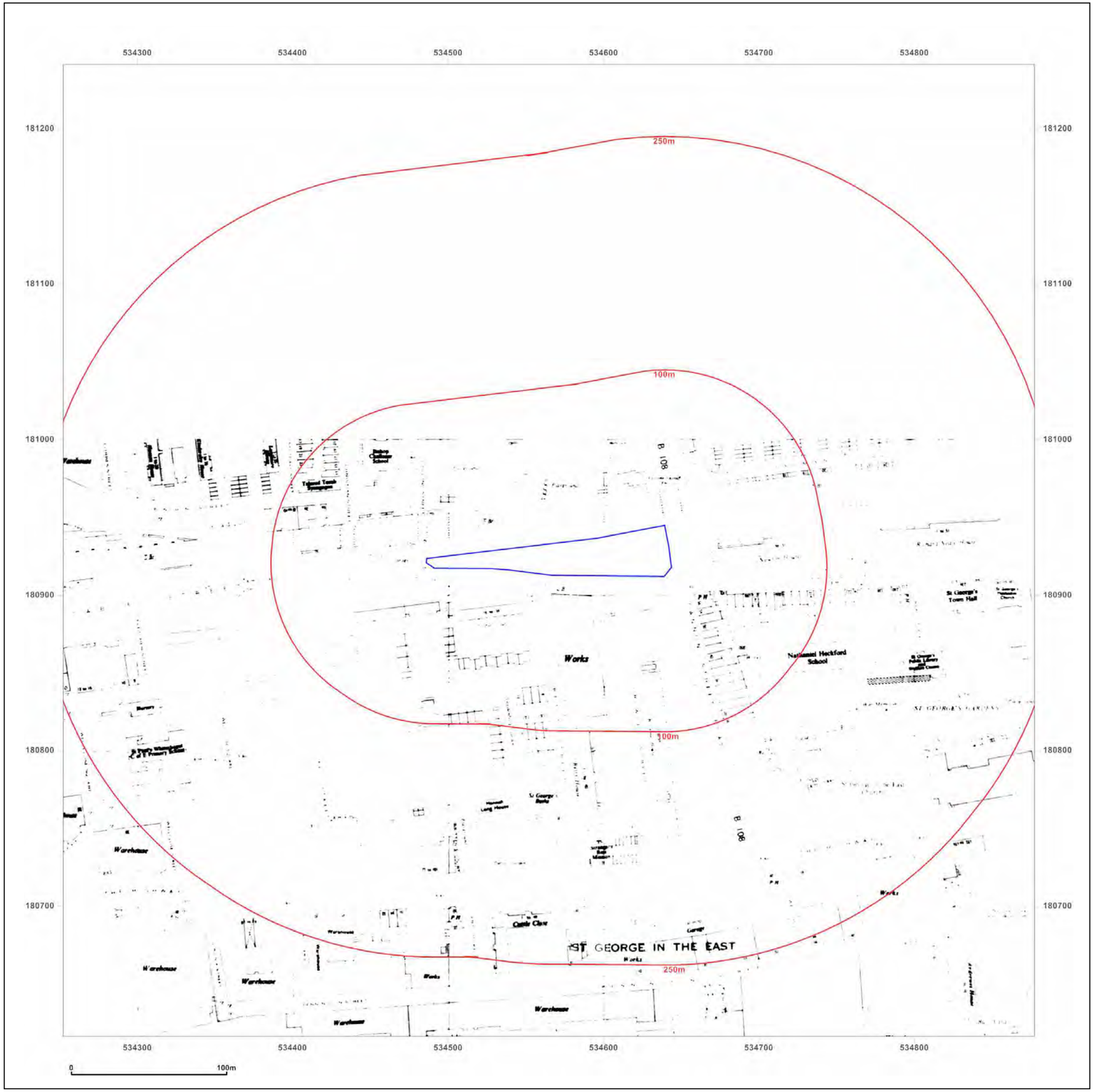
Surveyed 1948
Revised 1967
Edition N/A
Copyright 1968
Levelled 1953

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1971**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

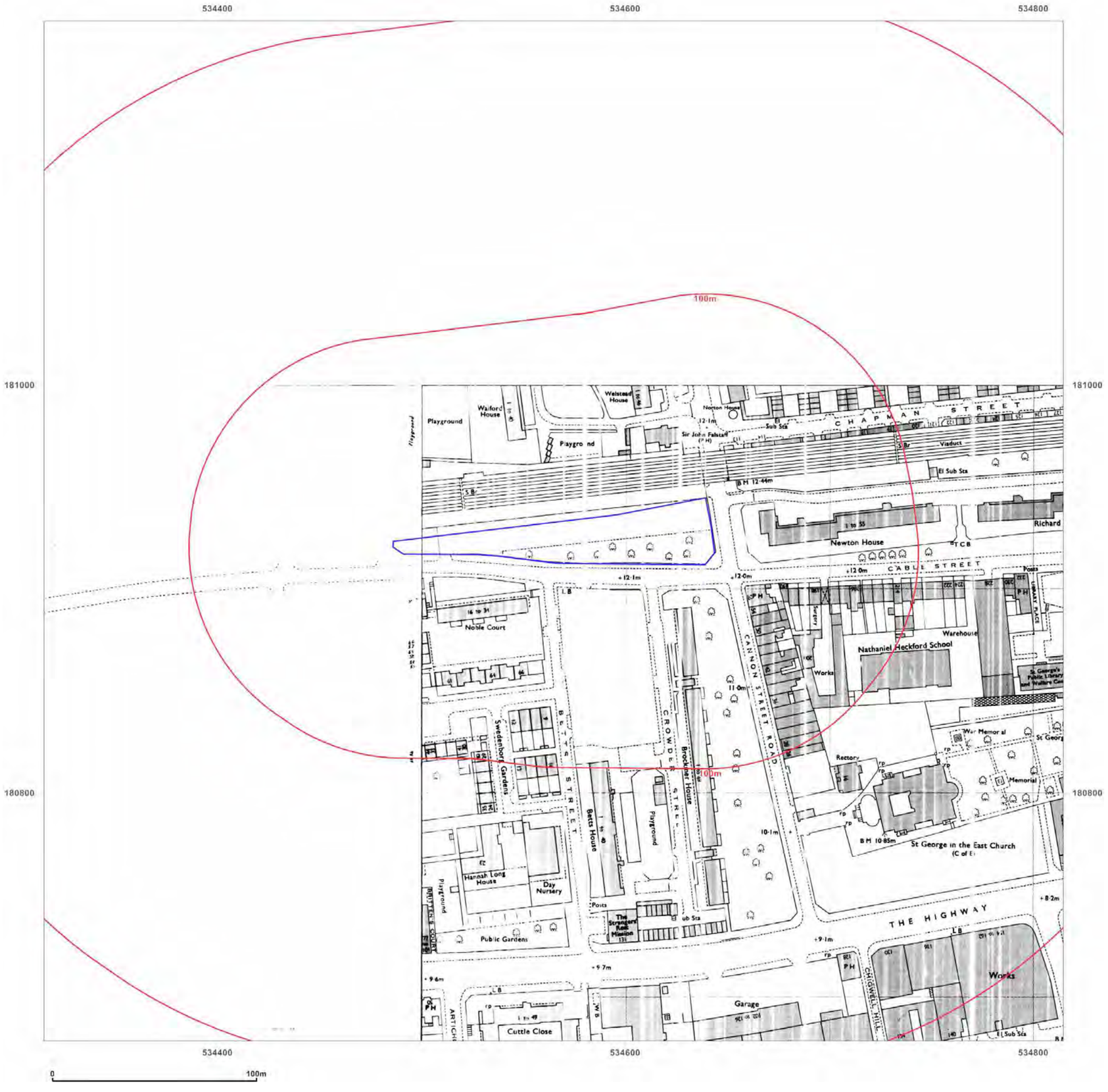
Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

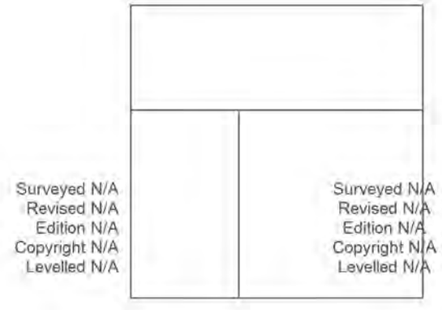
Map Name: National Grid

Map date: **1974**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S



Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1973-1978**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1978
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1976
Levelled N/A

Surveyed 1948
Revised 1972
Edition N/A
Copyright 1973
Levelled 1953

Surveyed 1948
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1976-1981**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1981
Levelled 1977

Surveyed 1981
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1976
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1982**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised 1981
Edition N/A
Copyright 1982
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1972

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1972

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1972

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1987-1990**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

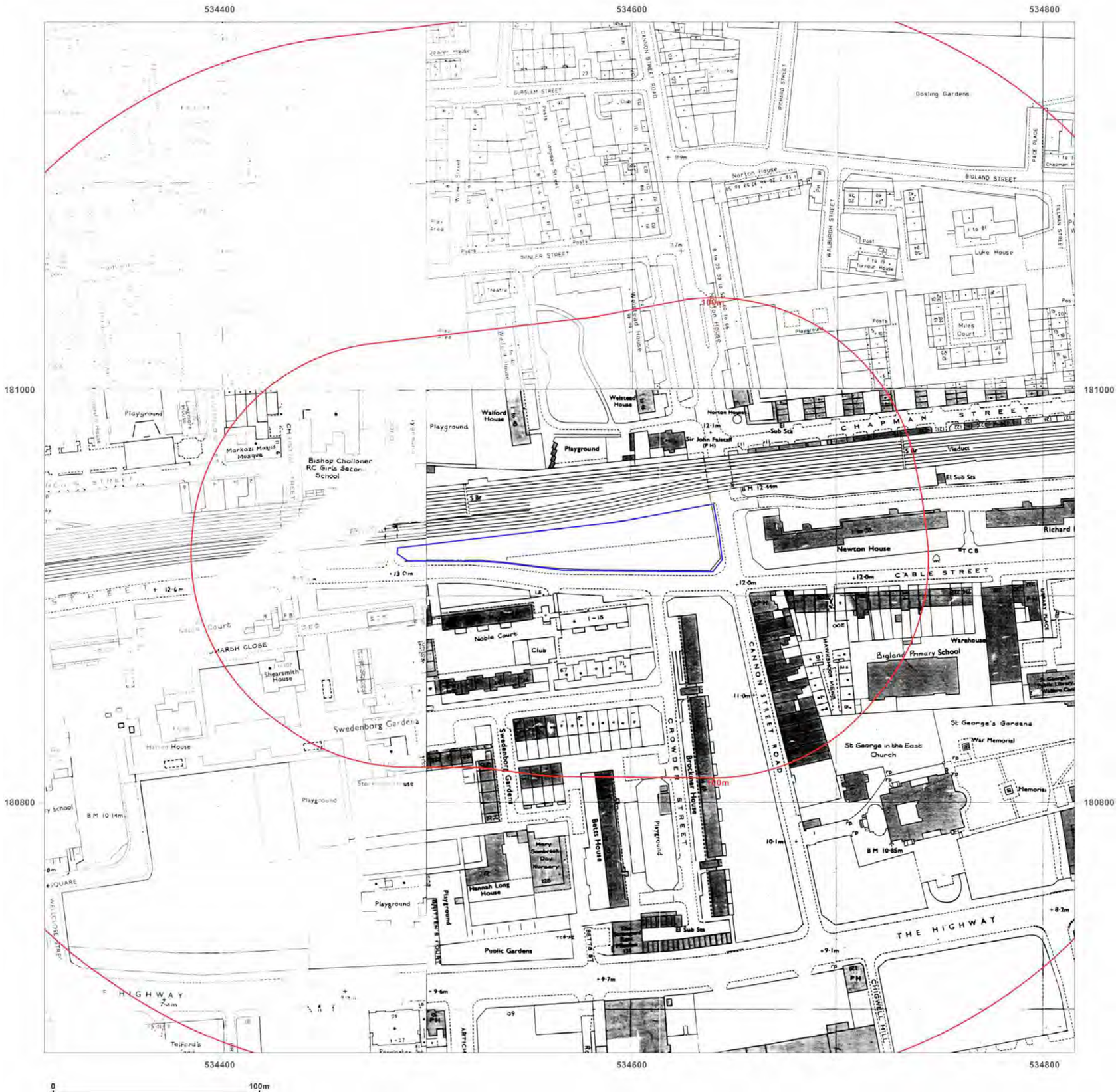
Surveyed 1970 Revised 1990 Edition N/A Copyright 1990 Levelled 1970	Surveyed 1972 Revised 1987 Edition N/A Copyright 1987 Levelled 1972
Surveyed 1972 Revised 1989 Edition N/A Copyright 1989 Levelled 1972	Surveyed N/A Revised N/A Edition N/A Copyright 1989 Levelled 1972

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1989-1991**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1989
Levelled 1972

Surveyed 1972
Revised 1989
Edition N/A
Copyright 1989
Levelled 1972

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1991
Revised 1991
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

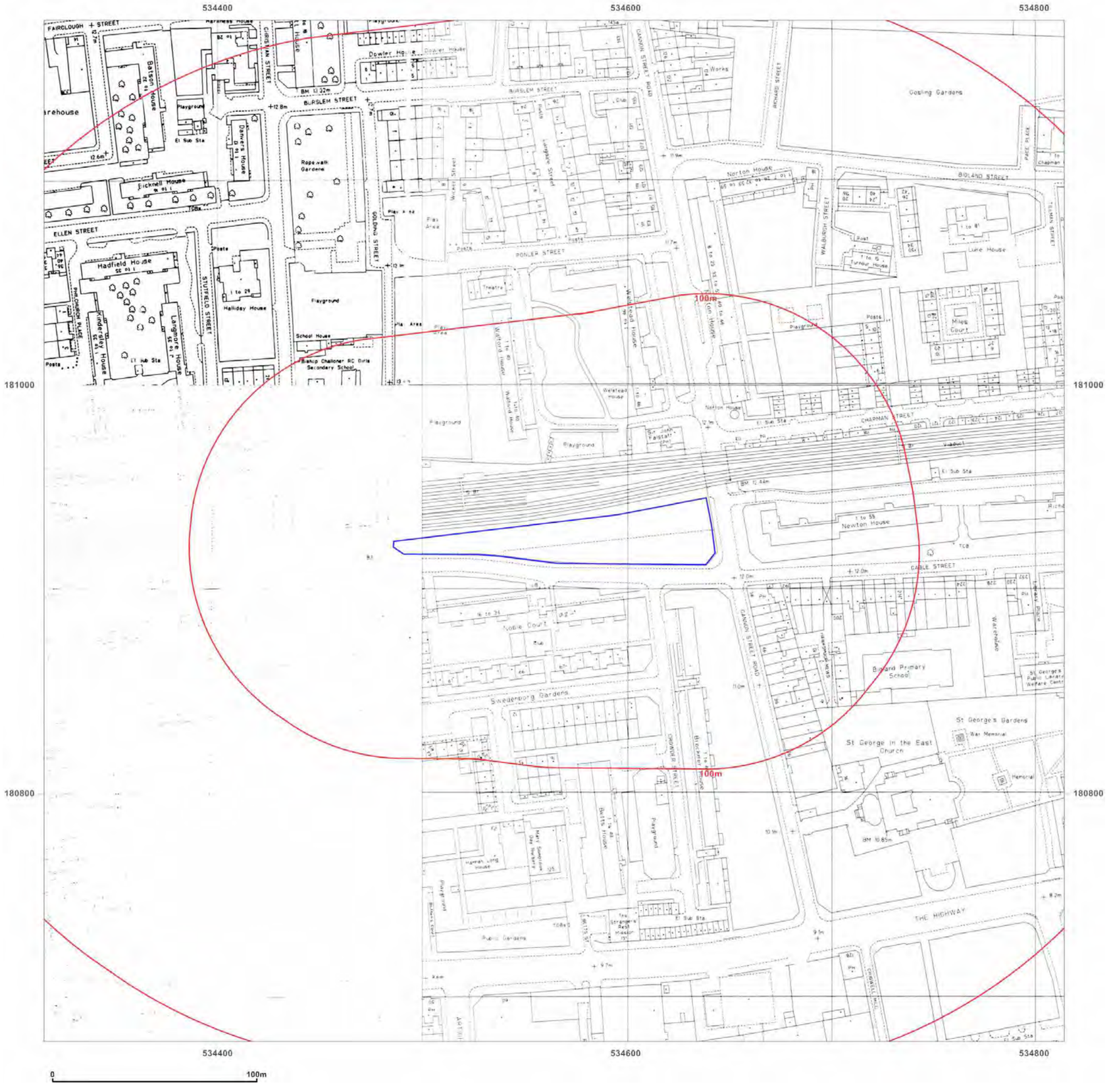
Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1991-1992**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1991
Revised 1991
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1991
Levelled N/A

Surveyed 1991
Revised 1991
Edition N/A
Copyright 1991
Levelled N/A

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1991-1992**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1991
Revised 1991
Edition N/A
Copyright 1991
Levelled N/A

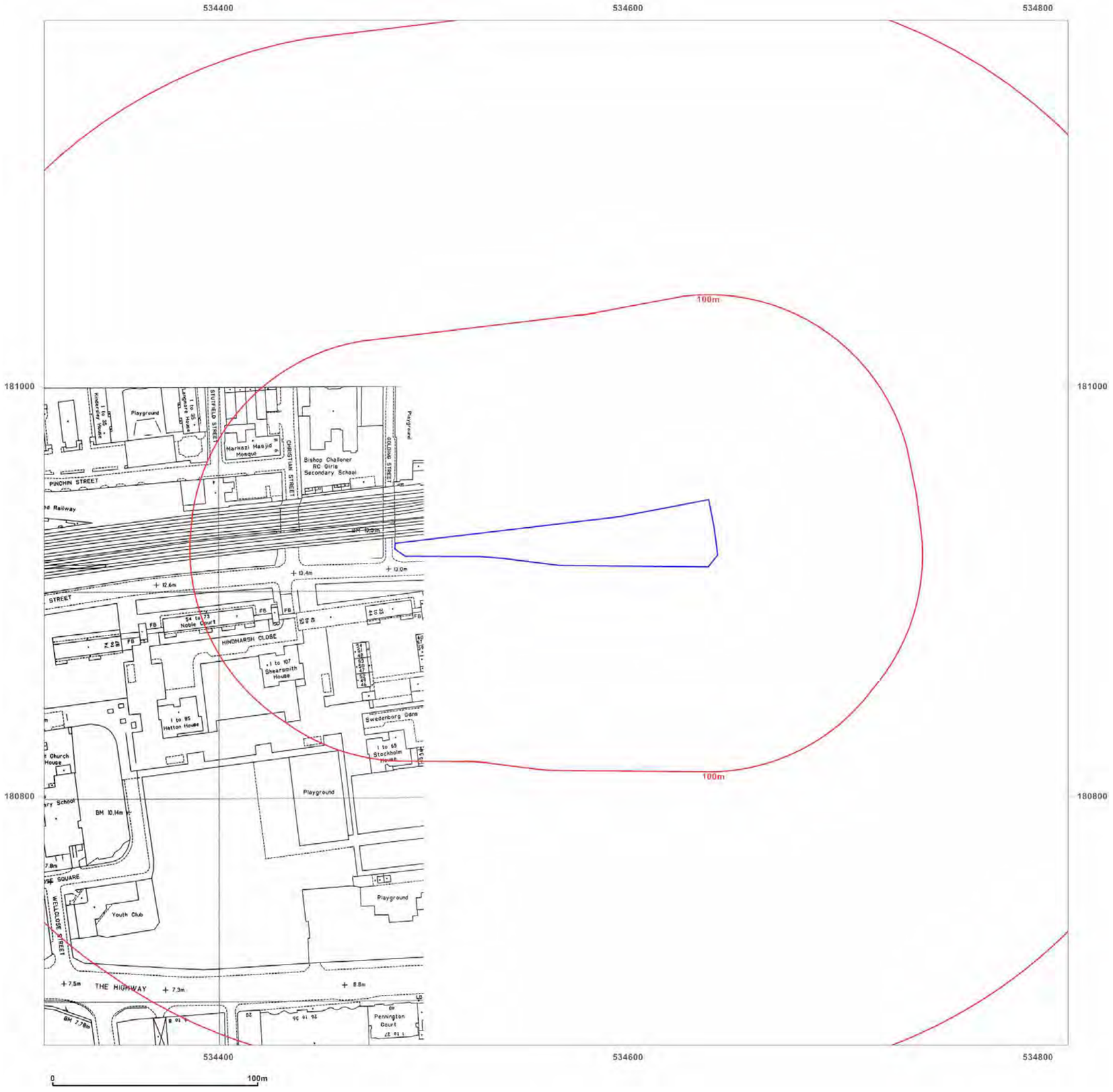
Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1992**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1991-1994**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1994
Levelled N/A

Surveyed 1991
Revised 1991
Edition N/A
Copyright 1991
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1992-1994**

Scale: 1:1,250

Printed at: 1:2,000

N
W E
S

Surveyed 1994
Revised 1994
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

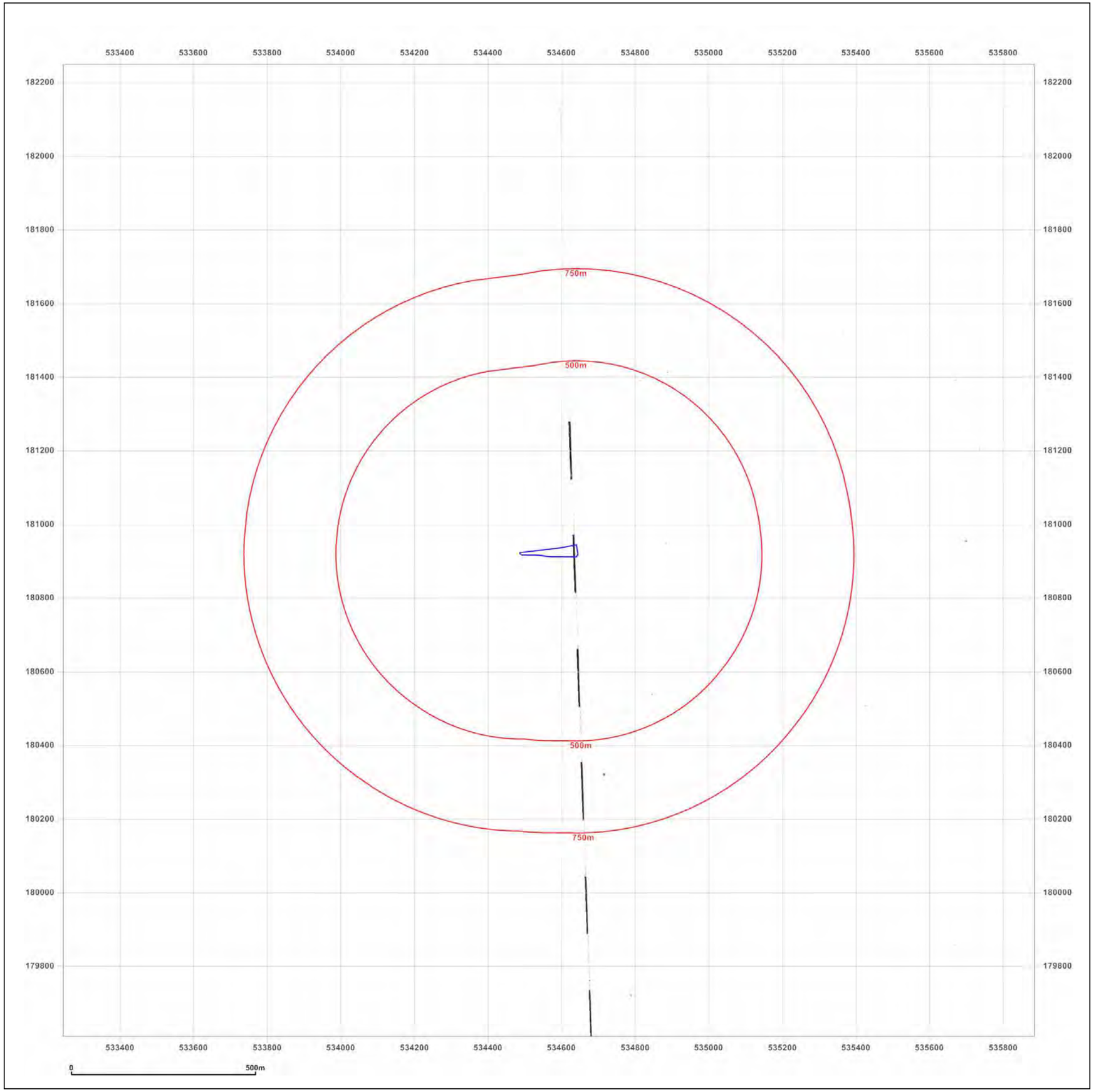
Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

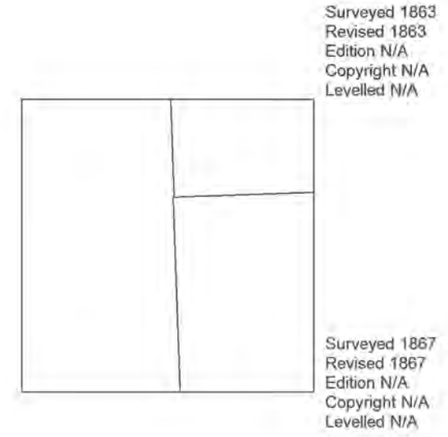
Map Name: County Series

Map date: **1863-1867**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

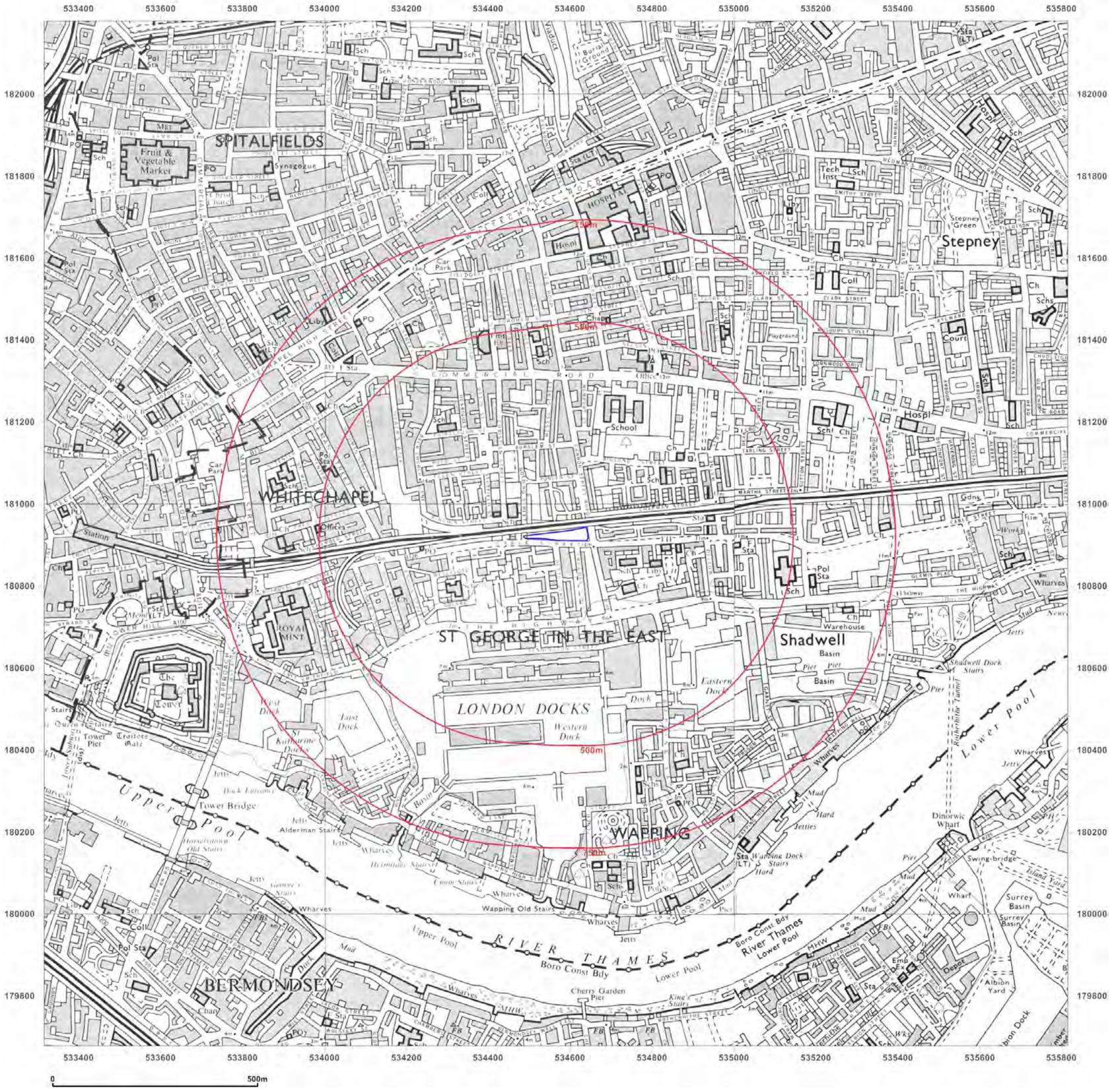


Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1971-1973**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1971
Revised 1971
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1973
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1973
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

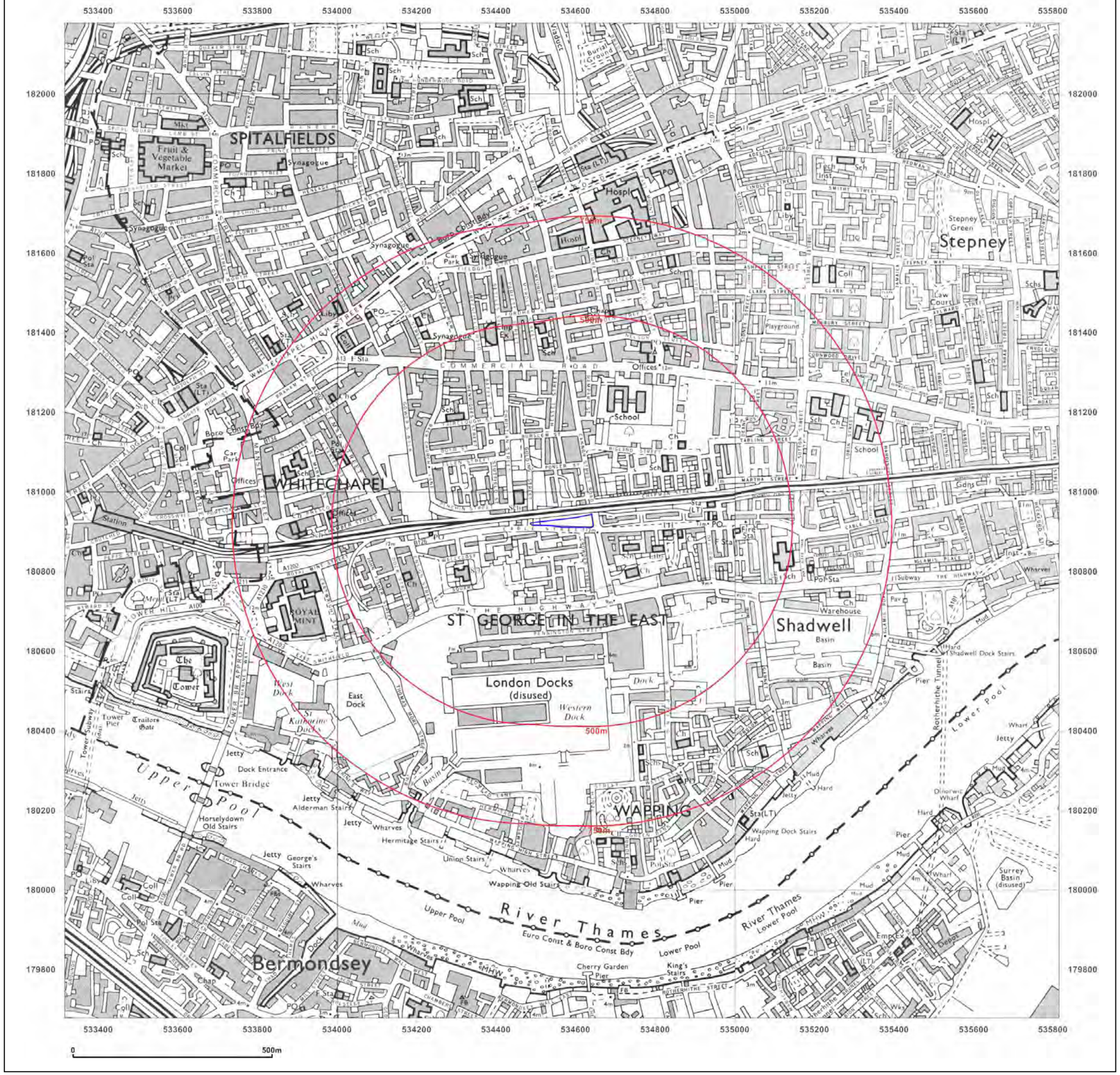
Surveyed 1972
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1976-1981**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1974
Revised 1976
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1981
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1978
Revised 1979
Edition N/A
Copyright N/A
Levelled N/A

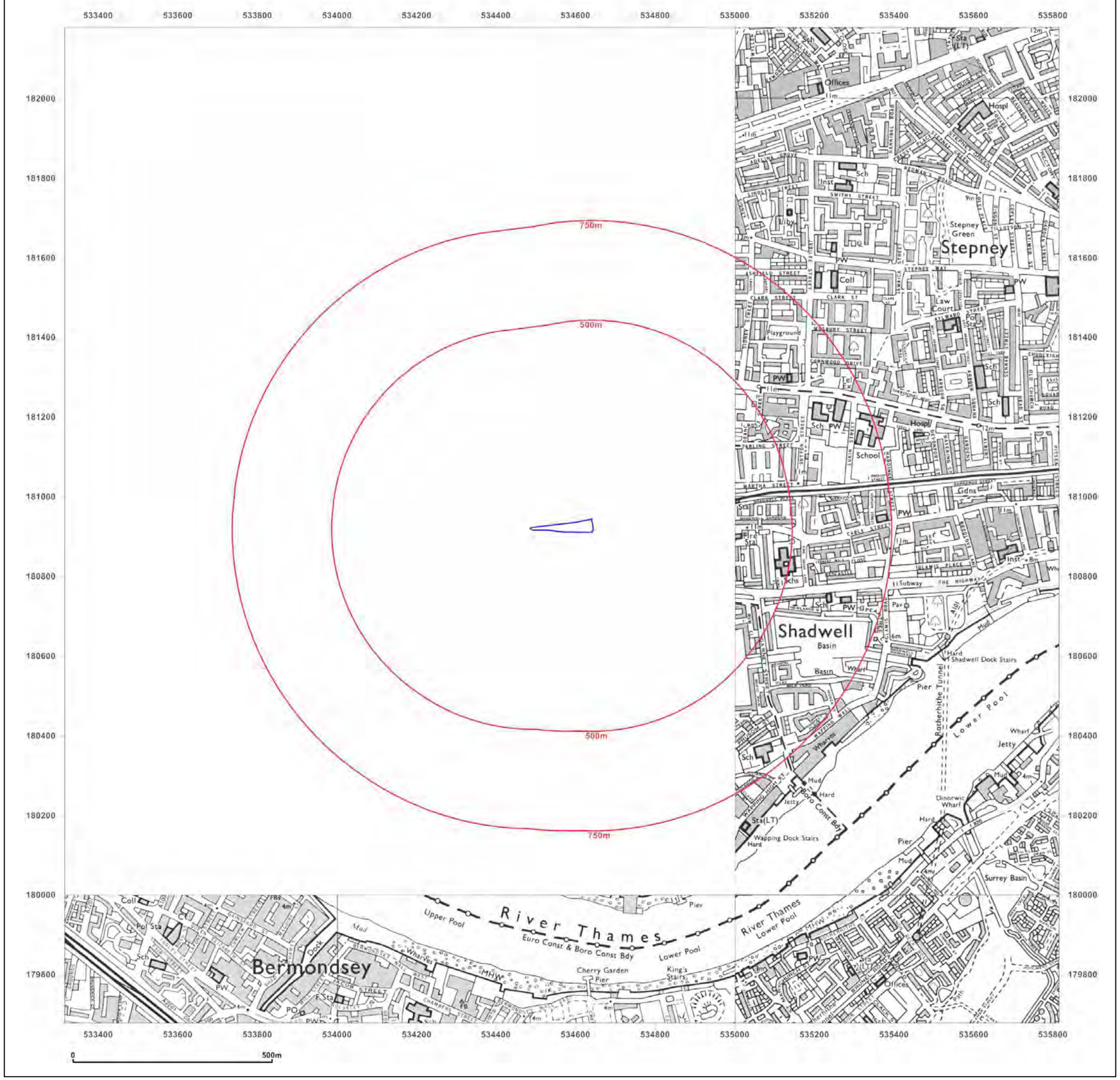
Surveyed 1978
Revised 1979
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1987-1989**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1988
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1986
Revised 1987
Edition N/A
Copyright N/A
Levelled N/A

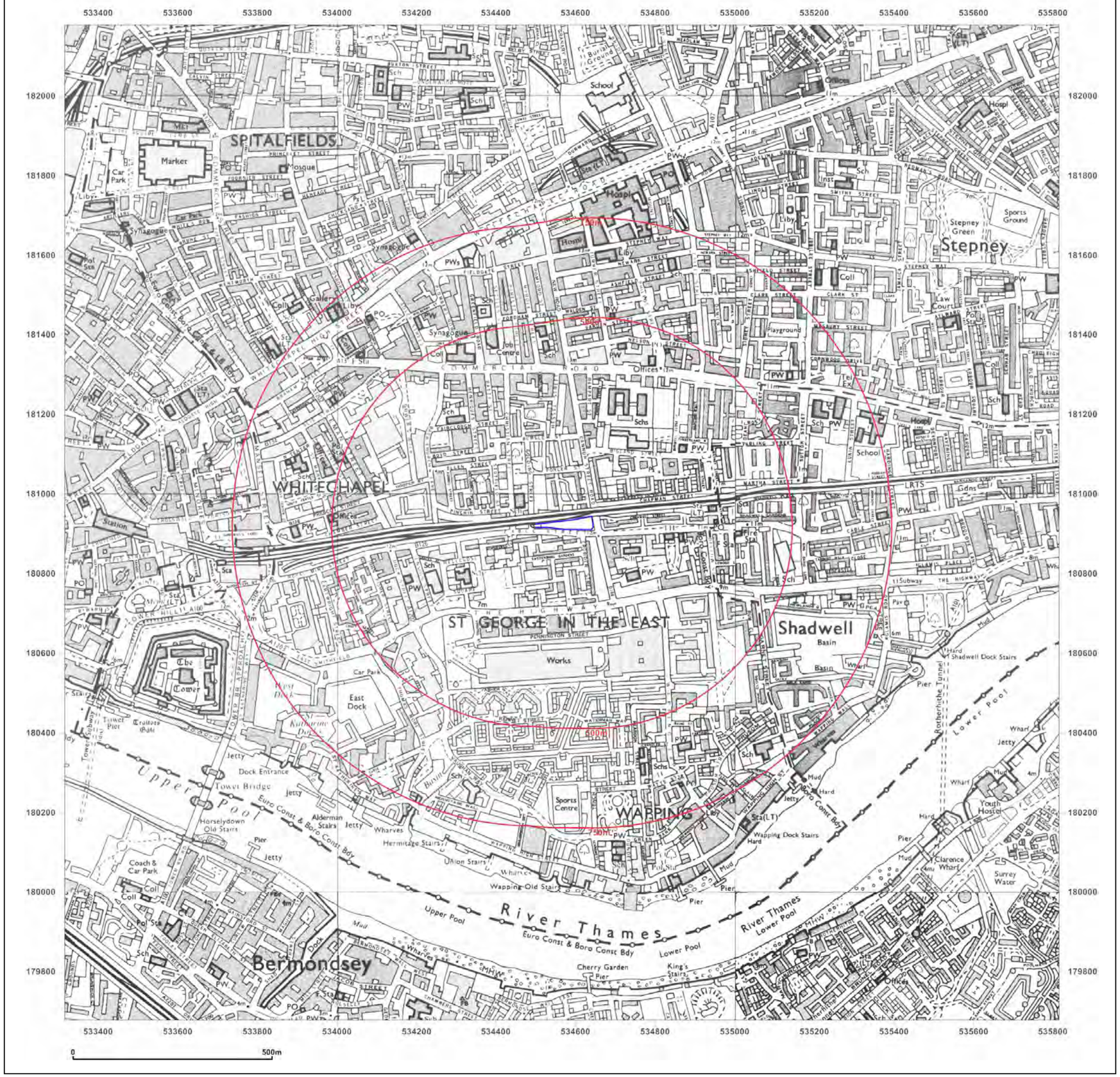
Surveyed 1988
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

Land to the North Side of Royal Mint Street / Cable Street

Client Ref: PO0067007-1
Report Ref: GS-4021732
Grid Ref: 534565, 180929

Map Name: National Grid

Map date: **1993-1994**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1984
Revised 1994
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1988
Revised 1994
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1986
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1988
Revised 1994
Edition N/A
Copyright N/A
Levelled N/A

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 27 June 2017

To view map legend click here *Legend*

APPENDIX B

Environmental Data Sheets

Arcadis

Arcadis,10, MEDAWAR ROAD,
GUILDFORD, GU2 7AR

Groundsure Reference:	GS-4021730
Your Reference:	PO0067007-1
Report Date	27 Jun 2017
Report Delivery Method:	Email - pdf

Enviro Insight

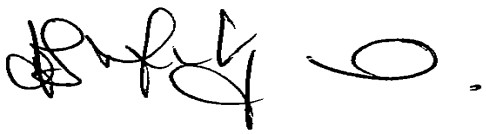
Address: Land to the North Side of Royal Mint Street / Cable Street,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Enviro Insight

Address:	**Land to the North Side of Royal Mint Street / Cable Street,**
Date:	**27 Jun 2017**
Reference:	**GS-4021730**
Client:	**Arcadis**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	07-Jun-2015
Grid Reference:	534598,180924
Site Size:	0.29ha

Report Reference: GS-4021730
Client Reference: PO0067007-1

Contents Page

Contents Page 3
Overview of Findings 6
Using this report 10
1. Historical Land Use 11
1. Historical Industrial Sites 12
1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping....12
1.2 Additional Information – Historical Tank Database....15
1.3 Additional Information – Historical Energy Features Database....17
1.4 Additional Information – Historical Petrol and Fuel Site Database....21
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database....21
1.6 Potentially Infilled Land....23
2. Environmental Permits, Incidents and Registers Map 25
2. Environmental Permits, Incidents and Registers 26
2.1 Industrial Sites Holding Licences and/or Authorisations....26
2.1.1 Records of historic IPC Authorisations within 500m of the study site:....26
2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:....26
2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:....26
2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:....26
2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:....26
2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: 27
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:....28
2.1.8 Records of Licensed Discharge Consents within 500m of the study site:....28
2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: 28
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:....28
2.2 Dangerous or Hazardous Sites....28
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents....29
2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:....29
2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:....29
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990....29
3. Landfill and Other Waste Sites Map 30
3. Landfill and Other Waste Sites 31
3.1 Landfill Sites....31
3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site: 31
3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site: 31
3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:....32
3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:....32
3.2 Other Waste Sites....32
3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site: 32
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site: 33
4. Current Land Use Map 34
4. Current Land Uses 35
4.1 Current Industrial Data....35
4.2 Petrol and Fuel Sites....37
4.3 National Grid High Voltage Underground Electricity Transmission Cables....37
4.4 National Grid High Pressure Gas Transmission Pipelines....38

5. Geology 39
5.1 Artificial Ground and Made Ground 39
5.2 Superficial Ground and Drift Geology 39
5.3 Bedrock and Solid Geology 39
6 Hydrogeology and Hydrology 40
6a. Aquifer Within Superficial Geology 40
6b. Aquifer Within Bedrock Geology and Abstraction Licenses 41
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses 42
6d. Hydrogeology – Source Protection Zones within confined aquifer 43
6e. Hydrology – Detailed River Network and River Quality 44
6.Hydrogeology and Hydrology 45
6.1 Aquifer within Superficial Deposits 45
6.2 Aquifer within Bedrock Deposits 45
6.3 Groundwater Abstraction Licences 46
6.4 Surface Water Abstraction Licences 61
6.5 Potable Water Abstraction Licences 61
6.6 Source Protection Zones 71
6.7 Source Protection Zones within Confined Aquifer 71
6.8 Groundwater Vulnerability and Soil Leaching Potential 71
6.9 River Quality 71
6.9.1 Biological Quality: 71
6.9.2 Chemical Quality: 72
6.10 Detailed River Network 72
6.11 Surface Water Features 72
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea) 73
7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map 74
7 Flooding 75
7.1 River and Coastal Zone 2 Flooding 75
7.2 River and Coastal Zone 3 Flooding 75
7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating 75
7.4 Flood Defences 75
7.5 Areas benefiting from Flood Defences 75
7.6 Areas benefiting from Flood Storage 76
7.7 Groundwater Flooding Susceptibility Areas 76
7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? No 76
7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions? 76
7.8 Groundwater Flooding Confidence Areas 76
8. Designated Environmentally Sensitive Sites Map 77
8. Designated Environmentally Sensitive Sites 78
8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site: 78
8.2 Records of National Nature Reserves (NNR) within 2000m of the study site: 78
8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site: 78
8.4 Records of Special Protection Areas (SPA) within 2000m of the study site: 78
8.5 Records of Ramsar sites within 2000m of the study site: 78
8.6 Records of Ancient Woodland within 2000m of the study site: 79
8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site: 79
8.8 Records of World Heritage Sites within 2000m of the study site: 79
8.9 Records of Environmentally Sensitive Areas within 2000m of the study site: 79

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site: 79
8.11 Records of National Parks (NP) within 2000m of the study site: 80
8.12 Records of Nitrate Sensitive Areas within 2000m of the study site: 80
8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site: 80
8.14 Records of Green Belt land within 2000m of the study site: 80
9. Natural Hazards Findings 81
9.1 Detailed BGS GeoSure Data 81
9.1.1 Shrink Swell 81
9.1.2 Landslides 81
9.1.3 Soluble Rocks 81
9.1.4 Compressible Ground 82
9.1.5 Collapsible Rocks 82
9.1.6 Running Sand 82
9.2 Radon 82
9.2.1 Radon Affected Areas 82
9.2.2 Radon Protection 83
10. Mining 84
10.1 Coal Mining 84
10.2 Non-Coal Mining 84
10.3 Brine Affected Areas 84
Contact Details 85
Standard Terms and Conditions 87

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	2	3	28	128
1.2 Additional Information – Historical Tank Database	0	10	2	36
1.3 Additional Information – Historical Energy Features Database	0	0	68	105
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	6	10	53
1.6 Potentially Infilled Land	0	0	9	35

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	6	2
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	0	1
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	2
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	2	0	4
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	1	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	1	0	1
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	1

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	4	29	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	3	1
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology	0-500m
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	2	4	93
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	1	3	51
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	0	0	1	0	Not searched	Not searched

Section 6: Hydrogeology and Hydrology

	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	No
6.10 Detailed River Network entries within 500m of the site	0	0	0	1	Not searched	Not searched
6.11 Surface water features within 250m of the study site	No	No	No	Not searched	Not searched	Not searched

Section 7: Flooding

7.1 Are there any Enviroment Agency Zone 2 floodplains within 250m of the study site?	No
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low
7.4 Are there any Flood Defences within 250m of the study site?	No
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Not Prone
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Not Applicable

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	0	0	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	1
8.8 Records of World Heritage Sites	0	0	0	0	1	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards

9.1 What is the maximum risk of natural ground subsidence?	Low
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Very Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Negligible
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining

10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

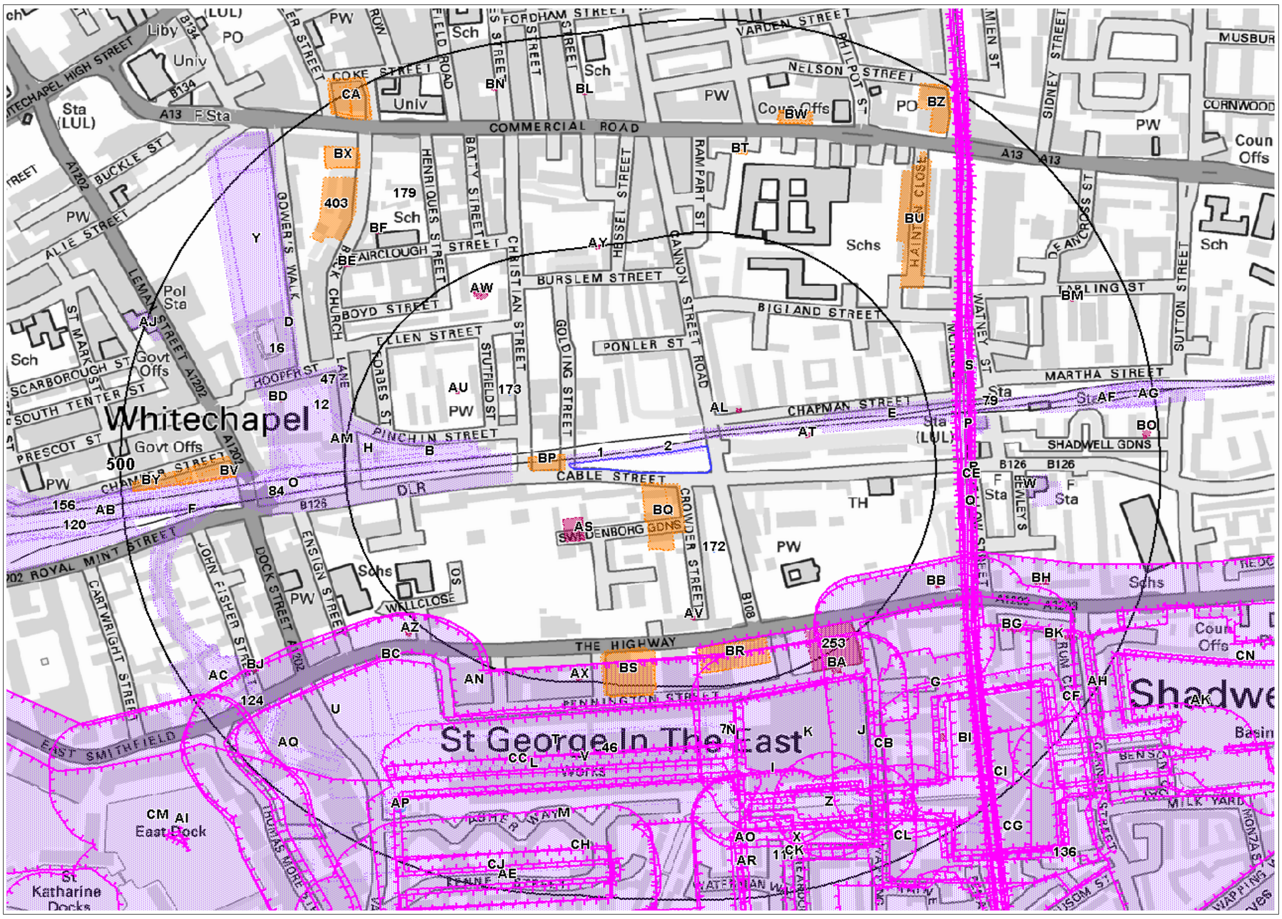
Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Historical Land Use

NW N NE

W E



SW S SE

Site Outline

Search Buffers (m): 250, 500

Historical 1:10,000 and 1:10,560 scale mapping

- Industrial Land Use
- Potentially Infilled Land

Historical 1:2,500, 1:1,250 and 1:500 scale mapping

- Energy Features
- Petrol Stations
- Tanks
- Garages

1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 161

ID	Distance [m]	Direction	Use	Date
1	0	On Site	Railway Building	1957
2	0	On Site	Railway Sidings	1957
3A	8	N	Railway Sidings	1898
4A	10	N	Railway Sidings	1899
5A	10	N	Railway Sidings	1899
6	64	W	Railway Sidings	1894
7B	89	W	Railway Sidings	1898
8B	94	W	Railway Sidings	1882
9C	98	W	Railway Sidings	1957
10C	98	W	Railway Sidings	1966
11C	98	W	Railway Sidings	1948
12	100	W	Railway Sidings	1894
13C	100	W	Unspecified Commercial/Industrial	1894
14D	110	W	Railway Sidings	1938
15D	110	W	Railway Sidings	1920
16	117	W	Railway Sidings	1898
17E	128	E	Railway Sidings	1882
18E	139	E	Railway Sidings	1898
19F	151	W	Railway Sidings	1971
20F	151	W	Railway Sidings	1976
21F	151	W	Railway Sidings	1994
22N	191	SE	Docks	1894
23G	195	SE	Dock	1948
24G	195	SE	Dock	1957
25G	195	SE	Dock	1966
26CB	197	S	Docks	1894
27H	200	W	Railway Building	1957
28H	200	W	Railway Building	1966
29H	211	W	Railway Building	1882
30L	213	S	Docks	1966
31K	214	S	Dock	1957
32I	245	SE	Docks	1920
33I	245	SE	Docks	1938

34O	254	W	Railway Station	1898
35CC	261	S	Dock	1898
36J	264	S	Unspecified Docks	1899
37J	264	S	Unspecified Docks	1899
38K	265	S	Unspecified Warehouse	1920
39K	265	S	Unspecified Warehouse	1938
40V	266	S	Unspecified Docks	1898
41L	268	S	Dock	1894
42M	269	S	Docks	1976
43M	269	S	Docks	1971
44N	269	S	Dock	1976
45N	269	S	Dock	1971
46	271	S	Unspecified Works	1994
47	274	W	Railway Building	1966
48Q	274	E	Tunnel	1894
49CD	274	E	Tunnel	1898
50P	275	E	Railway Station	1898
51O	277	W	Railway Station	1894
52P	277	E	Railway Station	1894
53CE	278	E	Tunnel	1894
54Q	279	E	Tunnel	1899
55Q	279	E	Tunnel	1899
56P	279	E	Railway Station	1899
57P	279	E	Railway Station	1899
58P	281	E	Railway Station	1894
59O	281	W	Railway Station	1920
60O	281	W	Railway Station	1938
61O	282	W	Railway Building	1957
62O	282	W	Railway Station	1948
63R	283	E	Tunnel	1938
64R	283	E	Tunnel	1920
65P	287	E	Unspecified Station	1971
66P	287	E	Unspecified Station	1957
67P	287	E	London Transport Station	1976
68P	287	E	Unspecified Station	1966
69P	287	E	London Transport Station	1994
70P	287	E	Railway Station	1894
71O	288	W	Railway Station	1894
72S	292	E	Railway Sidings	1966
73S	292	E	Railway Sidings	1957
74T	293	S	Unspecified Warehouses	1920
75T	293	S	Unspecified Warehouses	1938
76T	295	S	Unspecified Warehouses	1948
77BI	295	SE	Dock	1971
78	301	S	Unspecified Tank	1994
79	302	E	Railway Building	1957

80U	309	SW	Unspecified Warehouse	1948
81U	311	SW	Unspecified Warehouse	1920
82U	311	SW	Unspecified Warehouse	1938
83V	318	S	Quay	1898
84	320	W	Railway Station	1882
85V	321	S	Quay	1948
86V	326	S	Unspecified Quay	1898
87V	333	S	Unspecified Warehouse	1920
88V	333	S	Unspecified Warehouse	1938
89V	334	S	Unspecified Warehouses	1948
90CF	341	SE	Dock	1898
91Z	350	S	Docks	1948
92W	350	E	Fire Station	1976
93W	350	E	Fire Station	1994
94X	355	S	Dock	1966
95X	355	S	Dock	1957
96W	357	E	Fire Station	1994
97W	357	E	Fire Station	1981
98W	357	E	Fire Station	1965
99W	357	E	Fire Station	1989
100W	357	E	Fire Station	1973
101CG	357	S	Docks	1894
102Y	357	NW	Goods Shed	1957
103Y	357	NW	Goods Depot	1948
104Y	357	NW	Goods Shed	1966
105Y	357	NW	Goods Shed	1938
106Y	357	NW	Goods Shed	1920
107AA	357	W	Railway Sidings	1898
108CH	357	S	Dock	1882
109Y	359	NW	Railway Building	1894
110AB	365	W	Railway Sidings	1882
111AF	371	E	Railway Sidings	1882
112CI	376	SE	Dock	1882
113	384	W	Railway Sidings	1966
114Z	387	S	Dock	1882
115CJ	391	S	Dock	1948
116CK	400	S	Dock	1898
117	409	S	Unspecified Docks	1898
118X	409	S	Unspecified Docks	1899
119X	409	S	Unspecified Docks	1899
120	414	W	Railway Sidings	1957
121X	419	S	Unspecified Warehouse	1920
122X	419	S	Unspecified Warehouse	1938
123AA	421	W	Railway Sidings	1898
124	424	SW	Railway Sidings	1957
125AB	428	W	Railway Sidings	1948

126AQ	431	SW	Railway Sidings	1882
127AC	431	SW	Railway Building	1966
128AC	433	SW	Railway Building	1957
129AP	435	SW	Unspecified Tank	1994
130CL	435	SE	Dock	1898
131AD	437	SW	Unspecified Warehouses	1920
132AD	437	SW	Unspecified Warehouses	1938
133AE	438	S	Dock	1976
134AE	438	S	Dock	1971
135AD	439	SW	Unspecified Warehouses	1948
136	440	SE	Unspecified Docks	1898
137AF	445	E	Railway Station	1894
138AF	446	E	Railway Station	1894
139AG	446	E	Railway Station	1898
140AG	447	E	Railway Station	1920
141AG	447	E	Railway Station	1938
142AF	448	E	Railway Station	1899
143AF	448	E	Railway Station	1899
144AG	451	E	Railway Station	1949
145AG	452	E	Railway Station	1955
146AG	454	E	Railway Station	1894
147CM	460	SW	Docks	1894
148AH	464	SE	Docks	1955
149AH	464	SE	Docks	1965
150AI	466	SW	Dock	1966
151AI	466	SW	Dock	1957
152CN	469	SE	Dock	1898
153AJ	476	W	Police Station	1971
154AJ	478	W	Police Station	1976
155AJ	478	W	Police Station	1994
156	482	W	Railway Sidings	1966
157AB	492	W	Railway Sidings	1920
158AB	492	W	Railway Sidings	1938
159AK	493	SE	Basin	1898
160AK	496	SE	Basin	1899
161AK	496	SE	Basin	1899

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 48

ID	Distance (m)	Direction	Use	Date
162AL	40	N	Unspecified Tank	1991
163AL	40	N	Unspecified Tank	1989
164AL	40	N	Unspecified Tank	1989
165AL	40	N	Unspecified Tank	1982
166AL	41	N	Unspecified Tank	1968
167AL	41	N	Unspecified Tank	1973
168AL	41	N	Unspecified Tank	1991
169AL	41	N	Unspecified Tank	1992
170AL	41	N	Unspecified Tank	1997
171AL	41	N	Unspecified Tank	1965
172	89	S	Unspecified Tank	1957
173	104	NW	Unspecified Tank	1896
174AM	253	W	Unspecified Tank	1948
175AM	254	W	Unspecified Tank	1951
176AM	254	W	Unspecified Tank	1948
177AN	274	SW	Unspecified Tank	1951
178AN	274	SW	Unspecified Tank	1948
179	362	NW	Unspecified Tank	1880
180I	408	S	Unspecified Tank	1989
181I	408	S	Unspecified Tank	1989
182I	408	S	Unspecified Tank	1991
183I	409	S	Unspecified Tank	1991
184I	409	S	Unspecified Tank	1997
185I	409	S	Unspecified Tank	1992
186I	410	S	Unspecified Tank	1989
187I	410	S	Unspecified Tank	1989
188I	410	S	Unspecified Tank	1991
189I	411	S	Unspecified Tank	1991
190I	411	S	Unspecified Tank	1992
191I	411	S	Unspecified Tank	1997
192AO	432	S	Unspecified Tank	1991
193AO	432	S	Unspecified Tank	1994
194AO	432	S	Unspecified Tank	1991
195AP	435	SW	Unspecified Tank	1982
196AP	435	SW	Unspecified Tank	1991
197AP	435	SW	Unspecified Tank	1989
198AP	435	SW	Unspecified Tank	1991
199AP	435	SW	Unspecified Tank	1989
200AP	436	SW	Unspecified Tank	1991
201AP	436	SW	Unspecified Tank	1991
202AP	436	SW	Unspecified Tank	1992

203AP	436	SW	Unspecified Tank	1997
204AQ	444	SW	Unspecified Tank	1991
205AQ	446	SW	Unspecified Tank	1997
206AQ	446	SW	Unspecified Tank	1992
207AR	459	S	Unspecified Tank	1991
208AR	459	S	Unspecified Tank	1994
209AR	459	S	Unspecified Tank	1991

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 173

ID	Distance (m)	Direction	Use	Date
210AL	51	NE	Electricity Substation	1982
211AL	51	NE	Electricity Substation	1989
212AL	51	NE	Electricity Substation	1991
213AL	51	NE	Electricity Substation	1989
214AL	51	NE	Electricity Substation	1973
215AL	51	NE	Electricity Substation	1968
216AL	51	NE	Electricity Substation	1965
217AL	51	NE	Electricity Substation	1991
218AL	51	NE	Electricity Substation	1997
219AL	51	NE	Electricity Substation	1992
220AS	57	S	Electricity Substation	1951
221AS	57	S	Electricity Substation	1948
222AS	57	S	Electricity Substation	1951
223AS	57	S	Electricity Substation	1948
224AS	57	S	Electricity Substation	1948
225AT	108	E	Electricity Substation	1982
226AT	108	E	Electricity Substation	1989
227AT	108	E	Electricity Substation	1991
228AT	108	E	Electricity Substation	1989
229AT	110	E	Electricity Substation	1997
230AT	110	E	Electricity Substation	1992
231AT	110	E	Electricity Substation	1991
232AT	110	E	Electricity Substation	1968
233AT	110	E	Electricity Substation	1973
234AT	110	E	Electricity Substation	1965
235AU	148	NW	Electricity Substation	1994
236AU	148	NW	Electricity Substation	1992
237AU	148	NW	Electricity Substation	1991

238AU	148	NW	Electricity Substation	1996
239AU	148	NW	Electricity Substation	1951
240AU	149	NW	Electricity Substation	1981
241AU	149	NW	Electricity Substation	1990
242AU	149	NW	Electricity Substation	1991
243AV	166	S	Electricity Substation	1997
244AV	166	S	Electricity Substation	1992
245AV	166	S	Electricity Substation	1991
246AV	166	S	Electricity Substation	1973
247AV	166	S	Electricity Substation	1968
248AV	166	S	Electricity Substation	1991
249AV	166	S	Electricity Substation	1989
250AV	166	S	Electricity Substation	1982
251AV	166	S	Electricity Substation	1989
252AV	166	S	Electricity Substation	1965
253	214	SE	Electricity Substation	1991
254AW	216	NW	Electricity Substation	1969
255AW	221	NW	Electricity Substation	1992
256AW	221	NW	Electricity Substation	1994
257AW	221	NW	Electricity Substation	1991
258AW	221	NW	Electricity Substation	1996
259AW	223	NW	Electricity Substation	1951
260AW	223	NW	Electricity Substation	1981
261AW	223	NW	Electricity Substation	1990
262AW	223	NW	Electricity Substation	1991
263AX	242	S	Electricity Substation	1991
264AX	242	S	Electricity Substation	1991
265AX	242	S	Electricity Substation	1989
266AX	242	S	Electricity Substation	1989
267AX	243	S	Electricity Substation	1997
268AX	243	S	Electricity Substation	1992
269AX	243	S	Electricity Substation	1991
270AX	243	S	Electricity Substation	1991
271AY	246	N	Electricity Substation	1981
272AY	247	N	Electricity Substation	1991
273AY	247	N	Electricity Substation	1987
274AY	247	N	Electricity Substation	1994
275AY	247	N	Electricity Substation	1997
276AY	248	N	Electricity Substation	1991
277AY	248	N	Electricity Substation	1991
278AZ	262	SW	Electricity Substation	1997
279AZ	262	SW	Electricity Substation	1992
280AZ	263	SW	Electricity Substation	1989
281AZ	263	SW	Electricity Substation	1982
282AZ	263	SW	Electricity Substation	1991
283AZ	263	SW	Electricity Substation	1991

284AZ	263	SW	Electricity Substation	1973
285AZ	264	SW	Electricity Substation	1991
286AZ	264	SW	Electricity Substation	1991
287BA	265	SE	Electricity Substation	1982
288BA	265	SE	Electricity Substation	1973
289BA	266	SE	Electricity Substation	1951
290BA	269	SE	Electricity Substation	1992
291BA	275	SE	Electricity Substation	1991
292BB	282	SE	Electricity Substation	1989
293BB	282	SE	Electricity Substation	1989
294BB	282	SE	Electricity Substation	1982
295BB	282	SE	Electricity Substation	1991
296BB	283	SE	Electricity Substation	1991
297BB	283	SE	Electricity Substation	1997
298BB	283	SE	Electricity Substation	1992
299BB	283	SE	Electricity Substation	1973
300BC	298	SW	Electricity Substation	1991
301BC	298	SW	Electricity Substation	1989
302BC	298	SW	Electricity Substation	1989
303BC	298	SW	Electricity Substation	1982
304BC	298	SW	Electricity Substation	1991
305BC	298	SW	Electricity Substation	1973
306BC	298	SW	Electricity Substation	1951
307BC	300	SW	Electricity Substation	1991
308BC	300	SW	Electricity Substation	1991
309BD	329	W	Electricity Substation	1991
310BD	330	W	Electricity Substation	1997
311BD	330	W	Electricity Substation	1992
312BD	330	W	Electricity Substation	1991
313BE	337	NW	Electricity Substation	1994
314BE	337	NW	Electricity Substation	1992
315BE	337	NW	Electricity Substation	1991
316BE	337	NW	Electricity Substation	1996
317BE	339	NW	Electricity Substation	1969
318BE	340	NW	Electricity Substation	1981
319BE	340	NW	Electricity Substation	1990
320BE	340	NW	Electricity Substation	1991
321BF	343	NW	Electricity Substation	1994
322BF	343	NW	Electricity Substation	1992
323BF	343	NW	Electricity Substation	1991
324BF	343	NW	Electricity Substation	1996
325BF	345	NW	Electricity Substation	1981
326BF	345	NW	Electricity Substation	1990
327BF	345	NW	Electricity Substation	1991
328BG	371	SE	Electricity Substation	1965
329BH	381	E	Electricity Substation	1994

330BG	388	SE	Electricity Substation	1968
331BG	388	SE	Electricity Substation	1973
332BH	394	E	Electricity Substation	1970
333BH	394	E	Electricity Substation	1989
334BH	394	E	Electricity Substation	1978
335BH	394	E	Electricity Substation	1991
336BH	394	E	Electricity Substation	1994
337BH	394	E	Electricity Substation	1991
338BH	394	E	Electricity Substation	1965
339BI	399	SE	Electricity Substation	1992
340BI	399	SE	Electricity Substation	1997
341BI	399	SE	Electricity Substation	1991
342BI	400	SE	Electricity Substation	1989
343BI	400	SE	Electricity Substation	1991
344BI	400	SE	Electricity Substation	1989
345BJ	419	SW	Electricity Substation	1997
346BJ	419	SW	Electricity Substation	1992
347BJ	419	SW	Electricity Substation	1991
348BJ	419	SW	Electricity Substation	1991
349BJ	420	SW	Electricity Substation	1991
350BJ	420	SW	Electricity Substation	1989
351BJ	420	SW	Electricity Substation	1991
352BJ	420	SW	Electricity Substation	1989
353BK	425	SE	Electricity Substation	1994
354BK	425	SE	Electricity Substation	1994
355BK	425	SE	Electricity Substation	1991
356BL	428	N	Electricity Substation	1981
357BL	428	N	Electricity Substation	1991
358BL	428	N	Electricity Substation	1987
359BL	429	N	Electricity Substation	1994
360BL	429	N	Electricity Substation	1991
361BL	429	N	Electricity Substation	1991
362BL	429	N	Electricity Substation	1997
363BM	437	NE	Electricity Substation	1992
364BM	437	NE	Electricity Substation	1991
365BM	437	NE	Electricity Substation	1999
366BM	437	NE	Electricity Substation	1981
367BM	437	NE	Electricity Substation	1994
368BM	438	NE	Electricity Substation	1991
369BM	438	NE	Electricity Substation	1991
370BK	439	SE	Electricity Substation	1989
371BK	440	SE	Electricity Substation	1991
372BN	445	N	Electricity Substation	1992
373BN	445	N	Electricity Substation	1994
374BN	445	N	Electricity Substation	1991
375BN	445	N	Electricity Substation	1996

376BN	446	N	Electricity Substation	1991
377BN	446	N	Electricity Substation	1990
378BO	482	E	Electricity Substation	1991
379BO	482	E	Electricity Substation	1994
380BO	482	E	Electricity Substation	1991
381BO	482	E	Electricity Substation	1994
382BO	482	E	Electricity Substation	1989

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 69

ID	Distance (m)	Direction	Use	Date
383BP	6	W	Garage	1965
384BP	6	W	Garage	1963
385BP	6	W	Garage	1973
386BQ	11	S	Coach Building Works	1948
387BQ	12	S	Coach Building Works	1948
388BQ	12	S	Coach Building Works	1951
389BR	200	S	Garage	1973
390BR	200	S	Garage	1968
391BR	201	S	Garage	1965
392BR	201	S	Garage	1982
393BS	204	S	Garage	1989
394BS	204	S	Garage	1989
395BS	204	S	Garage	1991
396BS	209	S	Garage	1991
397BS	209	S	Garage	1997
398BS	209	S	Garage	1992
399BU	283	NE	Garage	1966
400BT	344	N	Garage	1948
401BT	345	N	Garage	1957

402BU	349	NE	Garage	1966
403	364	NW	Garage	1951
404BV	371	W	Garage	1965
405BV	372	W	Garage	1973
406BV	372	W	Garage	1963
407BV	372	W	Garage	1991
408BV	372	W	Garage	1982
409BV	374	W	Garage	1991
410BV	374	W	Garage	1991
411BV	374	W	Garage	1989
412BW	386	N	Garage	1966
413BW	386	N	Garage	1987
414BW	386	N	Garage	1991
415BV	387	W	Garage	1991
416BW	388	N	Garage	1997
417BW	388	N	Garage	1994
418BW	388	N	Garage	1991
419BW	388	N	Garage	1991
420BW	390	N	Garage	1981
421BW	390	N	Garage	1966
422BX	418	NW	Garage	1991
423BX	419	NW	Garage	1992
424BX	420	NW	Garage	1991
425BX	420	NW	Garage	1981
426BX	420	NW	Garage	1990
427BY	434	W	Garage	1991
428BY	434	W	Garage	1991
429BY	436	W	Garage	1982
430BZ	444	NE	Garage	1987
431BZ	444	NE	Garage	1991
432BZ	445	NE	Garage	1991
433BZ	445	NE	Garage	1991
434BZ	445	NE	Garage	1994
435BZ	445	NE	Garage	1997
436BZ	445	NE	Garage	1981
437BY	457	W	Garage	1951
438BY	457	W	Garage	1948
439CA	460	NW	Garage	1966
440BY	461	W	Garage	1991
441BY	461	W	Garage	1991
442BY	461	W	Garage	1992
443BY	461	W	Garage	1997
444CA	461	NW	Garage	1981
445CA	463	NW	Garage	1951
446CA	464	NW	Garage	1948
447CA	473	NW	Garage	1981

448CA	475	NW	Garage	1951
449CA	475	NW	Garage	1948
450CA	475	NW	Garage	1969
451CA	475	NW	Garage	1962

1.6 Potentially Infilled Land

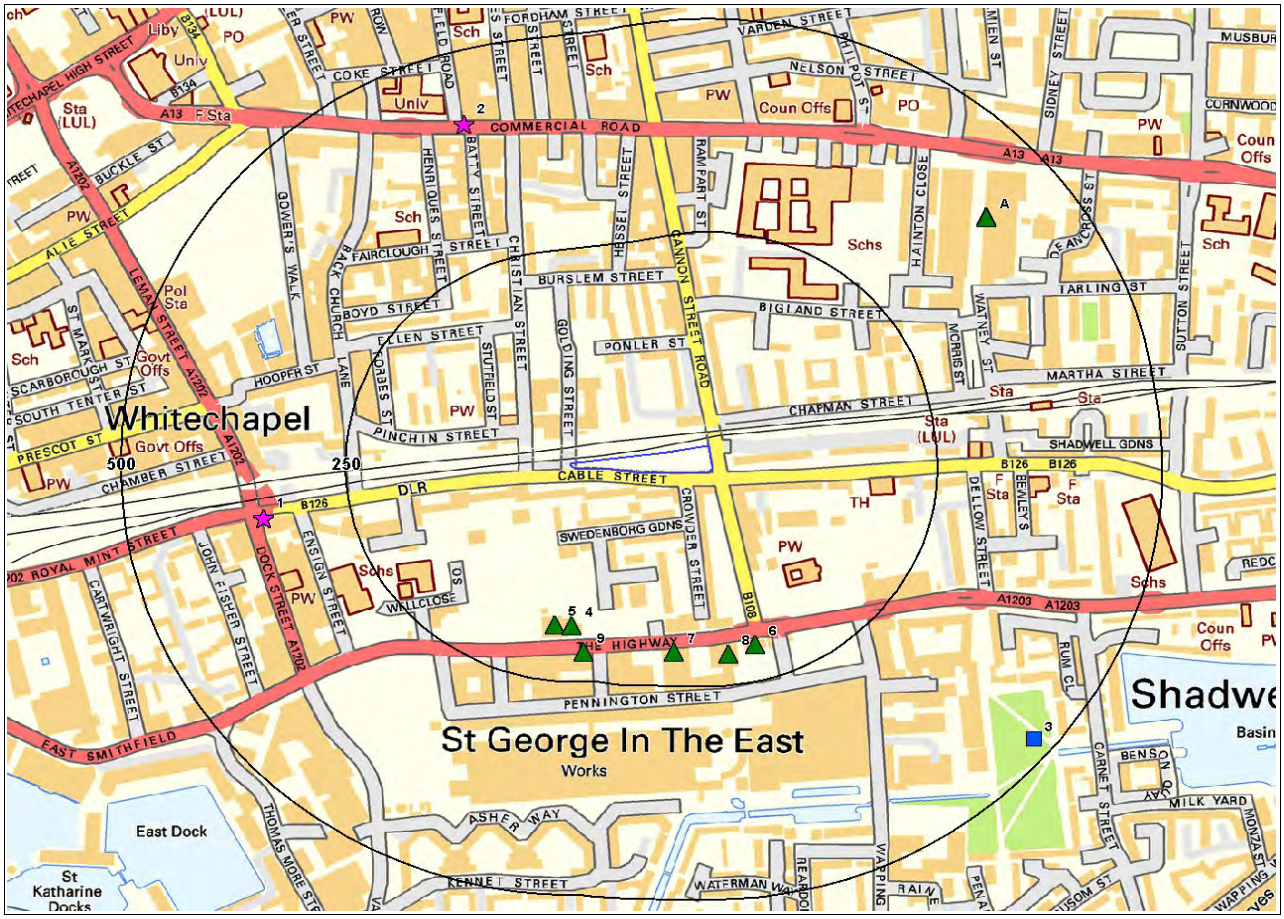
Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 44

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
452N	191	SE	Docks	1894
453G	195	SE	Dock	1966
454G	195	SE	Dock	1948
455G	195	SE	Dock	1957
456CB	197	S	Docks	1894
457L	213	S	Docks	1966
458K	214	S	Dock	1957
459I	245	SE	Docks	1920
460I	245	SE	Docks	1938
461CC	261	S	Dock	1898
462L	268	S	Dock	1894
463M	269	S	Docks	1976
464M	269	S	Docks	1971
465N	269	S	Dock	1971
466N	269	S	Dock	1976
467Q	274	E	Tunnel	1894
468CD	274	E	Tunnel	1898
469CE	278	E	Tunnel	1894
470Q	279	E	Tunnel	1899
471Q	279	E	Tunnel	1899
472R	283	E	Tunnel	1938
473R	283	E	Tunnel	1920
474BI	295	SE	Dock	1971
475V	318	S	Quay	1898
476V	321	S	Quay	1948
477CF	341	SE	Dock	1898
478Z	350	S	Docks	1948
479X	355	S	Dock	1966
480X	355	S	Dock	1957
481CG	357	S	Docks	1894
482CH	357	S	Dock	1882
483CI	376	SE	Dock	1882
484Z	387	S	Dock	1882
485CJ	391	S	Dock	1948

486CK	400	S	Dock	1898
487CL	435	SE	Dock	1898
488AE	438	S	Dock	1976
489AE	438	S	Dock	1971
490CM	460	SW	Docks	1894
491AH	464	SE	Docks	1955
492AH	464	SE	Docks	1965
493AI	466	SW	Dock	1957
494AI	466	SW	Dock	1966
495CN	469	SE	Dock	1898

2. Environmental Permits, Incidents and Registers Map



- Site Outline
- Search Buffers (m) (250, 500)
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

8

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
4	186	S	534486 180731	Address: Star Service Stations Ltd, 77-101 The Highway, London, E1 9BN Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
5	187	S	534468 180732	Address: Star Service Stations Ltd, 77-101 The Highway, London, E1 9BN Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
6	209	S	534690 180709	Address: Star Service Stations Ltd, 102-106 The Highway, London, E1 9BU Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: Enforcement Transfer Date of Enforcement: 15/07/2009 Comment: No Enforcement Notified
7	212	S	534600 180700	Address: Texaco(1), The Highway, E1 Process: Petrol Vapour Recovery Process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
8	215	S	534661 180698	Address: BP Service Stations Ltd, 102-106 The Highway, London, E1 9BU Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
9	217	S	534500 180700	Address: Texaco(2), The Highway, E1 Process: Petrol Vapour Recovery Process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
10A	406	NE	534947 181210	Address: Dry Cleaning by Sandringham, 21 Watney Market Process: Dry Cleaning Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
11A	407	NE	534947 181211	Address: Diamond Tailors & Dry Cleaners, 21 Watney Market, London, E1 2PP Process: Dry Cleaning Status: Current Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

1

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
3	477	SE	535000 180600	Address: BRENT EUROPE LTD, THE RIDGEWAY, IVE, BRENT EUROPE LTD, THE RIDGEWAY,, IVER, BUCKINGHAMSHIRE, -, - Effluent Type: MISCELLANEOUS DISCHARGES - UNSPECIFIED Permit Number: CNTW.0662 Permit Version: 1	Receiving Water: RIVER GRAVELS Status: REVOKED - UNSPECIFIED Issue date: 14/09/1990 Effective Date: 14-Sep-1990 Revocation Date: 01/08/1994

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 0

Database searched and no data found.

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

2

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1	347	W	534144 180859	Incident Date: 04-Jan-2002 Incident Identification: 50416 Pollutant: Contaminated Water Pollutant Description: Firefighting Run-Off	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2	415	N	534366 181321	Incident Date: 25-Oct-2003 Incident Identification: 198168 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Smoke	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 3 (Minor)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

Database searched and no data found.

2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

3. Landfill and Other Waste Sites Map

Site Outline

250 / 500 Search Buffers (m)

EA/NRW Active Landfill

EA/NRW Historic Landfill

BGS / DoE Survey Landfill

Historic and Planned Waste Sites

EA/NRW Licensed Waste Site

Local Authority/Historical Mapping Landfill Records

3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

6

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
2	365	SE	534600 180400	Site Address: Wapping Basin, St. George in the East, Tower Hamlets, London Waste Licence: - Site Reference: 8TH003, TOW003 Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
3	394	SE	535100 180600	Site Address: Shadwell Basin, Eastern Dock, E1, London Waste Licence: - Site Reference: - Waste Type: - Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	1165	SE	535900 180000	Site Address: Island Dock, Rotherhithe, Bermondsey, London Waste Licence: - Site Reference: 8SO004, SOU004 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: 31-Dec-1975
Not shown	1363	SE	536200 180100	Site Address: Lavender Dock, Rotherhithe, Bermondsey, London Waste Licence: - Site Reference: 8SO006, SOU006 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: 31-Dec-1975

ID	Distance (m)	Direction	NGR	Details	
Not shown	1436	SE	535800 179900	Site Address: Stave Dock, Rotherhithe, Bermondsey, London Waste Licence: - Site Reference: 8SO005, SOU005 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: 31-Dec-1975
Not shown	1444	SE	535600 179700	Site Address: Albion Dock, Rotherhithe, Bermondsey, London Waste Licence: - Site Reference: 8SO002, SOU002 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: 31-Dec-1975

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

1

The following landfill records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
Not shown	667	E	535300.0 180800.0	Address: Shadwell Basin, E1, Eastern Dock, E1, London BGS Number: 2095.0	Risk: No risk to aquifer Waste Type: N/A

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

2

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Site Address	Source	Data Type
9	377	S	534586 180426	Wapping Basin	Tower Hamlets London Borough Council	Polygon
Not shown	1444	SE	535674 179689	Albion Dock	Southwark Council	Polygon

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

Database searched and no data found.

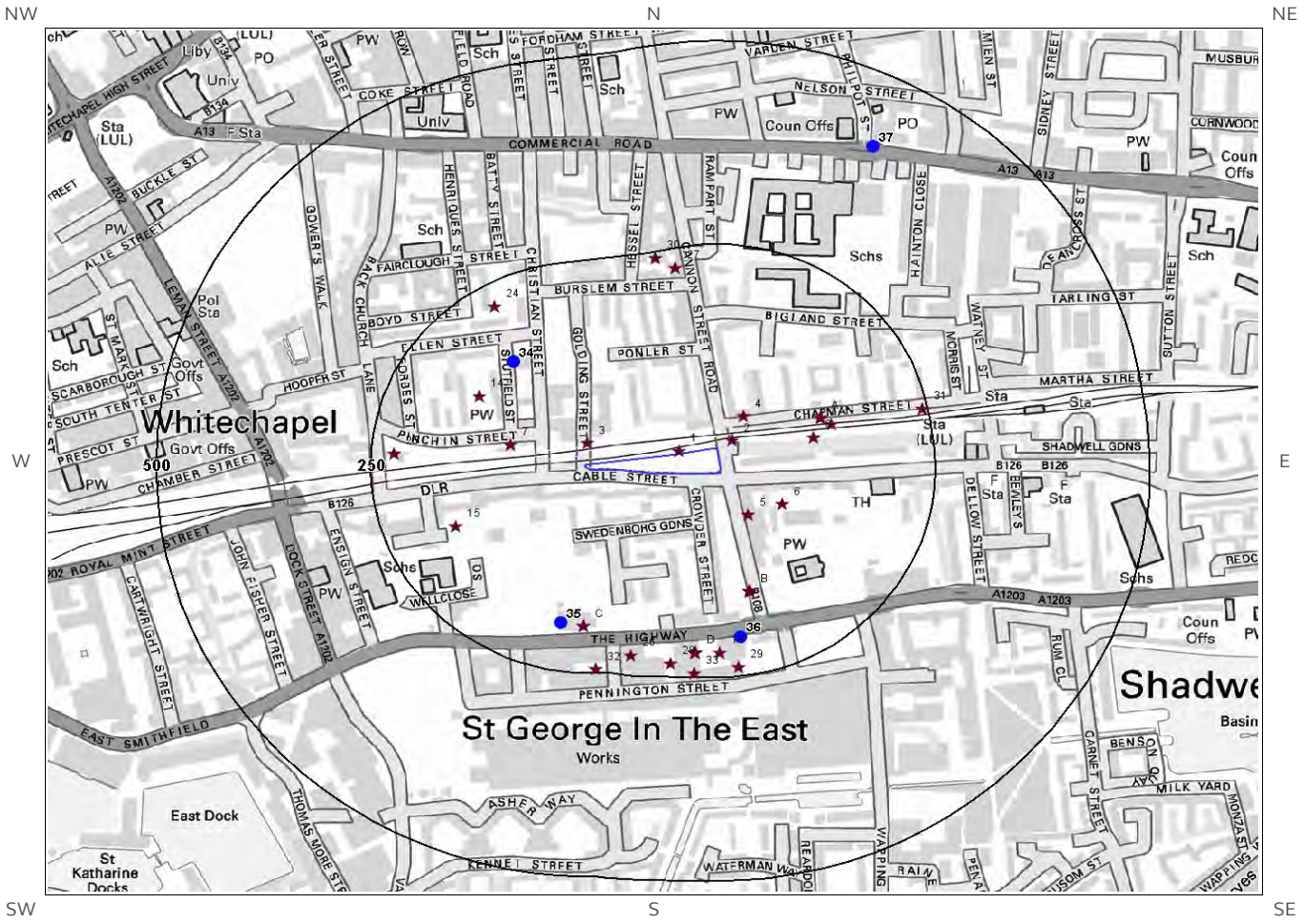
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

1

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1295	W	533250 181310	Site Address: - Type: Mobile Plant for remediation of land Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: EMA001 EPR reference: EA/EPR/BB3708FZ/A001 Operator: Environmental Resources Management Limited Waste Management licence No: 401554 Annual Tonnage: 0.0	Issue Date: 25/06/2014 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Mobile Plant Sr2008 No.27 Correspondence Address: -

4. Current Land Use Map



Site Outline

Search Buffers (m)
250
500

Current Industrial Sites

Petrol & Fuel Sites

Electricity Transmission Cables

Gas Transmission Pipelines

4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 33

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	5	N	J M G Cargo	534595 180941	J M G Cargo, 107 Railway Arches, Cannon Street Road, London, E1 2LY	Distribution and Haulage	Transport, Storage and Delivery
2	19	NE	Fabians Haberdashery & Trimmings	534655 180954	Fabians Haberdashery & Trimmings, 110 Railway Arches, Cannon Street Road, London, E1 2LY	Ropes, Nets and Cordage	Industrial Products
3	27	N	Cab Fix	534488 180951	Cab Fix, Railway Arch 98-100, Golding Street, London, E1 1QH	Vehicle Repair, Testing and Servicing	Repair and Servicing
4	49	NE	Electricity Sub Station	534669 180984	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
5	61	SE	F N H Jewels	534675 180862	F N H Jewels, 42, Cannon Street Road, London, E1 0BH	Jewellery, Gems, Clocks and Watches	Consumer Products
6	83	SE	Electricity Sub Station	534715 180876	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
7	91	W	Skyrose Ltd	534398 180949	Skyrose Ltd, 10, Pinchin & Johnsons Yard, London, E1 1SD	Textiles, Fabrics, Silk and Machinery	Industrial Products
8	112	E	Electricity Sub Station	534751 180958	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
9A	125	E	S M Car Centre	534758 180981	S M Car Centre, 122 Railway Arches, Chapman Street, London, E1 2PH	Secondhand Vehicles	Motoring
10A	126	E	Sm Car Center	534760 180982	Sm Car Center, 122, Railway Arches, Chapman Street, Shadwell, London, E1 2PH	Vehicle Repair, Testing and Servicing	Repair and Servicing
11A	136	E	E One M O T Centre	534771 180974	E One M O T Centre, 123 Railway Arches, Chapman Street, London, E1 2PH	Vehicle Repair, Testing and Servicing	Repair and Servicing
12B	148	S	Electricity Sub Station	534676 180769	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
13B	149	S	Electricity Sub Station	534677 180768	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
14	151	NW	Electricity Sub Station	534362 181009	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
15	168	SW	Electricity Sub Station	534334 180849	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
16C	191	S	Somerfield St Katherines	534483 180726	Somerfield St Katherines, 77-101, The Highway, London, E1W 2BN	Petrol and Fuel Stations	Road and Rail
17C	191	S	Texaco	534482 180726	Texaco, 77-101, The Highway, London, E1W 2BN	Petrol and Fuel Stations	Road and Rail
18	219	S	Tower Connect	534641 180693	Tower Connect, 102-106, The Highway, London, E1W 2BU	Petrol and Fuel Stations	Road and Rail
19D	219	S	Full Circle Recording Studios	534612 180693	Full Circle Recording Studios, 110, Pennington Street, London, E1W 2BB	Recording Studios and Record Companies	IT, Advertising, Marketing and Media Services
20D	219	S	Wapping Highway Tyers Ltd	534612 180693	Wapping Highway Tyers Ltd, 110, Pennington Street, London, E1W 2BB	Vehicle Repair, Testing and Servicing	Repair and Servicing
21D	219	S	Walter Reginald Group Ltd	534612 180693	Walter Reginald Group Ltd, Unit 6 100, The Highway, London, E1W 2BX	Leather Products	Consumer Products
22D	219	S	C M T London UK Ltd	534613 180693	C M T London UK Ltd, 100, The Highway, London, E1W 2BX	Clothing, Components and Accessories	Consumer Products
23D	219	S	City Bike Service	534613 180693	City Bike Service, Unit 5, 100 The Highway, London, E1W 2BX	Vehicle Repair, Testing and Servicing	Repair and Servicing
24	223	NW	Electricity Sub Station	534379 181119	Electricity Sub Station, E1	Electrical Features	Infrastructure and Facilities
25	224	W	Artzone Co-operative Ltd	534262 180938	Artzone Co-operative Ltd, 10, Back Church Lane, London, E1 1LX	Published Goods	Industrial Products
26	225	S	Alan Day Volkswagen	534538 180689	Alan Day Volkswagen, 60, The Highway, London, E1W 2BF	New Vehicles	Motoring
27	227	N	Tech O Phone	534590 181166	Tech O Phone, 143, Cannon Street Road, London, E1 2LX	Electronic Equipment	Industrial Products
28	233	S	Electricity Sub Station	534585 180680	Electricity Sub Station, E1W	Electrical Features	Infrastructure and Facilities
29	238	S	Smokehouse Studios	534664 180675	Smokehouse Studios, 120, Pennington Street, London, E1W 2BB	Recording Studios and Record Companies	IT, Advertising, Marketing and Media Services
30	243	N	Mansell Street Garage	534567 181178	Mansell Street Garage, 145-147, Cannon Street Road, London, E1 2LX	Vehicle Repair, Testing and Servicing	Repair and Servicing
31	244	E	Babley Auto	534878 180993	Babley Auto, 134 Railway Arches, Chapman Street, London, E1 2PH	Vehicle Repair, Testing and Servicing	Repair and Servicing
32	244	S	Electricity Sub Station	534497 180673	Electricity Sub Station, E1W	Electrical Features	Infrastructure and Facilities
33	244	S	Works	534612 180668	Works, E1W	Unspecified Works Or Factories	Industrial Features

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 4

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
34	152	NW	534401 181050	Obsolete	Tower Hamlets And City Garages, Back Church Lane, Back Church Lane, Whitechapel, London, Inner London, E1 1LX	Not Applicable	Obsolete
35	191	S	534457 180729	Texaco	Co-Op St Katherines, 77-101, The Highway, The Highway, Shadwell, London, Inner London, E1W 2BN	No	Open
36	202	S	534666 180712	BP	Tower Connect, 102-106, The Highway, The Highway, Shadwell, London, Inner London, E1W 2BU	No	Open
37	412	NE	534821 181315	Obsolete	Hamlet Service Station, 261-267, Commercial Road, Commercial Road, Stepney, London, Inner London, E1 2BT	Not Applicable	Obsolete

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
LASI-XCZ	LANGLEY SILT MEMBER	CLAY AND SILT

5.3 Bedrock and Solid Geology

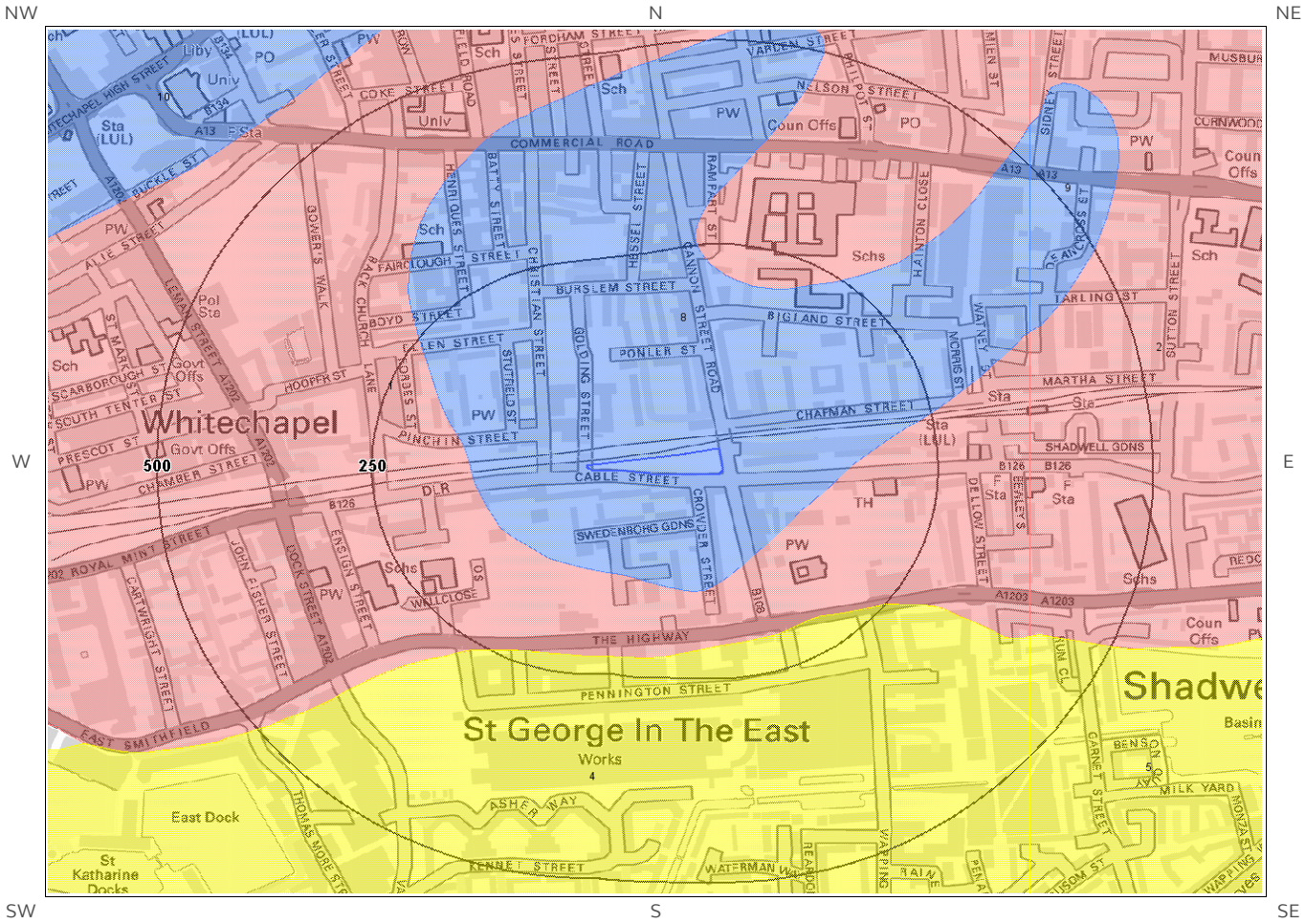
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
LC-XCZS	LONDON CLAY FORMATION	CLAY, SILT AND SAND

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology



6b. Aquifer Within Bedrock Geology and Abstraction Licenses

NW N NE

W E

SW S SE

Site Outline

250 — 500 — Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

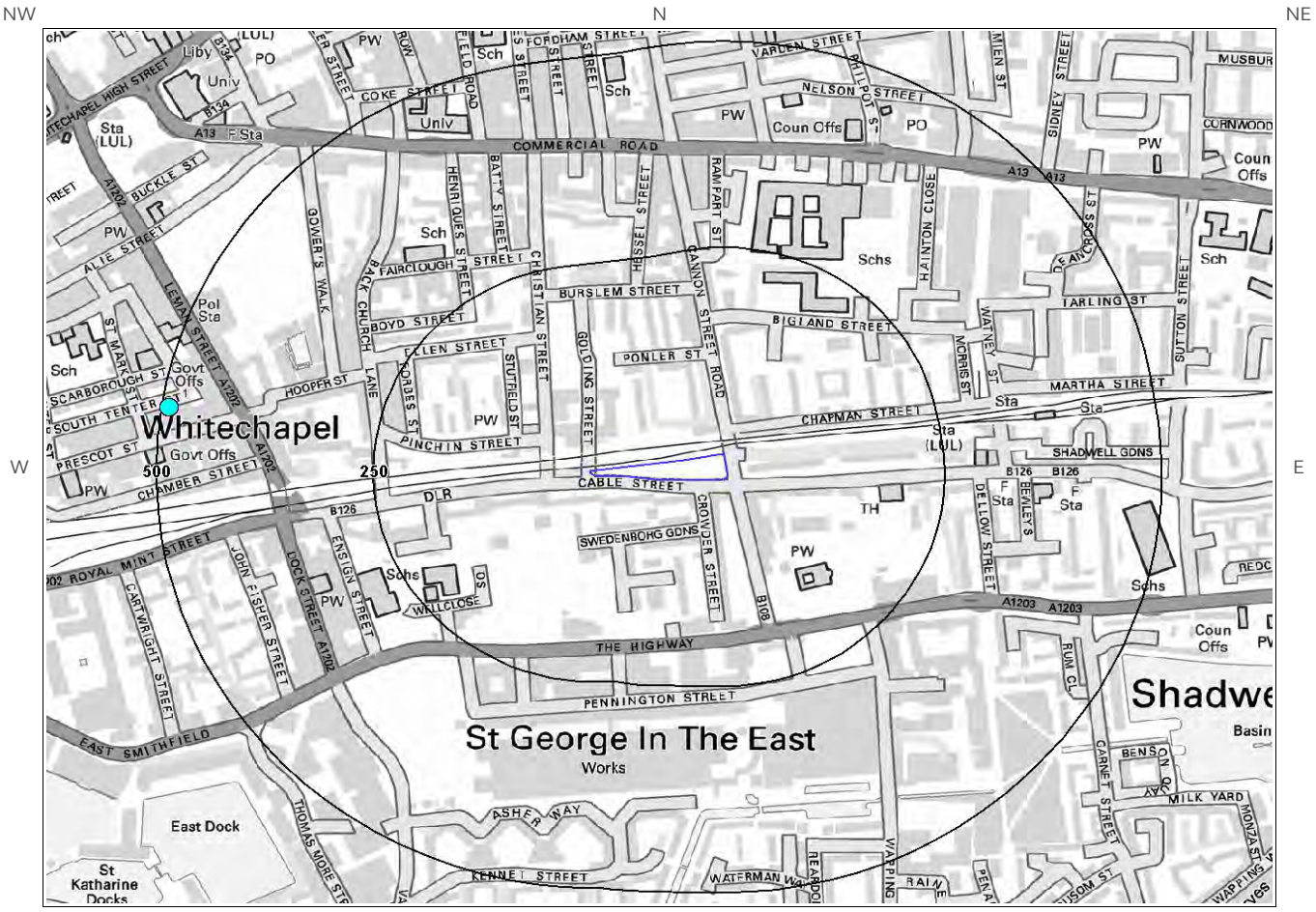
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



Site Outline

250 — 500 — Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

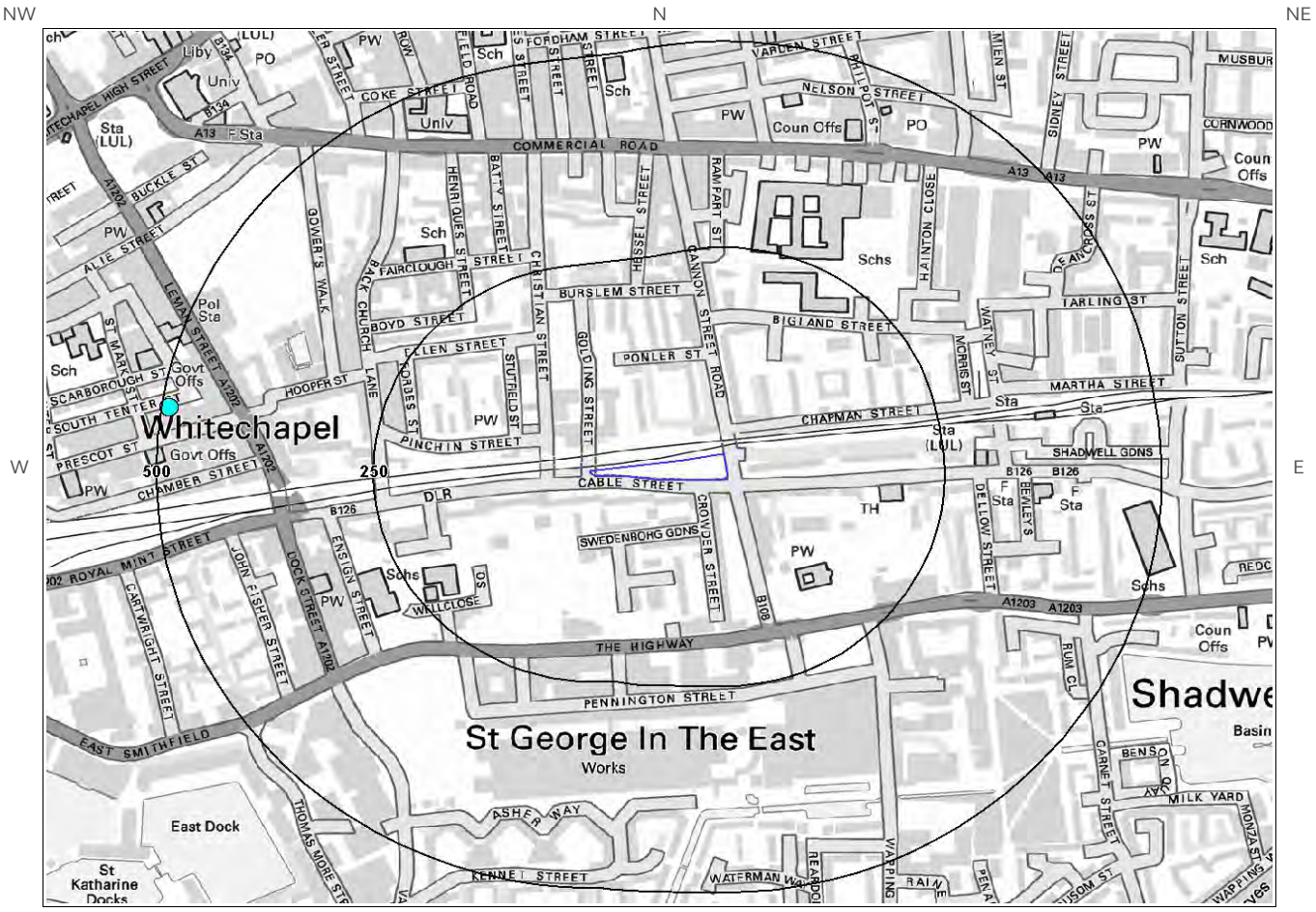
Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

6d. Hydrogeology – Source Protection Zones within confined aquifer



Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2C - Outer Catchment within Confined Aquifer

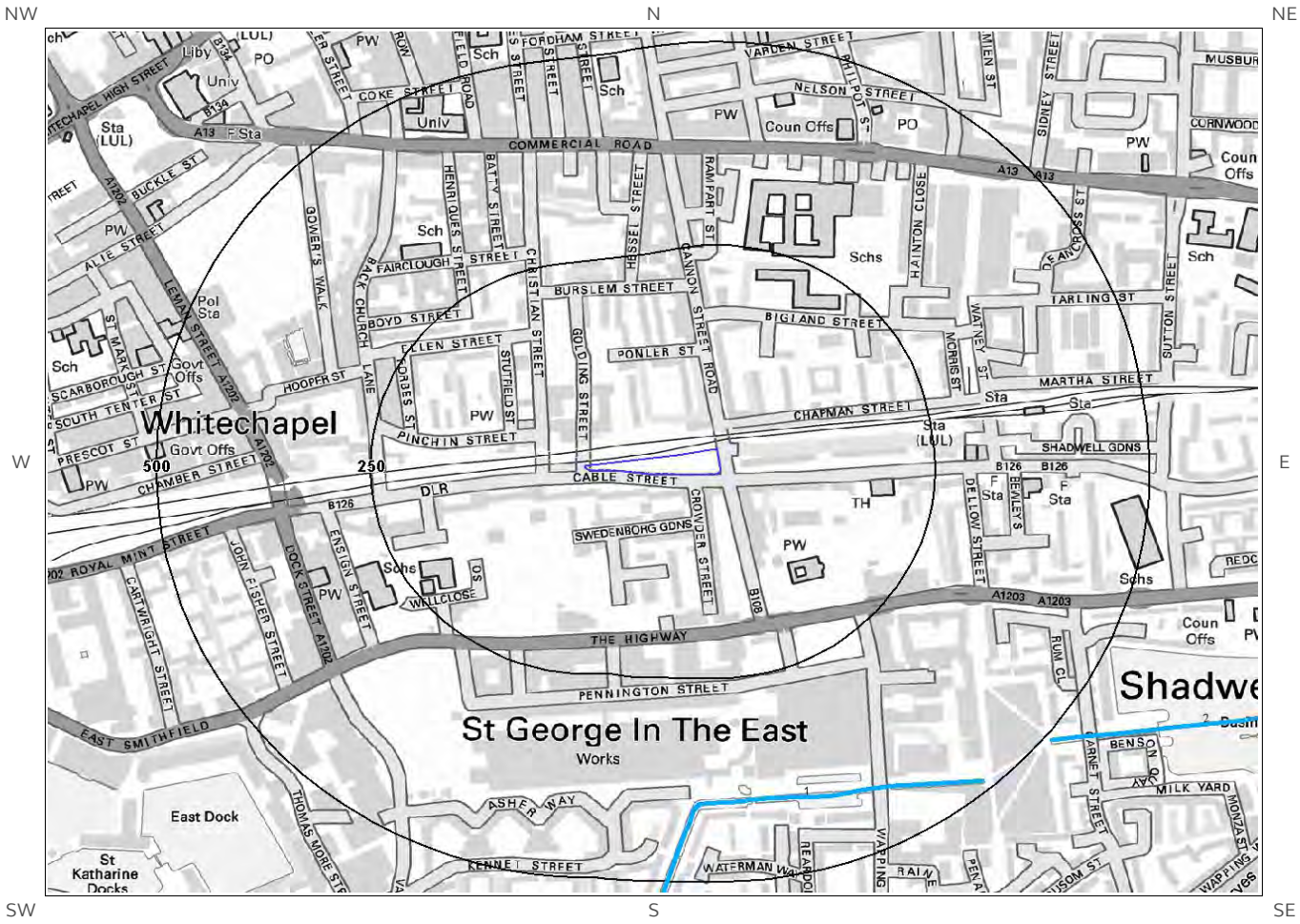
Source Protection Zone 3C - Total Catchment within Confined Aquifer

Site Outline

Potable Water Abstraction Licence

250 — 500 — Search Buffers (m)

6e. Hydrology – Detailed River Network and River Quality



6.Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
8	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
1	98	SE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	205	SE	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
2	357	E	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
9	388	E	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
5	411	SE	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
5	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
6	357	E	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
8	460	SE	534910 180540	Status: Historical Licence No: 28/39/39/0184 Details: Supply to a Canal for Throughflow Direct Source: Thames Groundwater Point: Borehole At Wapping Wood Canal, John Rennie Walk, London Data Type: Point Name: LONDON BOROUGH OF TOWER HAMLETS	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/N/6481 Original Start Date: 13/2/1998 Expiry Date: 31/12/2004 Issue No: 100 Version Start Date: 1/4/1999 Version End Date:
9	492	W	534000 181000	Status: Historical Licence No: 28/39/39/0048 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Eastgate, 73 Leman Street, London E1 Data Type: Point Name: NATIONAL WESTMINSTER BANK LIMITED	Annual Volume (m^3): 28217 Max Daily Volume (m^3): 148.2 Original Application No: - Original Start Date: 9/5/1966 Expiry Date: - Issue No: 100 Version Start Date: 6/8/1981 Version End Date:
10	571	W	533917 180973	Status: Active Licence No: TH/039/0039/017 Details: General Use Relating To Secondary Category (Medium Loss) Direct Source: Thames Groundwater Point: Grange Tower Hotel Borehole Data Type: Point Name: GLOBAL GRANGE LIMITED	Annual Volume (m^3): 63875 Max Daily Volume (m^3): 175 Original Application No: NPS/WR/004102 Original Start Date: 5/11/2009 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 30/9/2010 Version End Date:
Not shown	786	W	533700 180900	Status: Historical Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Ibex House, The Minories, London. Ec3 Data Type: Point Name: MARS PENSION TRUSTEES LIMITED	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: - Original Start Date: 11/10/1965 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2008 Version End Date:
Not shown	786	W	533700 180900	Status: Historical Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Ibex House, The Minories, London. Ec3 Data Type: Point Name: MARS PENSION TRUSTEES LIMITED	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: - Original Start Date: 11/10/1965 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2008 Version End Date:
Not shown	787	W	533700 180970	Status: Active Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Ibex House, The Minories, London. Ec3 Data Type: Point Name: Ibex London Limited	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: NPS/WR/021973 Original Start Date: 11/10/1965 Expiry Date: - Issue No: 102 Version Start Date: 17/2/2016 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1026	N	534890 181940	Status: Historical Licence No: 28/39/39/0195 Details: General Use Relating To Secondary Category (Medium Loss) Direct Source: Thames Groundwater Point: Borehole At Albion Yard, London E1 Data Type: Point Name: PENINSULA WATER LIMITED	Annual Volume (m^3): 274500 Max Daily Volume (m^3): 750 Original Application No: - Original Start Date: 1/12/2000 Expiry Date: 31/12/2009 Issue No: 3 Version Start Date: 1/7/2003 Version End Date:
Not shown	1100	W	533400 181100	Status: Historical Licence No: 28/39/39/0066 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Four Boreholes At Furnace House, 101/106 Fenchurch Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 17/12/1970 Version End Date:
Not shown	1105	W	533390 181060	Status: Historical Licence No: 28/39/39/0066 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Furnace House, 101/106 Fenchurch Street-borehole A Data Type: Point Name: DB6 LIMITED	Annual Volume (m^3): 24821 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2008 Version End Date:
Not shown	1237	W	533280 181200	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Bankside House, 107/112 Leadenhall Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 14/3/1966 Version End Date:
Not shown	1237	W	533280 181200	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bankside House, 107/112 Leadenhall Street - Borehole B Data Type: Point Name: SHIATZU HOLDINGS LIMITED	Annual Volume (m^3): 12574 Max Daily Volume (m^3): 50 Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2008 Version End Date:
Not shown	1243	W	533270 181180	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Bankside House, 107/112 Leadenhall Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 14/3/1966 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1243	W	533270 181180	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bankside House, 107/112 Leadenhall Street- Borehole A Data Type: Point Name: SHIATZU HOLDINGS LIMITED	Annual Volume (m^3): 12574 Max Daily Volume (m^3): 50 Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2008 Version End Date:
Not shown	1266	W	533220 180890	Status: Historical Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1266	W	533220 180890	Status: Active Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1266	W	533220 180890	Status: Historical Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1266	W	533220 180890	Status: Active Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1266	W	533220 180890	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1266	W	533220 180890	Status: Active Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole 'a' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: 13/1/2003 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: 17/5/2007 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: 13/1/2003 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: 17/5/2007 Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1-Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1291	SW	533450 180150	Status: Active Licence No: TH/039/0042/022 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1-Borehole 'a' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 30/1/2014 Version End Date:
Not shown	1291	SW	533450 180150	Status: Active Licence No: TH/039/0042/022 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1-Borehole 'a' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 30/1/2014 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Borehole 'b' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Borehole 'a' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Borehole 'd' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole 'b' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole 'd' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole 'a' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: 4/6/2001 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: 13/1/2003 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: 17/5/2007 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole 'b' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: 13/1/2003 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: 17/5/2007 Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 13/12/2005 Version End Date:
Not shown	1323	SW	533390 180180	Status: Active Licence No: TH/039/0042/022 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 30/1/2014 Version End Date:
Not shown	1323	SW	533390 180180	Status: Active Licence No: TH/039/0042/022 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 30/1/2014 Version End Date:
Not shown	1348	W	533140 180850	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1348	W	533140 180850	Status: Historical Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1348	W	533140 180850	Status: Historical Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1348	W	533140 180850	Status: Active Licence No: 28/39/39/0011 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1348	W	533140 180850	Status: Active Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1348	W	533140 180850	Status: Active Licence No: 28/39/39/0011 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: 14/11/2006 Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole A Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole B Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole C Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'e' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'c' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Thames Groundwater Point: Borehole At The Bathhouse, Cheshire Street, London E2 Data Type: Point Name: METROPOLITAN WATER CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/N/1106 Original Start Date: - Expiry Date: 31/12/2009 Issue No: 1 Version Start Date: 1/10/2000 Version End Date:
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Borehole At The Bathhouse, Cheshire Street, London E2 Data Type: Point Name: METROPOLITAN WATER CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 2/8/2000 Expiry Date: 31/12/2009 Issue No: 3 Version Start Date: 8/8/2002 Version End Date:
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: The Bathhouse, Cheshire Street, London E2-borehole A Data Type: Point Name: PENINSULA WATER LIMITED	Annual Volume (m^3): 80000 Max Daily Volume (m^3): 360 Original Application No: - Original Start Date: 2/8/2000 Expiry Date: 31/12/2009 Issue No: 5 Version Start Date: 3/8/2003 Version End Date:
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: General Use Relating To Secondary Category (Medium Loss) Direct Source: Thames Groundwater Point: The Bathhouse, Cheshire Street, London E2-borehole A Data Type: Point Name: PENINSULA WATER LIMITED	Annual Volume (m^3): 80000 Max Daily Volume (m^3): 360 Original Application No: - Original Start Date: 2/8/2000 Expiry Date: 31/12/2009 Issue No: 5 Version Start Date: 1/1/2007 Version End Date:
Not shown	1467	N	534310 182380	Status: Active Licence No: TH/039/0039/029 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: The Bathhouse, Cheshire Street, London E2-borehole A Data Type: Point Name: Magee	Annual Volume (m^3): 40000 Max Daily Volume (m^3): 100 Original Application No: NPSWR004240 Original Start Date: 13/8/2010 Expiry Date: 31/3/2019 Issue No: 1 Version Start Date: 13/8/2010 Version End Date:
Not shown	1579	NW	533138 181746	Status: Active Licence No: TH/039/0039/038 Details: Evaporative Cooling Direct Source: Thames Groundwater Point: Borehole At 5 Broadgate London Data Type: Point Name: UBS AG	Annual Volume (m^3): 73000 Max Daily Volume (m^3): 200 Original Application No: NPS/WR/020385 Original Start Date: 19/11/2012 Expiry Date: 31/3/2025 Issue No: 3 Version Start Date: 22/9/2015 Version End Date:
Not shown	1588	W	532900 181000	Status: Historical Licence No: 28/39/39/0056 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Three Boreholes At 9 Gracechurch Street, London Ec3 Data Type: Point Name: J.P.I.T. (Pte) LIMITED	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 9/5/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/1/1997 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1685	W	532810 181100	Status: Active Licence No: 28/39/39/0166 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 71 Lombard Street- Borehole A Data Type: Point Name: Ashton Global Investments Ltd	Annual Volume (m^3): 6819 Max Daily Volume (m^3): 250.94 Original Application No: NPS/WR/001299 Original Start Date: 25/3/1982 Expiry Date: - Issue No: 102 Version Start Date: 24/6/2009 Version End Date:
Not shown	1685	W	532810 181100	Status: Active Licence No: 28/39/39/0166 Details: Hydraulic Testing Direct Source: Thames Groundwater Point: 71 Lombard Street- Borehole A Data Type: Point Name: Ashton Global Investments Ltd	Annual Volume (m^3): 6819 Max Daily Volume (m^3): 250.94 Original Application No: NPS/WR/001299 Original Start Date: 25/3/1982 Expiry Date: - Issue No: 102 Version Start Date: 24/6/2009 Version End Date:
Not shown	1695	W	532800 181100	Status: Historical Licence No: 28/39/39/0166 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 71 Lombard Street, London - Borehole Data Type: Point Name: LLOYDS TSB BANK PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 25/3/1982 Expiry Date: - Issue No: 100 Version Start Date: 6/4/2000 Version End Date:
Not shown	1695	W	532800 181100	Status: Historical Licence No: 28/39/39/0166 Details: Hydraulic Testing Direct Source: Thames Groundwater Point: 71 Lombard Street, London - Borehole Data Type: Point Name: LLOYDS TSB BANK PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 25/3/1982 Expiry Date: - Issue No: 100 Version Start Date: 6/4/2000 Version End Date:
Not shown	1701	SE	535540 179470	Status: Historical Licence No: 28/39/42/0048 Details: Supply to a Canal for Throughflow Direct Source: Thames Groundwater Point: Canada Water, Surrey Quays Road, Borehole 'b' Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/5833 Original Start Date: 13/8/1991 Expiry Date: - Issue No: 100 Version Start Date: 22/4/1998 Version End Date:
Not shown	1701	SE	535540 179470	Status: Historical Licence No: 28/39/42/0048 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Canada Water, Surrey Quays Road,london - Borehole 'b' Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 67500 Max Daily Volume (m^3): 229 Original Application No: WRA/5833 Original Start Date: 13/8/1991 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2005 Version End Date:
Not shown	1710	SE	535533 179454	Status: Active Licence No: 28/39/42/0048 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Borehole B At Canada Water, Surrey Quays Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 67500 Max Daily Volume (m^3): 229 Original Application No: NPS/WR/009243 Original Start Date: 13/8/1991 Expiry Date: 31/3/2028 Issue No: 102 Version Start Date: 15/10/2013 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1742	NW	533544 182389	Status: Active Licence No: TH/039/0039/006 Details: Heat Pump Direct Source: Thames Groundwater Point: Boundary Street - Abstraction Borehole Data Type: Point Name: 2 - 4 Boundary Street Limited	Annual Volume (m^3): 157680 Max Daily Volume (m^3): 432 Original Application No: NPS/WR/004722 Original Start Date: 29/10/2009 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: 20/2/2017 Version End Date:
Not shown	1790	W	532700 180800	Status: Historical Licence No: 28/39/39/0094 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At 98/106 Cannon Street, London Ec4 Data Type: Point Name: ASGARD ESTATES LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 20/2/1990 Version End Date:
Not shown	1807	W	532700 181200	Status: Active Licence No: 28/39/39/0024 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bank Of England, Threadneedle Street - Nine Boreholes Data Type: Point Name: BANK OF ENGLAND	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 127 Original Application No: - Original Start Date: 10/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 9/11/1993 Version End Date:
Not shown	1807	W	532700 181200	Status: Historical Licence No: 28/39/39/0024 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Nine Boreholes At The Bank Of England, Threadneedle Street Data Type: Point Name: BANK OF ENGLAND	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 127 Original Application No: - Original Start Date: 10/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 9/11/1993 Version End Date:
Not shown	1817	W	532800 181600	Status: Historical Licence No: 28/39/39/0129 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Three Boreholes At Salisbury House, London Wall, London Ec2 Data Type: Point Name: MREF II Salisbury Property Limited	Annual Volume (m^3): 25457 Max Daily Volume (m^3): 81.8 Original Application No: NPS/WR/009934 Original Start Date: 12/6/1967 Expiry Date: - Issue No: 101 Version Start Date: 5/4/2012 Version End Date:
Not shown	1817	W	532800 181600	Status: Active Licence No: 28/39/39/0129 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Salisbury House, London Wall, London Ec2 - Three Boreholes Data Type: Point Name: MREF II Salisbury Property Limited	Annual Volume (m^3): 25457 Max Daily Volume (m^3): 81.8 Original Application No: NPS/WR/009934 Original Start Date: 12/6/1967 Expiry Date: - Issue No: 101 Version Start Date: 5/4/2012 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1821	SE	536180 179940	Status: Historical Licence No: 28/39/42/0064 Details: Make-Up or Top Up Water Direct Source: Thames Groundwater Point: Stave Hill Ecology Park, Rotherhithe - Borehole Data Type: Point Name: THE TRUST FOR URBAN ECOLOGY	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/S/1155 Original Start Date: 19/11/2003 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 19/11/2003 Version End Date:
Not shown	1821	SE	536180 179940	Status: Historical Licence No: 28/39/42/0064 Details: Make-Up or Top Up Water Direct Source: Thames Groundwater Point: Stave Hill Ecology Park, Rotherhithe - Borehole Data Type: Point Name: THE TRUST FOR URBAN ECOLOGY	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/S/1155 Original Start Date: 19/11/2003 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 19/11/2003 Version End Date:
Not shown	1828	S	535101 179144	Status: Active Licence No: TH/039/0042/021 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Point 'a' At Southwark Park Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 2100 Max Daily Volume (m^3): 800 Original Application No: NPS/WR/009262 Original Start Date: 1/4/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 27/2/2017 Version End Date:
Not shown	1828	S	535101 179144	Status: Active Licence No: TH/039/0042/021 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Point 'a' At Southwark Park Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 2100 Max Daily Volume (m^3): 800 Original Application No: NPS/WR/009262 Original Start Date: 1/4/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 27/2/2017 Version End Date:
Not shown	1828	S	535101 179144	Status: Active Licence No: TH/039/0042/021 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Point 'a' At Southwark Park Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 2100 Max Daily Volume (m^3): 800 Original Application No: NPS/WR/009262 Original Start Date: 1/4/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 27/2/2017 Version End Date:
Not shown	1853	SE	535552 179300	Status: Active Licence No: 28/39/42/0048 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Canada Water, Surrey Quays Road, London , Borehole 'a' Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 67500 Max Daily Volume (m^3): 229 Original Application No: NPS/WR/009243 Original Start Date: 13/8/1991 Expiry Date: 31/3/2028 Issue No: 102 Version Start Date: 15/10/2013 Version End Date:
Not shown	1853	SE	535570 179310	Status: Historical Licence No: 28/39/42/0048 Details: Supply to a Canal for Throughflow Direct Source: Thames Groundwater Point: Canada Water, Surrey Quays Road, London, Borehole 'a' Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: WRA/5833 Original Start Date: 13/8/1991 Expiry Date: - Issue No: 100 Version Start Date: 22/4/1998 Version End Date:
Not shown	1853	SE	535570 179310	Status: Historical Licence No: 28/39/42/0048 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Canada Water, Surrey Quays Road, London , Borehole 'a' Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 67500 Max Daily Volume (m^3): 229 Original Application No: WRA/5833 Original Start Date: 13/8/1991 Expiry Date: - Issue No: 101 Version Start Date: 1/4/2005 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1872	S	535110 179100	Status: Historical Licence No: TH/039/0042/001 Details: Make-Up Or Top Up Water Direct Source: Thames Groundwater Point: Borehole At Southwark Park, Southwark London Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 25000 Max Daily Volume (m^3): 800 Original Application No: NPSWR 000165 Original Start Date: 18/5/2009 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 18/5/2009 Version End Date:
Not shown	1872	S	535110 179100	Status: Historical Licence No: TH/039/0042/001 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Southwark Park, Southwark London Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 25000 Max Daily Volume (m^3): 800 Original Application No: NPSWR 000165 Original Start Date: 18/5/2009 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 18/5/2009 Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'c' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 3/4/2000 Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 3/4/2000 Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 3/4/2000 Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: 3/4/2000 Version End Date:
Not shown	1945	NW	532900 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole D Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: 11/1/2007 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1953	NW	532890 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole C Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: 11/1/2007 Version End Date:
Not shown	1970	NW	532870 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole B Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: 11/1/2007 Version End Date:

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? Yes

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

ID	Distance (m)	Direction	NGR	Details	
1	492	W	534000 181000	Status: Historical Licence No: 28/39/39/0048 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Eastgate, 73 Leman Street, London E1 Data Type: Point Name: NATIONAL WESTMINSTER BANK LIMITED	Annual Volume (m^3): 28217 Max Daily Volume (m^3): 148.2 Original Application No: - Original Start Date: 9/5/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	786	W	533700 180900	Status: Historical Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Ibex House, The Minories, London. Ec3 Data Type: Point Name: MARS PENSION TRUSTEES LIMITED	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: - Original Start Date: 11/10/1965 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	786	W	533700 180900	Status: Historical Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Ibex House, The Minories, London. Ec3 Data Type: Point Name: MARS PENSION TRUSTEES LIMITED	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: - Original Start Date: 11/10/1965 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	787	W	533700 180970	Status: Active Licence No: 28/39/39/0002 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Ibex House, The Minories, London. Ec3 Data Type: Point Name: Ibex London Limited	Annual Volume (m^3): 28185 Max Daily Volume (m^3): 90.9 Original Application No: NPS/WR/021973 Original Start Date: 11/10/1965 Expiry Date: - Issue No: 102 Version Start Date: Version End Date:
Not shown	1100	W	533400 181100	Status: Historical Licence No: 28/39/39/0066 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Four Boreholes At Furnace House, 101/106 Fenchurch Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1105	W	533390 181060	Status: Historical Licence No: 28/39/39/0066 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Furnace House, 101/106 Fenchurch Street-borehole A Data Type: Point Name: DB6 LIMITED	Annual Volume (m^3): 24821 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1237	W	533280 181200	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Bankside House, 107/112 Leadenhall Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1237	W	533280 181200	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bankside House, 107/112 Leadenhall Street - Borehole B Data Type: Point Name: SHIATZU HOLDINGS LIMITED	Annual Volume (m^3): 12574 Max Daily Volume (m^3): 50 Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1243	W	533270 181180	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Bankside House, 107/112 Leadenhall Street Data Type: Point Name: PRUDENTIAL ASSURANCE CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1243	W	533270 181180	Status: Historical Licence No: 28/39/39/0031 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bankside House, 107/112 Leadenhall Street- Borehole A Data Type: Point Name: SHIATZU HOLDINGS LIMITED	Annual Volume (m^3): 12574 Max Daily Volume (m^3): 50 Original Application No: - Original Start Date: 14/3/1966 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1266	W	533220 180890	Status: Active Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: Version End Date:
Not shown	1266	W	533220 180890	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole B Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: Version End Date:
Not shown	1291	SW	533450 180150	Status: Active Licence No: TH/039/0042/022 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1- Borehole 'a' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1- Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1- Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1291	SW	533450 180150	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1- Borehole 'a' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1291	W	533200 180800	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Plantation House, 4/7 Mincing Lane, London Data Type: Point Name: BLCT LIMITED	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 208 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Gla Building, Tooley Street, London Se1 Data Type: Point Name: LONDON BRIDGE HOLDINGS LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 15/11/2001 Expiry Date: 31/12/2013 Issue No: 2 Version Start Date: Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Gla Building, Tooley Street, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 610400 Max Daily Volume (m^3): 4320 Original Application No: WRA/S/1083 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1323	SW	533390 180180	Status: Active Licence No: TH/039/0042/022 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: MLFH Limited	Annual Volume (m^3): 400000 Max Daily Volume (m^3): 1850 Original Application No: NPS/WR/015223 Original Start Date: 5/6/2013 Expiry Date: 31/3/2019 Issue No: 2 Version Start Date: Version End Date:
Not shown	1323	SW	533390 180180	Status: Historical Licence No: 28/39/42/0062 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: City Hall, The Queens Walk, London Se1 -borehole 'b' Data Type: Point Name: LONDON BRIDGE DEVELOPMENT LIMITED	Annual Volume (m^3): 300000 Max Daily Volume (m^3): 1850 Original Application No: WRA/S/1295 Original Start Date: 15/11/2001 Expiry Date: 31/3/2013 Issue No: 5 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1348	W	533140 180850	Status: Active Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, London Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: Version End Date:
Not shown	1348	W	533140 180850	Status: Historical Licence No: 28/39/39/0011 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 1 Plantation Place, 30 Fenchurch St, Lndon Ec3 - Borehole A Data Type: Point Name: THE ONE PLANTATION PLACE UNIT TRUST	Annual Volume (m^3): 71074 Max Daily Volume (m^3): 624 Original Application No: - Original Start Date: 8/11/1965 Expiry Date: - Issue No: 103 Version Start Date: Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole B Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole A Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1397	W	533100 181100	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'e' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'c' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Leadenhall Street, London Ec3 - Borehole C Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1413	W	533100 181200	Status: Historical Licence No: 28/39/39/0151 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Leadenhall Street, London Ec3 Data Type: Point Name: TOKIO MARINE PROPERTIES LIMITED	Annual Volume (m^3): 2240 Max Daily Volume (m^3): 70.46 Original Application No: - Original Start Date: 12/5/1976 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1467	N	534310 182380	Status: Active Licence No: TH/039/0039/029 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: The Bathhouse, Cheshire Street, London E2-borehole A Data Type: Point Name: Magee	Annual Volume (m^3): 40000 Max Daily Volume (m^3): 100 Original Application No: NPSWR004240 Original Start Date: 13/8/2010 Expiry Date: 31/3/2019 Issue No: 1 Version Start Date: Version End Date:
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: The Bathhouse, Cheshire Street, London E2-borehole A Data Type: Point Name: PENINSULA WATER LIMITED	Annual Volume (m^3): 80000 Max Daily Volume (m^3): 360 Original Application No: - Original Start Date: 2/8/2000 Expiry Date: 31/12/2009 Issue No: 5 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1467	N	534310 182380	Status: Historical Licence No: 28/39/39/0193 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Borehole At The Bathhouse, Cheshire Street, London E2 Data Type: Point Name: METROPOLITAN WATER CO LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 2/8/2000 Expiry Date: 31/12/2009 Issue No: 3 Version Start Date: Version End Date:
Not shown	1588	W	532900 181000	Status: Historical Licence No: 28/39/39/0056 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Three Boreholes At 9 Gracechurch Street, London Ec3 Data Type: Point Name: J.P.I.T. (Pte) LIMITED	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 9/5/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1685	W	532810 181100	Status: Active Licence No: 28/39/39/0166 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 71 Lombard Street- Borehole A Data Type: Point Name: Ashton Global Investments Ltd	Annual Volume (m^3): 6819 Max Daily Volume (m^3): 250.94 Original Application No: NPS/WR/001299 Original Start Date: 25/3/1982 Expiry Date: - Issue No: 102 Version Start Date: Version End Date:
Not shown	1695	W	532800 181100	Status: Historical Licence No: 28/39/39/0166 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: 71 Lombard Street, London - Borehole Data Type: Point Name: LLOYDS TSB BANK PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 25/3/1982 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1790	W	532700 180800	Status: Historical Licence No: 28/39/39/0094 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At 98/106 Cannon Street, London Ec4 Data Type: Point Name: ASGARD ESTATES LTD	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1807	W	532700 181200	Status: Active Licence No: 28/39/39/0024 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Bank Of England, Threadneedle Street - Nine Boreholes Data Type: Point Name: BANK OF ENGLAND	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 127 Original Application No: - Original Start Date: 10/1/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1807	W	532700 181200	Status: Historical Licence No: 28/39/39/0024 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Nine Boreholes At The Bank Of England, Threadneedle Street Data Type: Point Name: BANK OF ENGLAND	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 127 Original Application No: - Original Start Date: 10/1/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1817	W	532800 181600	Status: Active Licence No: 28/39/39/0129 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Salisbury House, London Wall, London Ec2 - Three Boreholes Data Type: Point Name: MREF II Salisbury Property Limited	Annual Volume (m^3): 25457 Max Daily Volume (m^3): 81.8 Original Application No: NPS/WR/009934 Original Start Date: 12/6/1967 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1817	W	532800 181600	Status: Historical Licence No: 28/39/39/0129 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Three Boreholes At Salisbury House, London Wall, London Ec2 Data Type: Point Name: MREF II Salisbury Property Limited	Annual Volume (m^3): 25457 Max Daily Volume (m^3): 81.8 Original Application No: NPS/WR/009934 Original Start Date: 12/6/1967 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1828	S	535101 179144	Status: Active Licence No: TH/039/0042/021 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Point 'a' At Southwark Park Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 2100 Max Daily Volume (m^3): 800 Original Application No: NPS/WR/009262 Original Start Date: 1/4/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: Version End Date:
Not shown	1872	S	535110 179100	Status: Historical Licence No: TH/039/0042/001 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole At Southwark Park, Southwark London Data Type: Point Name: LONDON BOROUGH OF SOUTHWARK	Annual Volume (m^3): 25000 Max Daily Volume (m^3): 800 Original Application No: NPSWR 000165 Original Start Date: 18/5/2009 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'b' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'c' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'd' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1906	W	532600 181200	Status: Historical Licence No: 28/39/39/0098 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Borehole 'a' At Poultry, London Ec2 Data Type: Point Name: HSBC BANK plc	Annual Volume (m^3): 33317.6 Max Daily Volume (m^3): 90.92 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1945	NW	532900 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole D Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: Version End Date:
Not shown	1953	NW	532890 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole C Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: Version End Date:
Not shown	1970	NW	532870 182050	Status: Active Licence No: 28/39/39/0069 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Thames Groundwater Point: Triton Court, Finsbury Square- Borehole B Data Type: Point Name: THE TRITON COURT LIMITED PARTNERSHIP	Annual Volume (m^3): 36368 Max Daily Volume (m^3): 118 Original Application No: - Original Start Date: 13/6/1966 Expiry Date: - Issue No: 104 Version Start Date: Version End Date:

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
137	SE	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? No

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	401	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

6.11 Surface Water Features

Are there any surface water features within 250m of the study site? No

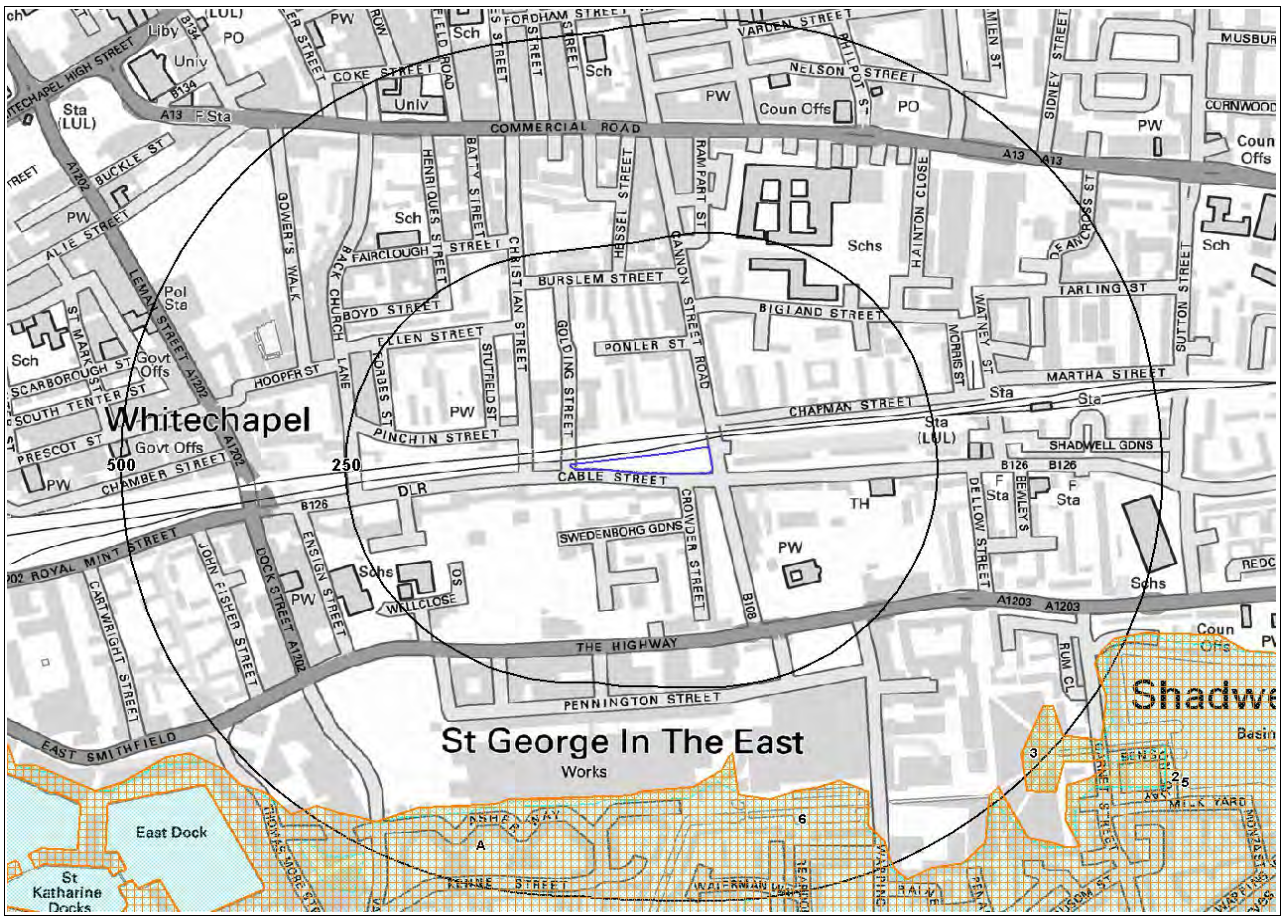
Database searched and no data found.

7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)

NW N NE

W E

SW S SE



Site Outline

100
250
Search Buffers (m)

Zone 2 Floodplain

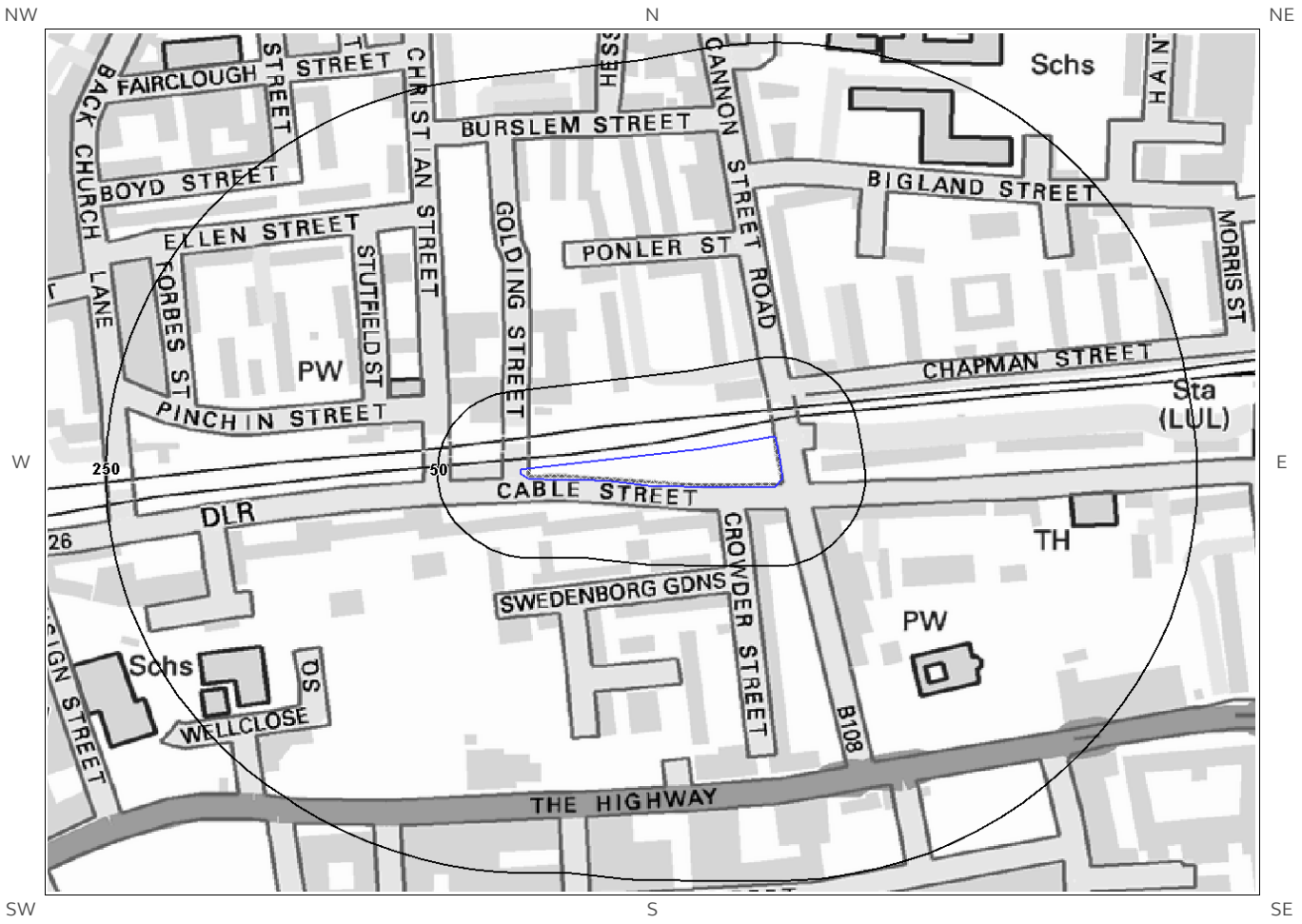
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

Very Low

Low

Medium

High

7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No

Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? No

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Not Prone

The area is not considered to be prone to groundwater flooding based on rock type.

7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Not Applicable

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map

NW N NE

W E

SW S SE

Site Outline

100 250 Search Buffers (m)

AONB

National Park

SSSI

Special Protection Areas

Nitrate Vulnerable Zones

Green Belt

Environmentally Sensitive Areas

Special Areas of Conservation

World Heritage Sites

Nitrate Sensitive Areas

Ancient Woodland

National Nature Reserve

Local Nature Reserves

Ramsar Sites

8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site?	Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

1

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
Not shown	1700	E	Lavender Pond	Natural England

8.8 Records of World Heritage Sites within 2000m of the study site:

1

The following World Heritage Site records provided by English Heritage and Cadw are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	World Heritage Site Name	Data Source
2	766	W	Tower of London	English Heritage

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

0

Database searched and no data found.

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure Geo Insight, available from our website. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell*[*] hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing
ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site? No

Database searched and no data found.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No
Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Environment Agency
National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 03708 506 506
Web: **www.environment-agency.gov.uk**
Email: enquiries@environment-agency.gov.uk

Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

The Coal Authority
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: London Borough of Tower Hamlets
Phone: 020 7364 5000
Web: http://www.towerhamlets.gov.uk/
Address: Town Hall, Mulberry Place, London, E14 2BG

Gemapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016

Groundsure
LOCATION INTELLIGENCE

Arcadis

Arcadis,10, MEDAWAR ROAD,
GUILDFORD, GU2 7AR

Groundsure Reference:	GS-4021731
Your Reference:	PO0067007-1
Report Date	27 Jun 2017
Report Delivery Method:	Email - pdf

Geo Insight

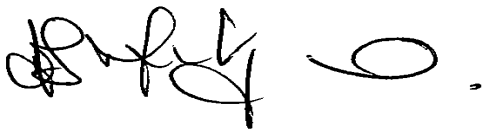
Address: Land to the North Side of Royal Mint Street / Cable Street,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight

Geo Insight

Address:	**Land to the North Side of Royal Mint Street / Cable Street,**
Date:	**27 Jun 2017**
Reference:	**GS-4021731**
Client:	**Arcadis**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	07-Jun-2015
Grid Reference:	534598,180924
Site Size:	0.29ha

Groundsure
LOCATION INTELLIGENCE

Contents Page

Contents Page ... 3
Overview of Findings ... 5
1:10,000 Scale Availability ... 8
Availability of 1:10,000 Scale Geology Mapping ... 9
1 Geology (1:10,000 scale) ... 10
1.1 Artificial Ground Map (1:10,000 scale) ... 10
1. Geology 1:10,000 scale ... 11
1.1 Artificial Ground ... 11
1.2 Superficial Deposits and Landslips Map (1:10,000 scale) ... 12
1.2 Superficial Deposits and Landslips ... 13
1.2.1 Superficial Deposits/ Drift Geology ... 13
1.2.2 Landslip ... 13
1.3 Bedrock and Faults Map (1:10,000 scale) ... 14
1.3 Bedrock and Faults ... 15
1.3.1 Bedrock/ Solid Geology ... 15
1.3.2 Faults ... 15
2 Geology 1:50,000 Scale ... 16
2.1 Artificial Ground Map ... 16
2. Geology 1:50,000 scale ... 17
2.1 Artificial Ground ... 17
2.1.1 Artificial/ Made Ground ... 17
2.1.2 Permeability of Artificial Ground ... 17
2.2 Superficial Deposits and Landslips Map (1:50,000 scale) ... 18
2.2 Superficial Deposits and Landslips ... 19
2.2.1 Superficial Deposits/ Drift Geology ... 19
2.2.2 Permeability of Superficial Ground ... 19
2.2.3 Landslip ... 19
2.2.4 Landslip Permeability ... 19
2.3 Bedrock and Faults Map (1:50,000 scale) ... 20
2.3 Bedrock, Solid Geology & Faults ... 21
2.3.1 Bedrock/Solid Geology ... 21
2.3.2 Permeability of Bedrock Ground ... 21
2.3.3 Faults ... 21
3 Radon Data ... 22
3.1 Radon Affected Areas ... 22
3.2 Radon Protection ... 22
4 Ground Workings Map ... 23
4 Ground Workings ... 24
4.1 Historical Surface Ground Working Features derived from Historical Mapping ... 24
4.2 Historical Underground Working Features derived from Historical Mapping ... 24
4.3 Current Ground Workings ... 26
5 Mining, Extraction & Natural Cavities ... 28
5.1 Historical Mining ... 28
5.2 Coal Mining ... 28
5.3 Johnson Poole and Bloomer ... 28
5.4 Non-Coal Mining ... 29
5.5 Non-Coal Mining Cavities ... 29
5.6 Natural Cavities ... 29
5.7 Brine Extraction ... 29
5.8 Gypsum Extraction ... 29
5.9 Tin Mining ... 30
5.10 Clay Mining ... 30
6 Natural Ground Subsidence ... 31
6.1 Shrink-Swell Clay Map ... 31
6.2 Landslides Map ... 32
6.3 Ground Dissolution of Soluble Rocks Map ... 33
6.4 Compressible Deposits Map ... 34
6.5 Collapsible Deposits Map ... 35
6.6 Running Sand Map ... 36

6 Natural Ground Subsidence 37
6.1 Shrink-Swell Clays 37
6.2 Landslides 37
6.3 Ground Dissolution of Soluble Rocks 37
6.4 Compressible Deposits 38
6.5 Collapsible Deposits 38
6.6 Running Sands 38
7 Borehole Records 40
8 Estimated Background Soil Chemistry 50
9 Railways and Tunnels Map 51
9 Railways and Tunnels 52
9.1 Tunnels 52
9.2 Historical Railway and Tunnel Features 53
9.3 Historical Railways 55
9.4 Active Railways 55
9.5 Railway Projects 56

Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology 1:10,000 Scale		
1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	Yes
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale		
2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?	Yes
	2.3.3 Are there any records of faults within 500m of the study site boundary?	No

Section 3: Radon

3. Radon	3.1Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
	3.2Radon Protection	No radon protective measures are necessary.

Section 4: Ground Workings	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	3	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	4	29
4.3 Current Ground Workings	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	3
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	1	0	1	4	2
5.4 Non-Coal Mining*	0	0	0	0	0
5.5 Non–Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0

Section 6: Natural Ground Subsidence	On-site
6.1 Shrink-Swell Clay	Very Low
6.2 Landslides	Very Low
6.3 Ground Dissolution of Soluble Rocks	Negligible
6.4 Compressible Deposits	Negligible
6.5 Collapsible Deposits	Low
6.5 Running Sand	Negligible

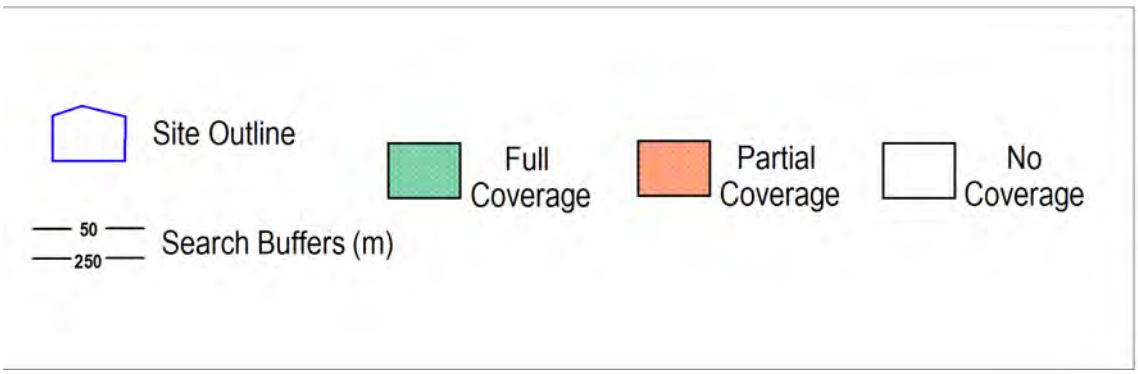
Section 7: Borehole Records	On-site	0-50m	51-250
7 BGS Recorded Boreholes	2	18	126

Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250
8 Records of Background Soil Chemistry	2	0	0

Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500
9.1 Tunnels	0	1	0	Not Searched
9.2 Historical Railway and Tunnel Features	7	16	29	Not Searched
9.3 Historical Railways	0	0	0	Not Searched
9.4 Active Railways	0	20	10	Not Searched
9.5 Railway Projects	0	0	0	0

1:10,000 Scale Availability

1_10,000 Availability Legend



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	No coverage
2	357.0	Some deposits are mapped	Full	Full	No coverage
3	912.0	Some deposits are mapped	Full	Full	No coverage
4	981.0	Some deposits are mapped	Full	Full	No coverage

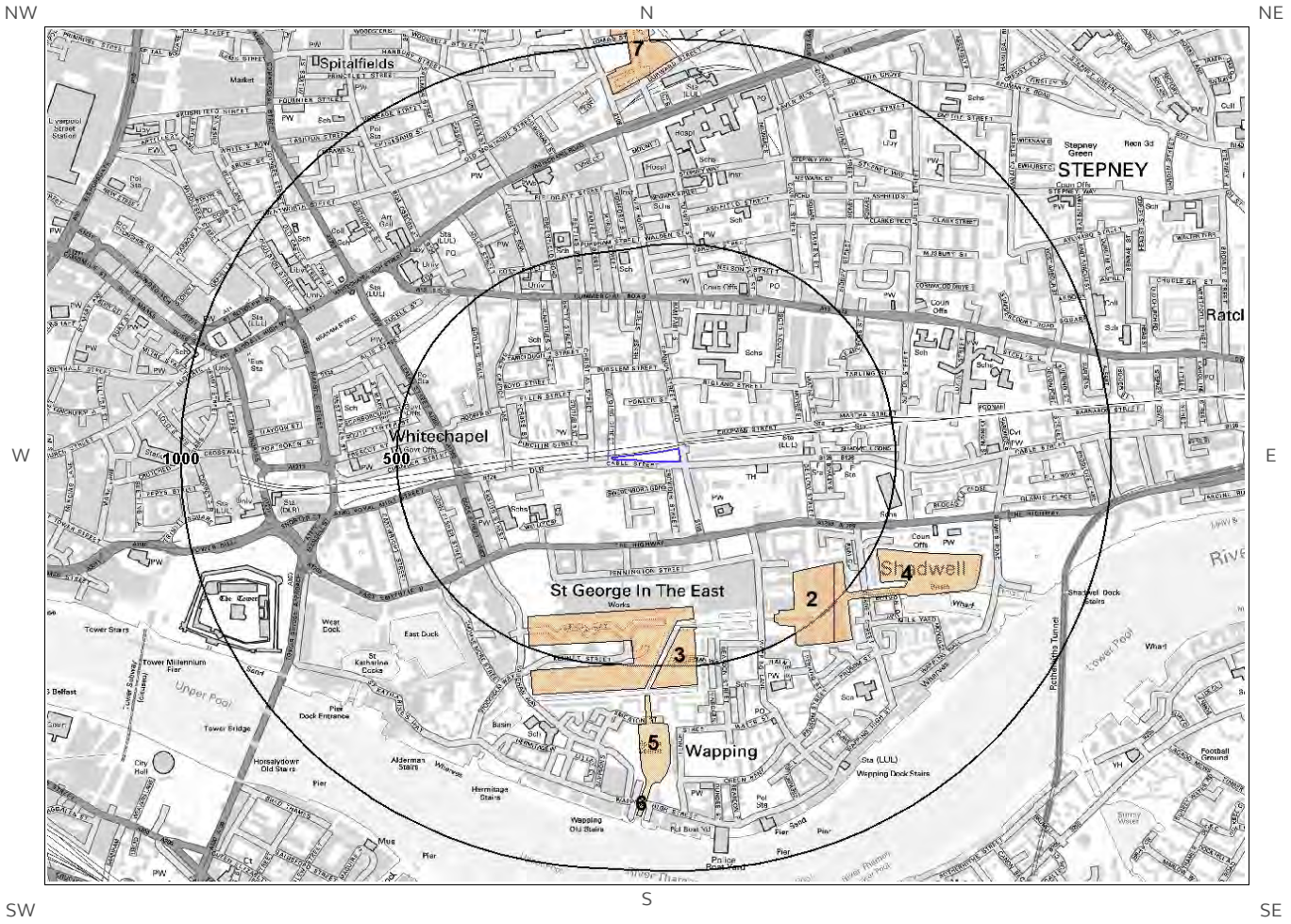
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

1. Geology 1:10,000 scale

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

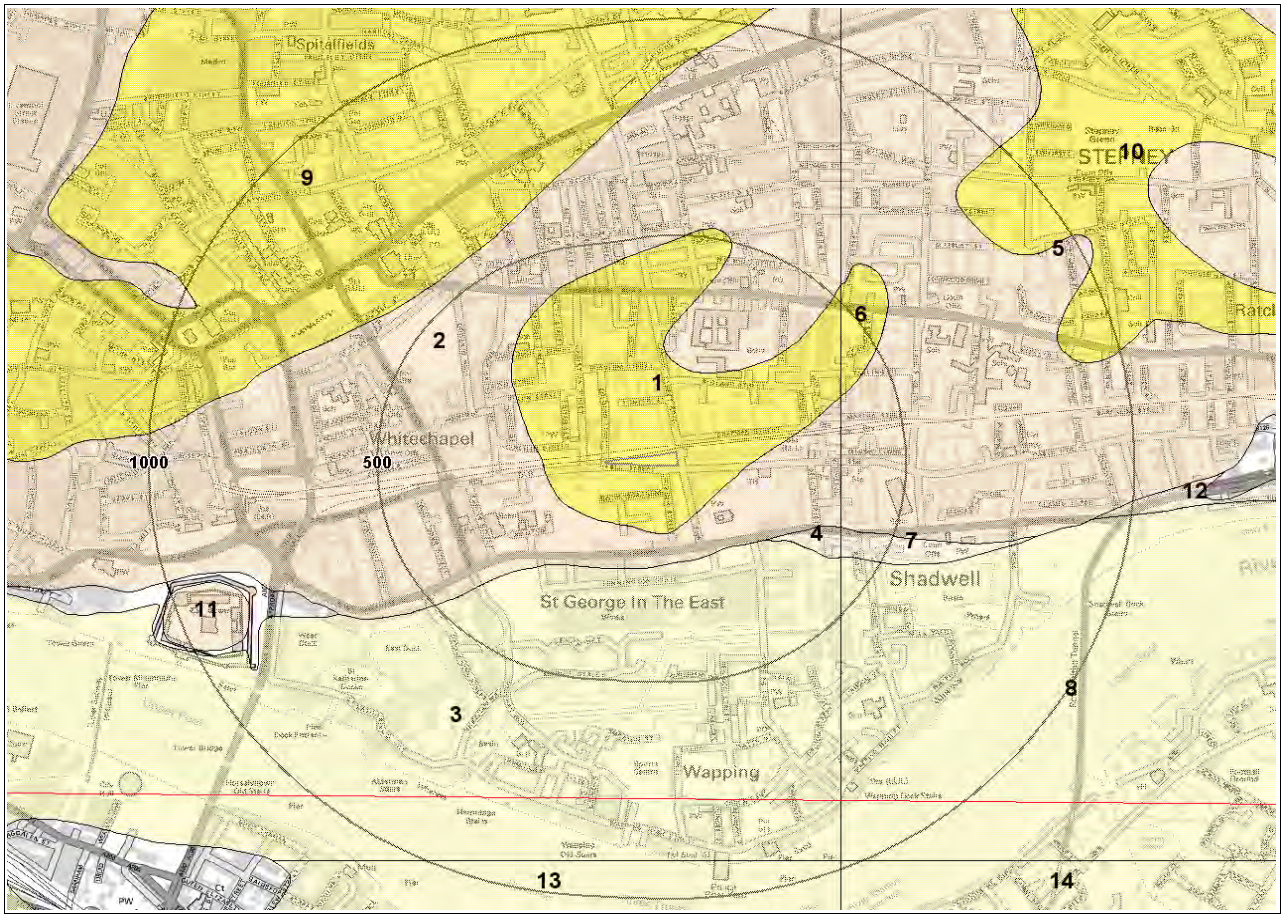
ID	Distance	Direction	LEX Code	Description	Rock Description
1	355.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	378.0	SE	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
3	404.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
4	437.0	SE	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)

NW N NE

W E

SW S SE



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	LASI-Z	Langley Silt Member - Silt (unlithified Deposits Coding Scheme)	Silt
2	108.0	SE	TPGR-XSV	Taplow Gravel Formation - Sand And Gravel	Sand And Gravel
3	217.0	SE	ALV-XCZ	Alluvium - Clay And Silt	Clay And Silt
4	259.0	SE	KPGR-XSV	Kempton Park Gravel Formation - Sand And Gravel	Sand And Gravel
5	357.0	E	TPGR-XSV	Taplow Gravel Formation - Sand And Gravel	Sand And Gravel
6	383.0	E	LASI-Z	Langley Silt Member - Silt (unlithified Deposits Coding Scheme)	Silt
7	386.0	E	KPGR-XSV	Kempton Park Gravel Formation - Sand And Gravel	Sand And Gravel
8	417.0	SE	ALV-C	Alluvium - Clay (unlithified Deposits Coding Scheme)	Clay

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

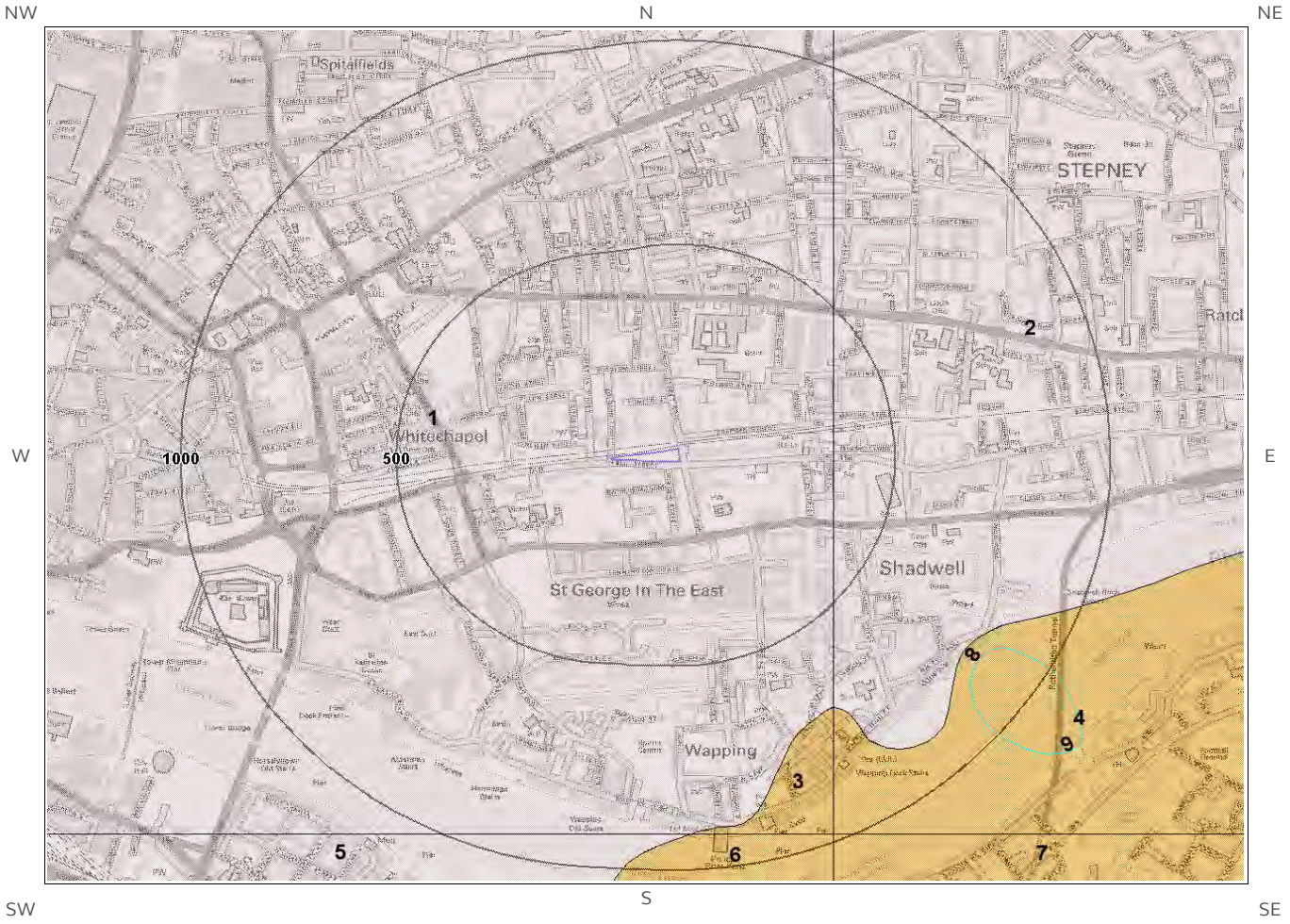
No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and Faults Map (1:10,000 scale)



Bedrock and Faults Legend

Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	LC-CLAY	London Clay Formation - Clay	Eocene Epoch
2	357.0	E	LC-CLAY	London Clay Formation - Clay	Eocene Epoch

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found at this scale.

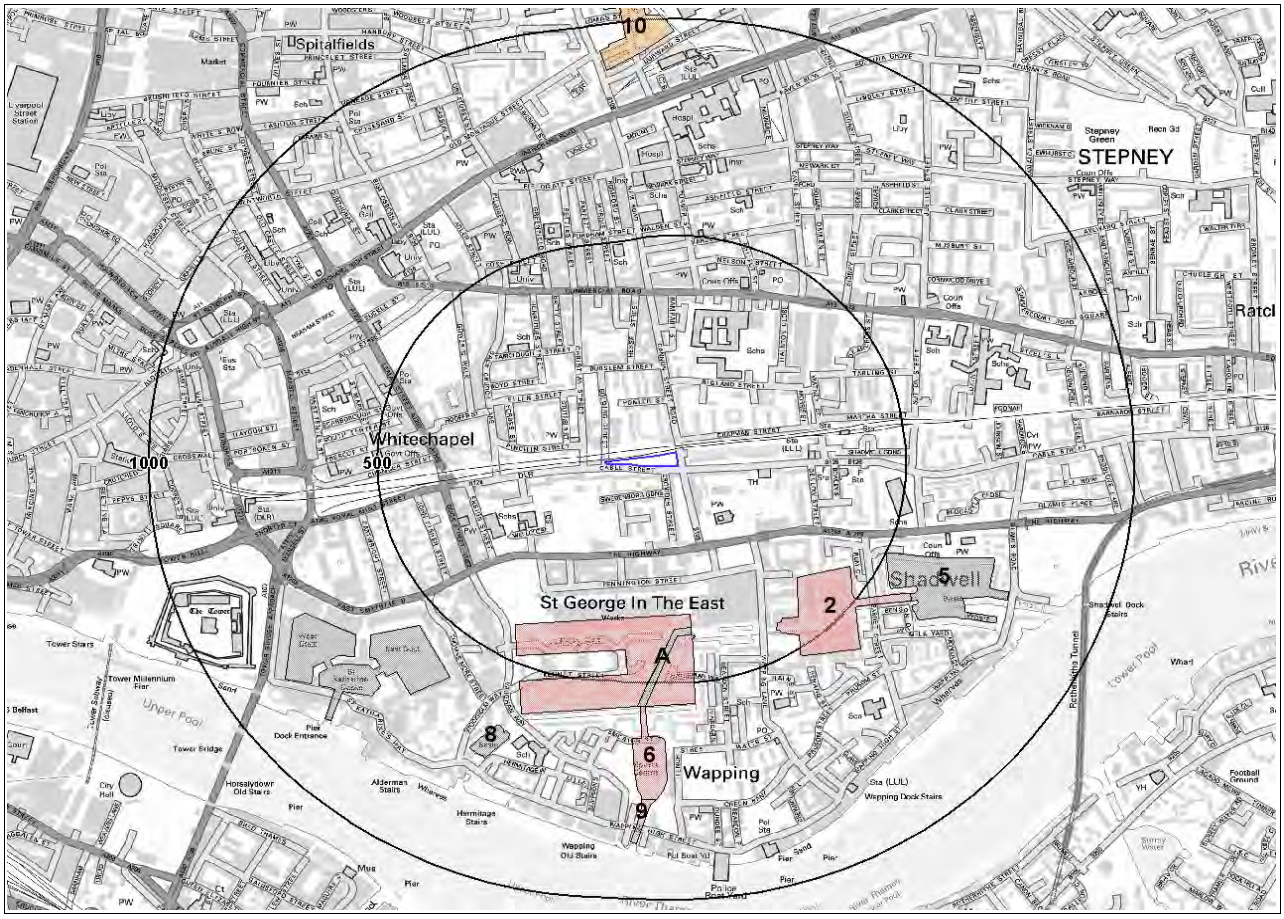
The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2 Geology 1:50,000 Scale

2.1 Artificial Ground Map

NW N NE



W E

SW S SE

Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 256

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

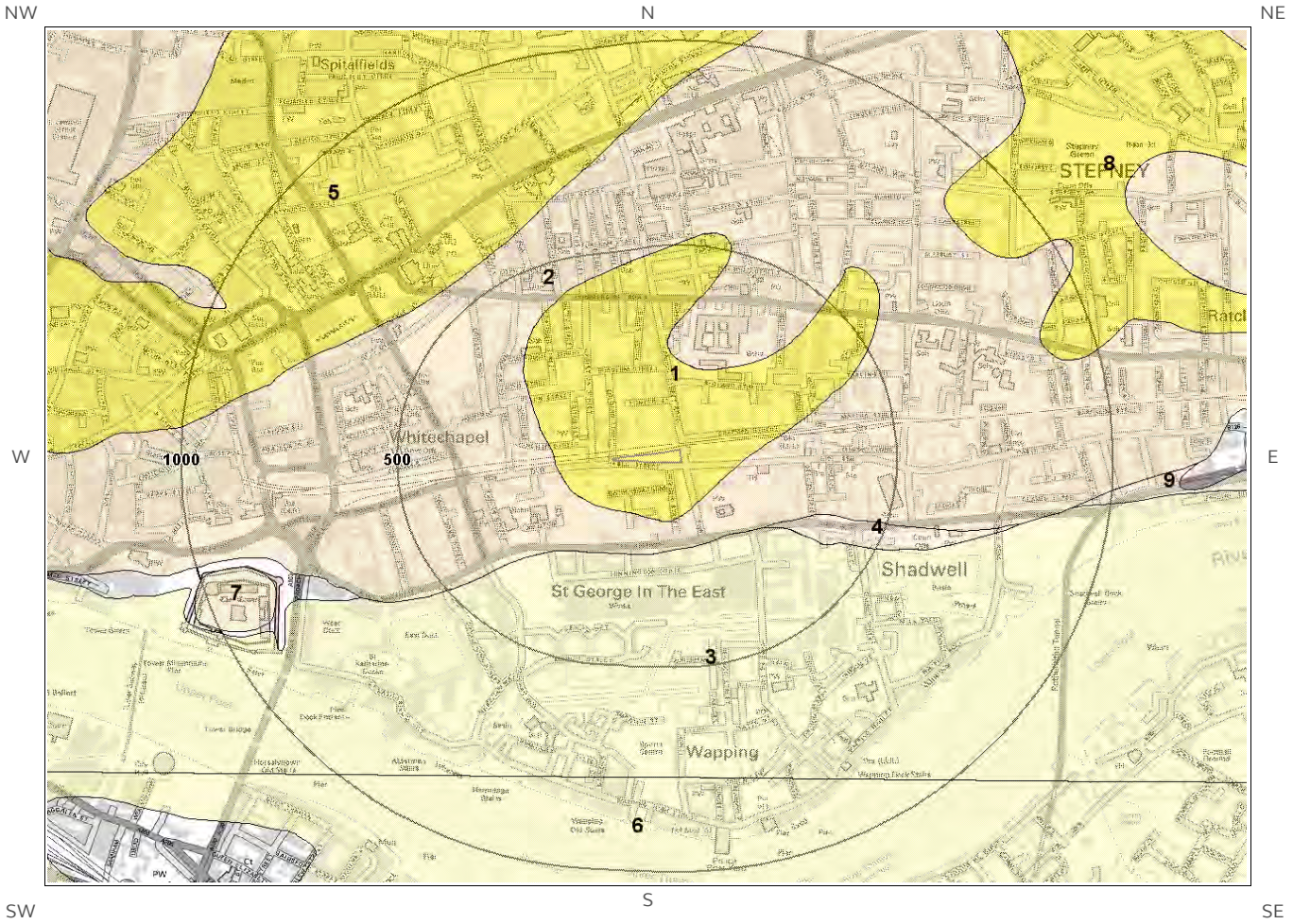
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	341.0	S	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
2	369.0	SE	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
3A	373.0	S	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
4A	390.0	S	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
5	500.0	SE	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	LASI-XCZ	LANGLEY SILT MEMBER	CLAY AND SILT
2	98.0	SE	TPGR-XSV	TAPLOW GRAVEL MEMBER	SAND AND GRAVEL
3	205.0	SE	ALV-XCZSP	ALLUVIUM	CLAY, SILT, SAND AND PEAT
4	250.0	SE	KPGR-XSV	KEMPTON PARK GRAVEL MEMBER	SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Low	Very Low

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

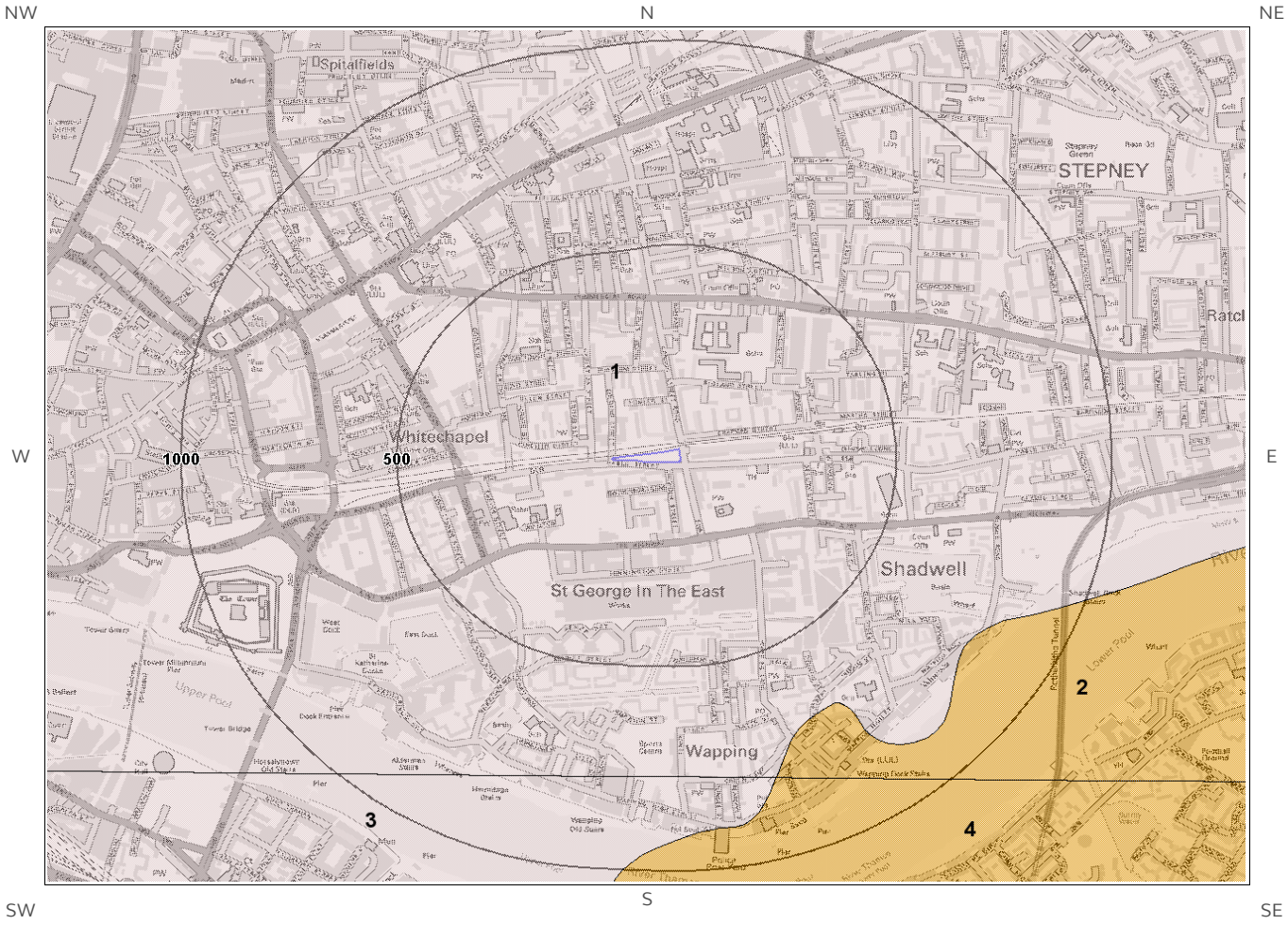
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 256

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	LC-XCZS	LONDON CLAY FORMATION - CLAY, SILT AND SAND	YPRESIAN

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Moderate	Very Low

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

3.1 Radon Affected Areas

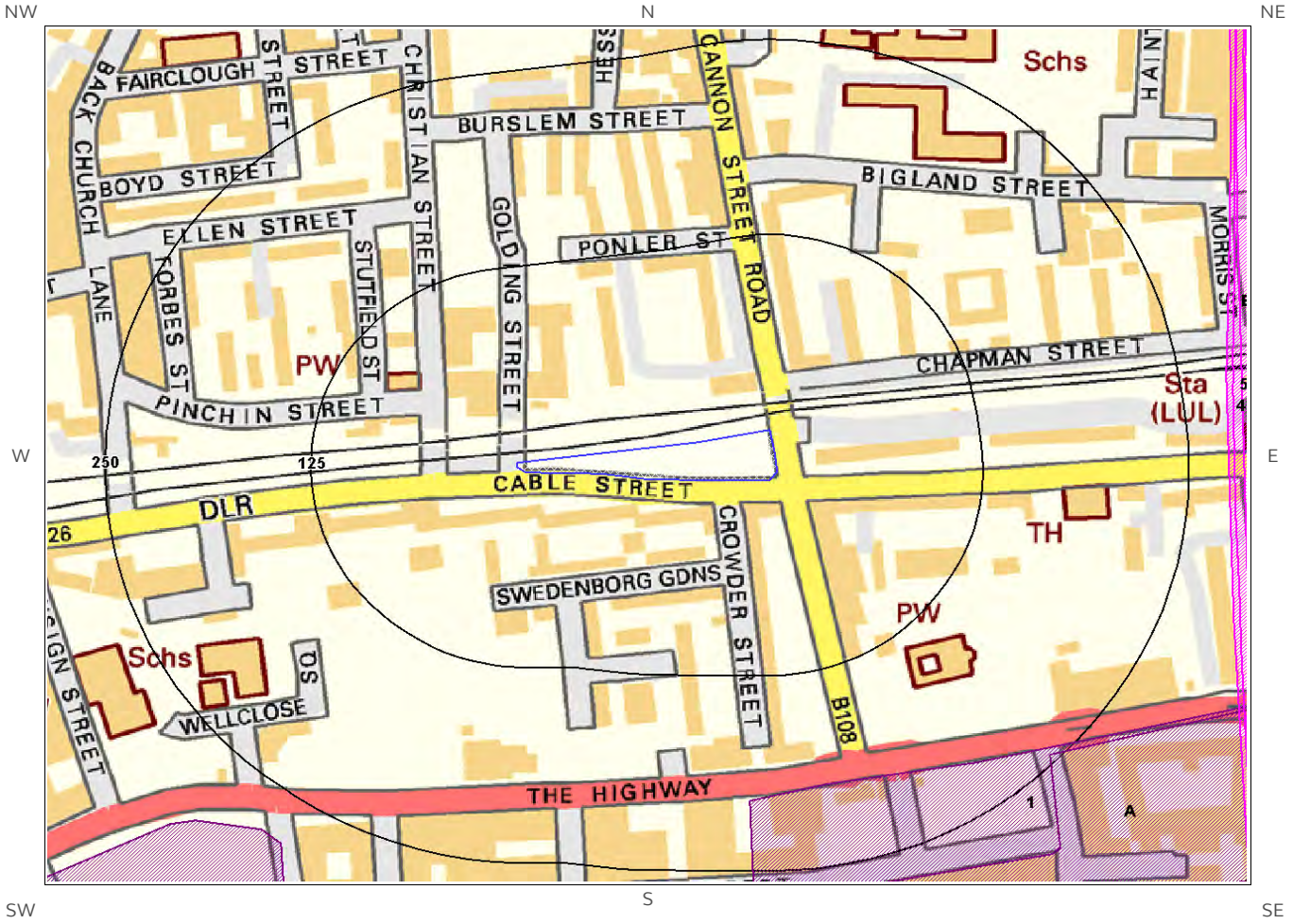
Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

---

4 Ground Workings Map



Ground Workings Legend

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1	197.0	S	535044 180514	Docks	1894
2A	245.0	SE	534734 180426	Docks	1914
3A	245.0	SE	534734 180426	Docks	1938

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? Yes

The following Historical Underground Working Features are provided by Groundsure:

ID	Distance (m)	Direction	NGR	Use	Date
4	274.0	E	534980 180260	Tunnel	1894
5	278.0	E	534932 180739	Tunnel	1894
6B	283.0	E	534958 180481	Tunnel	1938
7B	283.0	E	534958 180481	Tunnel	1914
Not shown	525.0	NE	534917 181549	Tunnel	1894
Not shown	686.0	NW	534103 181501	Tunnel	1894
Not shown	766.0	SE	535005 180206	Tunnel	1873
Not shown	766.0	SE	535005 180206	Tunnel	1873
Not shown	768.0	N	534467 181725	Tunnel	1894

ID	Distance (m)	Direction	NGR	Use	Date
Not shown	777.0	SE	535066 180110	Tunnel	1940
Not shown	791.0	N	534782 181772	Tunnel	1894
Not shown	796.0	N	534629 181773	Tunnel	1894
Not shown	825.0	N	534768 181795	Tunnel	1940
Not shown	829.0	SE	535135 180028	Tunnel	1873
Not shown	829.0	SE	535135 180028	Tunnel	1873
Not shown	834.0	W	533643 180956	Tunnel	1894
Not shown	835.0	NW	533634 181276	Tunnel	1894
Not shown	844.0	SE	535139 180023	Tunnel	1873
Not shown	844.0	SE	535139 180023	Tunnel	1873
Not shown	861.0	SE	535167 179989	Tunnel	1894
Not shown	917.0	E	535529 180644	Air Shaft	1914
Not shown	919.0	E	535528 180651	Air Shaft	1938
Not shown	919.0	E	535527 180644	Air Shaft	1940
Not shown	920.0	E	535518 180343	Tunnel	1914
Not shown	920.0	E	535518 180343	Tunnel	1938
Not shown	920.0	E	535523 180455	Tunnel	1973
Not shown	920.0	E	535523 180455	Tunnel	1989
Not shown	920.0	E	535523 180455	Tunnel	1965
Not shown	920.0	E	535523 180455	Tunnel	1994
Not shown	920.0	E	535523 180455	Tunnel	1981
Not shown	920.0	E	535523 180455	Tunnel	1955
Not shown	921.0	E	535520 180452	Tunnel	1940
Not shown	941.0	W	532977 180815	Tunnel	1895

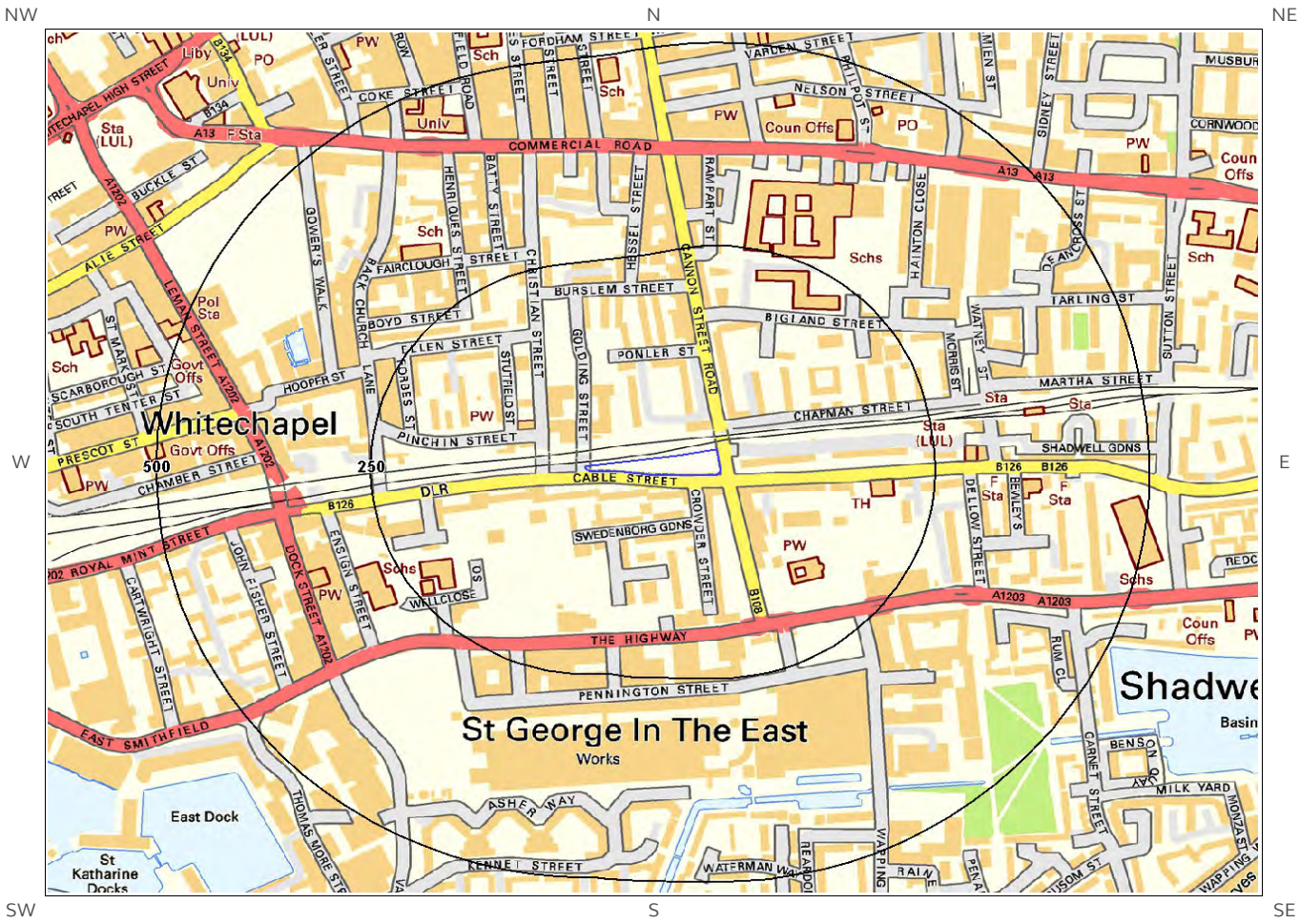
4.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? No

Database searched and no data found.

5 Mining, Extraction & Natural Cavities Map



Mining, Extraction and Natural Cavities Legend

Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? Yes

The following Historical Mining information is provided by Groundsure:

ID	Distance (m)	Direction	NGR	Details	Date
Not shown	917.0	E	535529 180644	Air Shaft	1914
Not shown	919.0	E	535528 180651	Air Shaft	1938
Not shown	919.0	E	535527 180644	Air Shaft	1940

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? Yes

The following information provided by JPB is not represented on mapping: Whilst outside of an area where The Coal Authority have information on coal mining activities, Johnson Poole & Bloomer (JPB) have information such as mining plans and maps held within their archive of mining activities that have occurred within 1km of this property. Further details and a quote for services can be obtained by emailing this report to enquiries.gs@jpb.co.uk.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

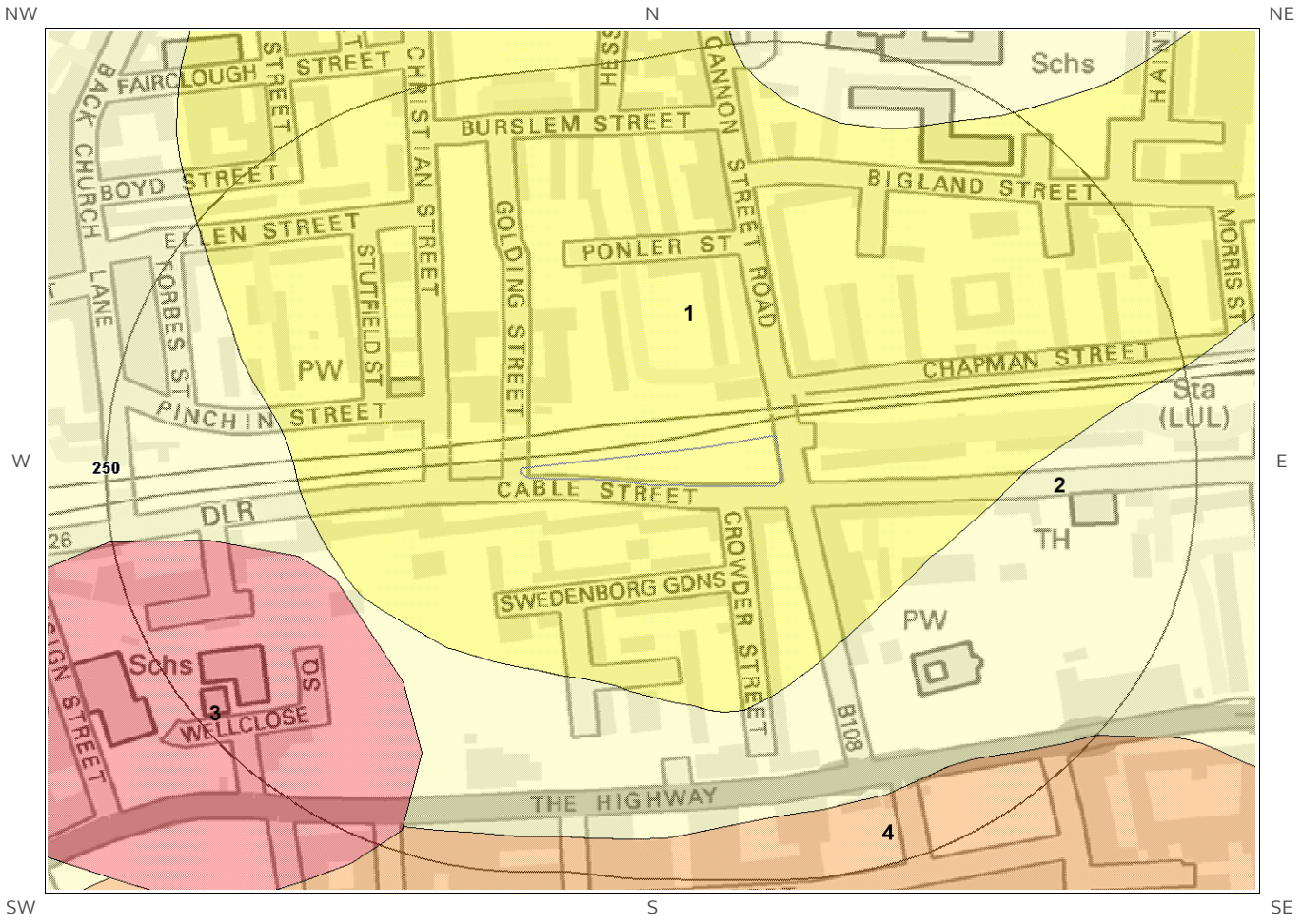
Are there any Clay Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

---

6 Natural Ground Subsidence

6.1 Shrink-Swell Clay Map



Shrink Swell Clay Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.2 Landslides Map

Landslides Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.3 Ground Dissolution of Soluble Rocks Map

Ground Dissolution Soluble Rocks Legend

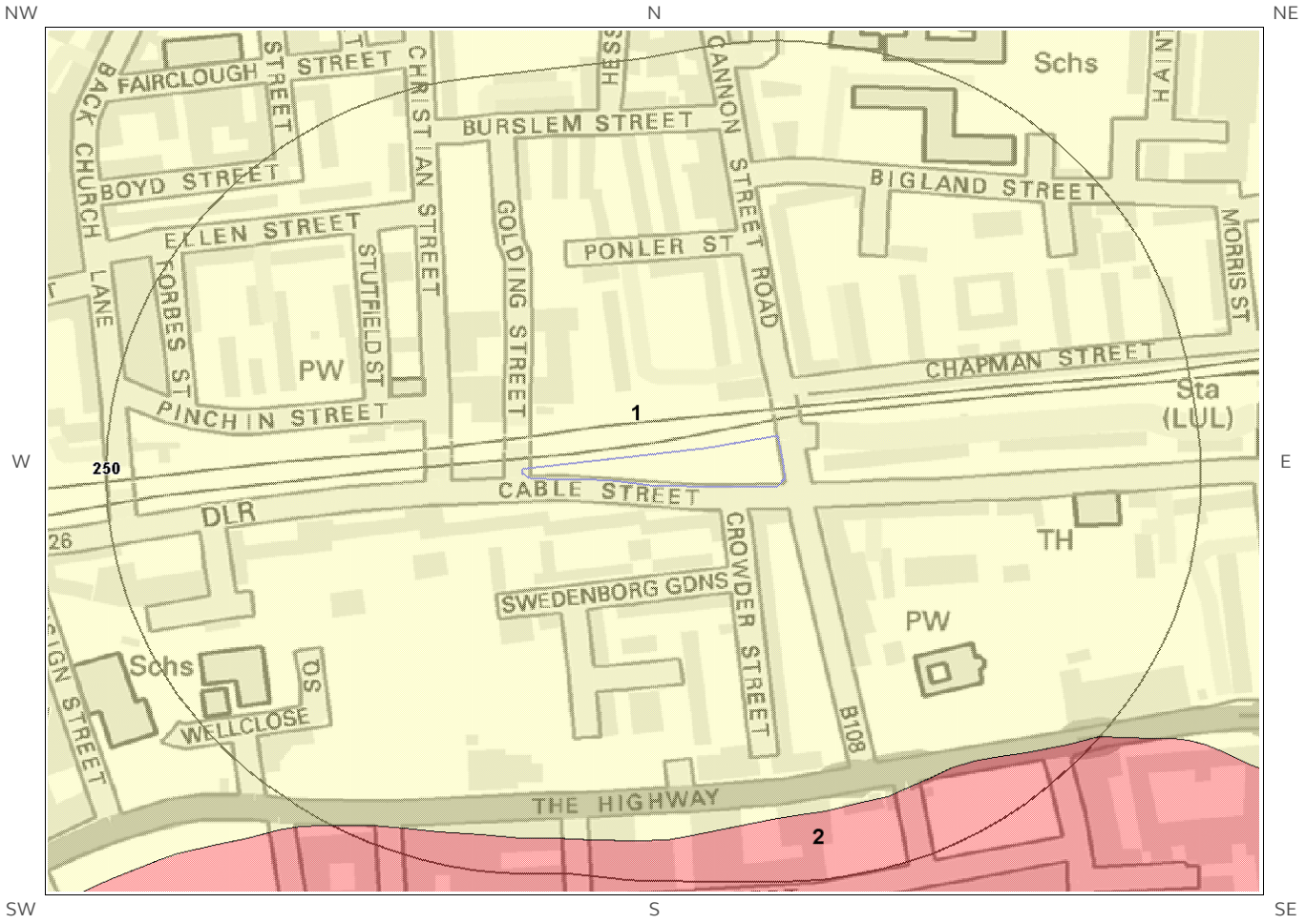
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

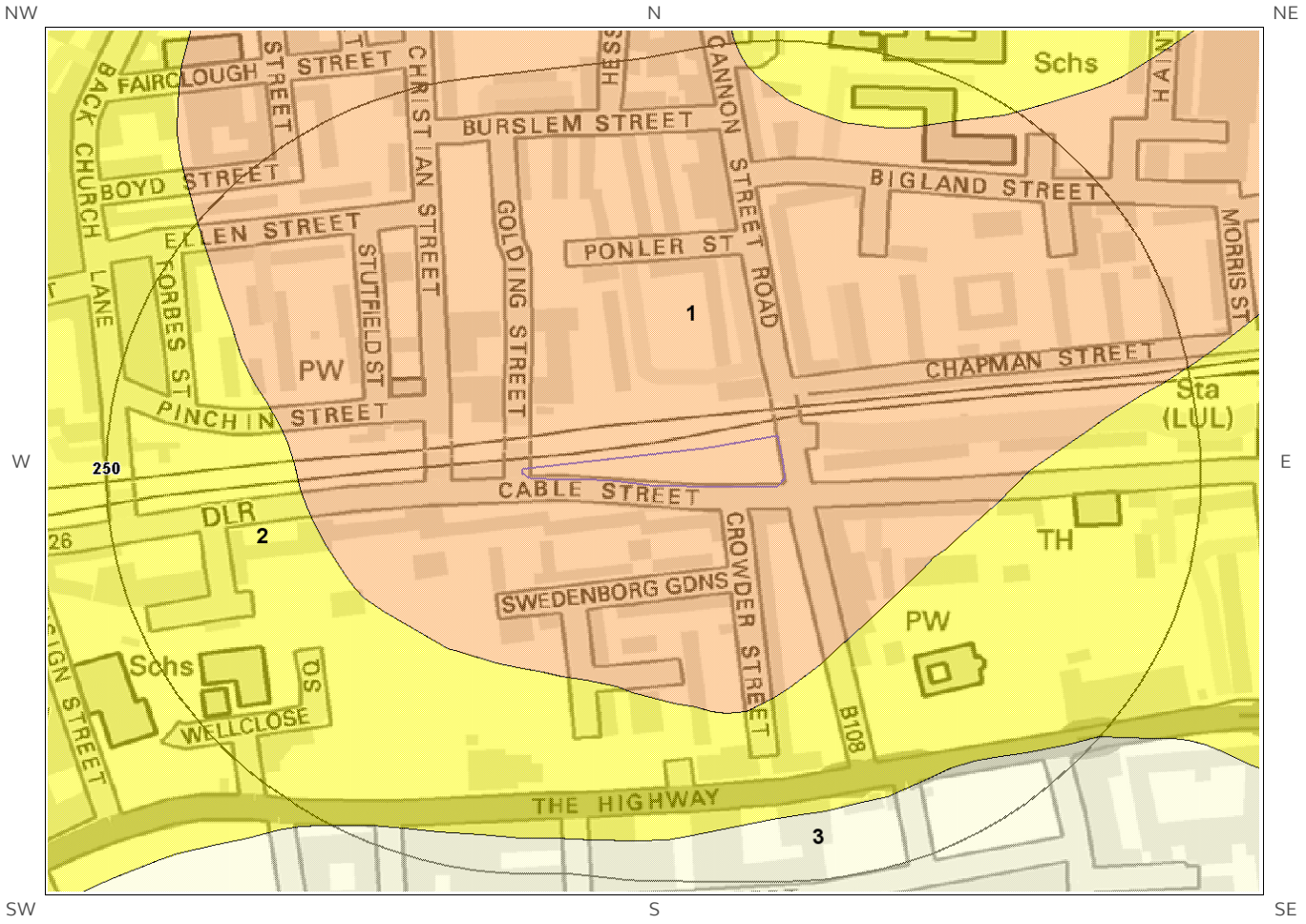
Low
Moderate
High

6.4 Compressible Deposits Map



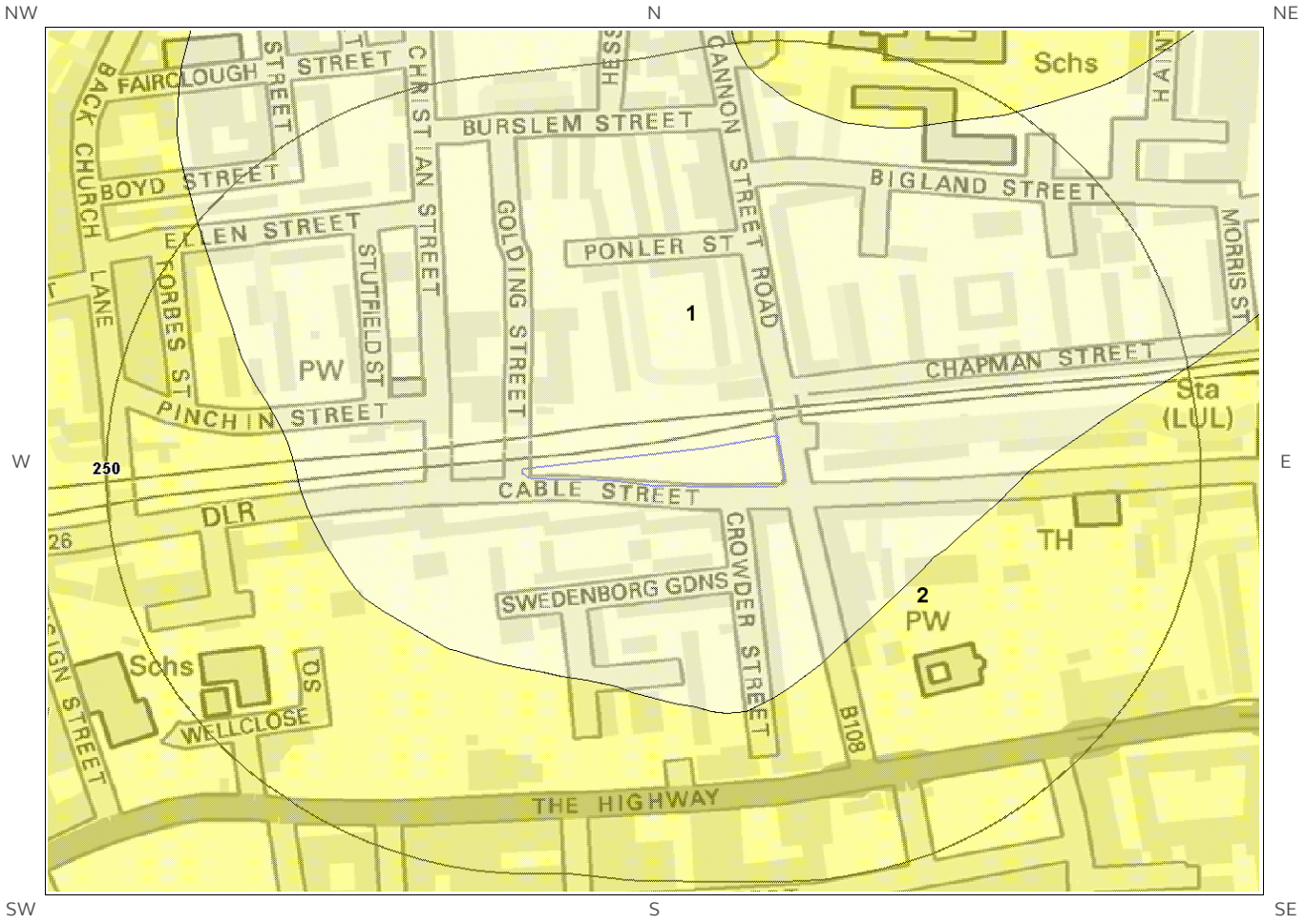
Compressible Deposits Legend

6.5 Collapsible Deposits Map



Collapsible Deposits Legend

6.6 Running Sand Map



Running Sand Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site*[*] boundary? Low

6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This includes an automatically generated 50m buffer zone around the site

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

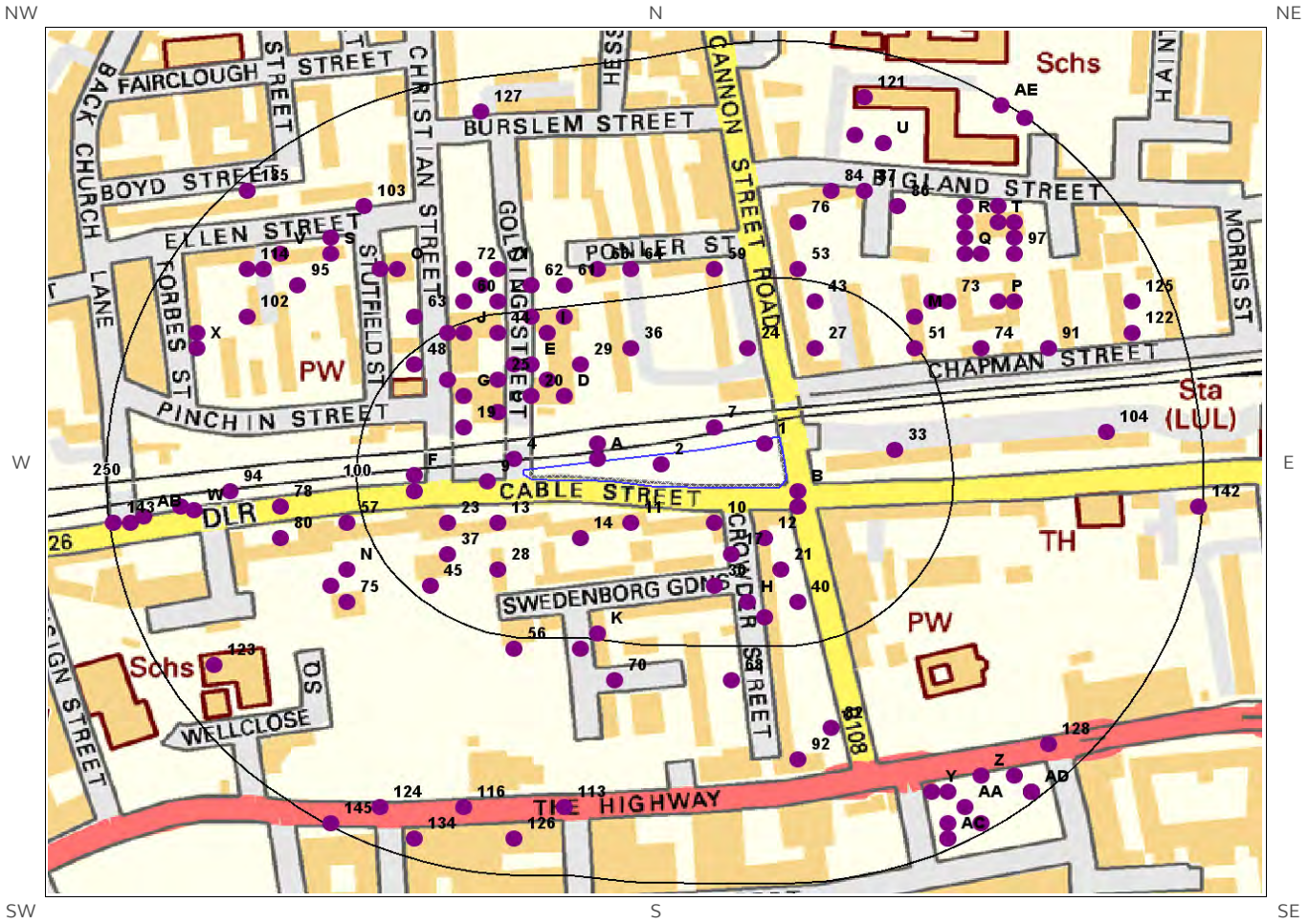
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely.

6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

7 Borehole Records Map



Borehole Records Legend

Site Outline

Borehole Locations

125
250
Search Buffers (m)

7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: 146

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	0.0	On Site	534630 180940	TQ38SW3813	30.0	LONDON DOCKLANDS RAILWAY 410
2	0.0	On Site	534568 180927	TQ38SW2209	30.0	DOCKLANDS RAILWAY 408
3A	1.0	N	534530 180930	TQ38SW3812	30.0	LONDON DOCKLANDS RAILWAY 409
4	9.0	NW	534480 180930	TQ38SW3801	1.6	LONDON DOCKLANDS RAILWAY TP 8
5B	10.0	SE	534650 180910	TQ38SW3910	16.3	LONDON DOCKS GS 9
6A	11.0	N	534530 180940	TQ38SW3802	2.2	LONDON DOCKLANDS RAILWAY TP 9
7	12.0	N	534600 180950	TQ38SW3803	1.5	LONDON DOCKLANDS RAILWAY TP 10
8B	16.0	SE	534650 180900	TQ38SW60	16.76	CANNON STREET/CABLE STREET
9	22.0	W	534464 180916	TQ38SW2208	30.0	DOCKLANDS RAILWAY 407
10	22.0	S	534600 180890	TQ38SW852	12.03	SWEDENBORG SQUARE W
11	25.0	S	534550 180890	TQ38SW758/C	9.14	SWEDENBORG SQ, STEPNEY C
12	32.0	S	534630 180880	TQ38SW1424	9.0	CROWDER STREET STEPNEY A
13	34.0	SW	534470 180890	TQ38SW758/A	9.9	SWEDENBORG SQ, STEPNEY A
14	37.0	S	534520 180880	TQ38SW758/B	9.14	SWEDENBORG SQ, STEPNEY B
15C	40.0	NW	534470 180960	TQ38SW4810	1.8	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP7
16C	40.0	NW	534470 180960	TQ38SW4801	30.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 2
17	42.0	S	534610 180870	TQ38SW853	12.19	SWEDENBORG SQUARE X
18D	43.0	N	534510 180970	TQ38SW4817	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS7
19	45.0	NW	534450 180950	TQ38SW4809	2.5	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP6
20	46.0	N	534490 180970	TQ38SW4816	3.6	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS6

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
21	52.0	S	534640 180860	TQ38SW1425	15.0	CROWDER STREET STEPNEY B
22D	54.0	N	534500 180980	TQ38SW4815	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS5
23	55.0	SW	534440 180890	TQ38SW773/G	12.19	SWEDENBORG SQ. STAGE 2 L
24	58.0	N	534620 181000	TQ38SW1406	6.0	BERNER ESTATE STEPNEY 1949 BH3
25	59.0	N	534470 180980	TQ38SW4822	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS12
26G	59.0	NW	534450 180970	TQ38SW4823	3.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS13
27	59.0	N	534660 181000	TQ38SW583/A	9.14	BIGLAND ST, STEPNEY 1
28	61.0	S	534470 180860	TQ38SW758/D	9.14	SWEDENBORG SQ, STEPNEY D
29	62.0	N	534520 180990	TQ38SW4818	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS8
30	62.0	S	534600 180850	TQ38SW758/K	6.1	SWEDENBORG SQ, STEPNEY K
31E	65.0	N	534490 180990	TQ38SW4814	3.6	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS4
32F	66.0	W	534420 180920	TQ38SW3799	1.5	LONDON DOCKLANDS RAILWAY TP 6
33	66.0	E	534708 180936	TQ38SW2210	30.0	DOCKLANDS RAILWAY 409
34E	67.0	N	534480 180990	TQ38SW4819	3.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS9
35F	67.0	W	534420 180910	TQ38SW3811	30.0	LONDON DOCKLANDS RAILWAY 408
36	68.0	N	534550 181000	TQ38SW1407	6.0	BERNER ESTATE STEPNEY 1949 BH4
37	68.0	SW	534440 180870	TQ38SW773/C	15.24	SWEDENBORG SQ. STAGE 2 O
38H	72.0	S	534620 180840	TQ38SW854	12.19	SWEDENBORG SQUARE Y
39G	73.0	NW	534440 180980	TQ38SW4824	3.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS14
40	73.0	S	534650 180840	TQ38SW1426	9.0	CROWDER STREET STEPNEY C
41H	82.0	S	534630 180830	TQ38SW1427	9.0	CROWDER STREET STEPNEY D
42I	84.0	N	534500 181010	TQ38SW4813	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS3
43	88.0	N	534660 181030	TQ38SW583/B	9.14	BIGLAND ST, STEPNEY 2
44	88.0	N	534470 181010	TQ38SW4820	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS10
45	90.0	SW	534430 180850	TQ38SW773/D	24.38	SWEDENBORG SQ. STAGE 2 P

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
46I	93.0	N	534510 181020	TQ38SW4812	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS2
47J	94.0	NW	534450 181010	TQ38SW4800	20.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 1/1A
48	94.0	NW	534420 180990	TQ38SW1168	10.0	HESSEL STREET (GLC) 6
49I	95.0	N	534490 181020	TQ38SW4802	20.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 3/3A
50K	97.0	S	534530 180820	TQ38SW758/H	6.55	SWEDENBORG SQ, STEPNEY H
51	98.0	NE	534720 181000	TQ38SW583/Q	9.14	BIGLAND ST, STEPNEY 24
52J	98.0	NW	534440 181010	TQ38SW4821	4.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS11
53	106.0	N	534650 181050	TQ38SW583/C	9.14	BIGLAND ST, STEPNEY 3
54K	107.0	S	534520 180810	TQ38SW758	24.38	TRIAL BORINGS A-K STEPNEY
55L	108.0	N	534470 181030	TQ38SW4808	1.7	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP5
56	108.0	S	534480 180810	TQ38SW758/G	24.38	SWEDENBORG SQ, STEPNEY G
57	110.0	W	534380 180890	TQ38SW773/K	8.53	SWEDENBORG SQ. STAGE 2 V
58M	110.0	NE	534720 181020	TQ38SW583/P	9.14	BIGLAND ST, STEPNEY 23
59	111.0	N	534600 181050	TQ38SW1405	6.0	BERNER ESTATE STEPNEY 1949 BH2
60	112.0	N	534450 181030	TQ38SW4805	1.7	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP2
61	113.0	N	534510 181040	TQ38SW4803	33.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 4/4A
62	115.0	N	534490 181040	TQ38SW4811	3.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 WS1
63	117.0	NW	534420 181020	TQ38SW1167	15.0	HESSEL STREET (GLC) 5
64	118.0	N	534550 181050	TQ38SW1404	6.0	BERNER ESTATE STEPNEY 1949 BH1
65L	119.0	N	534460 181040	TQ38SW4806	3.6	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP3
66	120.0	N	534530 181050	TQ38SW1408	3.0	BERNER ESTATE STEPNEY 1949 TP.A
67N	122.0	SW	534380 180860	TQ38SW773	9.14	SWEDENBORG SQ STAGE 2 STEPNEY
68	122.0	S	534610 180790	TQ38SW1428	15.0	CROWDER STREET STEPNEY E
69M	124.0	NE	534730 181030	TQ38SW4955	2.5	MILES COURT BIGLAND ESTATE LONDON TP2
70	125.0	S	534540 180790	TQ38SW758/J	6.25	SWEDENBORG SQ, STEPNEY J

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
71	127.0	N	534470 181050	TQ38SW4807	3.0	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP4
72	131.0	N	534450 181050	TQ38SW4804	2.5	CHRISTIAN STREET BETHNAL GREEN LONDON E1 TP1
73	132.0	NE	534740 181030	TQ38SW583/O	9.14	BIGLAND ST, STEPNEY 22
74	133.0	NE	534760 181000	TQ38SW4957	2.5	MILES COURT BIGLAND ESTATE LONDON TP4
75	133.0	SW	534380 180840	TQ38SW773/E	15.24	SWEDENBORG SQ. STAGE 2 Q
76	136.0	N	534650 181080	TQ38SW583/D	9.14	BIGLAND ST, STEPNEY 4
77N	136.0	SW	534370 180850	TQ38SW773/F	24.38	SWEDENBORG SQ. STAGE 2 R
78	147.0	W	534340 180900	TQ38SW3810	30.0	LONDON DOCKLANDS RAILWAY 407
79O	148.0	NW	534410 181050	TQ38SW638/A	13.72	CHRISTIAN ST, STEPNEY 1
80	151.0	W	534340 180880	TQ38SW773/J	15.24	SWEDENBORG SQ. STAGE 2 T
81O	153.0	NW	534400 181050	TQ38SW638	-1.0	L.C.C. CHRISTIAN ST STEPNEY
82	155.0	S	534670 180760	TQ38SW1429	15.24	CROWDER STREET STEPNEY F
83P	156.0	NE	534770 181030	TQ38SW732	33.83	L.C.C. BIGLAND STREET STEPNEY
84	158.0	N	534670 181100	TQ38SW583/E	9.14	BIGLAND ST, STEPNEY 6
85Q	160.0	NE	534750 181060	TQ38SW4924	0.6	LUKE HOUSE SOUTH WEST INFILL C4
86	161.0	NE	534710 181090	TQ38SW583/G	9.14	BIGLAND ST, STEPNEY 8
87	163.0	N	534690 181100	TQ38SW583/F	9.14	BIGLAND ST, STEPNEY 7
88P	165.0	NE	534780 181030	TQ38SW4956	2.5	MILES COURT BIGLAND ESTATE LONDON TP3
89Q	167.0	NE	534760 181060	TQ38SW4925	0.5	LUKE HOUSE SOUTH WEST INFILL C5
90Q	167.0	NE	534750 181070	TQ38SW4923	0.5	LUKE HOUSE SOUTH WEST INFILL C3
91	170.0	E	534800 181000	TQ38SW583	9.14	L.C.C. BIGLAND STREET SITE STEPNEY
92	172.0	S	534650 180740	TQ38SW1430	9.0	CROWDER STREET STEPNEY G
93R	175.0	NE	534750 181080	TQ38SW4922	0.65	LUKE HOUSE SOUTH WEST INFILL C2
94	176.0	W	534310 180910	TQ38SW3800	3.0	LONDON DOCKLANDS RAILWAY TP 7
95	179.0	NW	534350 181040	TQ38SW1410	6.09	CHRISTIAN STREET AREAS STEPNEY 3
96S	179.0	NW	534370 181060	TQ38SW4912	15.45	HADFIELD HOUSE ELLEN STREET LONDON E1 1
97	182.0	NE	534780 181060	TQ38SW4926	0.6	LUKE HOUSE SOUTH WEST INFILL C6
98R	183.0	NE	534750 181090	TQ38SW583/H	9.14	BIGLAND ST, STEPNEY 9

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
99S	187.0	NW	534370 181070	TQ38SW4913	3.0	HADFIELD HOUSE ELLEN STREET LONDON E1 TP1
100T	188.0	NE	534770 181080	TQ38SW4921	0.5	LUKE HOUSE SOUTH WEST INFILL C1
101T	188.0	NE	534780 181070	TQ38SW583/R	3.35	BIGLAND ST, STEPNEY 25
102	192.0	NW	534320 181020	TQ38SW1166	10.0	HESSEL STREET (GLC) 4
103	192.0	NW	534390 181090	TQ38SW1411	4.57	CHRISTIAN STREET AREAS STEPNEY 2
104	194.0	E	534835 180947	TQ38SW2211	30.0	DOCKLANDS RAILWAY 410
105U	195.0	N	534701 181130	TQ38SW2768	4.5	BIGLAND SCHOOL 5
106T	195.0	NE	534780 181080	TQ38SW583/S	3.28	BIGLAND ST, STEPNEY 26
107U	195.0	N	534684 181135	TQ38SW2766	4.5	BIGLAND SCHOOL 3
108T	195.0	NE	534770 181090	TQ38SW583/I	9.14	BIGLAND ST, STEPNEY 10
109W	199.0	W	534288 180898	TQ38SW2206	30.0	DOCKLANDS RAILWAY 405
110V	200.0	NW	534340 181060	TQ38SW4914	2.1	HADFIELD HOUSE ELLEN STREET LONDON E1 TP2
111V	201.0	NW	534330 181050	TQ38SW4915	2.1	HADFIELD HOUSE ELLEN STREET LONDON E1 TP3
112W	207.0	W	534280 180900	TQ38SW3798	2.35	LONDON DOCKLANDS RAILWAY TP 5
113	207.0	S	534510 180710	TQ38SW1033	3.0	THE HIGHWAY STEPNEY BH5
114	209.0	NW	534320 181050	TQ38SW1164	10.0	HESSEL STREET (GLC) 2
115X	210.0	W	534290 181000	TQ38SW1409	7.0	CHRISTIAN STREET AREAS STEPNEY 4
116	211.0	S	534450 180710	TQ38SW1032	3.0	THE HIGHWAY STEPNEY BH4
117Y	213.0	SE	534730 180720	TQ38SW1329	2.13	PENNINGTON STREET STEPNEY TH4
118X	214.0	NW	534290 181010	TQ38SW1165	15.0	HESSEL STREET (GLC) 3
119Y	217.0	SE	534740 180720	TQ38SW5084	-1.0	COOPERS YARD CAR PARK TP 7
120Z	219.0	SE	534760 180730	TQ38SW5081	-1.0	COOPERS YARD CAR PARK TP 4
121	220.0	N	534690 181159	TQ38SW2765	7.0	BIGLAND SCHOOL 2
122	221.0	E	534850 181010	TQ38SW583/N	9.14	BIGLAND ST, STEPNEY 19
123	222.0	SW	534300 180800	TQ38SW452	122.53	WELLCLOSE SQUARE, STEPNEY
124	226.0	SW	534400 180710	TQ38SW1031	3.0	THE HIGHWAY STEPNEY BH3
125	227.0	E	534850 181030	TQ38SW583/M	9.14	BIGLAND ST, STEPNEY 18
126	228.0	S	534480 180690	TQ38SW1327	3.0	PENNINGTON STREET STEPNEY TH2
127	228.0	N	534460 181150	TQ38SW1415	9.0	UMBERSTON STREET AREA 1952 TB.C

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
128	229.0	SE	534800 180750	TQ38SW1034	3.0	THE HIGHWAY STEPNEY BH6
129A B	229.0	W	534258 180894	TQ38SW2207	30.0	DOCKLANDS RAILWAY 406
130Z	230.0	SE	534780 180730	TQ38SW5080	-1.0	COOPERS YARD CAR PARK TP 3
131A A	231.0	SE	534750 180710	TQ38SW5085	-1.0	COOPERS YARD CAR PARK TP 8
132A A	235.0	SE	534740 180700	TQ38SW5075	-1.0	COOPERS YARD CAR PARK 2
133A B	238.0	W	534250 180890	TQ38SW3809	30.0	LONDON DOCKLANDS RAILWAY 406
134	238.0	S	534420 180690	TQ38SW1326	1.0	PENNINGTON STREET STEPNEY TH1
135	242.0	NW	534320 181100	TQ38SW1403	4.0	ELLEN ST AREA STEPNEY TH2
136A C	244.0	SE	534740 180690	TQ38SW1330	3.0	PENNINGTON STREET STEPNEY TH5
137A C	244.0	SE	534740 180690	TQ38SW5083	-1.0	COOPERS YARD CAR PARK TP 6
138A A	244.0	SE	534760 180700	TQ38SW5082	-1.0	COOPERS YARD CAR PARK TP 5
139A D	244.0	SE	534790 180720	TQ38SW5077	-1.0	COOPERS YARD CAR PARK TP STARTER PIT BH1B
140A D	244.0	SE	534790 180720	TQ38SW5074	-1.0	COOPERS YARD CAR PARK 1
141A D	244.0	SE	534790 180720	TQ38SW5076	-1.0	COOPERS YARD CAR PARK TP STARTER PIT BH1A
142	247.0	E	534890 180900	TQ38SW765/H	30.78	SOLANDER GDNS EXTN, STEPNEY 8
143	248.0	W	534240 180890	TQ38SW3797	-1.0	LONDON DOCKLANDS RAILWAY TP 4
144A E	248.0	NE	534772 181154	TQ38SW2767	4.5	BIGLAND SCHOOL 4
145	249.0	SW	534370 180700	TQ38SW3120	12.0	47-49 THE HIGHWAY, STEPNEY
146A E	249.0	NE	534786 181146	TQ38SW2769	5.0	BIGLAND SCHOOL 6

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#1: scans.bgs.ac.uk/sobi_scans/boreholes/13600949
#2: scans.bgs.ac.uk/sobi_scans/boreholes/1066382
#3A: scans.bgs.ac.uk/sobi_scans/boreholes/13600948
#4: scans.bgs.ac.uk/sobi_scans/boreholes/13600937
#5B: scans.bgs.ac.uk/sobi_scans/boreholes/14772078
#6A: scans.bgs.ac.uk/sobi_scans/boreholes/13600938
#7: scans.bgs.ac.uk/sobi_scans/boreholes/13600939
#8B: scans.bgs.ac.uk/sobi_scans/boreholes/1063316
#9: scans.bgs.ac.uk/sobi_scans/boreholes/1066381
#10: scans.bgs.ac.uk/sobi_scans/boreholes/1064543
#11: scans.bgs.ac.uk/sobi_scans/boreholes/1064308
#12: scans.bgs.ac.uk/sobi_scans/boreholes/1065301
#13: scans.bgs.ac.uk/sobi_scans/boreholes/1064306
#14: scans.bgs.ac.uk/sobi_scans/boreholes/1064307
#15C: scans.bgs.ac.uk/sobi_scans/boreholes/18376001
#16C: scans.bgs.ac.uk/sobi_scans/boreholes/18375927
#17: scans.bgs.ac.uk/sobi_scans/boreholes/1064544
#18D: scans.bgs.ac.uk/sobi_scans/boreholes/18376008
#19: scans.bgs.ac.uk/sobi_scans/boreholes/18376000
#20: scans.bgs.ac.uk/sobi_scans/boreholes/18376007
#21: scans.bgs.ac.uk/sobi_scans/boreholes/1065302
#22D: scans.bgs.ac.uk/sobi_scans/boreholes/18376006
#23: scans.bgs.ac.uk/sobi_scans/boreholes/1064348
#24: scans.bgs.ac.uk/sobi_scans/boreholes/1065283
#25: scans.bgs.ac.uk/sobi_scans/boreholes/18376013
#26G: scans.bgs.ac.uk/sobi_scans/boreholes/18376015
#27: scans.bgs.ac.uk/sobi_scans/boreholes/1063998
#28: scans.bgs.ac.uk/sobi_scans/boreholes/1064309
#29: scans.bgs.ac.uk/sobi_scans/boreholes/18376009
#30: scans.bgs.ac.uk/sobi_scans/boreholes/1064313
#31E: scans.bgs.ac.uk/sobi_scans/boreholes/18376005
#32F: scans.bgs.ac.uk/sobi_scans/boreholes/13600935
#33: scans.bgs.ac.uk/sobi_scans/boreholes/1066383
#34E: scans.bgs.ac.uk/sobi_scans/boreholes/18376010
#35F: scans.bgs.ac.uk/sobi_scans/boreholes/13600947
#36: scans.bgs.ac.uk/sobi_scans/boreholes/1065284
#37: scans.bgs.ac.uk/sobi_scans/boreholes/1064344
#38H: scans.bgs.ac.uk/sobi_scans/boreholes/1064545
#39G: scans.bgs.ac.uk/sobi_scans/boreholes/18376016
#40: scans.bgs.ac.uk/sobi_scans/boreholes/1065303
#41H: scans.bgs.ac.uk/sobi_scans/boreholes/1065304
#42I: scans.bgs.ac.uk/sobi_scans/boreholes/18376004
#43: scans.bgs.ac.uk/sobi_scans/boreholes/1063999
#44: scans.bgs.ac.uk/sobi_scans/boreholes/18376011
#45: scans.bgs.ac.uk/sobi_scans/boreholes/1064345
#46I: scans.bgs.ac.uk/sobi_scans/boreholes/18376003
#47J: scans.bgs.ac.uk/sobi_scans/boreholes/18375917
#48: scans.bgs.ac.uk/sobi_scans/boreholes/1064922
#49I: scans.bgs.ac.uk/sobi_scans/boreholes/18375928
#50K: scans.bgs.ac.uk/sobi_scans/boreholes/1064311
#51: scans.bgs.ac.uk/sobi_scans/boreholes/1064014
#52J: scans.bgs.ac.uk/sobi_scans/boreholes/18376012
#53: scans.bgs.ac.uk/sobi_scans/boreholes/1064000
#54K: scans.bgs.ac.uk/sobi_scans/boreholes/1064314
#55L: scans.bgs.ac.uk/sobi_scans/boreholes/18375999
#56: scans.bgs.ac.uk/sobi_scans/boreholes/1064310

#57: scans.bgs.ac.uk/sobi_scans/boreholes/1064350
#58M: scans.bgs.ac.uk/sobi_scans/boreholes/1064013
#59: scans.bgs.ac.uk/sobi_scans/boreholes/1065282
#60: scans.bgs.ac.uk/sobi_scans/boreholes/18375931
#61: scans.bgs.ac.uk/sobi_scans/boreholes/18375929
#62: scans.bgs.ac.uk/sobi_scans/boreholes/18376002
#63: scans.bgs.ac.uk/sobi_scans/boreholes/1064921
#64: scans.bgs.ac.uk/sobi_scans/boreholes/1065281
#65L: scans.bgs.ac.uk/sobi_scans/boreholes/18375997
#66: scans.bgs.ac.uk/sobi_scans/boreholes/1065285
#67N: scans.bgs.ac.uk/sobi_scans/boreholes/1064351
#68: scans.bgs.ac.uk/sobi_scans/boreholes/1065305
#69M: scans.bgs.ac.uk/sobi_scans/boreholes/18464252
#70: scans.bgs.ac.uk/sobi_scans/boreholes/1064312
#71: scans.bgs.ac.uk/sobi_scans/boreholes/18375998
#72: scans.bgs.ac.uk/sobi_scans/boreholes/18375930
#73: scans.bgs.ac.uk/sobi_scans/boreholes/1064012
#74: scans.bgs.ac.uk/sobi_scans/boreholes/18464254
#75: scans.bgs.ac.uk/sobi_scans/boreholes/1064346
#76: scans.bgs.ac.uk/sobi_scans/boreholes/1064001
#77N: scans.bgs.ac.uk/sobi_scans/boreholes/1064347
#78: scans.bgs.ac.uk/sobi_scans/boreholes/13600946
#79O: scans.bgs.ac.uk/sobi_scans/boreholes/1064082
#80: scans.bgs.ac.uk/sobi_scans/boreholes/1064349
#81O: scans.bgs.ac.uk/sobi_scans/boreholes/1064083
#82: scans.bgs.ac.uk/sobi_scans/boreholes/1065306
#83P: scans.bgs.ac.uk/sobi_scans/boreholes/1064265
#84: scans.bgs.ac.uk/sobi_scans/boreholes/1064002
#85Q: scans.bgs.ac.uk/sobi_scans/boreholes/18462998
#86: scans.bgs.ac.uk/sobi_scans/boreholes/1064004
#87: scans.bgs.ac.uk/sobi_scans/boreholes/1064003
#88P: scans.bgs.ac.uk/sobi_scans/boreholes/18464253
#89Q: scans.bgs.ac.uk/sobi_scans/boreholes/18462999
#90Q: scans.bgs.ac.uk/sobi_scans/boreholes/18462997
#91: scans.bgs.ac.uk/sobi_scans/boreholes/1064017
#92: scans.bgs.ac.uk/sobi_scans/boreholes/1065307
#93R: scans.bgs.ac.uk/sobi_scans/boreholes/18462996
#94: scans.bgs.ac.uk/sobi_scans/boreholes/13600936
#95: scans.bgs.ac.uk/sobi_scans/boreholes/1065287
#96S: scans.bgs.ac.uk/sobi_scans/boreholes/18456828
#97: scans.bgs.ac.uk/sobi_scans/boreholes/18463000
#98R: scans.bgs.ac.uk/sobi_scans/boreholes/1064005
#99S: scans.bgs.ac.uk/sobi_scans/boreholes/18457497
#100T: scans.bgs.ac.uk/sobi_scans/boreholes/18462995
#101T: scans.bgs.ac.uk/sobi_scans/boreholes/1064015
#102: scans.bgs.ac.uk/sobi_scans/boreholes/1064920
#103: scans.bgs.ac.uk/sobi_scans/boreholes/1065288
#104: scans.bgs.ac.uk/sobi_scans/boreholes/1066384
#105U: scans.bgs.ac.uk/sobi_scans/boreholes/1066942
#106T: scans.bgs.ac.uk/sobi_scans/boreholes/1064016
#107U: scans.bgs.ac.uk/sobi_scans/boreholes/1066940
#108T: scans.bgs.ac.uk/sobi_scans/boreholes/1064006
#109W: scans.bgs.ac.uk/sobi_scans/boreholes/1066379
#110V: scans.bgs.ac.uk/sobi_scans/boreholes/18457586
#111V: scans.bgs.ac.uk/sobi_scans/boreholes/18457587
#112W: scans.bgs.ac.uk/sobi_scans/boreholes/13600934

#113: scans.bgs.ac.uk/sobi_scans/boreholes/1064754
#114: scans.bgs.ac.uk/sobi_scans/boreholes/1064918
#115X: scans.bgs.ac.uk/sobi_scans/boreholes/1065286
#116: scans.bgs.ac.uk/sobi_scans/boreholes/1064753
#117Y: scans.bgs.ac.uk/sobi_scans/boreholes/1065204
#118X: scans.bgs.ac.uk/sobi_scans/boreholes/1064919
#121: scans.bgs.ac.uk/sobi_scans/boreholes/1066939
#122: scans.bgs.ac.uk/sobi_scans/boreholes/1064011
#123: scans.bgs.ac.uk/sobi_scans/boreholes/1063834
#124: scans.bgs.ac.uk/sobi_scans/boreholes/1064752
#125: scans.bgs.ac.uk/sobi_scans/boreholes/1064010
#126: scans.bgs.ac.uk/sobi_scans/boreholes/1065202
#127: scans.bgs.ac.uk/sobi_scans/boreholes/1065292
#128: scans.bgs.ac.uk/sobi_scans/boreholes/1064755
#129AB: scans.bgs.ac.uk/sobi_scans/boreholes/1066380
#133AB: scans.bgs.ac.uk/sobi_scans/boreholes/13600945
#134: scans.bgs.ac.uk/sobi_scans/boreholes/1065201
#135: scans.bgs.ac.uk/sobi_scans/boreholes/1065280
#136AC: scans.bgs.ac.uk/sobi_scans/boreholes/1065205
#142: scans.bgs.ac.uk/sobi_scans/boreholes/1064334
#143: scans.bgs.ac.uk/sobi_scans/boreholes/13600933
#144AE: scans.bgs.ac.uk/sobi_scans/boreholes/1066941
#145: scans.bgs.ac.uk/sobi_scans/boreholes/1067294
#146AE: scans.bgs.ac.uk/sobi_scans/boreholes/1066943

8 Estimated Background Soil Chemistry

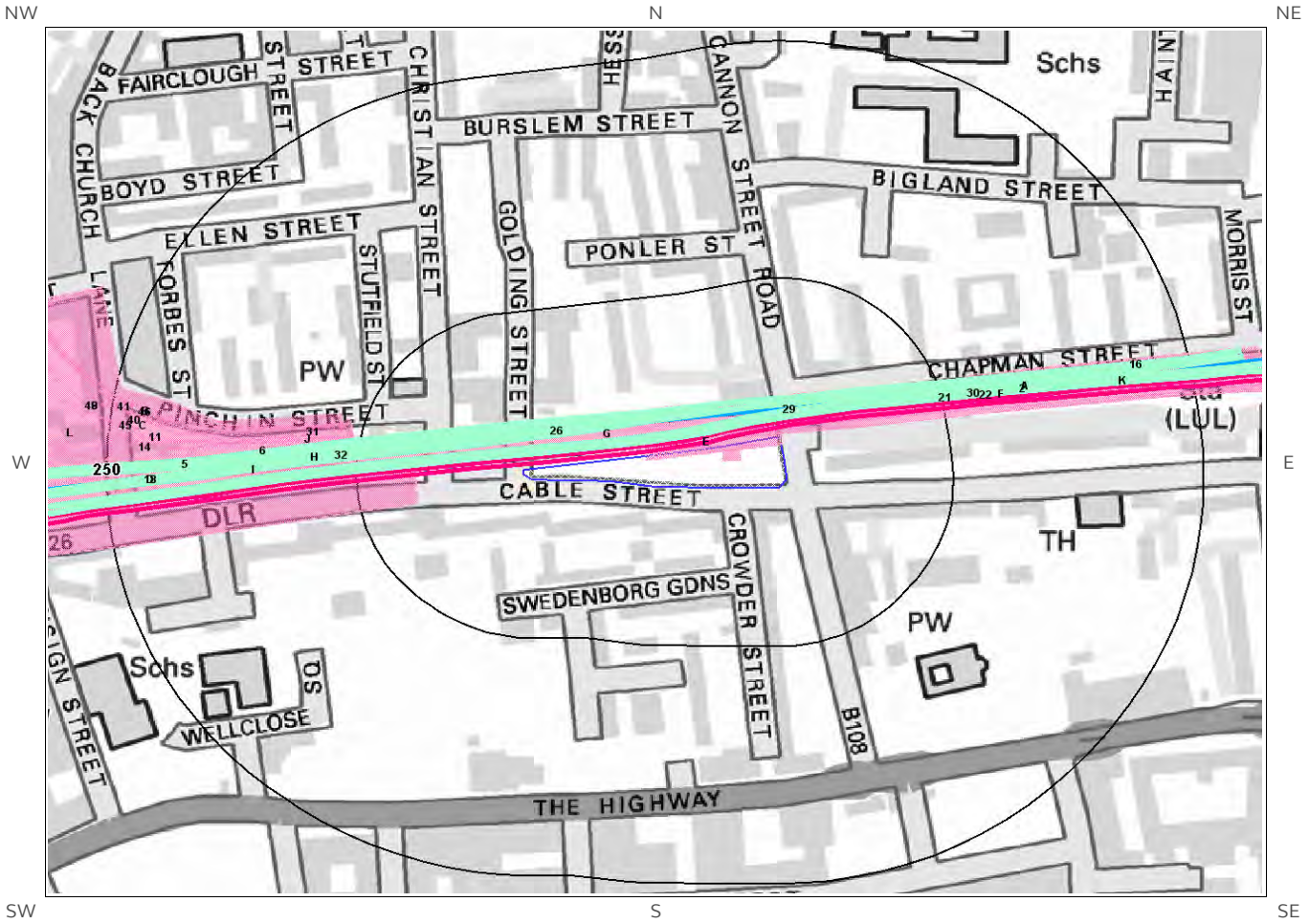
Records of background estimated soil chemistry within 250m of the study site boundary: 2

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	London	No data	No data	No data	No data	No data
0.0	On Site	London	No data	No data	No data	No data	No data

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

9 Railways and Tunnels Map



Railways and Tunnels Legend

- Site Outline
- Search Buffers (m): 250, 500
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- High Speed 2 Revised Proposed Route
- Crossrail 1
- Railway and/or Tunnel Feature from Historical Mapping

9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Detail
3	N	London Underground - Docklands Light Railway

The approximate depth value for the nearest London Underground line given in this dataset has been extrapolated from published depths of tube lines at station platforms, and assume a constant gradient between stations. Using this method, topographical variation has resulted in some parts of the line having associated depth values either shallower or deeper than the real-world situation. Depth values are for indication only and should not be relied upon for any calculation or technical purpose and are in no way a substitute for a professional survey.

Line
London Underground Line: Docklands Light Railway Depth: 0mbgl Track Type: Surface Track

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? Yes

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1E	0	On Site	534597 180939	Railway Sidings	1957
20E	0	On Site	534601 180942	Railway Sidings	1957
21	0	On Site	n/a	Railway	1930
22	0	On Site	n/a	Railway	1875
23E	0	On Site	534601 180942	Railway Sidings	1951
24E	0	On Site	534601 180942	Railway Sidings	1948
25E	0	On Site	534601 180942	Railway Sidings	1948
26	1	N	n/a	Railway	1896
27F	5	N	n/a	Railway	1911
28F	5	N	n/a	Railway	1930
29	6	N	n/a	Railway	1896
30	6	N	n/a	Railways	1916
2	8	N	535257 181017	Railway Sidings	1898
31	9	N	533791 180933	Railway Sidings	1896
3A	10	N	535261 181019	Railway Sidings	1899
4A	10	N	535261 181019	Railway Sidings	1899
32	10	N	n/a	Railway	1873
33G	11	N	534543 180945	Railway Sidings	1991
34G	11	N	534543 180945	Railway Sidings	1989
35G	11	N	534543 180945	Railway Sidings	1989
36H	12	N	n/a	Railway	1897
37H	12	N	n/a	Railway	1916
38H	12	N	n/a	Railway	1880
5	64	W	534177 180956	Railway Sidings	1894
6	89	W	534333 180933	Railway Sidings	1872
39I	89	W	534324 180921	Railway Sidings	1880
40	91	W	534197 180962	Railway Sidings	1948
7I	94	W	534328 180920	Railway Sidings	1882

ID	Distance (m)	Direction	NGR	Details	Date
8B	98	W	534148 181106	Railway Sidings	1948
9B	98	W	534148 181106	Railway Sidings	1957
10B	98	W	534148 181106	Railway Sidings	1966
11	100	W	534204 180961	Railway Sidings	1894
41	103	W	n/a	Railway	1916
42J	104	W	534356 180941	Railway Sidings	1948
43J	104	W	534356 180941	Railway Sidings	1963
44J	104	W	534356 180941	Railway Sidings	1951
45	105	W	n/a	Railway	1896
12C	110	W	534147 181116	Railway Sidings	1938
13C	110	W	534147 181116	Railway Sidings	1920
46	110	W	534169 181015	Railway Sidings	1916
14	117	W	534135 181077	Railway Sidings	1898
15K	128	E	534845 180978	Railway Sidings	1882
47K	131	E	534845 180978	Railway Sidings	1880
16	139	E	534851 180988	Railway Sidings	1872
17D	151	W	533966 180864	Railway Sidings	1994
18	151	W	534035 180813	Railway Sidings	1971
19D	151	W	533966 180864	Railway Sidings	1976
48	181	W	n/a	Railway	1930
49	181	W	n/a	Railway	1911
50L	247	W	534197 180962	Railway Sidings	1963
51L	247	W	534197 180962	Railway Sidings	1948
52L	247	W	534197 180962	Railway Sidings	1951

Any records that have been identified are represented on the Railways and Tunnels Map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Name	Type
9	N	Docklands Light Railway	Light Rail
9	N	Docklands Light Railway	Light Rail
12	N	Docklands Light Railway	Light Rail
12	N	Docklands Light Railway	Light Rail
17	N	Not given	Multi Track
17	N	Not given	Multi Track
20	N	London, Tilbury & Southend Railway	Rail
20	N	London, Tilbury & Southend Railway	Rail
20	N	London, Tilbury & Southend Railway	Rail
20	N	London, Tilbury & Southend Railway	Rail
23	N	London, Tilbury & Southend Railway	Rail
23	N	London, Tilbury & Southend Railway	Rail
24	N	London, Tilbury & Southend Railway	Rail
24	N	London, Tilbury & Southend Railway	Rail
24	N	London, Tilbury & Southend Railway	Rail
24	N	London, Tilbury & Southend Railway	Rail
25	N	London, Tilbury & Southend Railway	Rail
25	N	London, Tilbury & Southend Railway	Rail
30	N	London, Tilbury & Southend Railway	Rail
30	N	London, Tilbury & Southend Railway	Rail
53	NE	London, Tilbury & Southend Railway	Rail
53	NE	London, Tilbury & Southend Railway	Rail
144	W	Docklands Light Railway	Light Rail
144	W	Docklands Light Railway	Light Rail
172	W	Docklands Light Railway	Light Rail
172	W	Docklands Light Railway	Light Rail
191	W	Docklands Light Railway	Light Rail
191	W	Docklands Light Railway	Light Rail
207	W	Docklands Light Railway	Light Rail
207	W	Docklands Light Railway	Light Rail

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project?	No
Is the study site within 500m of the route of the Crossrail 1 rail project?	No

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

Contact Details

Groundsure Helpline

Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:**enquiries@bgs.ac.uk**
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries

British Gypsum

British Gypsum Ltd
East Leake
Loughborough
Leicestershire
LE12 6HX

The Coal Authority

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
https://www.gov.uk/government/organisations/public-health-england
Email: **enquiries@phe.gov.uk**
Main switchboard: 020 7654 8000

Johnson Poole & Bloomer Limited

Harris and Pearson Building, Brettel Lane
Brierley Hill, West Midlands
DY5 3LH
Tel: +44 (0) 1384 262 000
Email:**enquiries.gs@jpb.co.uk**
Website: **www.jpb.co.uk**

Ordnance Survey

Adanac Drive, Southampton
SO16 0AS

Tel: 08456 050505
Website: http://www.ordnancesurvey.co.uk/

Getmapping PLC

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444
Website:**http://www1.getmapping.com/**

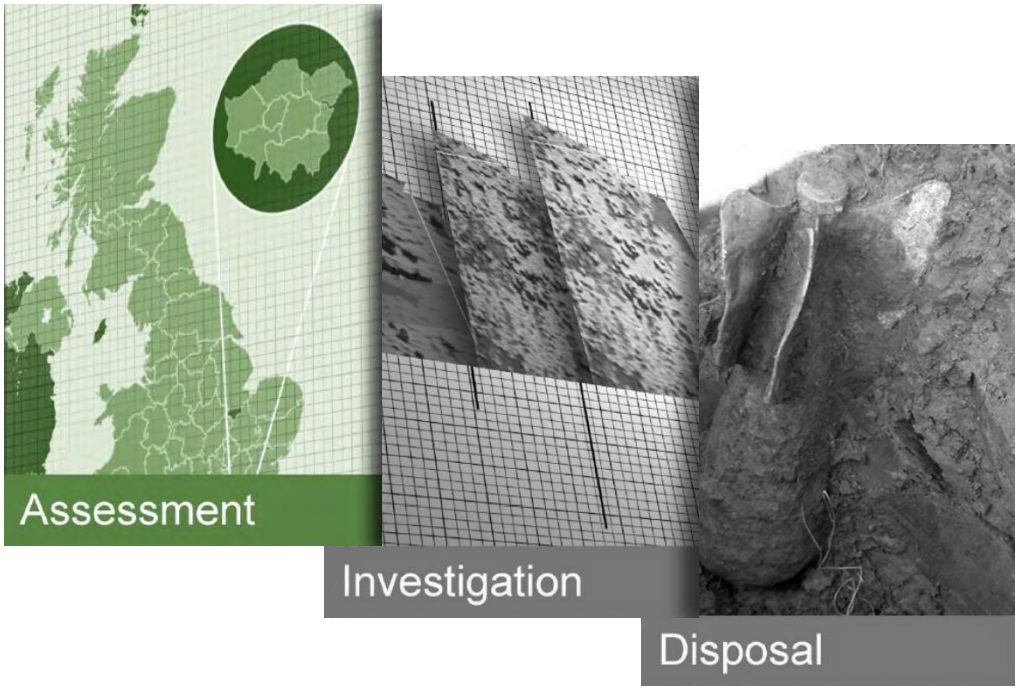
Peter Brett Associates
Caversham Bridge House
Waterman Place
Reading
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail:**reading@pba.co.uk**
Website:**http://www.peterbrett.com/home**

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016/

APPENDIX C

Zetica Desk Study and Risk Assessment Report



Cable Street, Whitechapel - UXO Desk Study & Risk Assessment

Drafted by Sam Nicklin
Checked by Will Hazell
Authorised by Mike Sainsbury

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P7005-17-R1**
Revision	**A**
Project Location	**Cable Street, Whitechapel**
Client	**Arcadis**
Date	**13th July 2017**

UXO DESK STUDY & RISK ASSESSMENT

Cable Street, Whitechapel

EXECUTIVE SUMMARY

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.4 hectares (ha) at Cable Street, Whitechapel ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Records have been found indicating that buildings adjacent to the western boundary of the Site were demolished by 1No. High Explosive (HE) bomb during World War Two (WWII).

It is considered that this may have masked the impact of an Unexploded Bomb (UXB), which may have offset beneath the western end of the Site and remain in situ. Consequently, the western end of the Site is assigned a moderate UXO hazard level.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the remainder of the Site. The central and eastern parts of the Site are assigned a low UXO hazard level.

Given this, it is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in the following Figure, reproduced as Figure 5 in the main report.

Figure	UXO hazard zone plan of the Site

Source: Google Earth *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

The main findings of the report are summarised below:

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- During WWII, the main strategic targets in the vicinity of the Site were the London Docks, major concentrations of transport infrastructure and public utilities.
- During WWII, the Site was located in the Metropolitan Borough (MB) of Stepney, which recorded a very high regional bombing density.
- No records have been found indicating that the Site was bombed during WWII. The nearest identified HE bomb fell adjacent to the Site.
- No significant post-WWII military activity has been identified on the Site.

The Table below, reproduced as Table 4 in the main report, provides a UXO risk assessment for potential work on the Site.

Further details on the methodology for the risk assessment are provided in Section 10.1 of the main report.

Table UXO risk assessment for the Site

Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	6	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Low Risk
Excavations Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff. **Boreholes/Piles** Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.
Moderate Risk
Excavations For those involved in excavations, the raising of awareness (as per low risk) is considered essential. A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk. Where UXO detection is not feasible due to ground conditions, restricted access or programme, an Explosive Ordnance Clearance (EOC) Engineer can be used to supervise during excavation works. The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material. **Boreholes/Piles** Clearance certification for any borehole or pile locations is considered essential. This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB. Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB. Table 5 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity. Further advice on the mitigation methods can be provided by Zetica on request.

CONTENTS

Page

Executive Summary

1 INTRODUCTION 1

1.1 Project Outline

1.2 Historical Information

1.3 Sources of Information

1.4 Data Confidence Level

2 THE SITE 4

2.1 Site Location

2.2 Proposed Works

2.3 Site History

2.4 Pre-WWI Military Activity

2.5 WWI Military Activity

2.6 WWII Military Activity

2.7 Post-WWII Military Activity

3 WWII BOMBING 10

3.1 Bombing in London

3.2 Strategic Targets

3.3 Bombing Density and Incidents

3.4 Geology and Bomb Penetration Depths

4 WWII DEFENCES 19

4.1 Bombing Decoys

4.2 Anti-Aircraft Defences

4.3 Barrage Balloons and Anti-Landing Obstacles

4.4 Anti-Invasion Defences

4.5 Pillboxes, Mortar and Gun Emplacements

4.6 Home Guard and Auxiliary Units

4.7 Minefields and Mined Locations

5 MILITARY AIRFIELDS 24

5.1 Aircraft Crashes

6 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS 25

6.1 Explosives and Ordnance Factories

6.2 Munitions Stores

6.3 Informal Munitions Depots

6.4 Munitions Disposal Areas and Bomb Cemeteries
7 FIRING RANGES AND MILITARY TRAINING AREAS 26
7.1 Small Arms Ranges
7.2 Artillery Ranges
7.3 Bombing Ranges
7.4 Training Areas
8 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES 27
8.1 Abandoned Bombs
8.2 EOC Tasks
9 UXO HAZARD ASSESSMENT 28
9.1 UXO Hazard Level
10 UXO RISK ASSESSMENT 29
10.1 UXO Risk Level
10.2 Risk Mitigation Recommendations

Figures, Plates, Tables & Drawings

Figure 1 Site location map
Figure 2 Historical map, 1875
Figure 3 Compiled bomb impact map for the vicinity of the Site
Figure 4 Extract from the London Bomb Damage Map
Figure 5 UXO hazard zone plan of the Site

Plate 1 Recent aerial photograph of the Site
Plate 2 Aerial photograph, 8th September 1937
Plate 3 Aerial photograph, 6th June 1955
Plate 4 Luftwaffe reconnaissance photograph of London Docks, 7th September 1940
Plate 5 Luftwaffe reconnaissance photograph of London Docks, 1939
Plate 6 Aerial photograph, 18th May 1948

Table 1 Bombing statistics
Table 2 Estimated average maximum bomb penetration depths
Table 3 WWII HAA and ZAA batteries within 10km of the Site
Table 4 UXO risk assessment for the Site
Table 5 Risk mitigation for assumed Site activities

Appendices

Appendix 1	WWII Bombing Incidents
Appendix 2	UXO Hazard and Ordnance Types
Appendix 3	Abbreviations
Appendix 4	Glossary and Definitions
Appendix 5	Bibliography

UXO DESK STUDY & RISK ASSESSMENT

Cable Street, Whitechapel

Note: To aid the reader of this report, Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Paragraphs in a dark green text with a green background are paragraphs containing background information or explanations which may appear as standard text in all similar reports.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.4 hectares (ha) at Cable Street, Whitechapel ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

This hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance (UXO).
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be readily identifiable and therefore there cannot be any guarantee that all UXO hazards within the Site have been identified in this report.

1.2 Historical Information

With most locations, the potential presence of UXO as a result of enemy action, unauthorised disposal or unrecorded military activity can never be totally discounted.

Detailed records of military activity are rarely released into the public domain. Even when military information is made public there may be gaps in the records because files have been lost or destroyed.

Records for periods such as WWII are only as detailed and accurate as the resources and working conditions would allow at the time. Densely populated areas tend to have a greater number of records than rural areas. Such records may be inaccurate due to the confusion surrounding continuous air raids.

Press records can supplement local information, although this source of information must be treated with caution, as inaccuracies do exist, either inadvertently or intentionally in order to confuse enemy intelligence. Classified official records can sometimes be considered inaccurate for the same reason.

Recent research indicates that England alone had 17,434No. recorded defence sites, of which 12,464No. were classified as defensive anti-invasion sites. The precise locations of many of these sites are still to be identified, illustrating the scale of the problem when establishing potential risks from limited historical data.

1.3 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area utilising a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.3.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

1.3.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica Ltd's website (http://zeticauxo.com/downloads-and-resources/risk-maps/).

1.3.3 Ministry of Defence and Government Records

Various government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Home Office records of abandoned bombs.

1.3.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, Historic England and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

1.3.5 Local Authority Records

Information has been obtained from Tower Hamlets London Borough Council.

1.3.6 Local Record Offices and Libraries

The London Metropolitan Archives and Tower Hamlets Local History Library and Archives were consulted for information.

1.3.7 Local Historical and Other Groups

Local history groups and archaeological bodies including the Greater London Historic Environment Record (GLHER), were consulted.

1.4 Data Confidence Level

In general, there is a high level of confidence in the researched information sources used for this report. An exception to this is the lack of detailed Air Raid Precaution (ARP) records for Stepney, which are thought to have been destroyed during WWII.

Various other sources (including bomb census maps, bomb damage maps, historical aerial photographs and Fire Brigade incident reports) have been used to provide a corroborative assessment of the UXO hazard level on the Site.

2 THE SITE

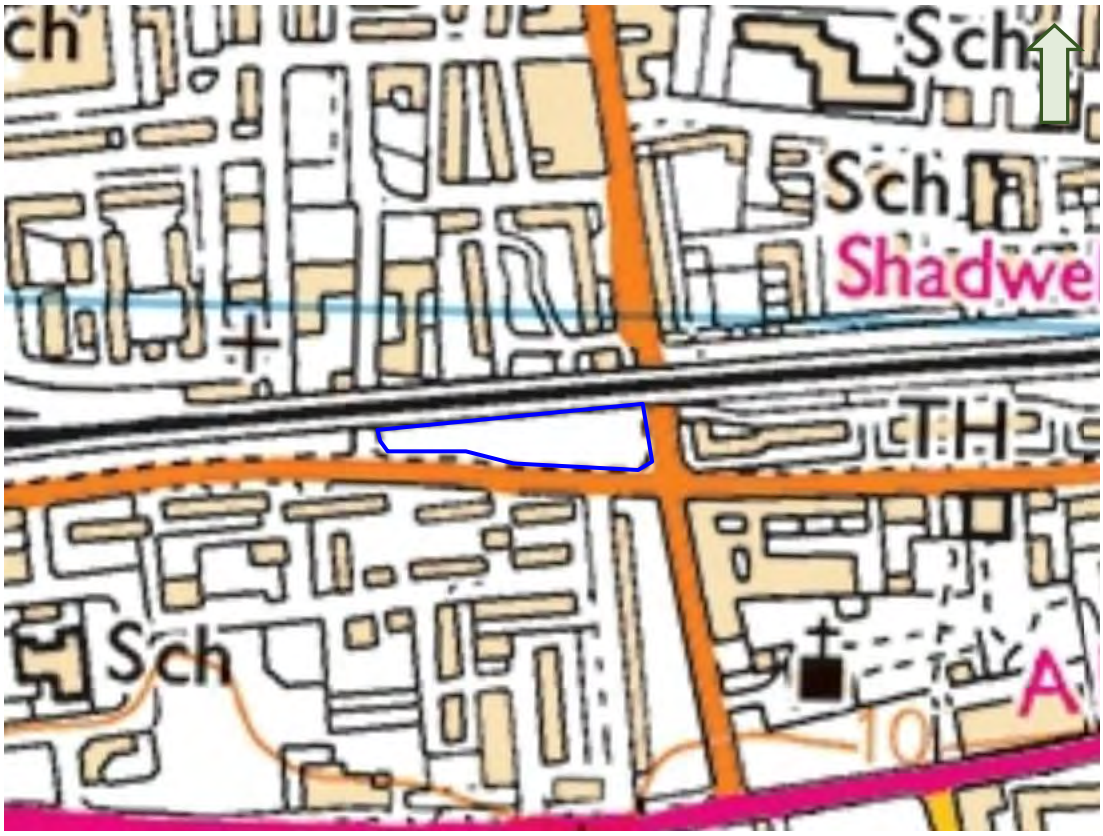
2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) TQ 346809. It is located in Whitechapel, approximately 2km east of London city centre.

The Site comprises an area of vacant ground and vegetation. It is bounded to the north by a railway line, to the east by Cannon Street Road, to the south by Cable Street, and to the west by Golding Street.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1	Site location map



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

Plate 1	Recent aerial photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site boundary

2.2 Proposed Works

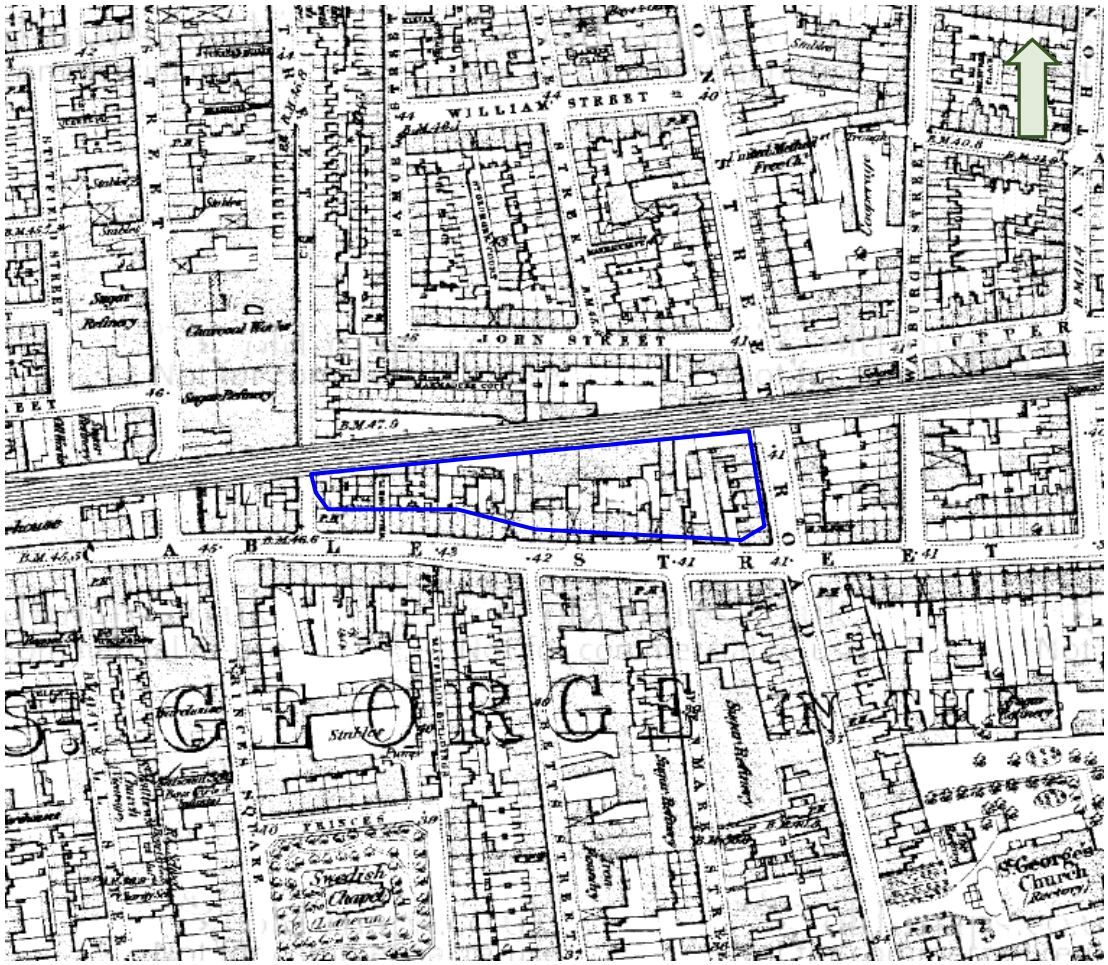
It is understood that planned works on the Site will include the sinking of 3No. cable tool boreholes.

2.3 Site History

The historical map of 1875 (Figure 2) shows that in the late 19th century the Site comprised terraced housing adjacent to the London and Blackwall Railway (L&BR).

The surrounding area was largely residential.

Figure 2	Historical map, 1875



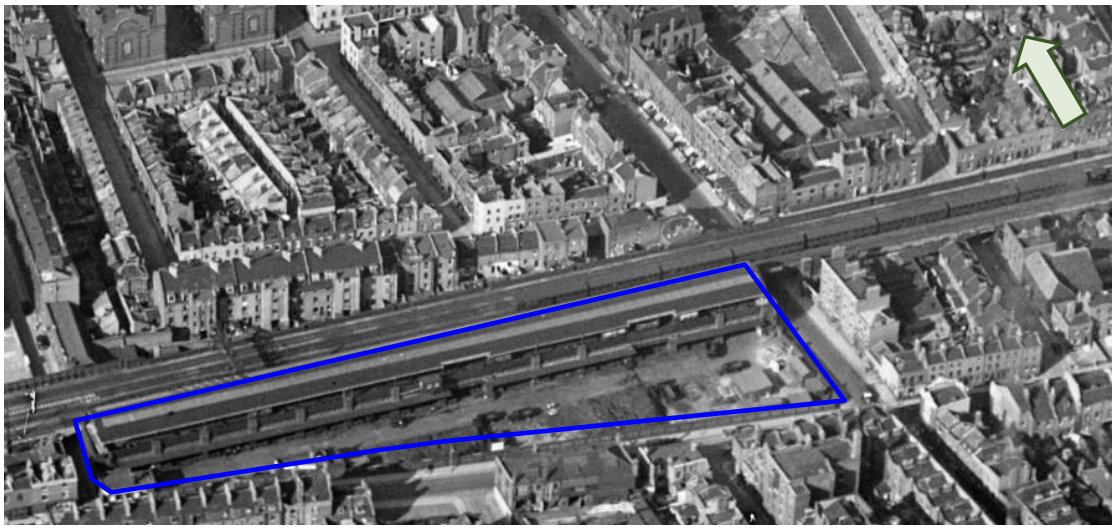
Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

During the late 19th century the housing on the Site was demolished and the land given over for use as a coal depot.

Plate 2 is an aerial photograph dated the 8th September 1937, showing the coal depot prior to WWII.

Plate 2	Aerial photograph, 8th September 1937



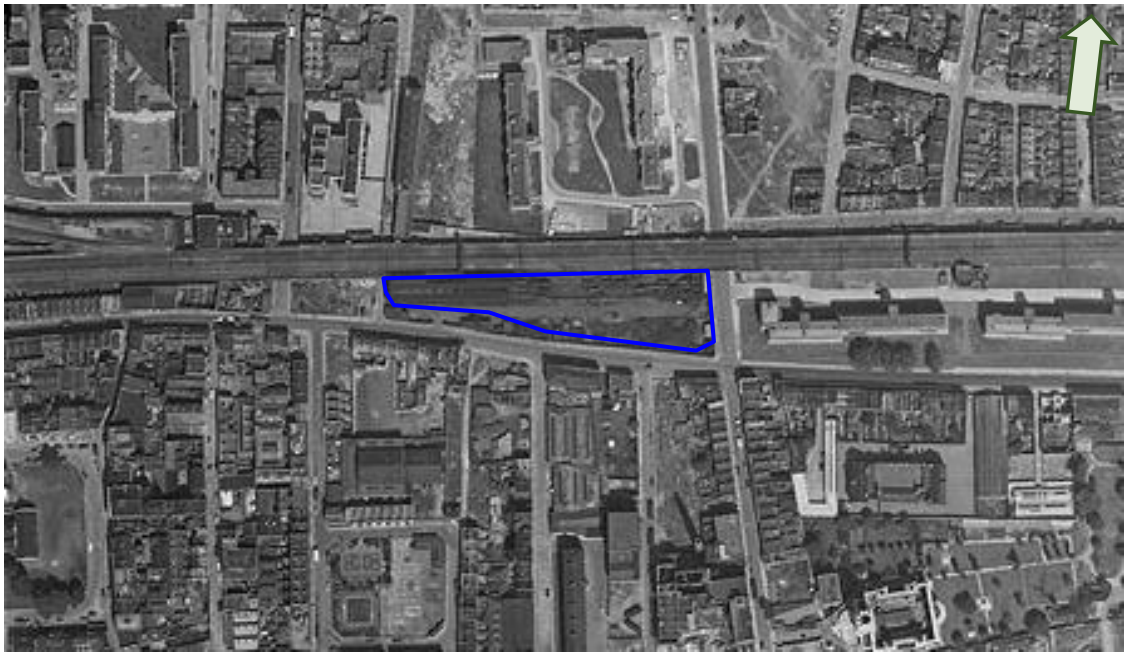
Source: Britain from Above *Not to Scale*

Legend	Approximate Site boundary

Plate 3, an aerial photograph dated the 6th June 1955, shows that there had been no significant development on the Site by the mid-20th century.

Buildings throughout the surrounding area had been destroyed by bombing during WWII (see Section 3).

Plate 3	Aerial photograph, 6th June 1955



Source: Historic England *Not to Scale*

Legend	Site boundary

Since 1955, the coal depot has been closed and the Site left vacant. Extensive redevelopment has occurred throughout the surrounding area (see Plate 1).

2.4 Pre-WWI Military Activity

No records of any significant pre-WWI military activity on or in close proximity to the Site have been found.

2.5 WWI Military Activity

No records of any significant WWI military activity on or in close proximity to the Site have been found.

During WWI an estimated 9,000No. German bombs were dropped over Britain. It was the first time that strategic aerial bombing had been used.

No records have been found indicating that the Site was bombed during WWI. The nearest recorded incidents to the Site are described below.

31st May 1915

1No. hand grenade fell on Burslem Street, approximately 0.2km north of the Site.

1No. hand grenade fell on Charles Street, approximately 0.3km west of the Site.

13th October 1915

1No. High Explosive (HE) bomb fell on Prince's Square, approximately 0.2km southwest of the Site.

13th June 1917

1No. HE bomb fell on Church Lane, approximately 0.3km northwest of the Site.

28th January 1918

1No. HE bomb fell on Cannon Street Road, approximately 50m south-southeast of the Site. This was recorded as an Unexploded Bomb (UXB).

1No. HE bomb fell on The Highway, approximately 0.3km southeast of the Site.

In response to the air raids, Anti-Aircraft (AA) guns were established. These were potential sources of Unexploded AA (UXAA) shells which could land up to 13km from the firing point, although more typically fell within 10km during WWI.

Records indicate 25No. static AA gun batteries were located within 10km of the Site. The nearest was located at the Tower of London (TQ 337806), approximately 0.8km southwest of the Site. This was armed with 2No. 3-inch (") guns.

WWI military activity is not considered to provide a source of UXO hazard to the Site.

2.6 WWII Military Activity

There were several important strategic targets in the vicinity of the Site and the Whitechapel area was heavily bombed. Details of recorded air raid incidents in the vicinity of the Site are provided in Section 3 and Appendix 1.

Numerous defensive and offensive military structures were built in the vicinity of the Site. These included lines of defence (Stop Lines), pillboxes, bombing decoys and AA guns. Further details are given in Section 4.

Other military establishments in the vicinity of the Site are described in Sections 5 to 7.

2.7 Post-WWII Military Activity

No records of any significant post-WWII military activity on or in close proximity to the Site has been found.

3 WWII BOMBING

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, industrial premises, power stations and airfields.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact, within 25m of this, death or fatal injury could occur.

PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration. Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any UXO. In more rural areas, fewer bombing raids occurred. It is known that ARP records under-represent the number and frequency of bombs falling in rural and coastal areas.

Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid Anti-Aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural, river, marsh or coastal areas were often unrecorded or entered as 'fell in open country', 'fell in the sea' or 'fell in the river' and left little evidence of the fall.

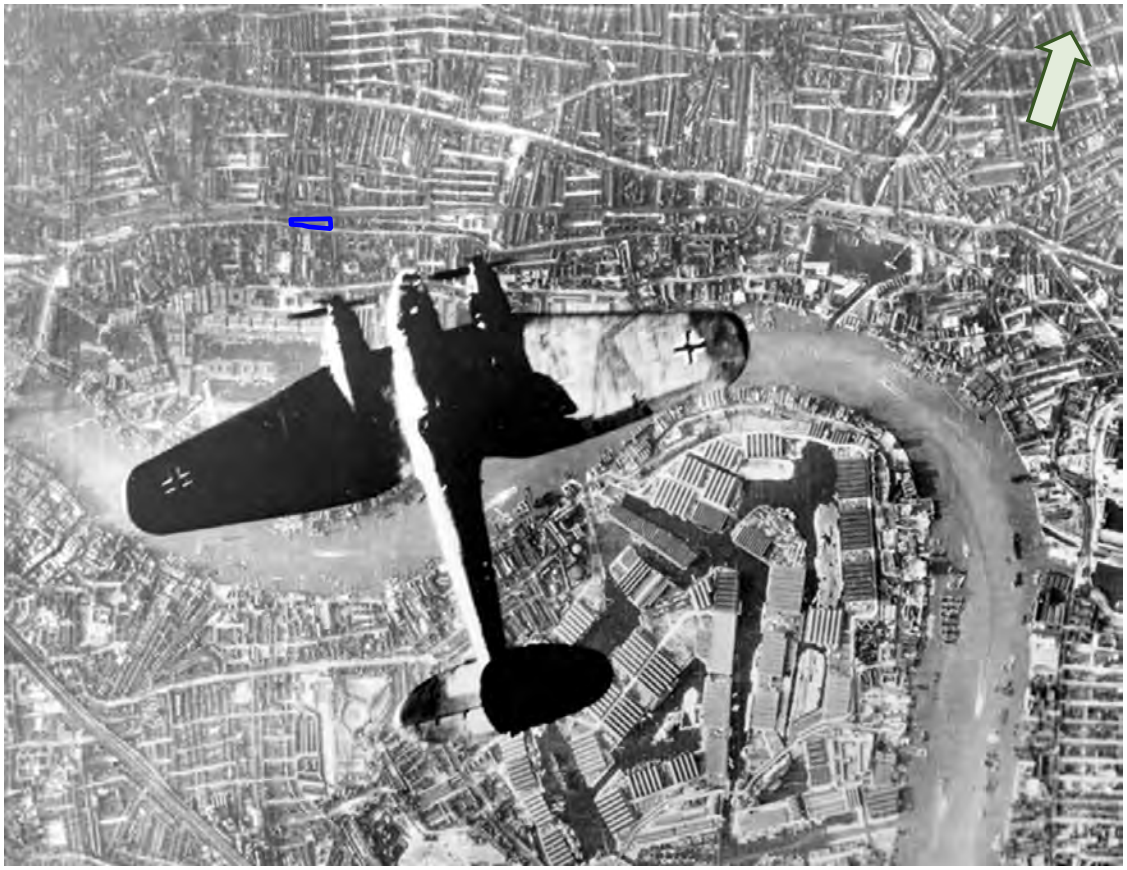
3.1 Bombing in London

London was a principal target of Luftwaffe bombing during WWII. The docks of East London were the main target of Luftwaffe bombing during the Blitz. The Port of London was the most heavily bombed civilian target in the United Kingdom.

The first air raid of the London Blitz took place on 7th September 1940 when a large German force bombed the docks and surrounding areas in West Ham, Stepney and Poplar.

Plate 4 is a reconnaissance photograph showing 1No. Heinkel He 111 bomber aircraft during this raid. The Site can be identified in the top-left of the frame.

Plate 4	Luftwaffe reconnaissance photograph of London Docks, 7th September 1940



Source: Ramsey *Not to Scale*

Legend	Site boundary

From mid-September until the end of that year, London was raided on all but 3No. nights. The raids continued through the early months of 1941 becoming less frequent, although often more intense. Heavier bombs, including PMs and OBs, were now used and major incendiary raids on the 29th December 1940 and 10th May 1941 caused widespread fire damage across the city.

From July 1941 the bombing campaign against London entered a period of relative inactivity. Raids still took place but tended to be relatively minor in severity. Manned bomber raids returned to London in the first few months of 1944 and, after a brief respite, were followed by the start of the Pilotless Aircraft (V1) offensive against the capital in June 1944.

These weapons arrived at any time of day and caused massive blast damage (although little fire damage). The V1 offensive on London was all but over by September 1944, although some V1s continued to fall on the capital until March 1945.

In September 1944 the Long Range Rocket (V2) offensive on London began. Falling from a height of some 50 miles (80km) above the city, these ballistic missiles caused larger craters and greater damage to underground utilities than the V1s, although their surface blast effect was generally less.

The area surrounding Wapping and the London Docks was bombed frequently between September 1940 and July 1941. Most of the air raids in the area were of a high intensity, including the use of 'mixed loads' of HE bombs and IBs.

3.2 Strategic Targets

The presence of strategic targets significantly increased the likelihood of bombing within the local area. Airfields, docks, industrial facilities, transport infrastructure and anti-invasion defences were all targeted by Luftwaffe bombers. The inherent bombing inaccuracies at the time meant that areas surrounding the targets were often subjected to bombing.

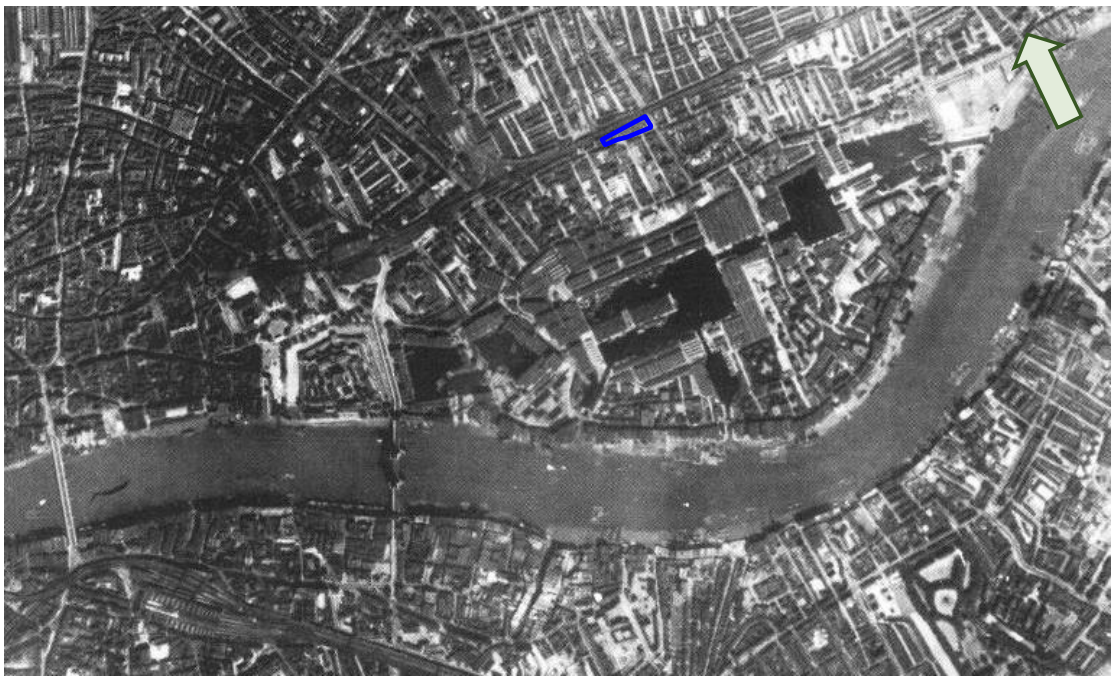
The main strategic targets in the vicinity of the Site are described below.

3.2.1 Docks and the River Thames

The Site was located in the vicinity of the London Docks. These were were the main destination for commercial commodities and industrial supplies being imported from overseas, and were also associated with industries such as timber yards, tar distillation works, sugar refineries and flour mills.

The docks were frequently photographed by the Luftwaffe, as is shown in Plate 5, a Luftwaffe reconnaissance photograph of the London Docks dating from 1939.

Plate 5	Luftwaffe reconnaissance photograph of London Docks, 1939



Source: Ramsey *Not to Scale*

Legend	Site boundary

The River Thames was located approximately 0.9km south of the Site. Its wharves, warehouses and industries were all potential targets and the river was used as a navigational aid by the Luftwaffe during raids against central London.

3.2.2 Transport Infrastructure

Transport and communications infrastructure were frequently targeted by the Luftwaffe to disrupt supply lines.

The London & North Eastern Railway (LNER) mainline ran adjacent to the Site. There was an associated coal depot located on the Site.

There was a large goods depot at Whitechapel, approximately 0.3km northwest of the Site.

Fenchurch Street Station, approximately 1km west of the Site, was a major railway terminus and had associated sidings and goods yards.

3.2.3 Public Utilities

Public utilities were frequently targeted to disrupt power supplies to local industries.

The Surrey Docks Gas Works were located approximately 1km southeast of the Site.

Stepney Power Station was located approximately 1.6km east of the Site and Stepney Gas Works were approximately 1.7km northeast of the Site.

3.3 Bombing Density and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal or Metropolitan Boroughs (MB) and Country Boroughs (CB). The Site was located in Stepney Metropolitan Borough.

The figures for West Ham CB, generally considered to represent a high regional bombing density, are included for comparison.

Table 1 Bombing Statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1,000 acres)
Stepney MB	**1,212**	**9**	**15**	**1,236**	**699.9**
City of London	393	9	13	415	613.0
Shoreditch MB	279	6	11	296	449.8
Bethnal Green MB	281	9	8	298	392.1
Finsbury MB	208	4	17	229	390.1
West Ham CB	1,498	45	47	1,590	334.0

Note that Table 1 excludes the figures for V1s (Pilotless Aircraft, also known as 'Doodlebugs'), V2s (Long Range Rockets), AA shells and IBs. Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

The nearest recorded incidents to the Site are described below. Appendix 1 provides detailed of further air raid incidents in the vicinity of the Site.

9th September 1940

1No. HE bomb fell on 228 Cable Street, approximately 0.1km east of the Site.

IBs fell on 209 and 211 Cable Street, approximately 0.1km east of the Site.

1No. HE bomb fell on 81 Cornwall Street, approximately 0.1km east of the Site. It was recorded as UXB and was removed on the 17th September 1940.

11th September 1940

IBs fell on the Public Library, approximately 50m southeast of the Site.

15th September 1940

1No. HE bomb and IBs fell on Walburgh Street, approximately 0.1km northeast of the Site.

18th September 1940

IBs fell on 61 Cable Street, approximately 0.1km west of the Site.

8th December 1940

1No. HE bomb fell on Cornwall Street, approximately 0.1km east of the Site.

8th March 1941

3No. HE bombs fell on St George's Church, approximately 0.1km southeast of the Site. 1No. of these was recorded as UXB.

19th March 1941

HE bombs fell on Cannon Street Road, approximately 50m north of the Site.

1No. HE bomb fell on 40 Christian Street, approximately 0.1km north-northwest of the Site.

16th April 1941

2No. HE bombs fell on Betts Street, approximately 0.1km south of the Site.

11th May 1941

1No. HE bomb fell at 125 Cannon Street Road, approximately 0.1km north of the Site. It was recorded as UXB and removed on the 22nd May 1941.

Unknown dates

1No. HE bomb fell on the LNER line, adjacent to the northern boundary of the Site.

1No. HE bomb fell between Grove Street and Christian Street, approximately 30m west of the Site.

1No. HE bomb fell on Crellin Street, approximately 30m north of the Site.

1No. HE bomb fell on Prince's Square, approximately 50m southwest of the Site.

1No. HE bomb fell on Christian Street, approximately 70m northwest of the Site.

It should be noted that during WWII, many UXB were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 3 is a map showing the approximate locations of recorded bomb impacts in the vicinity of the Site. IBs shown are indicative of large numbers of similar devices that fell within the given area. The map has been compiled from a number of different sources, including air raid incident reports, bomb census maps and historical aerial photographs.

Note that air raid incident reports did not always record precise locations, often only indicating on which street, area or farm a bomb fell.

Figure 3	Compiled bomb impact map for the vicinity of the Site

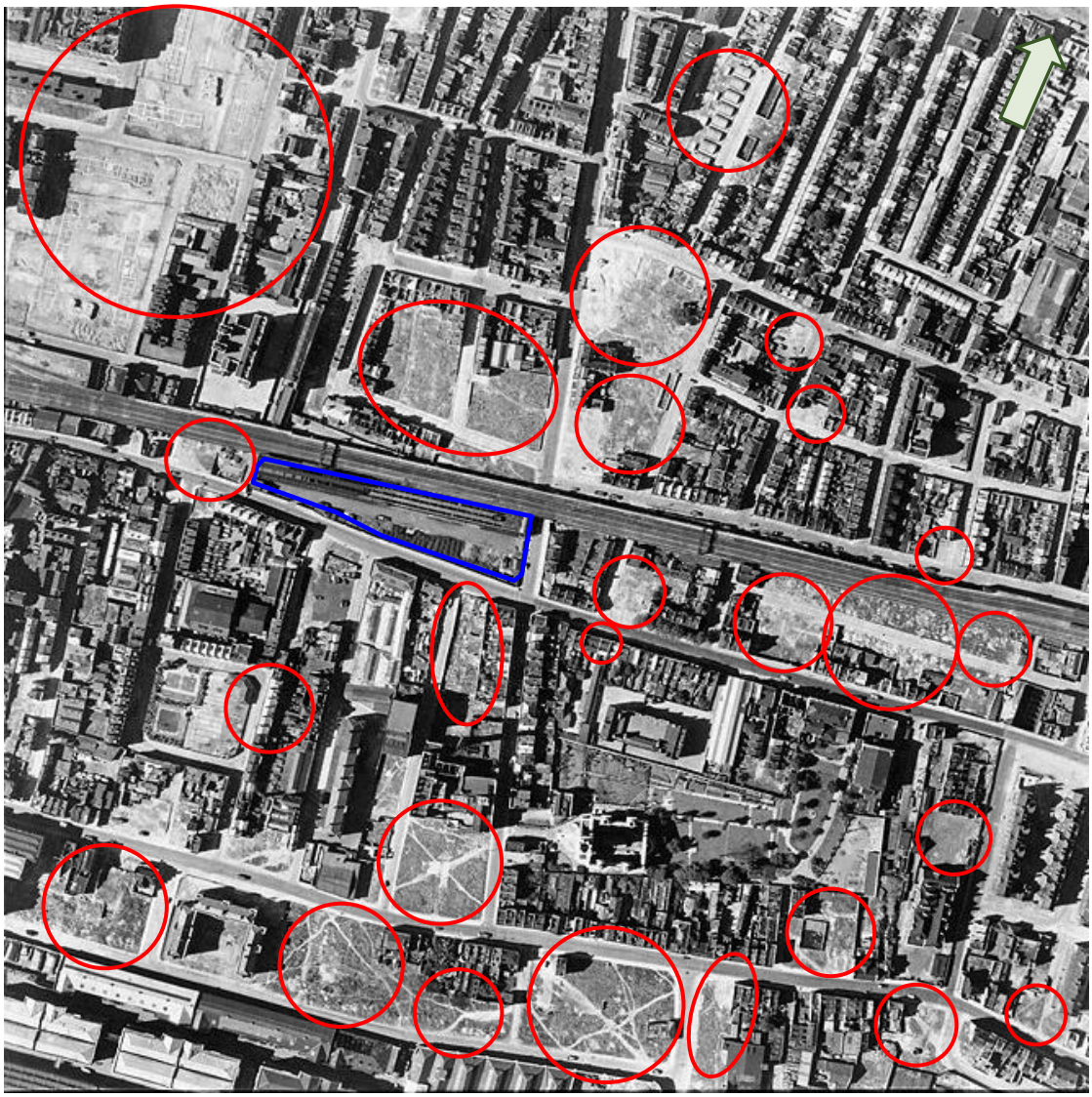
Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to scale*

Legend	Site boundary	HE bomb	UXB	V1	IBs

Plate 6 is an aerial photograph of the Site dated the 18th May 1948. No significant damage has been identified on the Site. Extensive bomb damage, characterised by demolished buildings and damaged roofing, has been identified throughout the surrounding area.

Buildings adjacent to the western boundary of the Site have been demolished.

Plate 6	Aerial photograph, 18th May 1948



Source: Historic England *Not to scale*

Legend	Site boundary	Bomb damage

Figure 4 is an extract from the London Bomb Damage Map, compiled at the end of WWII, on which the colouring denotes the severity of damage to buildings. Black indicates a destroyed building, purple and red indicate severe damage, while orange and yellow indicate blast damage. The pale green indicate areas cleared of rubble.

The map indicates that several buildings in close proximity to the Site, including buildings adjacent to the western boundary of the Site, were recorded as demolished.

Figure 4	Extract from the London Bomb Damage Map

Source: London County Council *Not to scale*

Legend	Site boundary

Records indicate that buildings adjacent to the western boundary of the Site were demolished by HE bombing. It is considered possible that this damage masked the impact of a UXB, which may have offset beneath the western end of the Site and remain in situ.

No records have been found indicating that the Site itself was bombed and no significant bomb damage has been identified on the Site on WWII aerial photography.

WWII bombing is considered to provide a source of UXO hazard to the western end of the Site.

3.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present on the Site at the time that a bomb was dropped in order to establish its maximum penetration depth. British Geological Survey (BGS) 1:50,000 Sheet 256 North London (Solid and Drift) were consulted, in addition to BGS borehole records.

During WWII the geology of the Site comprised Made Ground over the Langley Silt Member overlying the London Clay Formation.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 3.5m of Made Ground over 1m of sand and 3.5m of gravel, overlying more than 20m of stiff to very stiff clay.

Table 2	Estimated average maximum bomb penetration depths	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	2.5m
	500kg	6.0m
	1,000kg	7.0m

The estimated bomb penetration depths given in Table 2 is from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

In low level attacks over deep water bodies, the offset distances from the point of entry at the water surface may be considerably enhanced due to hydrodynamic effects before the bomb penetrates or settles on the sea bed. Shallow water has little effect on bomb penetration depths during high level attacks.

4 WWII DEFENCES

4.1 Bombing Decoys

In order to draw enemy aircraft away from towns and other strategically important targets, a series of decoys were developed between 1940 and 1941.

They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. Approximately 792No. static decoy sites were built at 593No. locations in England. In addition, numerous temporary and mobile decoys were deployed.

Several different types of decoy were devised:

- Night time dummy airfields (Q sites).
- Daytime dummy airfields (K sites).
- Diversionary fires to simulate successful bombing raids on airfields (QF sites), petroleum depots (P sites) and major towns and cities (Starfish or SF sites).
- Simulated urban lighting (QL sites).
- Dummy Heavy Anti-Aircraft (HAA) batteries, factories and buildings (C series).
- Mobile decoys representing 'hards' for troop embarkation (MQLs), tanks and other vehicles.

Machine gun emplacements and Light Anti-Aircraft (LAA) guns were used to prevent possible enemy landings at decoy airfields.

By their nature, decoy sites provide a potential risk from Unexploded Bombs (UXB), both within the decoy site boundary and in the surrounding areas.

The nearest recorded bombing decoy was located at Richmond Park (TQ203730), approximately 16.1km southwest of the Site.

This is not considered to provide a source of UXO hazard to the Site.

4.2 Anti-Aircraft Defences

Anti-Aircraft (AA) gun batteries were targeted by the Luftwaffe. They were also a source of Unexploded AA (UXAA) shells which could land up to 27km from the firing point during WWII, although more typically fell within 15km. These could be distributed over a wide area.

AA batteries present a potential source of UXO hazard as a result of the storage, use and disposal of ordnance associated with the armaments used. They may have a risk from small caches of ammunition buried locally to them. 3No. types of AA batteries existed:

- Heavy Anti-Aircraft (HAA) batteries of large guns designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- Light Anti-Aircraft (LAA) weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields.
- Rocket batteries (ZAA) firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were also relatively permanent emplacements.

Many AA batteries were associated with searchlights and consequently 'visible' at night, providing clear targets to the Luftwaffe bombers and a potential for UXB.

During WWII the Site was within the range of guns deployed in the London Gun Defended Area (GDA). Table 3 is a list of recorded HAA and ZAA batteries within 10km of the Site.

Table 3 WWII HAA and ZAA batteries within 10km of the Site

Grid Reference	Serial No.	Location	Armament	Approximate Distance and Direction from Site
TQ 356819	ZE19	Wathamstow	Unknown	1.3km NE
TQ 350794	ZE12	Southwark Park	Unknown	1.4km SSE
TQ 354788	21Z	Southwark Park	64No. UP projectors	2.1km SSE
TQ 353789	ZE13	Finsbury Park	Unknown	2.1km SSE
TQ 366842	-	Victoria Park	Unknown	3.7km NNE
TQ 365842	19Z	Victoria Park	Unknown	3.9km NNE
TQ 382788	ZE8	Isle of Dogs	4No. 4.5" guns & GL Mk II radar	4.1km SE
TQ 395827	25Z	West Ham	Unknown	5.2km NE
TQ 375853	ZE21	Hackney Marshes	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	5.1km NNE
TQ 346753	ZS25	Peckham Rye	Unknown	5.6km S
TQ 374859	ZE21	Hackney Marshes	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	5.7km NNE
TQ 326865	ZE22	Hampstead	4No. 3.7" guns & GL Mk II radar	5.8km NNW
TQ 373754	ZS11	Brockley	4No. 3.7" guns & GL Mk IA radar	6.1km SSE
TQ 395768	4Z	Blackheath Common	64No. UP projectors	6.5km SE
TQ 278806	ZW5	Hyde Park	4No. 3.7" guns & GL Mk IA radar	6.7km W
TQ 280805	8Z	Hyde Park	64No. projectors	6.7km W
TQ 284775	9Z	Battersea Park	64No. Projectors	6.8km SW
TQ 417815	ZE16	Beckton	Unknown	7.1km E
TQ 275838	ZE14	Primrose Hill	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	7.5km NW
TQ 409864	20Z	Wanstead Flats	64No. projectors	8.1km NE
TQ 289751	ZS16	Clapham Common	4No. 4.5" guns and later 4No. 3.7" guns & GL Mk II radar	8.1km SW
TQ 341727	ZS14	Dulwich	4No. 4.5" guns and later 4No. 5.25" guns & GL Mk II radar	8.2km S
TQ 341729	18Z	Dulwich		8.5km S
TQ 411865	ZE9	Wanstead	4No. 3.7" guns & GL Mk II radar	8.5km NE
TQ 427773	ZS8	Woolwich Common	4No. 4.5" guns & GL Mk II radar	8.8km SE
TQ 277864	16Z	Parliament Hill	64No. projectors	9.0km NW

It should be noted that the lack of official records of HAA batteries or armaments cannot be taken to imply their absence because many units were mobile and were moved around as operational requirements dictated.

Given the number of gun batteries in the surrounding area, the possibility that a UXAA shell fell on the Site unnoticed, whilst unlikely, cannot be discounted.

4.3 Barrage Balloons and Anti-Landing Obstacles

Balloon barrages were flown in many British towns and cities to protect against air raids. Their presence deterred low flying aircraft, making it more difficult for bombs to reach their intended targets. Barrage balloon sites can be a source of UXO as they were targeted by the Luftwaffe. They also often had a small explosive charge fitted with tilt fuzes attached approximately 50m from each end of the balloon cables and designed to detonate if the cables were hit by an aircraft.

Measures were also taken to prevent enemy aircraft landing in the event of invasion. Obstructions were constructed around airfields and on other open sites deemed fit for use as landing grounds. Solid obstructions (such as concrete blocks), posts or stakes, felled trees, haystacks, scaffolding with wire and trenching were the main measures used.

No records have been found indicating that barrage balloons or anti-landing obstacles were located on or in close proximity to the Site.

Records have been found indicating that floating barrage balloon pontoons were located in St Katherine's Dock, approximately 0.6km southwest of the Site.

Barrage balloons and anti-landing obstacles are not considered to provide a source of UXO hazard to the Site.

4.4 Anti-Invasion Defences

Defence structures are a potential source of UXB as they were especially targeted by low flying enemy aircraft, particularly during 'tip and run' raids which were common in industrialised regions. These defences may also be associated with small caches of UXO in the form of small arms, used by the troops manning the emplacement.

The rapid advance of German Troops into France, Holland and Belgium after the start of WWII prompted the War Office to review the vulnerability of the UK to invasion and a decision was taken to begin work on a national plan of anti-invasion defences. Static defences were built to interrupt and delay the progress of any invading force.

Coastal defences were strengthened (the 'Coastal Crust'). These defences included barbed wire entanglements and minefields, which were often combined to give defence in depth.

Inland, lines of defence structures were constructed along 'Stop Lines' in order to impede enemy progress for long enough to allow mobile defending forces to counter-attack.

Stop Lines included the fortification of key 'centres of resistance', such as river crossings and important road or rail junctions that could seriously hamper the enemy's advance across country. Bridges were mined for demolition and tank traps installed.

Stop Lines were further integrated into a network of fortified nodal points and 'Anti-Tank (AT) Islands'.

No records have been found indicating that anti-invasion defences were located on or in close proximity to the Site.

4.5 Pillboxes, Mortar and Gun Emplacements

Defences also included spigot mortar positions and gun emplacements.

Spigot mortars, also known as Blacker Bombards, were used primarily in an anti-tank role at road blocks or to defend airfields. Typically they fired a 20 pound (lb) HE mortar bomb. The fixed positions, in weapons pits with ammunition lockers, were frequently positioned near pillboxes.

Spigot mortar positions could be either fixed or mobile.

No records have been found indicating that gun emplacements were located on or in close proximity to the Site.

Pillboxes provide a potential UXO hazard both from the storage, use and disposal of ordnance associated with them and from UXB because they were targeted by enemy aircraft.

Pillboxes were common along Stop Lines, perimeters of airfields, potential land invasion sites and around important civil sites. Several different designs existed including Seagull Trenches (semi-buried structures), Alan Williams and Tett Turrets (small prefabricated pillboxes). Fortified sites, buildings or loop-holed walls also functioned as pillboxes.

No records have been found indicating that pillboxes were located on the Site.

The nearest identified pillbox was located on the river bank near Tower Bridge (TQ 336804), approximately 0.9km southwest of the Site.

Pillboxes and gun emplacements are not considered to provide a source of UXO hazard to the Site.

4.6 Home Guard and Auxiliary Units

Local Defence Volunteers (LDV) units, later known as the Home Guard, were located in all cities, towns and large villages. Anti-invasion defences were to be defended by the Home Guard and regular Army troops for as long as possible in the event of an invasion. The troops were issued with 'No Withdrawal' orders.

Important elements of the ordnance supply for the use of the Home Guard included substantial supplies of Mills bombs (fragmentation grenades) and Self Igniting Phosphorus (SIP) grenades as well as machine gun and small arms ammunition.

Records of Home Guard activities and related sites are rarely preserved. Storage and disposal of munitions by the Home Guard was poorly documented and surplus supplies were either buried or dumped in lakes and ponds. Given the irregular nature of this activity, the possibility of items of UXO being discovered at any locations occupied or used for training by the Home Guard can never be totally discounted.

In addition to the regular Home Guard, Auxiliary Units existed which were made up of guerrilla troops trained in sabotage and assassination in case of invasion. Sites used by these Units were Top Secret and many locations are still unknown.

No Home Guard or Auxiliary Unit activity has been identified on or in close proximity to the Site

4.7 Minefields and Mined Locations
Minefields were laid along the coast, in estuaries and along the banks of major rivers to deter infantry invasion. Strategic points such as bridges and gaps in cliffs were mined to impede enemy advance. Most of the mined locations in the UK have been cleared and the risk of finding UXO in these areas is considered to be low.
No records of minefields or mined locations on or in close proximity to the Site have been found.

5 MILITARY AIRFIELDS

Military airfields offer the potential for significant UXO hazards due to the use, storage and disposal of ordnance and as a result of enemy bombing during WWI and WWII.

Airfields active during WWII were targeted by the Luftwaffe, providing a potential source of UXB on the airfield.

As bombing accuracy was so poor during WWII, it is likely to find UXB in the surrounding areas. Aircraft crashes are also associated with operational airfields.

No records have been found of any military airfields within 10km of the Site.

The nearest recorded operational military airfield was Royal Air Force (RAF) Fairlop, located approximately 14.2km northeast of the Site. This was used throughout WWII as a satellite airfield for RAF Hornchurch, and accommodated a series of fighter squadron. The airfield was closed in August 1946.

Military airfields are not considered to provide a source of UXO hazard to the Site.

5.1 Aircraft Crashes

No records of aircraft crashes on or in close proximity to the Site have been found.

6 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS

Explosives and munitions manufacturing or storage sites offer a particularly high risk from both explosive substances and UXO. Standard procedures of explosive/ordnance disposal through burial or burning means that explosive and UXO hazards will be present in some areas of such establishments.

In addition, UXB hazards may be present as a result of enemy bombing during WWI and WWII.

6.1 Explosives and Ordnance Factories

No records of any explosives or ordnance factories on or in close proximity to the Site have been found.

The Southwark National Filling Factory (NFF), approximately 2.3km west-southwest of the Site, filled fuzes with explosives during WWI.

Explosives and ordnance factories are not considered to provide a source of UXO hazard to the Site.

6.2 Munitions Stores

Local ammunition caches would have been present near to defended road blocks, pillboxes, HAA and LAA sites. Most of those associated with the anti-invasion sites are understood to have been cleared.

No records of any official munitions stores on or in close proximity to the Site have been found.

6.3 Informal Munitions Depots

Informal munitions depots, often made by requisitioning roadside lay-bys or parks. Other informal munitions depots were commonly located in areas of woodland or on train wagons along sidings in marshalling yards.

No records of any informal munitions depots on or in close proximity to the Site have been found.

6.4 Munitions Disposal Areas and Bomb Cemeteries

Munitions disposal areas were often made by requisitioning open areas of land, usually away from habitation. Marshland, beaches or sand dunes were frequently used for this purpose. Disposal of munitions was carried out in many different ways, ranging from destruction to burial. Full records were not necessarily maintained for these locations, and so they can potentially be a source of UXO.

No records of any munitions disposal areas or bomb cemeteries on or in close proximity to the Site have been found.

7 FIRING RANGES AND MILITARY TRAINING AREAS

By their nature, firing ranges and military training areas represent a potential source of UXO due to associated training activities. The training will involve both practice and live munitions and will offer a significant risk from a very wide range of potential UXO.

7.1 Small Arms Ranges

Small arms ranges (such as rifle ranges) and close combat ranges (such as mortar and grenade ranges) are likely to provide a significant source of UXO. It should be noted that even on small arms ranges, larger munitions such as mortars or grenades cannot be discounted.

No records of any small arms ranges on or in close proximity to the Site have been found.

7.2 Artillery Ranges

Artillery ranges will have utilised a wide range of munitions, predominantly shells, although close combat munitions such as mortars, or larger munitions such as bombs, cannot be discounted.

No records of any artillery ranges on or in close proximity to the Site have been found.

7.3 Bombing Ranges

Bombing ranges will have primarily used bombs, although other munitions such as shells and close combat munitions such as mortars cannot be totally discounted.

No records of any bombing ranges on or in close proximity to the Site have been found.

7.4 Training Areas

Training areas will have primarily used blank ammunition or practice shells in 'dry' areas, although live munitions such as shells and close combat munitions such as mortars cannot be discounted in any training area.

No records of any military training on or in close proximity to the Site have been found.

8 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear.

Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

8.1 Abandoned Bombs

No records of any officially abandoned bombs on the Site have been found.

8.2 EOC Tasks

Zetica Ltd holds the following records of post-WWII EOC task being undertaken in the vicinity of the Site.

8th March 1951

1No. 250kg UXB with 2No. Type 25 fuzes was removed from Prescott Street, approximately 0.5km west of the Site.

12th March 1965

1No. 250kg UXB with 2No. Type 25 fuzes was made safe and removed from the Tower Hill underground station, approximately 0.9km west-southwest of the Site.

3rd February 1989

1No. 1,000kg UXB was discovered at Ford Square, Whitechapel, approximately 0.6km north-northeast of the Site. It was removed.

The MoD has provided no additional information of official EOC tasks on the Site.

9 UXO HAZARD ASSESSMENT

9.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site

Hazard Level	Definition
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present and that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

Records have been found indicating that buildings adjacent to the western boundary of the Site were demolished by 1No. HE bomb during WWII.

It is considered that this may have masked the impact of a UXB, which may have offset beneath the western end of the Site and remain in situ. Consequently, the western end of the Site is assigned a moderate UXO hazard level.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the remainder of the Site. The central and eastern parts of the Site are assigned a low UXO hazard level.

Given this, it is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in Figure 5.

Figure 5 UXO hazard zone plan of the Site

Source: Google Earth *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

10 UXO RISK ASSESSMENT

10.1 UXO Risk Level

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	**Rating**
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	**Rating**
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	**LIKELIHOOD of Encounter and Detonation**	**Rating**
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0

P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix

		SEVERITY (S)					
		5	4	3	2	1	0
LIKELIHOOD (P)	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

The final risk assessment for the Site is given in Table 4.

Table 4 UXO risk assessment for the Site

Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	6	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

UXO Risk	Matrix Rating	Definition
Very Low	0-1	Little action is required by the client provided that suitable records and procedures are in place to ensure appropriate action is undertaken should the UXO risk level change.
Low	2-5	Tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to.
Moderate	6-15	May be tolerable for the client, but it is prudent to reduce the risk where cost effective and reasonably practicable.
High	16-20	Tolerable to the client only where further risk reduction is impracticable or disproportionate to the risk involved. Essential that all practicable measures are taken to reduce the level of risk.
Very High	21-25	Unacceptable to the client except in extraordinary circumstances. Imperative that all control measures are taken.

10.2 Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Low Risk

Excavations

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

Boreholes/Piles

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

Moderate Risk

Excavations

For those involved in excavations, the raising of awareness (as per low risk) is considered essential.

A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.

Where UXO detection is not feasible due to ground conditions, restricted access or programme, an EOC Engineer can be used to supervise during excavation works.

The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.

Boreholes/Piles

Clearance certification for any borehole or pile locations is considered essential.

This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB.

Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.

Table 5 gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.

Table 5	Risk mitigation for assumed Site activities			
Risk Level	**Typical Future Activity on the Site**			
	None	**Shallow Excavations (<1.0m)**	**Deep Excavations (>1.0m)**	**Boreholes or Pile Construction**
Very low	Ensure suitable records and procedures are in place to highlight the risk should future development be planned.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.
Low	**As very low.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+Clearance certification for borehole or pile locations would be considered prudent only if a zero tolerance to risk is adopted.** **Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.**
Moderate	**As very low.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Clearance certification for borehole or pile locations is considered essential.**
High	As very low.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate.
Very High	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.
The above table is for guidance only.				

Appendices

Appendix 1 WWII Bombing Incidents

7th September 1940

On the day known as 'Black Saturday' the East End, the London Docks and the City of Westminster were heavily bombed by approximately 340No. Luftwaffe bomber aircraft with many escorting fighter aircraft.

1No. HE bomb and several IBs fell on Sheridan Street, approximately 0.3km northeast of the Site.

8th September 1940

IBs and HE bombs fell on Cable Street, in the vicinity of the Site.

9th September 1940

1No. HE bomb fell on 228 Cable Street, approximately 0.1km east of the Site.

IBs fell on 209 and 211 Cable Street, approximately 0.1km east of the Site.

1No. HE bomb fell on 81 Cornwall Street, approximately 0.1km east of the Site. It was recorded as UXB and was removed on the 17th September 1940.

10th September 1940

HE bombs and IBs fell on the London Docks, approximately 0.3km south of the Site, causing widespread fires.

11th September 1940

IBs fell on the Public Library, approximately 50m southeast of the Site.

1No. HE bomb and IBs fell on Cable Street, approximately 0.2km east of the Site.

12th September 1940

1No. HE and IBs fell on Wapping Lane and The Highway, approximately 0.3km southeast of the Site.

13th September 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

15th September 1940

1No. HE bomb and IBs fell on Walburgh Street, approximately 0.1km northeast of the Site.

1No. HE bomb fell on Chapman Street, approximately 0.2km east-northeast of the Site.

18th September 1940

IBs fell on 61 Cable Street, approximately 0.2km west of the Site.

1No. HE bomb fell on Bewley House, Bewley Street, approximately 0.3km southeast of the Site.

8th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

9th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

11th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

26th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

8th December 1940

1No. HE bomb fell on Cornwall Street, approximately 0.1km east of the Site.

8th March 1941

3No. HE bombs fell on St George's Church, approximately 0.1km southeast of the Site. 1No. of these was recorded as UXB.

1No. HE bomb fell on 47 The Highway, approximately 0.2km south-southwest of the Site.

HE bombs fell on Wellclose Street and Wellclose Square, approximately 0.2km southwest of the Site.

1No. HE bomb fell at the junction of Cable Street and Back Church Lane, approximately 0.2km west of the Site.

15th March 1941

1No. HE bomb fell on the Church Wardens Garden, Cannon Street Road, approximately 0.2km northeast of the Site.

19th March 1941

HE bombs fell on Cannon Street Road, approximately 50m north of the Site.

1No. HE bomb fell on 40 Christian Street, approximately 0.1km north-northwest of the Site.

HE bombs fell on Wellclose Square, approximately 0.2km southwest of the Site.

HE bombs fell on Philchurch Street, approximately 0.2km northwest of the Site.

1No. HE bomb fell on Brinsley Street, approximately 0.3km east of the Site.

IBs fell on Morris Street, approximately 0.3km northeast of the Site.

1No. HE bomb fell on Watney Passage, approximately 0.3km northeast of the Site.

1No. HE bomb fell on London County Council Fire Service building, Fairclough Road, approximately 0.3km northwest of the Site.

16th April 1941

2No. HE bombs fell on Betts Street, approximately 0.1km south of the Site.

3No. HE bombs fell on Cuttle Close, approximately 0.2km south of the Site.

11th May 1941

1No. HE bomb fell at 125 Cannon Street Road, approximately 0.1km north of the Site. It was recorded as UXB and removed on the 22nd May 1941.

1No. HE bomb fell on Bigland Street, approximately 0.2km northeast of the Site.

23rd June 1944

1No. V1 fell at the junction of Crowder Street and The Highway, approximately 0.2km south-southeast of the Site.

4th July 1944

1No. V1 fell on land between The Highway and Pennington Street, approximately 0.2km south-southwest of the Site.

1st August 1944

1No. V1 fell on the junction of Lambeth Street and Goodman Street, approximately 0.3km west-northwest of the Site.

Unknown dates

1No. HE bomb fell on the LNER line, adjacent to the northern boundary of the Site.

1No. HE bomb fell between Grove Street and Christian Street, approximately 30m west of the Site.

1No. HE bomb fell on Crellin Street, approximately 30m north of the Site.

1No. HE bomb fell on Prince's Square, approximately 50m southwest of the Site.

1No. HE bomb fell on Christian Street, approximately 70m northwest of the Site.

1No. HE bomb fell on a warehouse on Wapping Lane, approximately 0.3km south-southeast of the Site.

Appendix 2 UXO Hazard and Ordnance Types

When assessing the risk from UXO including UXB, it is important to be aware of ordnance type and function. The following Section briefly describes the more common types of UXO. More data on these can be found at http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/.

A2.1 Small Arms Ammunition

Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Larger calibre small arms munitions can contain fuze mechanisms and high explosives or pyrotechnic fillings and may have been used for anti-aircraft or anti-vehicle purposes.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance. SAA is often associated with discarded ammunition boxes around firing practice ranges. The Plate below illustrates some common SAA.

Plate	Photograph of typical WWII small arms ammunition

Source: Google Images

A2.2 Hand Grenades

Hand grenades can be filled with explosives or chemicals and have 3No. main parts, a body, a fuze with a pull ring and a safety-clip assembly. Fragmentation grenades are the most common and have a metal or plastic body filled with an explosive. Most use a burning delay fuze that functions for 3 to 5 seconds after the safety lever is released.

Some, such as smoke grenades, are activated instantly when the lever is released. The Plate below illustrates the typical character and condition of No. 36 hand grenades (Mills Bombs) that have been excavated from a site.

Plate	Photographs of a typical and an excavated WWII No. 36 hand grenades

Source: Google Images

Source: Zetica Ltd

A2.3 Projected Grenades

Projected grenades are among the most commonly found UXO items, particularly the 40mm type. These contain high explosives and use a variety of fuzes, including some of the most sensitive internal impact-fuzing systems. They are extremely dangerous and can explode if moved or handled.

A2.4 Mortars

A mortar is a short tube designed to fire a projectile at a steep angle. Mortars can range from approximately 50mm to 280mm in diameter and can be filled with explosives, toxic chemicals, white phosphorous or illumination flares. They generally have a thinner metal casing than projectiles, but use the same types of fuzing and stabilisation.

During WWII there are records that the target areas of RAF practice bombing ranges were occasionally used for mortar training.

The Plate below shows a typical 2-inch mortar bomb found (left) and a demonstration 3-inch mortar bomb (right).

Plate	Photographs of WWII 2-inch and 3-inch mortars

Source: Daily Mail

Source: Zetica Ltd

A2.5 Shells

Shells are a projectile containing an explosive charge designed to burst the casing that can contain High Explosives, pyrotechnic compounds or other chemicals.

Shells can be found in a range of sizes, from <20mm to several times this size. The most likely shells to be found on the Site are Small Arms Ammunition (SAA) or UXAA shells that have fallen back to the ground unexploded.

Most commonly used anti-aircraft shells were 2" and 3.7" HE shells.

If fired and found as UXO, shells can offer a particular hazard from accidental detonation as they can have sensitive fuze mechanisms. A fuze is a device which incorporates mechanical, electrical, chemical or hydrostatic components to initiate a train of fire or detonation.

The Plate below is a photograph of a 3.7" UXAA shell found in Camberwell, London.

Plate	Photograph of a recently excavated 3.7" AA shell

Source: Zetica Ltd

A2.6 Incendiary Bombs

Incendiary Bombs (IBs) ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. By far the most common air dropped devices across the UK during WWII were small 1kg to 2kg IBs.

In some cases the IBs were fitted with a very small High Explosive (HE) bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs.

The small amount of HE, if any, and the almost negligible potential for IBs to remain active after more than 65 years in the ground means that these items have very little prospect of causing damage. In the majority of cases if IBs are found in the ground, the incendiary materials have deteriorated to such an extent that they are considered to provide a low UXO hazard level.

However, since magnesium and phosphorus were common components in IBs, some localised chemical contamination may occur where the contents have leached out of the IB into the surrounding soil.

The Plate below shows a typical variety of fragmentary remains of IBs and 2No. IBs recovered by the Civil Defence during WWII.

Plate	Photographs of typical fragmentary remains of IBs and a UXIB

Source: Swansea Museum

Source: Museum of London

A2.7 German High Explosive Bombs

Probably the most common and certainly most publicised UXOs to be found in the UK are bombs. Air dropped bombs, as a result of WWII enemy action, are found on a relatively frequent basis as UXO. They tend to be highly publicised (at least on a local basis) due to the common disruption where an evacuation of the potentially affected area is put in place.

The amount of High Explosive and the potential for a fuze to still be activated means that these devices have the prospect of causing some of the most widespread damage. WWII bombs were particularly sophisticated for their time, with anti-tamper fuzes.

Many German bombs were designed to not explode on impact and instead to cause disruption as a UXB. Some fuzes were set with a delay time of over 70 hours. During this time, an anti-tamper fuze could also be activated to detonate should it be disturbed.

The most commonly used bombs during WWII were the 50kg and 250kg sized general purpose bombs. Less frequently, the 500kg bomb was also used. Larger bombs were used, but so infrequently that any assessment of hazard is more typically based on bombs ranging up to 500kg only.

It should be noted that the June 2008 find of a 1000kg bomb in London, does demonstrate that larger bombs can be found and any risk mitigation measures should consider this.

The Plate below shows the variety of UXB recovered by the Civil Defence during WWII.

Plate	Photograph of a variety of UXB recovered by the Civil Defence during WWII

Source: Imperial War Museum

A2.8 Detonators, Gaines and Fuzes

Bomb components such as detonators, gaines and fuzes were stored at operational airfields during WWII and typically contained some type of explosive charge to initiate the detonation of a munition.

A wide variety of these components were used and examples of some common fuzes are shown in the Plate below.

Plate	Photographs showing examples of WWII fuzes

Source: Zetica Ltd

A2.9 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

Plate	Photographs of original and recently excavated WWII land mines

Source: Google Images

Source: Zetica Ltd

A2.10 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset. Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010.

Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

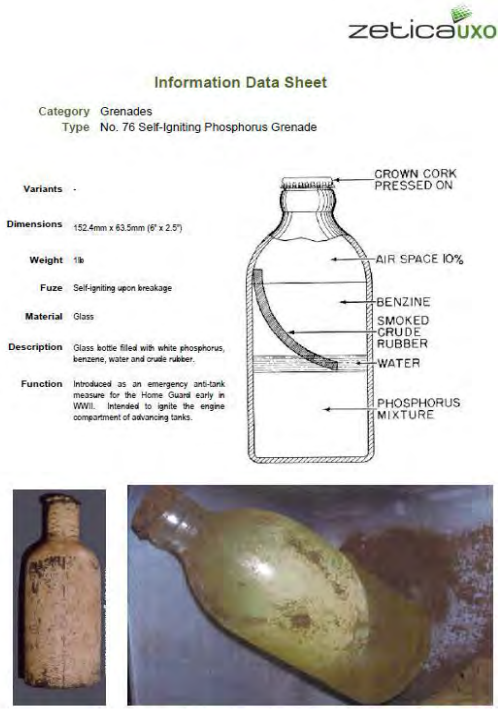
In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

Plate	Photograph of the No. 76 SIP grenade



Source: Zetica Ltd

Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

A2.11 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

A2.9 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

Plate	Photographs of original and recently excavated WWII land mines

Source: Google Images

Source: Zetica Ltd

A2.10 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset. Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010.

Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

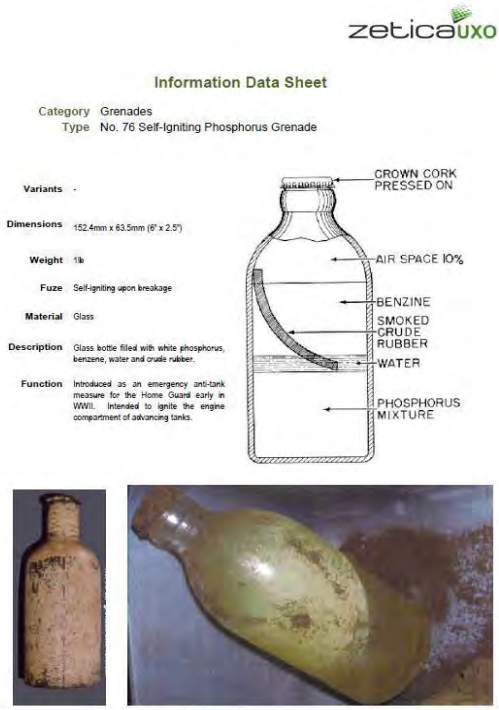
In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

Plate	Photograph of the No. 76 SIP grenade



Source: Zetica Ltd

Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

A2.11 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

A2.12 Effects and Consequences

There have been a limited number of recorded incidents in the UK since WWII where bombs have detonated during engineering works, though a significant number of bombs have been discovered. Incidents involving smaller ordnance are, however, relatively common in the UK.

In the UK, there are no recorded incidents since the decade after WWII, of a UXB accidentally detonating. In recent years, bombs have been found that have fuze mechanisms that have started to operate indicating that given the right conditions a UXB may still function.

In June 2008 the UXB uncovered in the Lea Valley caused difficulty to No. 33 Regiment (Explosive Ordnance Disposal) Royal Engineers because the fuze mechanism started to operate.

The 1,000kg 'Hermann' bomb, the first of this size to be found in over 30 years, took 5 days to deactivate. This demonstrates that larger bombs can be found and any risk mitigation measures should provide the option to deal with this size of device. Since WWII, UXBs have been found on a regular basis in London.

Since WWII, UXBs have been found on a regular basis throughout Britain. Some of the most recent cases are described below.

In May 2009 1No. 50kg WWII bomb was found on a building site in Bexhill-on-Sea, Sussex, and on the 16th August 2009, 1No. 250kg WWII bomb was found near Ebberston, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8th March 2010 1No. 500kg WWII bomb was found at Bowers Marsh in Essex by Zetica EOC operatives following a Zetica desk study concluding a high risk of UXB on the site. The bomb was demolished in situ by members of the Army Royal Logistics Corps (RLC).

The Plate below is a photograph of the bomb in situ.

Plate	Photograph of the 500kg WWII UXB at Bowers Marsh, 8th March 2010

Source: Zetica Ltd

On the 23rd February 2011, 1No. WWII UXB was found on a building site in Notte Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.

On the 22nd July 2012, a landslip in the cliffs at Mappleton in the East Riding of Yorkshire exposed over 1,000No. UXO items, including practice bombs, mortars, rockets, shells and grenades. The cliff was part of a former bombing and artillery range, used during WWII and until the 1970s.

UXO items were removed by Explosive Ordnance Disposal (EOD) officers from Catterick and MoD staff from Leconfield. 15No. controlled explosions were undertaken by the Royal Engineers (RE) to detonate the more volatile items in situ, while other less hazardous UXO devices were left in place to be dealt with at a later date.

1No. WWI bomb (shown in the Plate below) was found on the Isle of Sheppey on the 2nd August 2012 during a geophysical survey following desk study research by Zetica Ltd which had established that a previously unknown WWI bombing range existed on the site. A further WWI bomb was found in the same location in August 2015.

Plate	Photograph of WWI bomb, Isle of Sheppey, 2nd August 2012

Source: Zetica Ltd

On the 23rd March 2015, 1No. WWII 500kg UXB was found on a building site in The Grange, Bermondsey. The bomb was made safe by EOD personnel and removed for demolition.

On the 21st May 2015, 1No. 50kg UXB was found on a building site near Wembley Stadium, London Borough of Brent. The bomb was made safe by EOD personnel and removed for demolition.

On the 10th August 2015, 1No. 250kg UXB was found under the basement of a building site at Bethnal Green, London Borough of Tower Hamlets. It was made safe and removed by an EOD team from the RLC.

On the 21st September 2015, 1No. UXB was uncovered on a construction site in Cheylesmore, Coventry, by the operator of a mechanical digger. It was destroyed in situ by an EOD team from the RLC.

In January 2016, Zetica discovered 3No. 500lb British UXB at a former airfield in Cambridgeshire. These were destroyed in controlled explosions. The Plate below is a photograph of one of the bombs.

Plate	Photograph of a recently excavated WWII British 500lb GP bomb

Source: Zetica Ltd

On the 12th May 2016, 1No. 250kg UXB was found on a building site in Bath. It was made safe and then taken to a local quarry for demolition.

In September 2016 1No. 500kg UXB and 1No. torpedo were discovered during dredging works in Portsmouth Harbour. An additional 250kg HE bomb was discovered on the 16th November 2016. These devices were towed out to sea and destroyed in controlled explosions.

On the 19th January 2017, 1No. 50kg UXB was found during dredging works along the River Thames Victoria Embankment in Central London. The device was towed to Tilbury in Essex where it was destroyed in a controlled explosion.

On the 25th January 2017, 1No. 250kg UXB and 1No. mortar shell were found in King's Forest, Thetford. They were destroyed in a controlled explosion.

On the 2nd March 2017, 1No. 250kg German UXB was found on a building site in Brondesbury Park in the London Borough of Brent. It was defuzed by an EOD team and removed to a safe location where it was destroyed in a controlled explosion.

On the 15th May 2017, 1No. suspected 250kg German UXB was found on a building site in Aston, Birmingham. Due to the corrosion of the fuzes, the UXB was destroyed in situ on the 17th May 2017.

There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.

In June 2010, 3No. members of a bomb disposal team were killed, and 6No. others injured, whilst attempting to defuze an unexploded WWII bomb in Goettingen, Central Germany.

The bomb, the second found in Goettingen in the space of a few days, was unearthed at a depth of 7.5m during excavations for a sports stadium.

In September 2008, 17No. people were injured and considerable damage occurred to adjacent buildings when a bomb exploded on a construction site in Hattingen, Germany.

In October 2006 during road works on a motorway near Aschaffenburg in Bavaria, southern Germany, a bomb was struck by a machine and detonated. The plant driver was killed and 5No. others injured, including passing motorists.

In a similar incident in October 2004 in Linz, Austria a bomb exploded injuring 3No. workers and causing considerable damage to plant. In the same month, a WWII bomb under a back garden in Vienna, Austria, was detonated without warning by a minor earth tremor, after remaining undiscovered for over 60 years.

Incidents involving UXO are also reported from the marine areas around the North Sea. For example, on 6th April 2005, 3No. Dutch fishermen were killed when they accidentally trawled up a WWII UX bomb which exploded when it hit the deck.

More recently, an unexploded HE bomb was trawled from the sea floor off South Shields on the 25th February 2015 but caused no damage.

Further details of similar finds can be found at http://zeticauxo.com/news/.

The effects of a partial or full detonation of ordnance are usually shock, blast, heat and shrapnel damage. A 50kg buried bomb can damage brick / concrete structures up to a distance of approximately 16m away. Unprotected personnel on the surface up to 70m away from the blast could also be seriously injured. Larger ordnance would obviously be more destructive.

Explosives rarely lose effectiveness with age, although over time mechanisms such as fuzes and gaines can become more sensitive and therefore more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of a detonation of explosive ordnance are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved.

Appendix 3 Abbreviations	
AA	Anti-Aircraft
ACPO	Association of Chief Police Officers
AFV	Armoured Fighting Vehicle
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
ATA	Assault Training Area
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
BTA	Battle Training Area
CBRN	Chemical, Biological, Radiological and Nuclear
CMD	Conventional Munitions Disposal
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HSE	Health and Safety Executive
JSEODOC	Joint Services EOD Operations Centre

IB	Incendiary Bomb
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
PUCA	Pick Up and Carry Away
RAF	Royal Air Force
SAA	Small Arms Ammunition
SIP	Self-Igniting Phosphorous
TEP	Time Expired Pyrotechnics
USAAF	United States Army Air Forces
UXB	Unexploded Bomb
UXO	Unexploded Ordnance

Appendix 4 Glossary & Definitions	
Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Camouflet	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.

Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.
Explosive Substances and Articles (ESA)	Explosive substance are solid or liquid substance (or a mixture of substances), which is either: • capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. • designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction. Explosive article is an article containing one or more explosive substances.
Fuze	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
High Explosive	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
Munition	Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:- • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.
Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.

Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.

Appendix 5 Bibliography

Birtles P, World War 2 Airfields, 1999

Bodleian Library, German Invasion Plans for the British Isles 1940, 2007

Brooksbank, B.W.L, London Main Line Damage, 2007

Bulloch G, Steeds J E, Green K, Sainsbury M G, Brockwell J S & Slade N J, Land Contamination: Technical Guidance on Special Sites: MoD Land

Bulloch G, Steeds J E, Green K, Sainsbury M G, Brockwell J S, & Slade N J, R&D Technical Report P5-042/TR/03, Land Contamination: Technical Guidance on Special Sites: Explosives Manufacturing & Processing Sites

Castle I, London 1914-17: The Zeppelin Menace, 2008

Castle I, London 1917-18: The Bomber Blitz, 2010

Christopher J, Balloons at War, 2004

CIRIA C681, Unexploded Ordnance, a Guide for the Construction Industry, 2009

Clarke N J, Luftwaffe Target Reconnaissance, German aerial Photography 1939-1942, 1996

Clarke N J, Luftwaffe Aerial Reconnaissance Photographs of England, Scotland and Wales, 2012

Cocroft W D, Dangerous Energy, 2000

Cocroft W D & Thomas R J, Cold War, 2003

Department of the Environment, Sampling Strategies for Contaminated Land, Department of the Environment: Contaminated Land Research Report, CLR Report No. 4, 1994.

Dobinson C S, Twentieth Century Fortifications in England, Volume I 1, Anti-Aircraft artillery, England's air defence gun sites. 1914 – 46. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 2, Anti-Aircraft artillery, site gazetteer, WWI. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I. 3. Anti-Aircraft artillery, 1914-46, Site gazetteer, WWII HAA & ZAA. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 4, Anti-Aircraft artillery, Site gazetteer, WWII LAA. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 5, Anti-Aircraft artillery, Sources. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume II, Anti-Invasion defences of WWII. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume III, Bombing decoys of WWII, England's passive air defence 1939-45. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume VIII, Civil defence in WWII, Protecting England's Civil Population. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Supporting paper AA/1 Searchlight sites in WWII. Council for British Archaeology, 1996

Dobinson C S, Fields of Deception, Britain's Bombing Decoys of World War II, 2000

Dobinson C S, AA Command, 2001

Evans M, Forrest H, Haynes D, Young R, Draper R, Sarangi J & Murray V, Discovery of WWII Special Incendiary Phosphorous (SIP) Grenades in a Wiltshire garden, Chemical Hazards and Poisons Report, 2007

Fegan T, The Baby Killers, 2002

Forty G, British Army Handbook 1939-1945, 2006

Front Line 1940-41, The Official Story of the Civil Defence of Britain, 1942

Groves C, The Home Guard of Britain, 1943

Halpenny B B, Action Stations: 8. Military Airfields of Greater London, 1984

Home Guard Manual, 1941

Innes G B, British Airfields of the Second World War, 1995

Morris J, German Air Raids on Britain 1914-1918, 1993

Osborne M, Defending Britain, Twentieth-Century military structures in the landscape, 2004

Price A, Blitz on Britain 1939-45, 2000

Ramsey W, The Blitz Then and Now, Vol 1, 1987

Ramsey W, The Blitz Then and Now, Vol 2, 1988

Ramsey W, The Blitz Then and Now, Vol 3, 1990

Ramsey W, The East End Then and Now, 1997

Rawson A, British Army Handbook 1914-1918, 2006

Wyatt J R, Unexploded Bombs (UXB) in the Thames Marshes, 2000

Established for over 25 years, Zetica's services include

- ☑ Desk studies
- ☑ Unexploded ordnance risk assessments and risk mitigation
- ☑ Topographic surveys
- ☑ Utility services detection
- ☑ Environmental and engineering geophysical surveys
- ☑ Transport infrastructure surveys
- ☑ Pipeline & cable route surveys
- ☑ Intrusive ground investigations

More details are available at

www.zetica.com


zeticauxo

APPENDIX D

Site Investigation Data

0002-UA009696 Borehole Location Plan

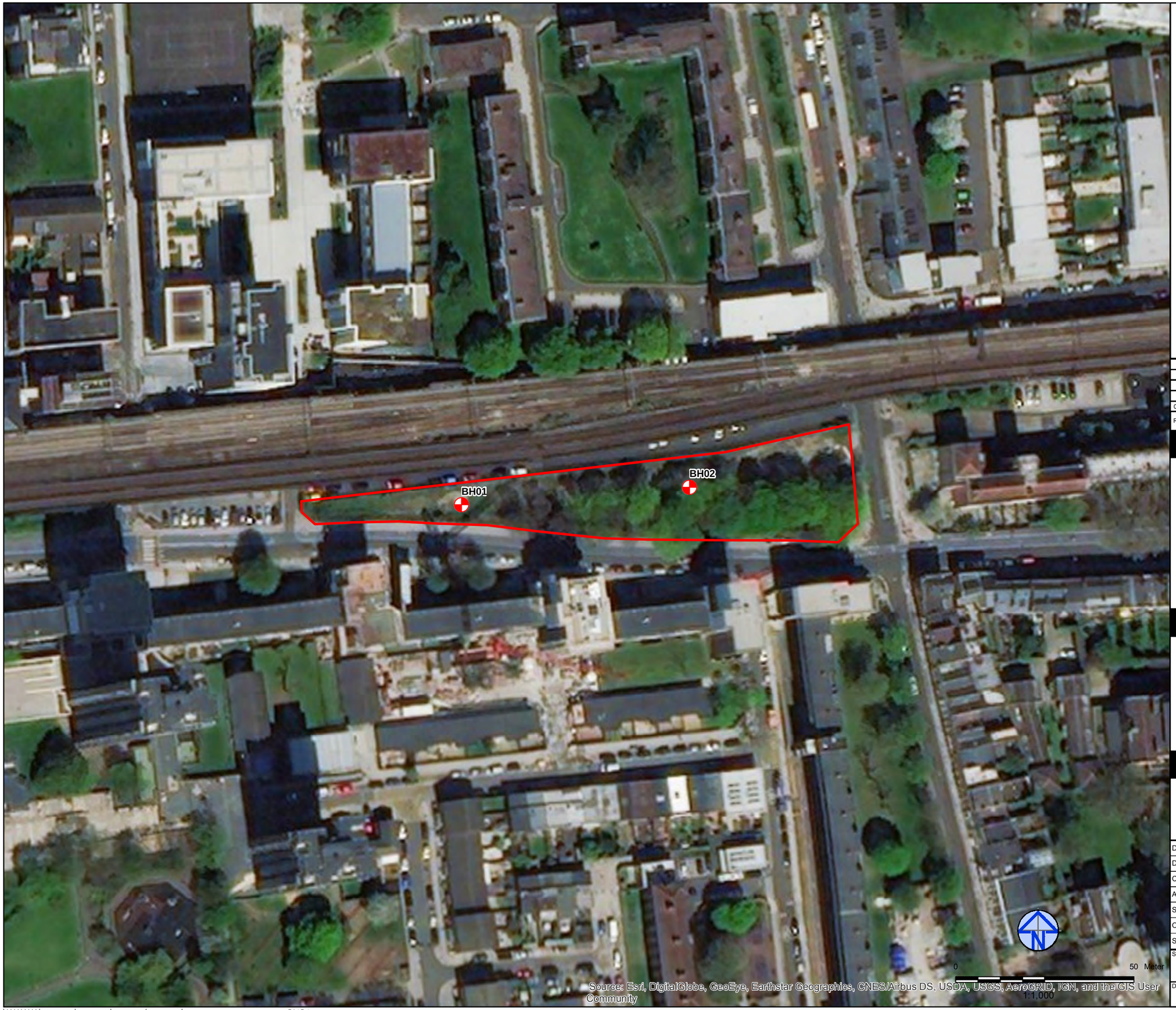
Borehole logs

Chemical testing laboratory certificates

Geotechnical testing laboratory certificates

Chemical soil screening summary

HazWaste Online report and summary



Legend:

Borehole location

Site boundary

Rev	Date	Description	Drawn	Check	Approv
01	07/11/17	First Issue	DD	SF	AP

Client

Transport for London

PROJECT:

TFL Small Sites

Site

Cable Street

ARCADIS Design & Consultancy for natural and built assets

Registered office:
Manning House
22 Carlisle Place
London
SW1P 1JA

Coordinating office:
Unit 17 Innovation Centre
Bridge of Don
Aberdeen AB23 8GX
Tel: 44 (0)1224 822494

www.arcadis.com

TITLE:

Cable Street
Exploratory Hole Location Plan

Designed	A. Pugh	Date 07/11/2017	Signed
Drawn	D. Delgado	Date 07/11/2017	Signed
Checked	S.Frith	Date 07/11/2017	Signed
Approved	A.Pugh	Date 07/11/2017	Signed
Scale:	1:1,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	UA009686

Suitability Description:

Issued for Information

Drawing Number: Figure 1

Revision: 01

50mm on Original

Print Date: 11-07-17 13:48:42

K:\UAprojects\UA009686 TFL Small Sites\F-Reports\Cable Street\GIS\UA009886_Cable_Street_Borehole_Location_Plan.mxd

ARCADIS Rotary Borehole Log

BH01

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
TFL - Cable Street	**UA009686-04**	**13.55**	**30/08/2017**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Transport For London	**534529.00**	**180923.00**	**30/08/2017**	**Sheet 1 of 2**

SAMPLES Depth	SAMPLES Type/ No.	TESTS Type/ No.	TESTS Results	DRILL LOG TCR% SCR% RQD%	DRILL LOG FI (min ave max)	DRILL LOG Flush Rtn%	Water Strikes	PROGRESS Date Time	PROGRESS Casing Water	STRATA Description	STRATA Legend	Depth (Thickness)	Level	Install/ Backfill
								30/08/2017 10:30	0.00	MADE GROUND: Granite cobbles and mortar.		(0.20)		
										MADE GROUND: Brick.		0.20	13.35	
										MADE GROUND: Concrete.		0.30 (0.15)	13.25	
0.40 - 0.45	ES1.00	PID	<1ppm							MADE GROUND: Light grey gravelly SAND. Gravel is subrounded to angular, fine to medium of quartz, flint and concrete.		0.45	13.10	
0.50 - 0.60	D8.00	PID	1ppm									0.50	13.05	
0.50 - 1.00	B19.00													
0.60 - 0.65	ES2.00													
1.00 - 1.10	D9.00	PID	1ppm							MADE GROUND: Dark brownish grey slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is rounded to subangular, fine to medium of flint and brick.				
1.00 - 1.10	ES3.00													
1.20 - 1.70	B20.00	SPT(C)	N=4 (2,1/1,1,1,1)							0.50 - 2.00 m: occaisional cobble of brick.		(1.50)		
		PID	<1ppm											
2.00 - 3.00	D10.00	SPT(C)	N=20 (7,12/10,4,3,3)							MADE GROUND: Soft dark brownish grey slightly sandy gravelly CLAY. Sand is fine. Gravel is rounded to subangular, fine to medium of flint, brick and concrete.		2.00	11.55	
		PID	<1ppm									(0.30)		
										No Recovery.		2.30	11.25	
												(0.70)		
3.00 - 3.50	B21.00	SPT(C)	N=5 (1,2/2,1,1,1)							MADE GROUND: Soft brown slightly sandy slightly gravelly SILT. Sand is fine to medium. Gravel is subangular to angular, fine to coarse of brick.		3.00	10.55	
		PID	<1ppm											
3.90 - 4.00	D11.00	PID	<1ppm									(1.80)		
4.00 - 4.50	B22.00	SPT(C)	N=2 (1,1/0,1,0,1)											
4.20 - 4.30	ES4.00													
4.70 - 4.80	D12.00	PID	<1ppm									4.80	8.75	
										Very dense orangish brown slightly silty slightly gravelly SAND. Sand is fine to medium. Gravel is rounded to subangular, fine to medium of quartz. [TAPLOW GRAVEL]		(0.20) 5.00	8.55	
5.00 - 5.50	B23.00	SPT(C)	N>50 (4,4/11,16,17,6 for 30mm)											
5.00 - 5.50	ES5.00													
5.20 - 5.30	D13.00	PID	4.2ppm							Medium dense orangish brown slightly silty gravelly SAND. Sand is fine. Gravel is rounded to subangular, fine to medium of quartz. [TAPLOW GRAVEL]				
5.90 - 6.00	D14.00									5.00 - 5.50 m: clayey pockets evident.				
6.00 - 6.50	B24.00	SPT(C)	N=29 (2,2/4,7,8,10)									(2.40)		
		PID	<1ppm											
6.90 - 7.00	D15.00													
7.00 - 7.50	B25.00	PID	<1ppm											
												7.40	6.15	
7.60 - 7.70	ES6.00									Stiff yellowish brown mottled light brown CLAY. [WEATHERED LONDON CLAY]		(0.40)		
												7.80	5.75	
7.90 - 8.00	D16.00									Stiff extremely closely fissured dark brownish grey CLAY. [LONDON CLAY]				
8.00 - 8.50	B26.00	SPT(C)	N=17 (3,3/4,4,4,5)							7.80 - 10.00 m: dark grey layers of CLAY.				
		PID	<1ppm											
8.20 - 9.30	ES7.00													
8.90 - 9.00	D17.00											(2.65)		
9.00 - 9.50	B27.00	SPT(C)	N=19 (3,3/4,4,5,6)											
		PID	<1ppm											
9.90 - 10.00	D18.00													
		SPT(C)	N=19 (3,3/4,4,5,6)											

DRILLING TECHNIQUE			FLUSH DETAILS				WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
Depth Top	Depth Base	Type	From	To	Rtn %	Flush Type	Date/Time	Strike At	Time Elapsed	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	1.20	Inspection Pit											300	1.20	150	7.50	4.80	7.40	120
1.20	10.45	Cable Percussion											150	10.00					

Remarks

No groundwater encountered. Hole terminated on Engineer's instruction

Termination Depth: 10.45m

ARCADIS Rotary Borehole Log

BH01

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
TFL - Cable Street	**UA009686-04**	**13.55**	**30/08/2017**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Transport For London	**534529.00**	**180923.00**	**30/08/2017**	**Sheet 2 of 2**

SAMPLES		TESTS		DRILL LOG			Water Strikes	PROGRESS		STRATA		Depth (Thickness)	Level	Install/ Backfill
Depth	Type/ No.	Type/ No.	Results	TCR% SCR% RQD%	FI (min ave max)	Flush Rtn%		Date Time	Casing Water	Description	Legend			
										Stiff extremely closely fissured dark brownish grey CLAY. [LONDON CLAY]				
								30/08/2017 17:00	7.50	Borehole terminated at 10.45m		10.45	3.10	

DRILLING TECHNIQUE			FLUSH DETAILS				WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
Depth Top	Depth Base	Type	From	To	Rtn %	Flush Type	Date/Time	Strike At	Time Elapsed	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	1.20	Inspection Pit											300	1.20	150	7.50	4.80	7.40	120
1.20	10.45	Cable Percussion											150	10.00					

Remarks

No groundwater encountered. Hole terminated on Engineer's instruction

Termination Depth: 10.45m

AGS Arcadis Cymru House St Mellons Business Park Cardiff CF3 0EY

Unless otherwise stated: Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mAOD).

Equipment Used	Contractor	Logged By	Checked By
Dando 2000	**Arcadis Consulting (UK) Ltd**	**B.C**	**AP**

ARCADIS Rotary Borehole Log

BH02

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
TFL - Cable Street	**UA009686-04**	**12.94**	**31/08/2017**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Transport For London	**534593.00**	**180928.00**	**31/08/2017**	**Sheet 1 of 1**

SAMPLES		TESTS		DRILL LOG			Water Strikes	PROGRESS		STRATA				
Depth	Type/ No.	Type/ No.	Results	TCR% SCR% RQD%	FI (min ave max)	Flush Rtn%		Date Time	Casing Water	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
								31/08/2017 12:30	0.00	MADE GROUND: Granite cobbles and mortar.		(0.16)		
										MADE GROUND: Concrete.		0.16 (0.18)	12.78	
0.30 - 0.40	ES1.00									MADE GROUND: Dark grey slightly clayey SAND. Sand is fine to coarse.		0.34 (0.12)	12.60	
0.50 - 0.60	D9.00									MADE GROUND: Concrete.		0.46 (0.04)	12.56	
0.50 - 1.00	B14.00									MADE GROUND: Soft dark brownish grey slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded, fine to medium of brick, flint and concrete.		0.50	12.44	
0.60 - 0.70	ES2.00									0.50 - 3.80 m: occaisional cobble of flint. Rootlets evident.				
1.00 - 1.10	D10.00													
1.00 - 1.10	ES3.00													
1.20 - 1.70	B15.00	SPT(C)	N=6 (2,2/2,2,1,1)											
1.90 - 2.00	D7.00													
2.00 - 2.50	B16.00	SPT(C)	N=7 (3,2/2,2,1,2)									(3.30)		
2.90 - 3.00	D8.00													
3.00 - 3.50	B17.00	SPT(C)	N=13 (3,3/2,4,4,3)											
3.00 - 3.50	ES4.00													
3.90 - 4.00	D11.00									Very dense soft greyish brown slightly sandy slightly gravelly SILT. Sand is fine. Gravel is rounded to subangular, fine to medium of flint. [LANGLEY SILT]		3.80	9.14	
4.00 - 4.50	B18.00	SPT(C)	N=14 (2,2/2,2,4,6)							3.80 - 4.90 m: occaisional cobble of flint.		(1.10)		
4.00 - 4.50	ES5.00													
4.90 - 5.00	D12.00									Very dense brown slightly clayey SAND and GRAVEL. Sand is fine. Gravel is rounded to subangular, fine to medium. [TAPLOW GRAVEL]		4.90	8.04	
5.00 - 5.50	B19.00	SPT(C)	N>50 (10,12/12,15,15,7 for 30mm)							4.90 - 6.00 m: occaisional cobble of flint.		(1.49)		
5.00 - 5.50	ES6.00													
5.90 - 6.00	D13.00													
		SPT(C)	N>50 (4,7/11,18,15,6 for 10mm)											
								31/08/2017 16:30	6.00	Borehole terminated at 6.39m		6.39	6.55	

DRILLING TECHNIQUE			FLUSH DETAILS				WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
Depth Top	Depth Base	Type	From	To	Rtn %	Flush Type	Date/Time	Strike At	Time Elapsed	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	1.20	Inspection Pit											300	1.20	150	6.00	5.00	6.00	50
1.20	6.39	Cable Percussion											150	6.00					

Remarks

Refusal at 6.00m bgl. No groundwater encountered. Hole terminated on Engineers instruction.

Termination Depth: 6.39m

Jon Raven
Arcadis Consulting (UK) Ltd
10 Medawar Road
The Surrey Research Park
Guildford
Surrey
GU2 7AR

t: 0870 000 3005
f: 0870 000 3905
e: jonathan.raven@arcadis.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 17-59425

Project / Site name:	Cable Street	**Samples received on:**	05/09/2017
Your job number:	UA009686	**Samples instructed on:**	05/09/2017
Your order number:		**Analysis completed by:**	12/09/2017
Report Issue Number:	1	**Report issued on:**	12/09/2017
Samples Analysed:	3 soil samples		

Signed:

Dr Irma Doyle
Senior Account Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 17-59425

Project / Site name: Cable Street

Lab Sample Number				811177	811178	811179		
Sample Reference				BH02	BH02	BH02		
Sample Number				10	12	13		
Depth (m)				0.60-0.70	4.00-4.50	3.00-3.50		
Date Sampled				31/08/2017	31/08/2017	31/08/2017		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	18	< 0.1		
Moisture Content	%	N/A	NONE	10	9.3	16		
Total mass of sample received	kg	0.001	NONE	2.0	2.0	2.0		
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected		
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.2	7.8	7.3		
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.7	0.9	4.2		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Phenanthrene	mg/kg	0.05	MCERTS	0.27	< 0.05	< 0.05		
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Fluoranthene	mg/kg	0.05	MCERTS	0.12	< 0.05	< 0.05		
Pyrene	mg/kg	0.05	MCERTS	0.12	< 0.05	< 0.05		
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	8.8	18		
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	1.4	2.6		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2		
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	16	18		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	230	38	310		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	550	110	1300		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	4.1	< 0.3	1.9		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	13	22		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.2	< 1.0		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	98	44	120		

Analytical Report Number : 17-59425

Project / Site name: Cable Street

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
811177	BH02	10	0.60-0.70	Brown loam and sand with gravel and vegetation.
811178	BH02	12	4.00-4.50	Light brown clay and sand with gravel and stones.
811179	BH02	13	3.00-3.50	Brown clay and sand with gravel and brick.

Analytical Report Number : 17-59425

Project / Site name: Cable Street

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number: 17-58925

Project / Site name: Cable Street TFL

Your Order No: PO 0068678

Lab Sample Number				808549	808551	808554	811177	811178	811179		
Sample Reference				BH01	BH01	BH01	BH02	BH02	BH02		
Sample Number				1	3	ENV7	10	12	13		
Depth (m)				0.40-0.45	1.00-1.10	5.00-5.50	0.60-0.70	4.00-4.50	3.00-3.50		
Date Sampled				30/08/2017	30/08/2017	30/08/2017	31/08/2017	31/08/2017	31/08/2017		
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status								GAC (residential with plant uptake) 1% SOM
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	18	< 0.1		NA
Moisture Content	%	N/A	NONE	8.4	18	13	10	9.3	16		NA
Total mass of sample received	kg	0.001	NONE	2.0	2.0	2.0	2.0	2.0	2.0		NA
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Amosite - Loose Fibres					NA
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	Not-detected	Not-detected		NA
General Inorganics											
pH - Automated	pH Units	N/A	MCERTS	10.9	8.6	8.2	8.2	7.8	7.3		NA
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.8	2.6	0.2	2.7	0.9	4.2		NA
Speciated PAHs											
Naphthalene	mg/kg	0.05	MCERTS	0.51	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		2.3
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		170
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		210
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		170
Phenanthrene	mg/kg	0.05	MCERTS	1.6	0.20	< 0.05	0.27	< 0.05	< 0.05		95
Anthracene	mg/kg	0.05	MCERTS	0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		2400
Fluoranthene	mg/kg	0.05	MCERTS	1.4	0.25	< 0.05	0.12	< 0.05	< 0.05		280
Pyrene	mg/kg	0.05	MCERTS	1.1	0.20	< 0.05	0.12	< 0.05	< 0.05		620
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.93	0.15	< 0.05	< 0.05	< 0.05	< 0.05		7.2
Chrysene	mg/kg	0.05	MCERTS	0.83	0.17	< 0.05	< 0.05	< 0.05	< 0.05		15
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.90	0.25	< 0.05	< 0.05	< 0.05	< 0.05		2.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.39	0.17	< 0.05	< 0.05	< 0.05	< 0.05		77
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.70	0.25	< 0.05	< 0.05	< 0.05	< 0.05		2.2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.36	0.17	< 0.05	< 0.05	< 0.05	< 0.05		27
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		0.24
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.40	0.22	< 0.05	< 0.05	< 0.05	< 0.05		32
Total PAH											
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	9.36	2.03	< 0.80	< 0.80	< 0.80	< 0.80		NA
Heavy Metals / Metalloids											
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	25	12	17	8.8	18		37
Boron (water soluble)	mg/kg	0.2	MCERTS	2.8	1.4	0.4	0.5	1.4	2.6		290
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	< 0.2	< 0.2	< 0.2	< 0.2		11
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0		6
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	13	12	12	16	18		910
Copper (aqua regia extractable)	mg/kg	1	MCERTS	28	170	10	230	38	310		2400
Lead (aqua regia extractable)	mg/kg	1	MCERTS	300	920	24	550	110	1300		220
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	2.4	< 0.3	4.1	< 0.3	1.9		40
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	25	16	19	13	22		130
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0		250
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	51	100	31	98	44	120		3700
Monoaromatics											
Benzene	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
Toluene	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
Ethylbenzene	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
p & m-xylene	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
o-xylene	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	< 1.0	< 1.0					
Petroleum Hydrocarbons											
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	< 1.0					
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	< 2.0					
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0	< 8.0					
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0	< 8.0					
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	< 10					
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001					
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	< 1.0					
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	< 2.0					
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10	< 10					
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	< 10	< 10					
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	12	< 10					

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

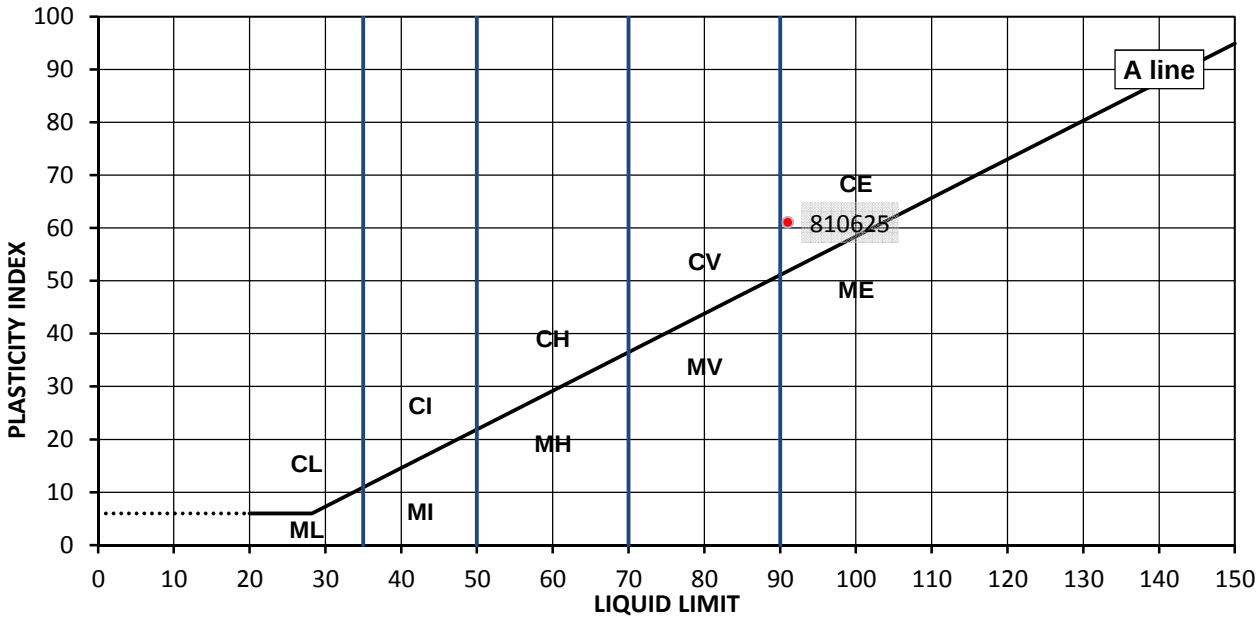
Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59293
		Date Sampled:	30/08/2017
		Date Received:	31/08/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 810625
Sample Reference: B8

Description:	Dark brown CLAY	Sample Type:	B
Location:	BH01	Depth Top [m]:	8.00
Sample Preparation:	Tested in natural condition	Depth Base [m]:	8.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	91	30	61	99



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 13/09/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

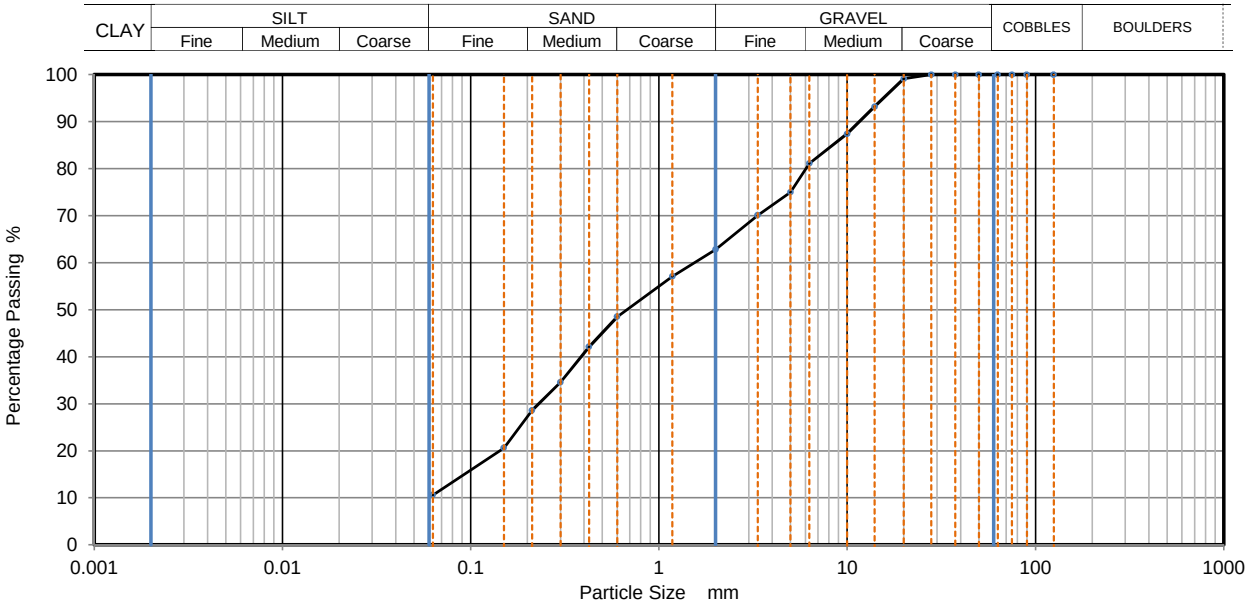
Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59293
		Date Sampled:	30/08/2017
		Date Received:	31/08/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 810623 Sample Reference: B1

Sample description: Greyish brown clayey very gravelly SAND Sample Type: B

Location: BH01 Depth Top [m]: 0.50

Supplier: Not Given Depth Base [m]: 1.00



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	99		
14	93		
10	87		
6.3	81		
5	75		
3.35	70		
2	63		
1.18	57		
0.6	49		
0.425	42		
0.3	35		
0.212	29		
0.15	21		
0.063	11		

Dry Mass of sample [g]: 612

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	37.20
Sand	52.20
Fines <0.063mm	10.60

Grading Analysis		
D100	mm	28
D60	mm	1.55
D30	mm	0.23
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 13/09/2017

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

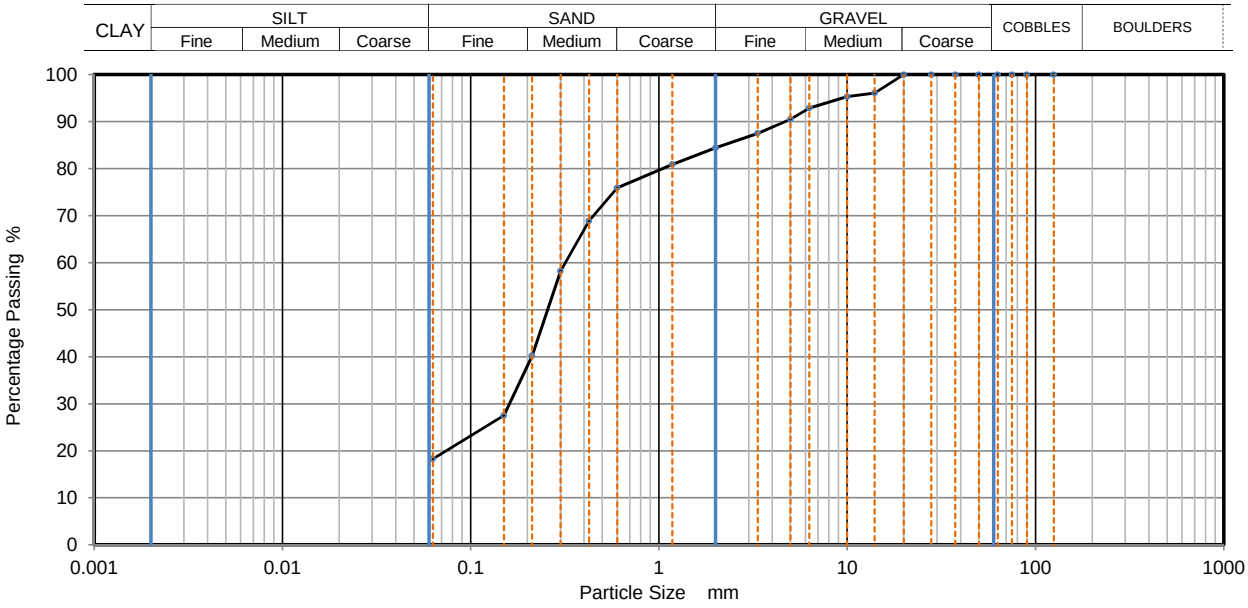
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59293
		Date Sampled:	30/08/2017
		Date Received:	31/08/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 810624

Sample description:	Yellowish brown gravelly clayey SAND	Sample Reference:	B5
Location:	BH01	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	5.00
		Depth Base [m]:	5.50



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	96		
10	95		
6.3	93		
5	91		
3.35	88		
2	84		
1.18	81		
0.6	76		
0.425	69		
0.3	58		
0.212	40		
0.15	28		
0.063	18		

Dry Mass of sample [g]: 213

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	15.60
Sand	66.10
Fines <0.063mm	18.30

Grading Analysis		
D100	mm	20
D60	mm	0.319
D30	mm	0.161
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 13/09/2017

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

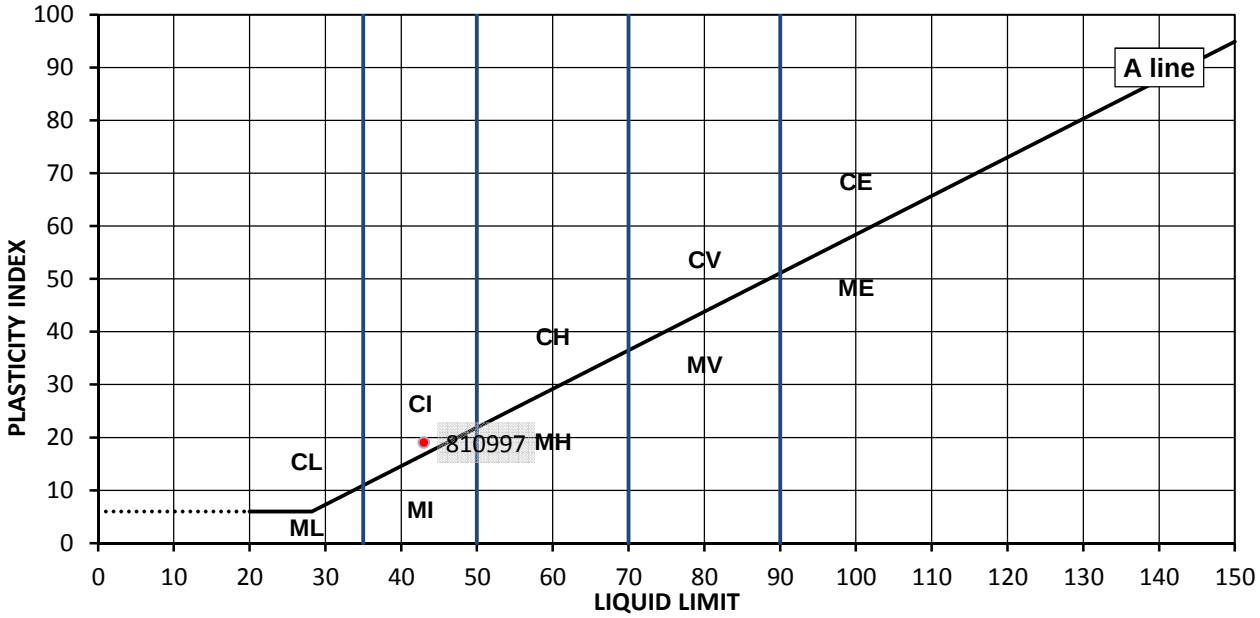
Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59384
		Date Sampled:	31/08/2017
		Date Received:	05/09/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 810997
Sample Reference: B11

Description:	Black gravelly very sandy CLAY	Sample Type:	B
Location:	BH02	Depth Top [m]:	1.20
Sample Preparation:	Tested after washing to remove >425um	Depth Base [m]:	1.70

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
21	43	24	19	53



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 14/09/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

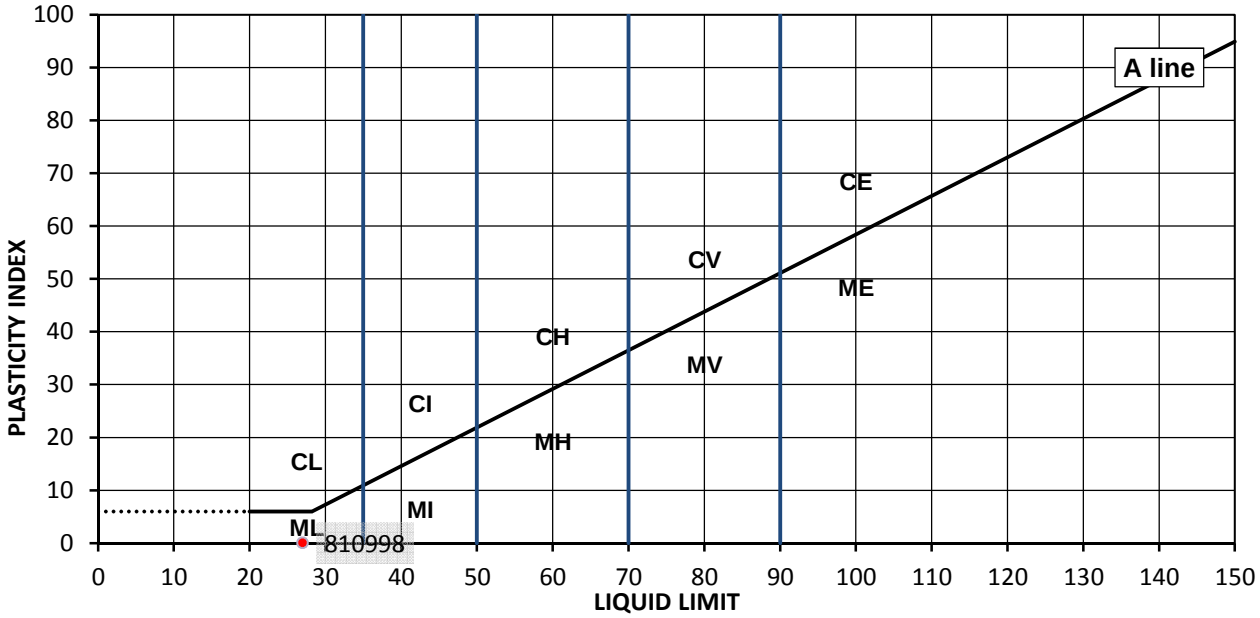
Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59384
		Date Sampled:	31/08/2017
		Date Received:	05/09/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 810998
Sample Reference: B14

Description:	Dark brown gravelly slightly clayey SAND	Sample Type:	B
Location:	BH02	Depth Top [m]:	4.00
Sample Preparation:	Tested after washing to remove >425um	Depth Base [m]:	4.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
7.3	27	NP.*	NA*	60



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

*Sample unsuitable for the test (PL); NP – non plastic; NA – non applicable for test

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 14/09/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: Arcadis Consulting (UK) Ltd
Client Address: 10 Medawar Road
The Surrey Research Park
Guildford
Surrey
GU2 7AR
Contact: Jon Raven
Site Name: Cable Street
Site Address: Not Given

Client Reference: UA009686
Job Number: 17-59384
Date Sampled: 31/08/2017
Date Received: 05/09/2017
Date Tested: 07/09/2017
Sampled By: BC

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
810997	BH02	B11	1.20	1.70	B	Black gravelly very sandy CLAY			21	53	43	24	19	
810998	BH02	B14	4.00	4.50	B	Dark brown gravelly slightly clayey SAND			7.3	60	27	NP.*	NA*	

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 14/09/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

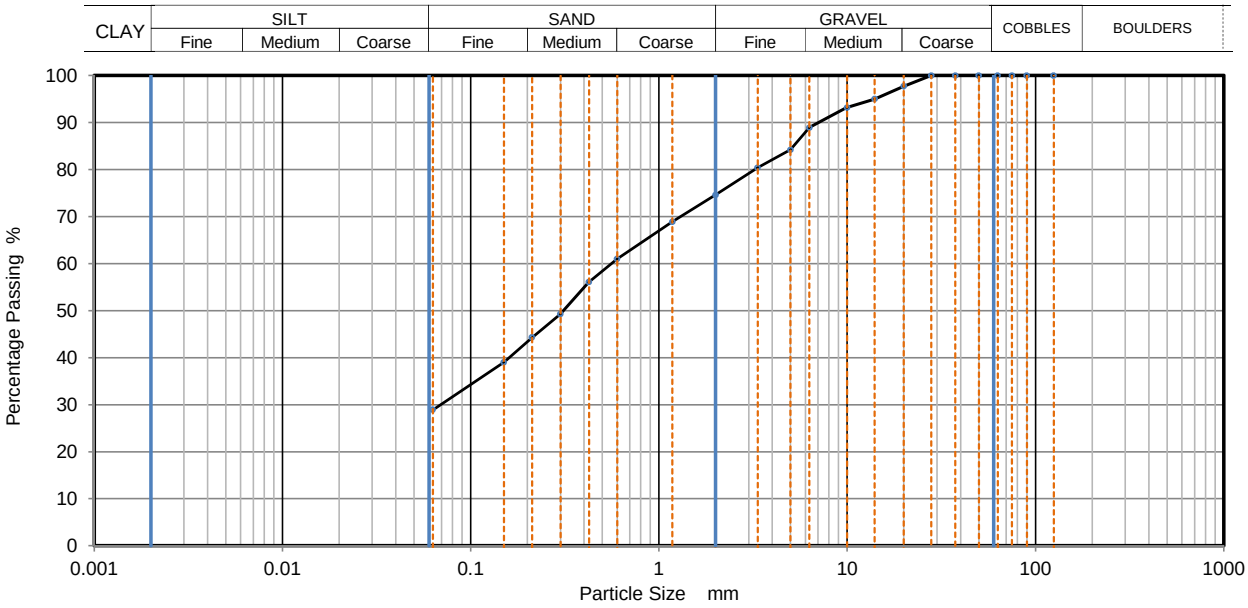
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	Arcadis Consulting (UK) Ltd	Client Reference:	UA009686
Client Address:	10 Medawar Road The Surrey Research Park Guildford Surrey GU2 7AR	Job Number:	17-59384
		Date Sampled:	31/08/2017
		Date Received:	05/09/2017
Contact:	Jon Raven	Date Tested:	07/09/2017
Site Name:	Cable Street	Sampled By:	BC
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 810997

Sample description:	Black gravelly very sandy CLAY	Sample Reference:	B11
Location:	BH02	Sample Type:	B
Supplier:	Not Given	Depth Top [m]:	1.20
		Depth Base [m]:	1.70



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	98		
14	95		
10	93		
6.3	89		
5	84		
3.35	80		
2	75		
1.18	69		
0.6	61		
0.425	56		
0.3	49		
0.212	44		
0.15	39		
0.063	29		

Dry Mass of sample [g]: 675

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	25.40
Sand	45.70
Fines <0.063mm	28.90

Grading Analysis		
D100	mm	28
D60	mm	0.558
D30	mm	0.0693
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 14/09/2017

for and on behalf of i2 Analytical Ltd

Cable Street - HazWaste Assessment

Determinand (laboratory concentrations)	Unit	BH01	BH01[1]	BH01[2]	BH02	BH02[1]	BH02[2]
Initial Classification Result		Non Hazardous	Potentially Hazardous	Non Hazardous	Non Hazardous	Non Hazardous	Hazardous
Hazardous Properties			HP3: Flammable	HP7: Carcinogenic			HP7: Carcinogenic
Comment / Justification			HP3 not relevant at concentrations of TPH present - see notes below	Asbestos fibres have been identified but not quantified - see notes below			
Arcadis Classification		Non Hazardous	Non Hazardous	Potentially Hazardous	Non Hazardous	Non Hazardous	Hazardous
Depth	m	0.40-0.45	1.00-1.10	5.00-5.50	0.60-0.70	4.00-4.50	3.00-3.50
moisture {no correction}	%	8.4	18	13	10	9.3	16
asbestos	mg/kg	Not detected	Not detected	Detected- Amosite Loose Fibres	Not detected	Not detected	Not detected
pH	pH	10.9	8.6	8.2	8.2	7.8	7.3
naphthalene	mg/kg	0.51	<0.05	<0.05	<0.05	<0.05	<0.05
acenaphthylene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
acenaphthene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
fluorene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
phenanthrene	mg/kg	1.6	0.2	<0.05	0.27	<0.05	<0.05
anthracene	mg/kg	0.25	<0.05	<0.05	<0.05	<0.05	<0.05
fluoranthene	mg/kg	1.4	0.25	<0.05	0.12	<0.05	<0.05
pyrene	mg/kg	1.1	0.2	<0.05	0.12	<0.05	<0.05
benzo[a]anthracene	mg/kg	0.93	0.15	<0.05	<0.05	<0.05	<0.05
chrysene	mg/kg	0.83	0.17	<0.05	<0.05	<0.05	<0.05
benzo[b]fluoranthene	mg/kg	0.9	0.25	<0.05	<0.05	<0.05	<0.05
benzo[k]fluoranthene	mg/kg	0.39	0.17	<0.05	<0.05	<0.05	<0.05
benzo[a]pyrene; benzo[def]chrysene	mg/kg	0.7	0.25	<0.05	<0.05	<0.05	<0.05
indeno[123-cd]pyrene	mg/kg	0.36	0.17	<0.05	<0.05	<0.05	<0.05
dibenz[a,h]anthracene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
benzo[ghi]perylene	mg/kg	0.4	0.22	<0.05	<0.05	<0.05	<0.05
arsenic {arsenic trioxide}	mg/kg	14	25	12	17	8.8	18
boron {boron tribromide/trichloride/trifluoride (combined)}	mg/kg	2.8	1.4	0.4	0.5	1.4	2.6
cadmium {cadmium sulfide}	mg/kg	<0.2	0.2	<0.2	<0.2	<0.2	<0.2
chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex	mg/kg	<4	<4	<4	<4	<4	<4
chromium in chromium(III) compounds {chromium(III) oxide}	mg/kg	14	13	12	12	16	18
copper {dicopper oxide; copper (I) oxide}	mg/kg	28	170	10	230	38	310
lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}	mg/kg	300	920	24	550	110	1300
mercury {mercury dichloride}	mg/kg	<0.3	2.4	<0.3	4.1	<0.3	1.9
nickel {nickel dihydroxide}	mg/kg	12	25	16	19	13	22
selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}	mg/kg	<1	<1	<1	<1	1.2	<1
zinc {zinc chromate}	mg/kg	51	100	31	98	44	120
benzene	mg/kg		<1	<1			
toluene	mg/kg		<1	<1			
ethylbenzene	mg/kg		<1	<1			
o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]	mg/kg		<1	<1			
tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	mg/kg		<1	<1			
TPH (C6 to C40) petroleum group	mg/kg		12	<10			

Notes

Asbestos fibres have been identified in the sample but not yet quantified. When WAC testing is undertaken by a waste carrier prior to removal of arisings, the waste will be classed as hazardous is greater than 0.1% loose asbestos fibres are found. If large individial pieces of aasbestos tile are found they must be assessed seperately. Therefore without quantification the waste has been assessed as potentially hazardous.
Note: even if less than 0.1% asbestos fibres are found the landfill operator may decline to accept the waste.

TPH (C6-C40) has a HP3 (Flammable) classification (may be highly flammable at high concentrations). Where a substance has a HP3 classification, it is assumed that enough material is present for ignition to occur, i.e. that the chemical is in its raw from, not within the soil matrix. In the case of soils, ignition is unlikely at concentrations <1000 mg/kg TPH. However, this would need to be confirmed by the operator of the landfill where the waste is intended to be taken

Waste Classification Report

B7TWU-6Y22V-L667F

Job name

Cable Street

Description/Comments

Project

TFL Small Sites

Site

Cable Street

Waste Stream Template

TFL Sites

Classified by

Name:
Fiona Waldron
Date:
14/09/2017 11:06:41 UTC
Telephone:
0117 3721231

Company:
Arcadis Consulting (UK) Ltd
The Pithay
5th Floor All Saints Street
Bristol
BS1 2NL

Report

Created by: Fiona Waldron
Created date: 14/09/2017 11:06 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	BH01	0.40-0.45	Non Hazardous		2
2	BH01[1]	1.00-1.10	Potentially Hazardous	HP 3(i)	4
3	BH01[2]	5.00-5.50	Non Hazardous		7
4	BH02	0.60-0.70	Non Hazardous		9
5	BH02[1]	4.00-4.50	Non Hazardous		11
6	BH02[2]	3.00-3.50	Hazardous	HP 7	13

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	15
Appendix B: Rationale for selection of metal species	17
Appendix C: Version	17

Classification of sample: BH01

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
BH01
Sample Depth:
0.40-0.45 m
Moisture content:
8.4%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 8.4% No Moisture Correction applied (MC)

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		pH			PH		10.9	pH		10.9	pH	10.9 pH		
2		naphthalene	601-052-00-2	202-049-5	91-20-3		0.51	mg/kg		0.51	mg/kg	0.000051 %		
3		acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
4		acenaphthene		201-469-6	83-32-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
5		fluorene		201-695-5	86-73-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
6		phenanthrene		201-581-5	85-01-8		1.6	mg/kg		1.6	mg/kg	0.00016 %		
7		anthracene		204-371-1	120-12-7		0.25	mg/kg		0.25	mg/kg	0.000025 %		
8		fluoranthene		205-912-4	206-44-0		1.4	mg/kg		1.4	mg/kg	0.00014 %		
9		pyrene		204-927-3	129-00-0		1.1	mg/kg		1.1	mg/kg	0.00011 %		
10		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.93	mg/kg		0.93	mg/kg	0.000093 %		
11		chrysene	601-048-00-0	205-923-4	218-01-9		0.83	mg/kg		0.83	mg/kg	0.000083 %		
12		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.9	mg/kg		0.9	mg/kg	0.00009 %		
13		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.39	mg/kg		0.39	mg/kg	0.000039 %		
14		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.7	mg/kg		0.7	mg/kg	0.00007 %		
15		indeno[123-cd]pyrene		205-893-2	193-39-5		0.36	mg/kg		0.36	mg/kg	0.000036 %		
16		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
17		benzo[ghi]perylene				0.4	mg/kg		0.4	mg/kg	0.00004 %		
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				14	mg/kg	1.32	18.485	mg/kg	0.00185 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				2.8	mg/kg	13.43	37.604	mg/kg	0.00376 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<**LOD**
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<**LOD**
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				14	mg/kg	1.462	20.462	mg/kg	0.00205 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				28	mg/kg	1.126	31.525	mg/kg	0.00315 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	300	mg/kg		300	mg/kg	0.03 %		
		082-001-00-6											
25		mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<**LOD**
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				12	mg/kg	1.579	18.954	mg/kg	0.0019 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<**LOD**
		034-002-00-8											
28		zinc { zinc chromate }				51	mg/kg	2.774	141.481	mg/kg	0.0141 %		
		024-007-00-3											
										Total:	0.0585 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH01[1]

Potentially Hazardous Waste
Classified as **17 05 04** or **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
BH01[1]
Sample Depth:
1.00-1.10 m
Moisture content:
18%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 or 17 05 03 * (Soil and stones other than those mentioned in 17 05 03 or Soil and stones containing hazardous substances)

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0012%)

Determinands

Moisture content: 18% No Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		pH		PH		8.6	pH		8.6	pH	8.6 pH		
2		naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-052-00-2	202-049-5	91-20-3									
3		acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			205-917-1	208-96-8									
4		acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			201-469-6	83-32-9									
5		fluorene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			201-695-5	86-73-7									
6		phenanthrene				0.2	mg/kg		0.2	mg/kg	0.00002 %		
			201-581-5	85-01-8									
7		anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			204-371-1	120-12-7									
8		fluoranthene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
			205-912-4	206-44-0									
9		pyrene				0.2	mg/kg		0.2	mg/kg	0.00002 %		
			204-927-3	129-00-0									
10		benzo[a]anthracene				0.15	mg/kg		0.15	mg/kg	0.000015 %		
		601-033-00-9	200-280-6	56-55-3									
11		chrysene				0.17	mg/kg		0.17	mg/kg	0.000017 %		
		601-048-00-0	205-923-4	218-01-9									
12		benzo[b]fluoranthene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
		601-034-00-4	205-911-9	205-99-2									

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
13		benzo[k]fluoranthene				0.17	mg/kg		0.17	mg/kg	0.000017 %		
		601-036-00-5	205-916-6	207-08-9									
14		benzo[a]pyrene; benzo[def]chrysene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
		601-032-00-3	200-028-5	50-32-8									
15		indeno[123-cd]pyrene				0.17	mg/kg		0.17	mg/kg	0.000017 %		
			205-893-2	193-39-5									
16		dibenz[a,h]anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-041-00-2	200-181-8	53-70-3									
17		benzo[ghi]perylene				0.22	mg/kg		0.22	mg/kg	0.000022 %		
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				25	mg/kg	1.32	33.008	mg/kg	0.0033 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				1.4	mg/kg	13.43	18.802	mg/kg	0.00188 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	0.2	mg/kg	1.285	0.257	mg/kg	0.00002 %		
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				13	mg/kg	1.462	19	mg/kg	0.0019 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				170	mg/kg	1.126	191.401	mg/kg	0.0191 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	920	mg/kg		920	mg/kg	0.092 %		
		082-001-00-6											
25		mercury { mercury dichloride }				2.4	mg/kg	1.353	3.248	mg/kg	0.000325 %		
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				25	mg/kg	1.579	39.487	mg/kg	0.00395 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
		034-002-00-8											
28		zinc { zinc chromate }				100	mg/kg	2.774	277.415	mg/kg	0.0277 %		
		024-007-00-3											
29		benzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-020-00-8	200-753-7	71-43-2									
30		toluene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-021-00-3	203-625-9	108-88-3									
31		ethylbenzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-023-00-4	202-849-4	100-41-4									
32		o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
33		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		603-181-00-X	216-653-1	1634-04-4									
34		TPH (C6 to C40) petroleum group				12	mg/kg		12	mg/kg	0.0012 %		
				TPH									
										Total:	0.153 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Potentially Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH01[2]

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
BH01[2]
Sample Depth:
5.00-5.50 m
Moisture content:
13%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 13% No Moisture Correction applied (MC)

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	●	pH			PH		8.2 pH		8.2 pH	8.2 pH		
2		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
3	●	acenaphthylene		205-917-1	208-96-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
4	●	acenaphthene		201-469-6	83-32-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
5	●	fluorene		201-695-5	86-73-7		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
6	●	phenanthrene		201-581-5	85-01-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
7	●	anthracene		204-371-1	120-12-7		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
8	●	fluoranthene		205-912-4	206-44-0		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
9	●	pyrene		204-927-3	129-00-0		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
10		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
11		chrysene	601-048-00-0	205-923-4	218-01-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
12		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
13		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
14		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
15	●	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
16		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
17		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				12	mg/kg	1.32	15.844	mg/kg	0.00158 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				0.4	mg/kg	13.43	5.372	mg/kg	0.000537 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				12	mg/kg	1.462	17.539	mg/kg	0.00175 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				10	mg/kg	1.126	11.259	mg/kg	0.00113 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	24	mg/kg		24	mg/kg	0.0024 %		
		082-001-00-6											
25		mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				16	mg/kg	1.579	25.272	mg/kg	0.00253 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
		034-002-00-8											
28		zinc { zinc chromate }				31	mg/kg	2.774	85.999	mg/kg	0.0086 %		
		024-007-00-3											
29		benzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-020-00-8	200-753-7	71-43-2									
30		toluene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-021-00-3	203-625-9	108-88-3									
31		ethylbenzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-023-00-4	202-849-4	100-41-4									
32		o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
33		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		603-181-00-X	216-653-1	1634-04-4									
34		TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
				TPH									
										Total:	0.0208 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH02

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
BH02
Sample Depth:
0.60-0.70 m
Moisture content:
10%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 10% No Moisture Correction applied (MC)

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	●	pH			PH		8.2	pH		8.2	pH	8.2 pH		
2		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
3	●	acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
4	●	acenaphthene		201-469-6	83-32-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
5	●	fluorene		201-695-5	86-73-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
6	●	phenanthrene		201-581-5	85-01-8		0.27	mg/kg		0.27	mg/kg	0.000027 %		
7	●	anthracene		204-371-1	120-12-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
8	●	fluoranthene		205-912-4	206-44-0		0.12	mg/kg		0.12	mg/kg	0.000012 %		
9	●	pyrene		204-927-3	129-00-0		0.12	mg/kg		0.12	mg/kg	0.000012 %		
10		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
11		chrysene	601-048-00-0	205-923-4	218-01-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
12		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
13		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
14		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
15	●	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
16		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
17		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				17	mg/kg	1.32	22.446	mg/kg	0.00224 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				0.5	mg/kg	13.43	6.715	mg/kg	0.000672 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				12	mg/kg	1.462	17.539	mg/kg	0.00175 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				230	mg/kg	1.126	258.954	mg/kg	0.0259 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	550	mg/kg		550	mg/kg	0.055 %		
		082-001-00-6											
25		mercury { mercury dichloride }				4.1	mg/kg	1.353	5.549	mg/kg	0.000555 %		
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				19	mg/kg	1.579	30.01	mg/kg	0.003 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
		034-002-00-8											
28		zinc { zinc chromate }				98	mg/kg	2.774	271.866	mg/kg	0.0272 %		
		024-007-00-3											
										Total:	0.117 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH02[1]

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
BH02[1]
Sample Depth:
4.00-4.50 m
Moisture content:
9.3%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 9.3% No Moisture Correction applied (MC)

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	●	pH			PH		7.8 pH		7.8 pH	7.8 pH		
2		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
3	●	acenaphthylene		205-917-1	208-96-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
4	●	acenaphthene		201-469-6	83-32-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
5	●	fluorene		201-695-5	86-73-7		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
6	●	phenanthrene		201-581-5	85-01-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
7	●	anthracene		204-371-1	120-12-7		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
8	●	fluoranthene		205-912-4	206-44-0		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
9	●	pyrene		204-927-3	129-00-0		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
10		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
11		chrysene	601-048-00-0	205-923-4	218-01-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
12		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
13		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
14		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
15	●	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
16		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
17		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				8.8	mg/kg	1.32	11.619	mg/kg	0.00116 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				1.4	mg/kg	13.43	18.802	mg/kg	0.00188 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				16	mg/kg	1.462	23.385	mg/kg	0.00234 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				38	mg/kg	1.126	42.784	mg/kg	0.00428 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	110	mg/kg		110	mg/kg	0.011 %		
		082-001-00-6											
25		mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				13	mg/kg	1.579	20.533	mg/kg	0.00205 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				1.2	mg/kg	2.554	3.064	mg/kg	0.000306 %		
		034-002-00-8											
28		zinc { zinc chromate }				44	mg/kg	2.774	122.062	mg/kg	0.0122 %		
		024-007-00-3											
										Total:	0.0358 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH02[2]

Hazardous Waste
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
BH02[2]
Sample Depth:
3.00-3.50 m
Moisture content:
16%
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 03 * (Soil and stones containing hazardous substances)

Hazard properties

HP 7: Carcinogenic "waste which induces cancer or increases its incidence"

Hazard Statements hit:

Carc. 1A; H350 "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.13%)

Determinands

Moisture content: 16% No Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
1		pH		PH		7.3	pH		7.3	pH	7.3 pH		
2		naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-052-00-2	202-049-5	91-20-3									
3		acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			205-917-1	208-96-8									
4		acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			201-469-6	83-32-9									
5		fluorene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			201-695-5	86-73-7									
6		phenanthrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			201-581-5	85-01-8									
7		anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			204-371-1	120-12-7									
8		fluoranthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			205-912-4	206-44-0									
9		pyrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			204-927-3	129-00-0									
10		benzo[a]anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-033-00-9	200-280-6	56-55-3									
11		chrysene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-048-00-0	205-923-4	218-01-9									
12		benzo[b]fluoranthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-034-00-4	205-911-9	205-99-2									

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
13		benzo[k]fluoranthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-036-00-5	205-916-6	207-08-9									
14		benzo[a]pyrene; benzo[def]chrysene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-032-00-3	200-028-5	50-32-8									
15		indeno[123-cd]pyrene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-893-2	193-39-5									
16		dibenz[a,h]anthracene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		601-041-00-2	200-181-8	53-70-3									
17		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
			205-883-8	191-24-2									
18		arsenic { arsenic trioxide }				18	mg/kg	1.32	23.766	mg/kg	0.00238 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				2.6	mg/kg	13.43	34.918	mg/kg	0.00349 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				18	mg/kg	1.462	26.308	mg/kg	0.00263 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				310	mg/kg	1.126	349.025	mg/kg	0.0349 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	1300	mg/kg		1300	mg/kg	0.13 %		
		082-001-00-6											
25		mercury { mercury dichloride }				1.9	mg/kg	1.353	2.572	mg/kg	0.000257 %		
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				22	mg/kg	1.579	34.749	mg/kg	0.00347 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
		034-002-00-8											
28		zinc { zinc chromate }				120	mg/kg	2.774	332.898	mg/kg	0.0333 %		
		024-007-00-3											
										Total:	0.211 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: None.
Hazard Statements: None.

acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R22 , R26 , R27 , R36 , R37 , R38
Hazard Statements: Acute Tox. 4 H302 , Acute Tox. 1 H330 , Acute Tox. 1 H310 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315

acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R36 , R37 , R38 , N R50/53 , N R51/53
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Aquatic Chronic 2 H411

fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: N R50/53
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: R22 , R36 , R37 , R38 , R40 , R43 , N R50/53
Hazard Statements: Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Carc. 2 H351 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Skin Irrit. 2 H315

anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R36 , R37 , R38 , R43 , N R50/53
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21/08/2015
Risk Phrases: Xn R22 , N R50/53
Hazard Statements: Acute Tox. 4 H302 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21/08/2015
Risk Phrases: Xi R36/37/38 , N R50/53
Hazard Statements: Skin Irrit. 2 H315 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: R40
Hazard Statements: Carc. 2 H351

benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23/07/2015
Risk Phrases: N R50/53
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43
Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06/08/2015
Risk Phrases: R14 , T+ R26/28 , C R34 , C R35
Hazard Statements: EUH014 , Acute Tox. 2 H330 , Acute Tox. 2 H300 , Skin Corr. 1A H314 , Skin Corr. 1B H314

chromium(III) oxide (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462
Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R20 , R22 , R36 , R37 , R38 , R42 , R43 , R50/53 , R60 , R61
Hazard Statements: Acute Tox. 4 H332 , Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Resp. Sens. 1 H334 , Skin Sens. 1 H317 , Repr. 1B H360FD , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

dicopper oxide; copper (I) oxide (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)
Additional Risk Phrases: N R50/53 , N R50/53 >= 0.25 %
Additional Hazard Statement(s): None.
Reason for additional Hazards Statement(s)/Risk Phrase(s):
10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases
10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

lead compounds with the exception of those specified elsewhere in this Annex (worst case)

CLP index number: 082-001-00-6
Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)
Additional Risk Phrases: None.
Additional Hazard Statement(s): Carc. 1A H350
Reason for additional Hazards Statement(s)/Risk Phrase(s):
03/06/2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

ethylbenzene (EC Number: 202-849-4, CAS Number: 100-41-4)

CLP index number: 601-023-00-4
Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)
Additional Risk Phrases: None.
Additional Hazard Statement(s): Carc. 2 H351
Reason for additional Hazards Statement(s)/Risk Phrase(s):
03/06/2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: R10 , R45 , R46 , R51/53 , R63 , R65
Hazard Statements: Flam. Liq. 3 H226 , Asp. Tox. 1 H304 , STOT RE 2 H373 , Muta. 1B H340 , Carc. 1B H350 , Repr. 2 H361d , Aquatic Chronic 2 H411

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in chromium(III) compounds {chromium(III) oxide}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Insufficient concentration of chromium to form lead chromate. Changed to next worst case.

mercury {mercury dichloride}

Worst case species based on hazard statements

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements

zinc {zinc chromate}

Worst case

Appendix C: Version

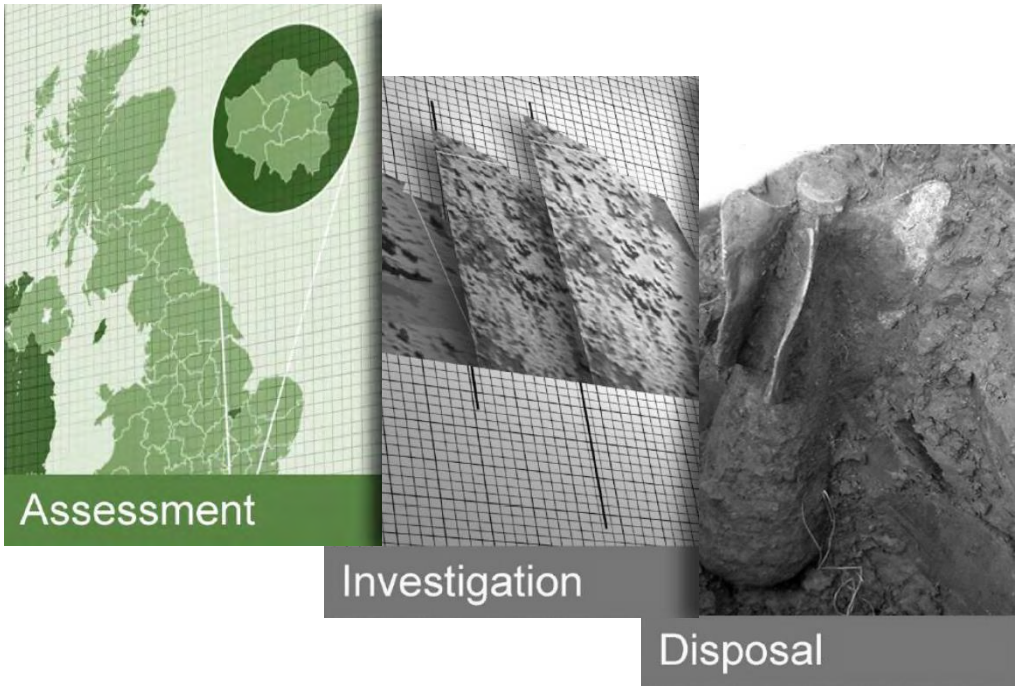
HazWasteOnline Classification Engine: WM3 1st Edition, May 2015
HazWasteOnline Classification Engine Version: 2017.248.3389.6849 (05 Sep 2017)
HazWasteOnline Database: 2017.255.3392.6861 (14 Sep 2017)

This classification utilises the following guidance and legislation:
WM3 - Waste Classification - May 2015
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004
1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010
2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

Arcadis Consulting (UK) Limited

Arcadis House
34 York Way
London
N1 9AB
United Kingdom
T: +44 (0)1483 803 000

arcadis.com



Cable Street, Whitechapel - UXO Desk Study & Risk Assessment

Drafted by Sam Nicklin
Checked by Will Hazell
Authorised by Mike Sainsbury

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P7005-17-R1**
Revision	**A**
Project Location	**Cable Street, Whitechapel**
Client	**Arcadis**
Date	**13th July 2017**

UXO DESK STUDY & RISK ASSESSMENT

Cable Street, Whitechapel

EXECUTIVE SUMMARY

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.4 hectares (ha) at Cable Street, Whitechapel ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Records have been found indicating that buildings adjacent to the western boundary of the Site were demolished by 1No. High Explosive (HE) bomb during World War Two (WWII).

It is considered that this may have masked the impact of an Unexploded Bomb (UXB), which may have offset beneath the western end of the Site and remain in situ. Consequently, the western end of the Site is assigned a moderate UXO hazard level.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the remainder of the Site. The central and eastern parts of the Site are assigned a low UXO hazard level.

Given this, it is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in the following Figure, reproduced as Figure 5 in the main report.

Figure	UXO hazard zone plan of the Site

Source: Google Earth *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

The main findings of the report are summarised below:

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- During WWII, the main strategic targets in the vicinity of the Site were the London Docks, major concentrations of transport infrastructure and public utilities.
- During WWII, the Site was located in the Metropolitan Borough (MB) of Stepney, which recorded a very high regional bombing density.
- No records have been found indicating that the Site was bombed during WWII. The nearest identified HE bomb fell adjacent to the Site.
- No significant post-WWII military activity has been identified on the Site.

The Table below, reproduced as Table 4 in the main report, provides a UXO risk assessment for potential work on the Site.

Further details on the methodology for the risk assessment are provided in Section 10.1 of the main report.

Table UXO risk assessment for the Site

Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	6	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Low Risk
Excavations Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff. **Boreholes/Piles** Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.
Moderate Risk
Excavations For those involved in excavations, the raising of awareness (as per low risk) is considered essential. A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk. Where UXO detection is not feasible due to ground conditions, restricted access or programme, an Explosive Ordnance Clearance (EOC) Engineer can be used to supervise during excavation works. The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material. **Boreholes/Piles** Clearance certification for any borehole or pile locations is considered essential. This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB. Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB. Table 5 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity. Further advice on the mitigation methods can be provided by Zetica on request.

CONTENTS

Page

Executive Summary

1 INTRODUCTION 1

1.1 Project Outline

1.2 Historical Information

1.3 Sources of Information

1.4 Data Confidence Level

2 THE SITE 4

2.1 Site Location

2.2 Proposed Works

2.3 Site History

2.4 Pre-WWI Military Activity

2.5 WWI Military Activity

2.6 WWII Military Activity

2.7 Post-WWII Military Activity

3 WWII BOMBING 10

3.1 Bombing in London

3.2 Strategic Targets

3.3 Bombing Density and Incidents

3.4 Geology and Bomb Penetration Depths

4 WWII DEFENCES 19

4.1 Bombing Decoys

4.2 Anti-Aircraft Defences

4.3 Barrage Balloons and Anti-Landing Obstacles

4.4 Anti-Invasion Defences

4.5 Pillboxes, Mortar and Gun Emplacements

4.6 Home Guard and Auxiliary Units

4.7 Minefields and Mined Locations

5 MILITARY AIRFIELDS 24

5.1 Aircraft Crashes

6 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS 25

6.1 Explosives and Ordnance Factories

6.2 Munitions Stores

6.3 Informal Munitions Depots

6.4 Munitions Disposal Areas and Bomb Cemeteries
7 FIRING RANGES AND MILITARY TRAINING AREAS 26
7.1 Small Arms Ranges
7.2 Artillery Ranges
7.3 Bombing Ranges
7.4 Training Areas
8 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES 27
8.1 Abandoned Bombs
8.2 EOC Tasks
9 UXO HAZARD ASSESSMENT 28
9.1 UXO Hazard Level
10 UXO RISK ASSESSMENT 29
10.1 UXO Risk Level
10.2 Risk Mitigation Recommendations

Figures, Plates, Tables & Drawings

Figure 1 Site location map
Figure 2 Historical map, 1875
Figure 3 Compiled bomb impact map for the vicinity of the Site
Figure 4 Extract from the London Bomb Damage Map
Figure 5 UXO hazard zone plan of the Site

Plate 1 Recent aerial photograph of the Site
Plate 2 Aerial photograph, 8th September 1937
Plate 3 Aerial photograph, 6th June 1955
Plate 4 Luftwaffe reconnaissance photograph of London Docks, 7th September 1940
Plate 5 Luftwaffe reconnaissance photograph of London Docks, 1939
Plate 6 Aerial photograph, 18th May 1948

Table 1 Bombing statistics
Table 2 Estimated average maximum bomb penetration depths
Table 3 WWII HAA and ZAA batteries within 10km of the Site
Table 4 UXO risk assessment for the Site
Table 5 Risk mitigation for assumed Site activities

Appendices

Appendix 1	WWII Bombing Incidents
Appendix 2	UXO Hazard and Ordnance Types
Appendix 3	Abbreviations
Appendix 4	Glossary and Definitions
Appendix 5	Bibliography

UXO DESK STUDY & RISK ASSESSMENT

Cable Street, Whitechapel

Note: To aid the reader of this report, Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Paragraphs in a dark green text with a green background are paragraphs containing background information or explanations which may appear as standard text in all similar reports.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.4 hectares (ha) at Cable Street, Whitechapel ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

This hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance (UXO).
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be readily identifiable and therefore there cannot be any guarantee that all UXO hazards within the Site have been identified in this report.

1.2 Historical Information

With most locations, the potential presence of UXO as a result of enemy action, unauthorised disposal or unrecorded military activity can never be totally discounted.

Detailed records of military activity are rarely released into the public domain. Even when military information is made public there may be gaps in the records because files have been lost or destroyed.

Records for periods such as WWII are only as detailed and accurate as the resources and working conditions would allow at the time. Densely populated areas tend to have a greater number of records than rural areas. Such records may be inaccurate due to the confusion surrounding continuous air raids.

Press records can supplement local information, although this source of information must be treated with caution, as inaccuracies do exist, either inadvertently or intentionally in order to confuse enemy intelligence. Classified official records can sometimes be considered inaccurate for the same reason.

Recent research indicates that England alone had 17,434No. recorded defence sites, of which 12,464No. were classified as defensive anti-invasion sites. The precise locations of many of these sites are still to be identified, illustrating the scale of the problem when establishing potential risks from limited historical data.

1.3 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area utilising a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.3.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

1.3.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica Ltd's website (http://zeticauxo.com/downloads-and-resources/risk-maps/).

1.3.3 Ministry of Defence and Government Records

Various government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Home Office records of abandoned bombs.

1.3.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, Historic England and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

1.3.5 Local Authority Records

Information has been obtained from Tower Hamlets London Borough Council.

1.3.6 Local Record Offices and Libraries

The London Metropolitan Archives and Tower Hamlets Local History Library and Archives were consulted for information.

1.3.7 Local Historical and Other Groups

Local history groups and archaeological bodies including the Greater London Historic Environment Record (GLHER), were consulted.

1.4 Data Confidence Level

In general, there is a high level of confidence in the researched information sources used for this report. An exception to this is the lack of detailed Air Raid Precaution (ARP) records for Stepney, which are thought to have been destroyed during WWII.

Various other sources (including bomb census maps, bomb damage maps, historical aerial photographs and Fire Brigade incident reports) have been used to provide a corroborative assessment of the UXO hazard level on the Site.

2 THE SITE

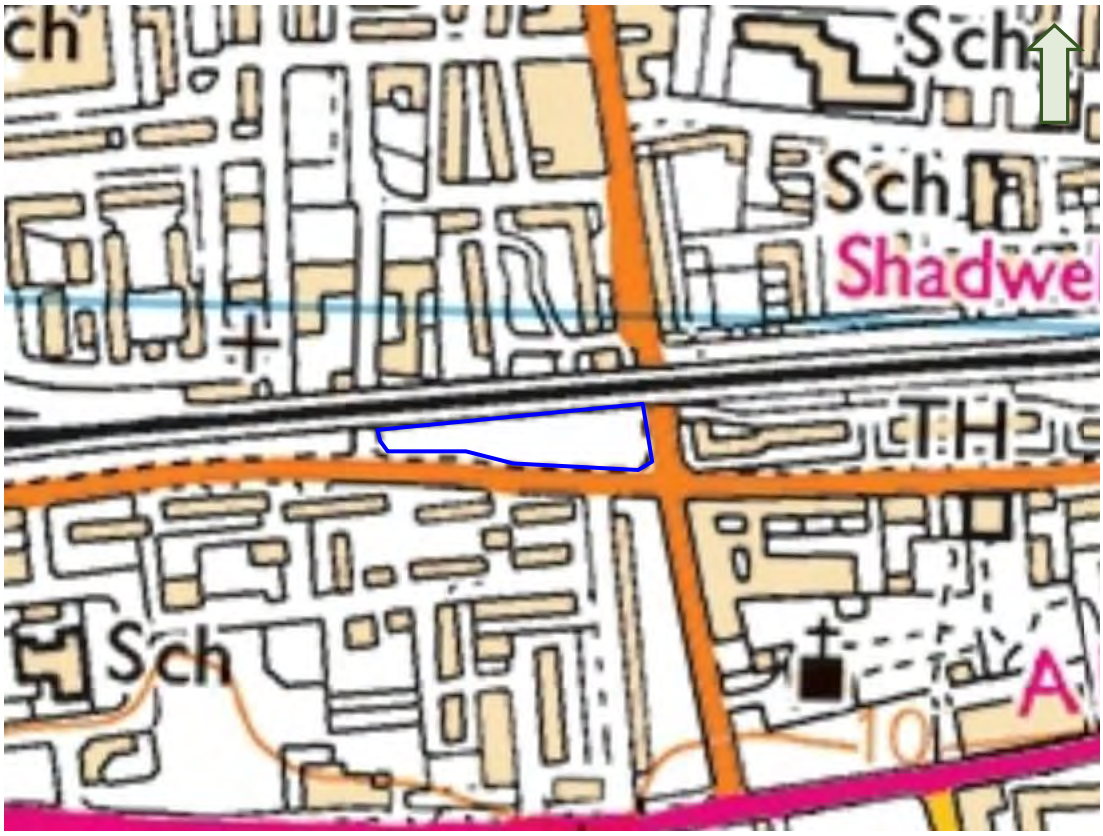
2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) TQ 346809. It is located in Whitechapel, approximately 2km east of London city centre.

The Site comprises an area of vacant ground and vegetation. It is bounded to the north by a railway line, to the east by Cannon Street Road, to the south by Cable Street, and to the west by Golding Street.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1	Site location map



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

Plate 1	Recent aerial photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site boundary

2.2 Proposed Works

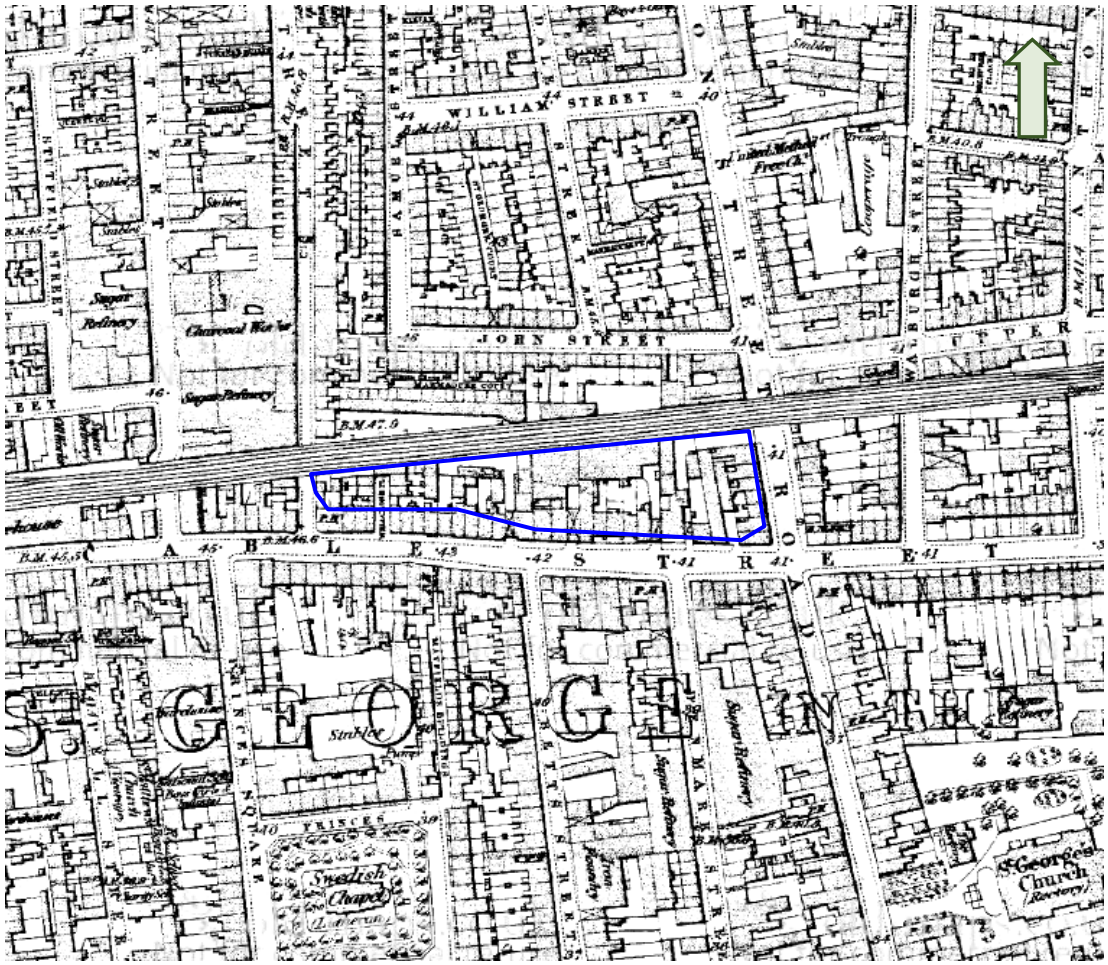
It is understood that planned works on the Site will include the sinking of 3No. cable tool boreholes.

2.3 Site History

The historical map of 1875 (Figure 2) shows that in the late 19th century the Site comprised terraced housing adjacent to the London and Blackwall Railway (L&BR).

The surrounding area was largely residential.

Figure 2	Historical map, 1875



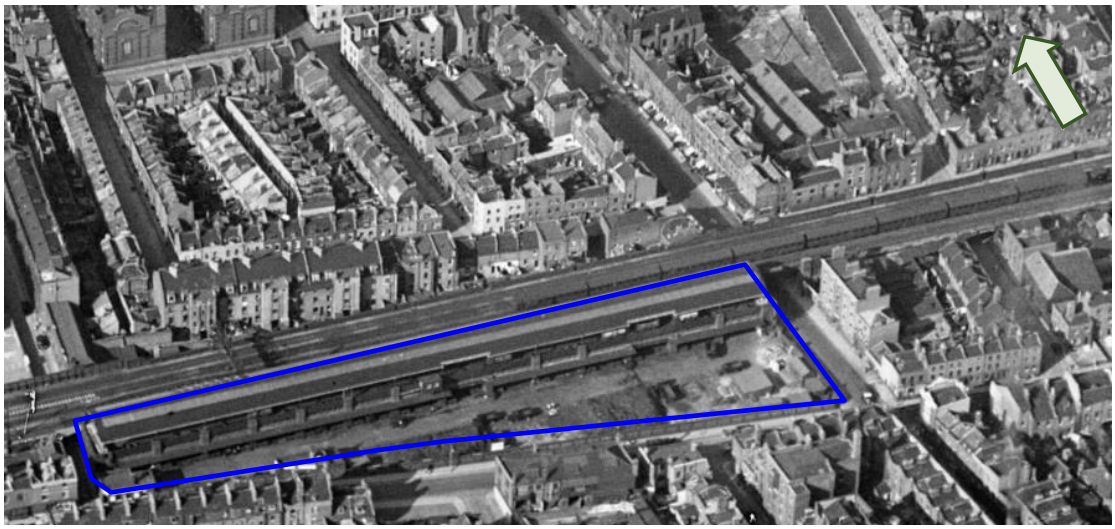
Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

During the late 19th century the housing on the Site was demolished and the land given over for use as a coal depot.

Plate 2 is an aerial photograph dated the 8th September 1937, showing the coal depot prior to WWII.

Plate 2	Aerial photograph, 8th September 1937



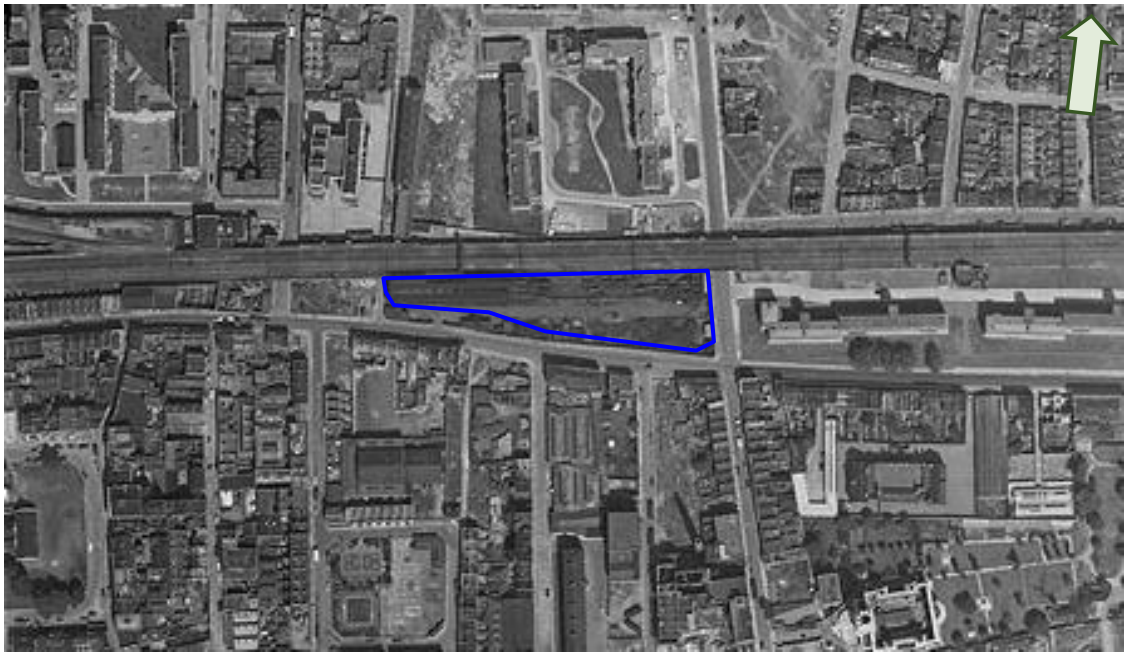
Source: Britain from Above *Not to Scale*

Legend	Approximate Site boundary

Plate 3, an aerial photograph dated the 6th June 1955, shows that there had been no significant development on the Site by the mid-20th century.

Buildings throughout the surrounding area had been destroyed by bombing during WWII (see Section 3).

Plate 3	Aerial photograph, 6th June 1955



Source: Historic England *Not to Scale*

Legend	Site boundary

Since 1955, the coal depot has been closed and the Site left vacant. Extensive redevelopment has occurred throughout the surrounding area (see Plate 1).

2.4 Pre-WWI Military Activity

No records of any significant pre-WWI military activity on or in close proximity to the Site have been found.

2.5 WWI Military Activity

No records of any significant WWI military activity on or in close proximity to the Site have been found.

During WWI an estimated 9,000No. German bombs were dropped over Britain. It was the first time that strategic aerial bombing had been used.

No records have been found indicating that the Site was bombed during WWI. The nearest recorded incidents to the Site are described below.

31st May 1915

1No. hand grenade fell on Burslem Street, approximately 0.2km north of the Site.

1No. hand grenade fell on Charles Street, approximately 0.3km west of the Site.

13th October 1915

1No. High Explosive (HE) bomb fell on Prince's Square, approximately 0.2km southwest of the Site.

13th June 1917

1No. HE bomb fell on Church Lane, approximately 0.3km northwest of the Site.

28th January 1918

1No. HE bomb fell on Cannon Street Road, approximately 50m south-southeast of the Site. This was recorded as an Unexploded Bomb (UXB).

1No. HE bomb fell on The Highway, approximately 0.3km southeast of the Site.

In response to the air raids, Anti-Aircraft (AA) guns were established. These were potential sources of Unexploded AA (UXAA) shells which could land up to 13km from the firing point, although more typically fell within 10km during WWI.

Records indicate 25No. static AA gun batteries were located within 10km of the Site. The nearest was located at the Tower of London (TQ 337806), approximately 0.8km southwest of the Site. This was armed with 2No. 3-inch (") guns.

WWI military activity is not considered to provide a source of UXO hazard to the Site.

2.6 WWII Military Activity

There were several important strategic targets in the vicinity of the Site and the Whitechapel area was heavily bombed. Details of recorded air raid incidents in the vicinity of the Site are provided in Section 3 and Appendix 1.

Numerous defensive and offensive military structures were built in the vicinity of the Site. These included lines of defence (Stop Lines), pillboxes, bombing decoys and AA guns. Further details are given in Section 4.

Other military establishments in the vicinity of the Site are described in Sections 5 to 7.

2.7 Post-WWII Military Activity

No records of any significant post-WWII military activity on or in close proximity to the Site has been found.

3 WWII BOMBING

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, industrial premises, power stations and airfields.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact, within 25m of this, death or fatal injury could occur.

PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration. Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any UXO. In more rural areas, fewer bombing raids occurred. It is known that ARP records under-represent the number and frequency of bombs falling in rural and coastal areas.

Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid Anti-Aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural, river, marsh or coastal areas were often unrecorded or entered as 'fell in open country', 'fell in the sea' or 'fell in the river' and left little evidence of the fall.

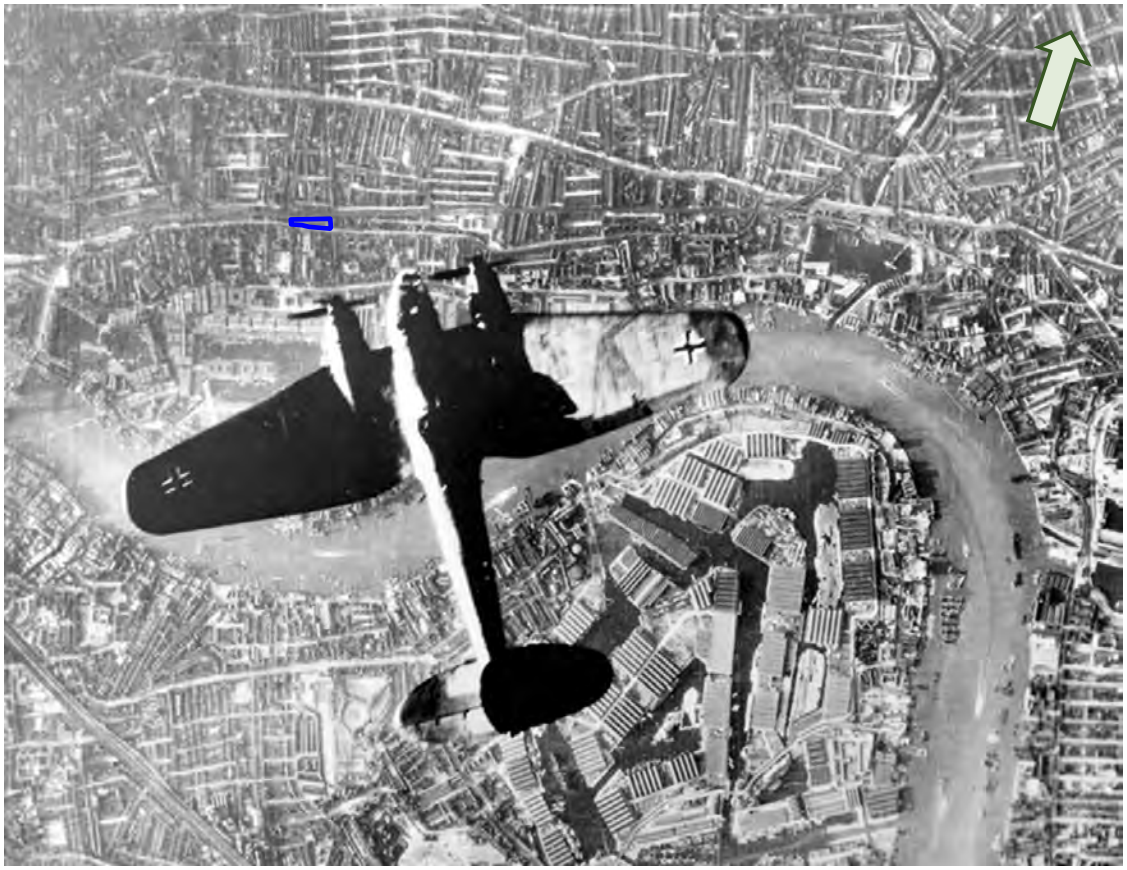
3.1 Bombing in London

London was a principal target of Luftwaffe bombing during WWII. The docks of East London were the main target of Luftwaffe bombing during the Blitz. The Port of London was the most heavily bombed civilian target in the United Kingdom.

The first air raid of the London Blitz took place on 7th September 1940 when a large German force bombed the docks and surrounding areas in West Ham, Stepney and Poplar.

Plate 4 is a reconnaissance photograph showing 1No. Heinkel He 111 bomber aircraft during this raid. The Site can be identified in the top-left of the frame.

Plate 4	Luftwaffe reconnaissance photograph of London Docks, 7th September 1940



Source: Ramsey *Not to Scale*

Legend	Site boundary

From mid-September until the end of that year, London was raided on all but 3No. nights. The raids continued through the early months of 1941 becoming less frequent, although often more intense. Heavier bombs, including PMs and OBs, were now used and major incendiary raids on the 29th December 1940 and 10th May 1941 caused widespread fire damage across the city.

From July 1941 the bombing campaign against London entered a period of relative inactivity. Raids still took place but tended to be relatively minor in severity. Manned bomber raids returned to London in the first few months of 1944 and, after a brief respite, were followed by the start of the Pilotless Aircraft (V1) offensive against the capital in June 1944.

These weapons arrived at any time of day and caused massive blast damage (although little fire damage). The V1 offensive on London was all but over by September 1944, although some V1s continued to fall on the capital until March 1945.

In September 1944 the Long Range Rocket (V2) offensive on London began. Falling from a height of some 50 miles (80km) above the city, these ballistic missiles caused larger craters and greater damage to underground utilities than the V1s, although their surface blast effect was generally less.

The area surrounding Wapping and the London Docks was bombed frequently between September 1940 and July 1941. Most of the air raids in the area were of a high intensity, including the use of 'mixed loads' of HE bombs and IBs.

3.2 Strategic Targets

The presence of strategic targets significantly increased the likelihood of bombing within the local area. Airfields, docks, industrial facilities, transport infrastructure and anti-invasion defences were all targeted by Luftwaffe bombers. The inherent bombing inaccuracies at the time meant that areas surrounding the targets were often subjected to bombing.

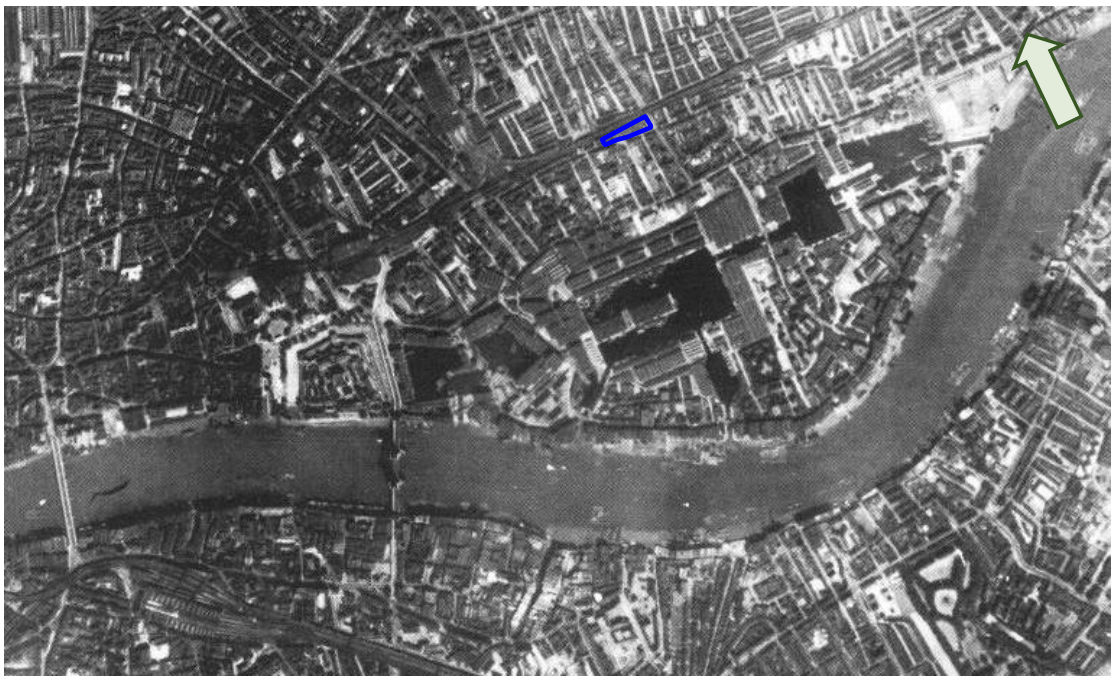
The main strategic targets in the vicinity of the Site are described below.

3.2.1 Docks and the River Thames

The Site was located in the vicinity of the London Docks. These were were the main destination for commercial commodities and industrial supplies being imported from overseas, and were also associated with industries such as timber yards, tar distillation works, sugar refineries and flour mills.

The docks were frequently photographed by the Luftwaffe, as is shown in Plate 5, a Luftwaffe reconnaissance photograph of the London Docks dating from 1939.

Plate 5	Luftwaffe reconnaissance photograph of London Docks, 1939



Source: Ramsey *Not to Scale*

Legend	Site boundary

The River Thames was located approximately 0.9km south of the Site. Its wharves, warehouses and industries were all potential targets and the river was used as a navigational aid by the Luftwaffe during raids against central London.

3.2.2 Transport Infrastructure

Transport and communications infrastructure were frequently targeted by the Luftwaffe to disrupt supply lines.

The London & North Eastern Railway (LNER) mainline ran adjacent to the Site. There was an associated coal depot located on the Site.

There was a large goods depot at Whitechapel, approximately 0.3km northwest of the Site.

Fenchurch Street Station, approximately 1km west of the Site, was a major railway terminus and had associated sidings and goods yards.

3.2.3 Public Utilities

Public utilities were frequently targeted to disrupt power supplies to local industries.

The Surrey Docks Gas Works were located approximately 1km southeast of the Site.

Stepney Power Station was located approximately 1.6km east of the Site and Stepney Gas Works were approximately 1.7km northeast of the Site.

3.3 Bombing Density and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal or Metropolitan Boroughs (MB) and Country Boroughs (CB). The Site was located in Stepney Metropolitan Borough.

The figures for West Ham CB, generally considered to represent a high regional bombing density, are included for comparison.

Table 1 Bombing Statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1,000 acres)
Stepney MB	**1,212**	**9**	**15**	**1,236**	**699.9**
City of London	393	9	13	415	613.0
Shoreditch MB	279	6	11	296	449.8
Bethnal Green MB	281	9	8	298	392.1
Finsbury MB	208	4	17	229	390.1
West Ham CB	1,498	45	47	1,590	334.0

Note that Table 1 excludes the figures for V1s (Pilotless Aircraft, also known as 'Doodlebugs'), V2s (Long Range Rockets), AA shells and IBs. Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

The nearest recorded incidents to the Site are described below. Appendix 1 provides detailed of further air raid incidents in the vicinity of the Site.

9th September 1940

1No. HE bomb fell on 228 Cable Street, approximately 0.1km east of the Site.

IBs fell on 209 and 211 Cable Street, approximately 0.1km east of the Site.

1No. HE bomb fell on 81 Cornwall Street, approximately 0.1km east of the Site. It was recorded as UXB and was removed on the 17th September 1940.

11th September 1940

IBs fell on the Public Library, approximately 50m southeast of the Site.

15th September 1940

1No. HE bomb and IBs fell on Walburgh Street, approximately 0.1km northeast of the Site.

18th September 1940

IBs fell on 61 Cable Street, approximately 0.1km west of the Site.

8th December 1940

1No. HE bomb fell on Cornwall Street, approximately 0.1km east of the Site.

8th March 1941

3No. HE bombs fell on St George's Church, approximately 0.1km southeast of the Site. 1No. of these was recorded as UXB.

19th March 1941

HE bombs fell on Cannon Street Road, approximately 50m north of the Site.

1No. HE bomb fell on 40 Christian Street, approximately 0.1km north-northwest of the Site.

16th April 1941

2No. HE bombs fell on Betts Street, approximately 0.1km south of the Site.

11th May 1941

1No. HE bomb fell at 125 Cannon Street Road, approximately 0.1km north of the Site. It was recorded as UXB and removed on the 22nd May 1941.

Unknown dates

1No. HE bomb fell on the LNER line, adjacent to the northern boundary of the Site.

1No. HE bomb fell between Grove Street and Christian Street, approximately 30m west of the Site.

1No. HE bomb fell on Crellin Street, approximately 30m north of the Site.

1No. HE bomb fell on Prince's Square, approximately 50m southwest of the Site.

1No. HE bomb fell on Christian Street, approximately 70m northwest of the Site.

It should be noted that during WWII, many UXB were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 3 is a map showing the approximate locations of recorded bomb impacts in the vicinity of the Site. IBs shown are indicative of large numbers of similar devices that fell within the given area. The map has been compiled from a number of different sources, including air raid incident reports, bomb census maps and historical aerial photographs.

Note that air raid incident reports did not always record precise locations, often only indicating on which street, area or farm a bomb fell.

Figure 3	Compiled bomb impact map for the vicinity of the Site

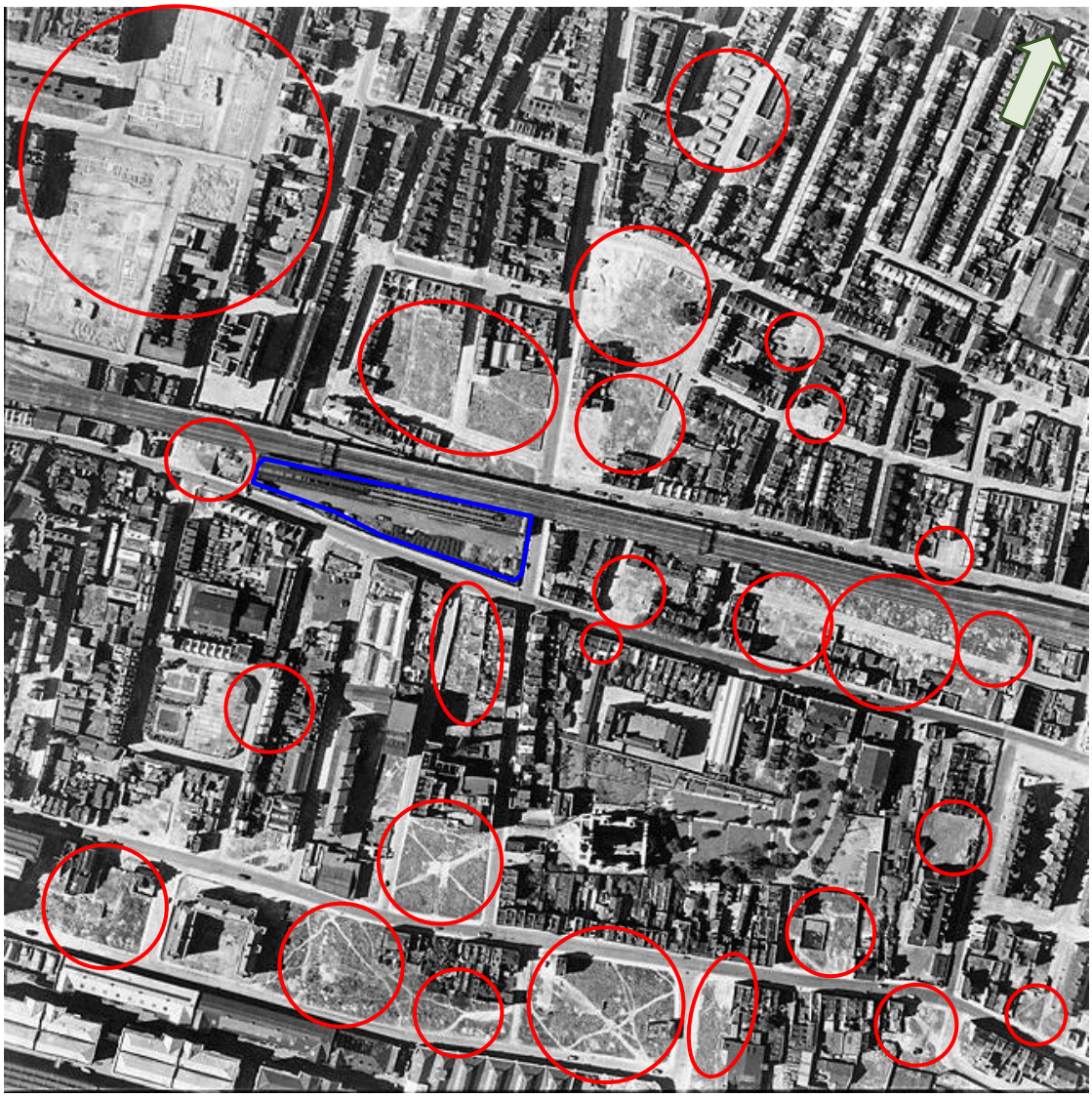
Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey *Not to scale*

Legend	Site boundary	HE bomb	UXB	V1	IBs

Plate 6 is an aerial photograph of the Site dated the 18th May 1948. No significant damage has been identified on the Site. Extensive bomb damage, characterised by demolished buildings and damaged roofing, has been identified throughout the surrounding area.

Buildings adjacent to the western boundary of the Site have been demolished.

Plate 6	Aerial photograph, 18th May 1948



Source: Historic England *Not to scale*

Legend	Site boundary	Bomb damage

Figure 4 is an extract from the London Bomb Damage Map, compiled at the end of WWII, on which the colouring denotes the severity of damage to buildings. Black indicates a destroyed building, purple and red indicate severe damage, while orange and yellow indicate blast damage. The pale green indicate areas cleared of rubble.

The map indicates that several buildings in close proximity to the Site, including buildings adjacent to the western boundary of the Site, were recorded as demolished.

Figure 4	Extract from the London Bomb Damage Map

Source: London County Council *Not to scale*

Legend	Site boundary

Records indicate that buildings adjacent to the western boundary of the Site were demolished by HE bombing. It is considered possible that this damage masked the impact of a UXB, which may have offset beneath the western end of the Site and remain in situ.

No records have been found indicating that the Site itself was bombed and no significant bomb damage has been identified on the Site on WWII aerial photography.

WWII bombing is considered to provide a source of UXO hazard to the western end of the Site.

3.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present on the Site at the time that a bomb was dropped in order to establish its maximum penetration depth. British Geological Survey (BGS) 1:50,000 Sheet 256 North London (Solid and Drift) were consulted, in addition to BGS borehole records.

During WWII the geology of the Site comprised Made Ground over the Langley Silt Member overlying the London Clay Formation.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 3.5m of Made Ground over 1m of sand and 3.5m of gravel, overlying more than 20m of stiff to very stiff clay.

Table 2	Estimated average maximum bomb penetration depths	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	2.5m
	500kg	6.0m
	1,000kg	7.0m

The estimated bomb penetration depths given in Table 2 is from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

In low level attacks over deep water bodies, the offset distances from the point of entry at the water surface may be considerably enhanced due to hydrodynamic effects before the bomb penetrates or settles on the sea bed. Shallow water has little effect on bomb penetration depths during high level attacks.

4 WWII DEFENCES

4.1 Bombing Decoys

In order to draw enemy aircraft away from towns and other strategically important targets, a series of decoys were developed between 1940 and 1941.

They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. Approximately 792No. static decoy sites were built at 593No. locations in England. In addition, numerous temporary and mobile decoys were deployed.

Several different types of decoy were devised:

- Night time dummy airfields (Q sites).
- Daytime dummy airfields (K sites).
- Diversionary fires to simulate successful bombing raids on airfields (QF sites), petroleum depots (P sites) and major towns and cities (Starfish or SF sites).
- Simulated urban lighting (QL sites).
- Dummy Heavy Anti-Aircraft (HAA) batteries, factories and buildings (C series).
- Mobile decoys representing 'hards' for troop embarkation (MQLs), tanks and other vehicles.

Machine gun emplacements and Light Anti-Aircraft (LAA) guns were used to prevent possible enemy landings at decoy airfields.

By their nature, decoy sites provide a potential risk from Unexploded Bombs (UXB), both within the decoy site boundary and in the surrounding areas.

The nearest recorded bombing decoy was located at Richmond Park (TQ203730), approximately 16.1km southwest of the Site.

This is not considered to provide a source of UXO hazard to the Site.

4.2 Anti-Aircraft Defences

Anti-Aircraft (AA) gun batteries were targeted by the Luftwaffe. They were also a source of Unexploded AA (UXAA) shells which could land up to 27km from the firing point during WWII, although more typically fell within 15km. These could be distributed over a wide area.

AA batteries present a potential source of UXO hazard as a result of the storage, use and disposal of ordnance associated with the armaments used. They may have a risk from small caches of ammunition buried locally to them. 3No. types of AA batteries existed:

- Heavy Anti-Aircraft (HAA) batteries of large guns designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- Light Anti-Aircraft (LAA) weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields.
- Rocket batteries (ZAA) firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were also relatively permanent emplacements.

Many AA batteries were associated with searchlights and consequently 'visible' at night, providing clear targets to the Luftwaffe bombers and a potential for UXB.

During WWII the Site was within the range of guns deployed in the London Gun Defended Area (GDA). Table 3 is a list of recorded HAA and ZAA batteries within 10km of the Site.

Table 3 WWII HAA and ZAA batteries within 10km of the Site

Grid Reference	Serial No.	Location	Armament	Approximate Distance and Direction from Site
TQ 356819	ZE19	Wathamstow	Unknown	1.3km NE
TQ 350794	ZE12	Southwark Park	Unknown	1.4km SSE
TQ 354788	21Z	Southwark Park	64No. UP projectors	2.1km SSE
TQ 353789	ZE13	Finsbury Park	Unknown	2.1km SSE
TQ 366842	-	Victoria Park	Unknown	3.7km NNE
TQ 365842	19Z	Victoria Park	Unknown	3.9km NNE
TQ 382788	ZE8	Isle of Dogs	4No. 4.5" guns & GL Mk II radar	4.1km SE
TQ 395827	25Z	West Ham	Unknown	5.2km NE
TQ 375853	ZE21	Hackney Marshes	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	5.1km NNE
TQ 346753	ZS25	Peckham Rye	Unknown	5.6km S
TQ 374859	ZE21	Hackney Marshes	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	5.7km NNE
TQ 326865	ZE22	Hampstead	4No. 3.7" guns & GL Mk II radar	5.8km NNW
TQ 373754	ZS11	Brockley	4No. 3.7" guns & GL Mk IA radar	6.1km SSE
TQ 395768	4Z	Blackheath Common	64No. UP projectors	6.5km SE
TQ 278806	ZW5	Hyde Park	4No. 3.7" guns & GL Mk IA radar	6.7km W
TQ 280805	8Z	Hyde Park	64No. projectors	6.7km W
TQ 284775	9Z	Battersea Park	64No. Projectors	6.8km SW
TQ 417815	ZE16	Beckton	Unknown	7.1km E
TQ 275838	ZE14	Primrose Hill	4No. 4.5" guns and later 5.25" guns & GL Mk II radar	7.5km NW
TQ 409864	20Z	Wanstead Flats	64No. projectors	8.1km NE
TQ 289751	ZS16	Clapham Common	4No. 4.5" guns and later 4No. 3.7" guns & GL Mk II radar	8.1km SW
TQ 341727	ZS14	Dulwich	4No. 4.5" guns and later 4No. 5.25" guns & GL Mk II radar	8.2km S
TQ 341729	18Z	Dulwich		8.5km S
TQ 411865	ZE9	Wanstead	4No. 3.7" guns & GL Mk II radar	8.5km NE
TQ 427773	ZS8	Woolwich Common	4No. 4.5" guns & GL Mk II radar	8.8km SE
TQ 277864	16Z	Parliament Hill	64No. projectors	9.0km NW

It should be noted that the lack of official records of HAA batteries or armaments cannot be taken to imply their absence because many units were mobile and were moved around as operational requirements dictated.

Given the number of gun batteries in the surrounding area, the possibility that a UXAA shell fell on the Site unnoticed, whilst unlikely, cannot be discounted.

4.3 Barrage Balloons and Anti-Landing Obstacles

Balloon barrages were flown in many British towns and cities to protect against air raids. Their presence deterred low flying aircraft, making it more difficult for bombs to reach their intended targets. Barrage balloon sites can be a source of UXO as they were targeted by the Luftwaffe. They also often had a small explosive charge fitted with tilt fuzes attached approximately 50m from each end of the balloon cables and designed to detonate if the cables were hit by an aircraft.

Measures were also taken to prevent enemy aircraft landing in the event of invasion. Obstructions were constructed around airfields and on other open sites deemed fit for use as landing grounds. Solid obstructions (such as concrete blocks), posts or stakes, felled trees, haystacks, scaffolding with wire and trenching were the main measures used.

No records have been found indicating that barrage balloons or anti-landing obstacles were located on or in close proximity to the Site.

Records have been found indicating that floating barrage balloon pontoons were located in St Katherine's Dock, approximately 0.6km southwest of the Site.

Barrage balloons and anti-landing obstacles are not considered to provide a source of UXO hazard to the Site.

4.4 Anti-Invasion Defences

Defence structures are a potential source of UXB as they were especially targeted by low flying enemy aircraft, particularly during 'tip and run' raids which were common in industrialised regions. These defences may also be associated with small caches of UXO in the form of small arms, used by the troops manning the emplacement.

The rapid advance of German Troops into France, Holland and Belgium after the start of WWII prompted the War Office to review the vulnerability of the UK to invasion and a decision was taken to begin work on a national plan of anti-invasion defences. Static defences were built to interrupt and delay the progress of any invading force.

Coastal defences were strengthened (the 'Coastal Crust'). These defences included barbed wire entanglements and minefields, which were often combined to give defence in depth.

Inland, lines of defence structures were constructed along 'Stop Lines' in order to impede enemy progress for long enough to allow mobile defending forces to counter-attack.

Stop Lines included the fortification of key 'centres of resistance', such as river crossings and important road or rail junctions that could seriously hamper the enemy's advance across country. Bridges were mined for demolition and tank traps installed.

Stop Lines were further integrated into a network of fortified nodal points and 'Anti-Tank (AT) Islands'.

No records have been found indicating that anti-invasion defences were located on or in close proximity to the Site.

4.5 Pillboxes, Mortar and Gun Emplacements

Defences also included spigot mortar positions and gun emplacements.

Spigot mortars, also known as Blacker Bombards, were used primarily in an anti-tank role at road blocks or to defend airfields. Typically they fired a 20 pound (lb) HE mortar bomb. The fixed positions, in weapons pits with ammunition lockers, were frequently positioned near pillboxes.

Spigot mortar positions could be either fixed or mobile.

No records have been found indicating that gun emplacements were located on or in close proximity to the Site.

Pillboxes provide a potential UXO hazard both from the storage, use and disposal of ordnance associated with them and from UXB because they were targeted by enemy aircraft.

Pillboxes were common along Stop Lines, perimeters of airfields, potential land invasion sites and around important civil sites. Several different designs existed including Seagull Trenches (semi-buried structures), Alan Williams and Tett Turrets (small prefabricated pillboxes). Fortified sites, buildings or loop-holed walls also functioned as pillboxes.

No records have been found indicating that pillboxes were located on the Site.

The nearest identified pillbox was located on the river bank near Tower Bridge (TQ 336804), approximately 0.9km southwest of the Site.

Pillboxes and gun emplacements are not considered to provide a source of UXO hazard to the Site.

4.6 Home Guard and Auxiliary Units

Local Defence Volunteers (LDV) units, later known as the Home Guard, were located in all cities, towns and large villages. Anti-invasion defences were to be defended by the Home Guard and regular Army troops for as long as possible in the event of an invasion. The troops were issued with 'No Withdrawal' orders.

Important elements of the ordnance supply for the use of the Home Guard included substantial supplies of Mills bombs (fragmentation grenades) and Self Igniting Phosphorus (SIP) grenades as well as machine gun and small arms ammunition.

Records of Home Guard activities and related sites are rarely preserved. Storage and disposal of munitions by the Home Guard was poorly documented and surplus supplies were either buried or dumped in lakes and ponds. Given the irregular nature of this activity, the possibility of items of UXO being discovered at any locations occupied or used for training by the Home Guard can never be totally discounted.

In addition to the regular Home Guard, Auxiliary Units existed which were made up of guerrilla troops trained in sabotage and assassination in case of invasion. Sites used by these Units were Top Secret and many locations are still unknown.

No Home Guard or Auxiliary Unit activity has been identified on or in close proximity to the Site

4.7 Minefields and Mined Locations
Minefields were laid along the coast, in estuaries and along the banks of major rivers to deter infantry invasion. Strategic points such as bridges and gaps in cliffs were mined to impede enemy advance. Most of the mined locations in the UK have been cleared and the risk of finding UXO in these areas is considered to be low.
No records of minefields or mined locations on or in close proximity to the Site have been found.

5 MILITARY AIRFIELDS

Military airfields offer the potential for significant UXO hazards due to the use, storage and disposal of ordnance and as a result of enemy bombing during WWI and WWII.

Airfields active during WWII were targeted by the Luftwaffe, providing a potential source of UXB on the airfield.

As bombing accuracy was so poor during WWII, it is likely to find UXB in the surrounding areas. Aircraft crashes are also associated with operational airfields.

No records have been found of any military airfields within 10km of the Site.

The nearest recorded operational military airfield was Royal Air Force (RAF) Fairlop, located approximately 14.2km northeast of the Site. This was used throughout WWII as a satellite airfield for RAF Hornchurch, and accommodated a series of fighter squadron. The airfield was closed in August 1946.

Military airfields are not considered to provide a source of UXO hazard to the Site.

5.1 Aircraft Crashes

No records of aircraft crashes on or in close proximity to the Site have been found.

6 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS

Explosives and munitions manufacturing or storage sites offer a particularly high risk from both explosive substances and UXO. Standard procedures of explosive/ordnance disposal through burial or burning means that explosive and UXO hazards will be present in some areas of such establishments.

In addition, UXB hazards may be present as a result of enemy bombing during WWI and WWII.

6.1 Explosives and Ordnance Factories

No records of any explosives or ordnance factories on or in close proximity to the Site have been found.

The Southwark National Filling Factory (NFF), approximately 2.3km west-southwest of the Site, filled fuzes with explosives during WWI.

Explosives and ordnance factories are not considered to provide a source of UXO hazard to the Site.

6.2 Munitions Stores

Local ammunition caches would have been present near to defended road blocks, pillboxes, HAA and LAA sites. Most of those associated with the anti-invasion sites are understood to have been cleared.

No records of any official munitions stores on or in close proximity to the Site have been found.

6.3 Informal Munitions Depots

Informal munitions depots, often made by requisitioning roadside lay-bys or parks. Other informal munitions depots were commonly located in areas of woodland or on train wagons along sidings in marshalling yards.

No records of any informal munitions depots on or in close proximity to the Site have been found.

6.4 Munitions Disposal Areas and Bomb Cemeteries

Munitions disposal areas were often made by requisitioning open areas of land, usually away from habitation. Marshland, beaches or sand dunes were frequently used for this purpose. Disposal of munitions was carried out in many different ways, ranging from destruction to burial. Full records were not necessarily maintained for these locations, and so they can potentially be a source of UXO.

No records of any munitions disposal areas or bomb cemeteries on or in close proximity to the Site have been found.

7 FIRING RANGES AND MILITARY TRAINING AREAS

By their nature, firing ranges and military training areas represent a potential source of UXO due to associated training activities. The training will involve both practice and live munitions and will offer a significant risk from a very wide range of potential UXO.

7.1 Small Arms Ranges

Small arms ranges (such as rifle ranges) and close combat ranges (such as mortar and grenade ranges) are likely to provide a significant source of UXO. It should be noted that even on small arms ranges, larger munitions such as mortars or grenades cannot be discounted.

No records of any small arms ranges on or in close proximity to the Site have been found.

7.2 Artillery Ranges

Artillery ranges will have utilised a wide range of munitions, predominantly shells, although close combat munitions such as mortars, or larger munitions such as bombs, cannot be discounted.

No records of any artillery ranges on or in close proximity to the Site have been found.

7.3 Bombing Ranges

Bombing ranges will have primarily used bombs, although other munitions such as shells and close combat munitions such as mortars cannot be totally discounted.

No records of any bombing ranges on or in close proximity to the Site have been found.

7.4 Training Areas

Training areas will have primarily used blank ammunition or practice shells in 'dry' areas, although live munitions such as shells and close combat munitions such as mortars cannot be discounted in any training area.

No records of any military training on or in close proximity to the Site have been found.

8 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear.

Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

8.1 Abandoned Bombs

No records of any officially abandoned bombs on the Site have been found.

8.2 EOC Tasks

Zetica Ltd holds the following records of post-WWII EOC task being undertaken in the vicinity of the Site.

8th March 1951

1No. 250kg UXB with 2No. Type 25 fuzes was removed from Prescott Street, approximately 0.5km west of the Site.

12th March 1965

1No. 250kg UXB with 2No. Type 25 fuzes was made safe and removed from the Tower Hill underground station, approximately 0.9km west-southwest of the Site.

3rd February 1989

1No. 1,000kg UXB was discovered at Ford Square, Whitechapel, approximately 0.6km north-northeast of the Site. It was removed.

The MoD has provided no additional information of official EOC tasks on the Site.

9 UXO HAZARD ASSESSMENT

9.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site

Hazard Level	Definition
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present and that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

Records have been found indicating that buildings adjacent to the western boundary of the Site were demolished by 1No. HE bomb during WWII.

It is considered that this may have masked the impact of a UXB, which may have offset beneath the western end of the Site and remain in situ. Consequently, the western end of the Site is assigned a moderate UXO hazard level.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the remainder of the Site. The central and eastern parts of the Site are assigned a low UXO hazard level.

Given this, it is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in Figure 5.

Figure 5 UXO hazard zone plan of the Site

Source: Google Earth *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

10 UXO RISK ASSESSMENT

10.1 UXO Risk Level

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	**Rating**
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	**Rating**
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	**LIKELIHOOD of Encounter and Detonation**	**Rating**
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0

P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix

		SEVERITY (S)					
		5	4	3	2	1	0
LIKELIHOOD (P)	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

The final risk assessment for the Site is given in Table 4.

Table 4 UXO risk assessment for the Site

Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	6	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

Shallow excavations defined as <1.0m below ground level (bgl).

UXO Risk	Matrix Rating	Definition
Very Low	0-1	Little action is required by the client provided that suitable records and procedures are in place to ensure appropriate action is undertaken should the UXO risk level change.
Low	2-5	Tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to.
Moderate	6-15	May be tolerable for the client, but it is prudent to reduce the risk where cost effective and reasonably practicable.
High	16-20	Tolerable to the client only where further risk reduction is impracticable or disproportionate to the risk involved. Essential that all practicable measures are taken to reduce the level of risk.
Very High	21-25	Unacceptable to the client except in extraordinary circumstances. Imperative that all control measures are taken.

10.2 Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

Low Risk

Excavations

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

Boreholes/Piles

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

Moderate Risk

Excavations

For those involved in excavations, the raising of awareness (as per low risk) is considered essential.

A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.

Where UXO detection is not feasible due to ground conditions, restricted access or programme, an EOC Engineer can be used to supervise during excavation works.

The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.

Boreholes/Piles

Clearance certification for any borehole or pile locations is considered essential.

This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB.

Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.

Table 5 gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.

Table 5	Risk mitigation for assumed Site activities			
Risk Level	**Typical Future Activity on the Site**			
	None	**Shallow Excavations (<1.0m)**	**Deep Excavations (>1.0m)**	**Boreholes or Pile Construction**
Very low	Ensure suitable records and procedures are in place to highlight the risk should future development be planned.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted. Appropriate action is required to be detailed within site procedures.
Low	**As very low.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+ It is considered prudent to include some UXO awareness training in site inductions.**	**As very low.** **+Clearance certification for borehole or pile locations would be considered prudent only if a zero tolerance to risk is adopted.** **Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.**
Moderate	**As very low.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Non-intrusive investigation methods considered prudent where practical.** **+Alternatively, EOC Engineer supervision is considered prudent.**	**As low.** **+Clearance certification for borehole or pile locations is considered essential.**
High	As very low.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate. +Non-intrusive investigation methods considered essential where practical. + Alternatively, EOC Engineer supervision is considered essential.	As moderate.
Very High	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.
The above table is for guidance only.				

Appendices

Appendix 1 WWII Bombing Incidents

7th September 1940

On the day known as 'Black Saturday' the East End, the London Docks and the City of Westminster were heavily bombed by approximately 340No. Luftwaffe bomber aircraft with many escorting fighter aircraft.

1No. HE bomb and several IBs fell on Sheridan Street, approximately 0.3km northeast of the Site.

8th September 1940

IBs and HE bombs fell on Cable Street, in the vicinity of the Site.

9th September 1940

1No. HE bomb fell on 228 Cable Street, approximately 0.1km east of the Site.

IBs fell on 209 and 211 Cable Street, approximately 0.1km east of the Site.

1No. HE bomb fell on 81 Cornwall Street, approximately 0.1km east of the Site. It was recorded as UXB and was removed on the 17th September 1940.

10th September 1940

HE bombs and IBs fell on the London Docks, approximately 0.3km south of the Site, causing widespread fires.

11th September 1940

IBs fell on the Public Library, approximately 50m southeast of the Site.

1No. HE bomb and IBs fell on Cable Street, approximately 0.2km east of the Site.

12th September 1940

1No. HE and IBs fell on Wapping Lane and The Highway, approximately 0.3km southeast of the Site.

13th September 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

15th September 1940

1No. HE bomb and IBs fell on Walburgh Street, approximately 0.1km northeast of the Site.

1No. HE bomb fell on Chapman Street, approximately 0.2km east-northeast of the Site.

18th September 1940

IBs fell on 61 Cable Street, approximately 0.2km west of the Site.

1No. HE bomb fell on Bewley House, Bewley Street, approximately 0.3km southeast of the Site.

8th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

9th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

11th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

26th October 1940

HE bombs and IBs fell on Cable Street, in the vicinity of the Site.

8th December 1940

1No. HE bomb fell on Cornwall Street, approximately 0.1km east of the Site.

8th March 1941

3No. HE bombs fell on St George's Church, approximately 0.1km southeast of the Site. 1No. of these was recorded as UXB.

1No. HE bomb fell on 47 The Highway, approximately 0.2km south-southwest of the Site.

HE bombs fell on Wellclose Street and Wellclose Square, approximately 0.2km southwest of the Site.

1No. HE bomb fell at the junction of Cable Street and Back Church Lane, approximately 0.2km west of the Site.

15th March 1941

1No. HE bomb fell on the Church Wardens Garden, Cannon Street Road, approximately 0.2km northeast of the Site.

19th March 1941

HE bombs fell on Cannon Street Road, approximately 50m north of the Site.

1No. HE bomb fell on 40 Christian Street, approximately 0.1km north-northwest of the Site.

HE bombs fell on Wellclose Square, approximately 0.2km southwest of the Site.

HE bombs fell on Philchurch Street, approximately 0.2km northwest of the Site.

1No. HE bomb fell on Brinsley Street, approximately 0.3km east of the Site.

IBs fell on Morris Street, approximately 0.3km northeast of the Site.

1No. HE bomb fell on Watney Passage, approximately 0.3km northeast of the Site.

1No. HE bomb fell on London County Council Fire Service building, Fairclough Road, approximately 0.3km northwest of the Site.

16th April 1941

2No. HE bombs fell on Betts Street, approximately 0.1km south of the Site.

3No. HE bombs fell on Cuttle Close, approximately 0.2km south of the Site.

11th May 1941

1No. HE bomb fell at 125 Cannon Street Road, approximately 0.1km north of the Site. It was recorded as UXB and removed on the 22nd May 1941.

1No. HE bomb fell on Bigland Street, approximately 0.2km northeast of the Site.

23rd June 1944

1No. V1 fell at the junction of Crowder Street and The Highway, approximately 0.2km south-southeast of the Site.

4th July 1944

1No. V1 fell on land between The Highway and Pennington Street, approximately 0.2km south-southwest of the Site.

1st August 1944

1No. V1 fell on the junction of Lambeth Street and Goodman Street, approximately 0.3km west-northwest of the Site.

Unknown dates

1No. HE bomb fell on the LNER line, adjacent to the northern boundary of the Site.

1No. HE bomb fell between Grove Street and Christian Street, approximately 30m west of the Site.

1No. HE bomb fell on Crellin Street, approximately 30m north of the Site.

1No. HE bomb fell on Prince's Square, approximately 50m southwest of the Site.

1No. HE bomb fell on Christian Street, approximately 70m northwest of the Site.

1No. HE bomb fell on a warehouse on Wapping Lane, approximately 0.3km south-southeast of the Site.

Appendix 2 UXO Hazard and Ordnance Types

When assessing the risk from UXO including UXB, it is important to be aware of ordnance type and function. The following Section briefly describes the more common types of UXO. More data on these can be found at http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/.

A2.1 Small Arms Ammunition

Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Larger calibre small arms munitions can contain fuze mechanisms and high explosives or pyrotechnic fillings and may have been used for anti-aircraft or anti-vehicle purposes.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance. SAA is often associated with discarded ammunition boxes around firing practice ranges. The Plate below illustrates some common SAA.

Plate	Photograph of typical WWII small arms ammunition

Source: Google Images

A2.2 Hand Grenades

Hand grenades can be filled with explosives or chemicals and have 3No. main parts, a body, a fuze with a pull ring and a safety-clip assembly. Fragmentation grenades are the most common and have a metal or plastic body filled with an explosive. Most use a burning delay fuze that functions for 3 to 5 seconds after the safety lever is released.

Some, such as smoke grenades, are activated instantly when the lever is released. The Plate below illustrates the typical character and condition of No. 36 hand grenades (Mills Bombs) that have been excavated from a site.

Plate	Photographs of a typical and an excavated WWII No. 36 hand grenades

Source: Google Images

Source: Zetica Ltd

A2.3 Projected Grenades

Projected grenades are among the most commonly found UXO items, particularly the 40mm type. These contain high explosives and use a variety of fuzes, including some of the most sensitive internal impact-fuzing systems. They are extremely dangerous and can explode if moved or handled.

A2.4 Mortars

A mortar is a short tube designed to fire a projectile at a steep angle. Mortars can range from approximately 50mm to 280mm in diameter and can be filled with explosives, toxic chemicals, white phosphorous or illumination flares. They generally have a thinner metal casing than projectiles, but use the same types of fuzing and stabilisation.

During WWII there are records that the target areas of RAF practice bombing ranges were occasionally used for mortar training.

The Plate below shows a typical 2-inch mortar bomb found (left) and a demonstration 3-inch mortar bomb (right).

Plate	Photographs of WWII 2-inch and 3-inch mortars

Source: Daily Mail

Source: Zetica Ltd

A2.5 Shells

Shells are a projectile containing an explosive charge designed to burst the casing that can contain High Explosives, pyrotechnic compounds or other chemicals.

Shells can be found in a range of sizes, from <20mm to several times this size. The most likely shells to be found on the Site are Small Arms Ammunition (SAA) or UXAA shells that have fallen back to the ground unexploded.

Most commonly used anti-aircraft shells were 2" and 3.7" HE shells.

If fired and found as UXO, shells can offer a particular hazard from accidental detonation as they can have sensitive fuze mechanisms. A fuze is a device which incorporates mechanical, electrical, chemical or hydrostatic components to initiate a train of fire or detonation.

The Plate below is a photograph of a 3.7" UXAA shell found in Camberwell, London.

Plate	Photograph of a recently excavated 3.7" AA shell

Source: Zetica Ltd

A2.6 Incendiary Bombs

Incendiary Bombs (IBs) ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. By far the most common air dropped devices across the UK during WWII were small 1kg to 2kg IBs.

In some cases the IBs were fitted with a very small High Explosive (HE) bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs.

The small amount of HE, if any, and the almost negligible potential for IBs to remain active after more than 65 years in the ground means that these items have very little prospect of causing damage. In the majority of cases if IBs are found in the ground, the incendiary materials have deteriorated to such an extent that they are considered to provide a low UXO hazard level.

However, since magnesium and phosphorus were common components in IBs, some localised chemical contamination may occur where the contents have leached out of the IB into the surrounding soil.

The Plate below shows a typical variety of fragmentary remains of IBs and 2No. IBs recovered by the Civil Defence during WWII.

Plate	Photographs of typical fragmentary remains of IBs and a UXIB

Source: Swansea Museum

Source: Museum of London

A2.7 German High Explosive Bombs

Probably the most common and certainly most publicised UXOs to be found in the UK are bombs. Air dropped bombs, as a result of WWII enemy action, are found on a relatively frequent basis as UXO. They tend to be highly publicised (at least on a local basis) due to the common disruption where an evacuation of the potentially affected area is put in place.

The amount of High Explosive and the potential for a fuze to still be activated means that these devices have the prospect of causing some of the most widespread damage. WWII bombs were particularly sophisticated for their time, with anti-tamper fuzes.

Many German bombs were designed to not explode on impact and instead to cause disruption as a UXB. Some fuzes were set with a delay time of over 70 hours. During this time, an anti-tamper fuze could also be activated to detonate should it be disturbed.

The most commonly used bombs during WWII were the 50kg and 250kg sized general purpose bombs. Less frequently, the 500kg bomb was also used. Larger bombs were used, but so infrequently that any assessment of hazard is more typically based on bombs ranging up to 500kg only.

It should be noted that the June 2008 find of a 1000kg bomb in London, does demonstrate that larger bombs can be found and any risk mitigation measures should consider this.

The Plate below shows the variety of UXB recovered by the Civil Defence during WWII.

Plate	Photograph of a variety of UXB recovered by the Civil Defence during WWII

Source: Imperial War Museum

A2.8 Detonators, Gaines and Fuzes

Bomb components such as detonators, gaines and fuzes were stored at operational airfields during WWII and typically contained some type of explosive charge to initiate the detonation of a munition.

A wide variety of these components were used and examples of some common fuzes are shown in the Plate below.

Plate	Photographs showing examples of WWII fuzes

Source: Zetica Ltd

A2.9 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

Plate	Photographs of original and recently excavated WWII land mines

Source: Google Images

Source: Zetica Ltd

A2.10 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset. Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010.

Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

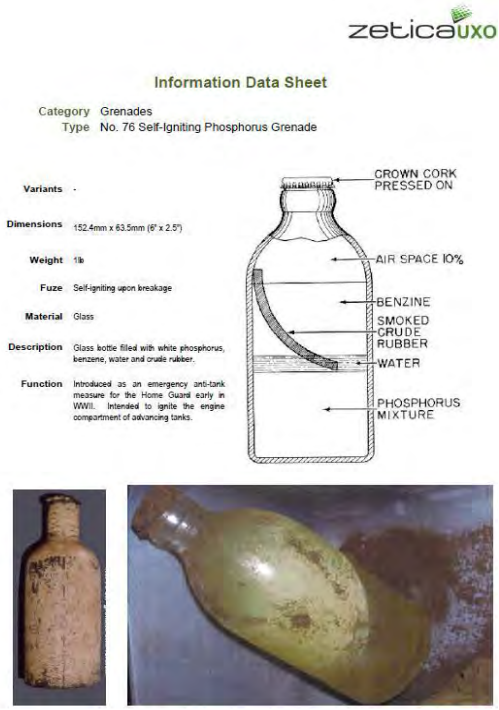
In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

Plate	Photograph of the No. 76 SIP grenade



Source: Zetica Ltd

Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

A2.11 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

A2.9 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

Plate	Photographs of original and recently excavated WWII land mines

Source: Google Images

Source: Zetica Ltd

A2.10 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset. Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010.

Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

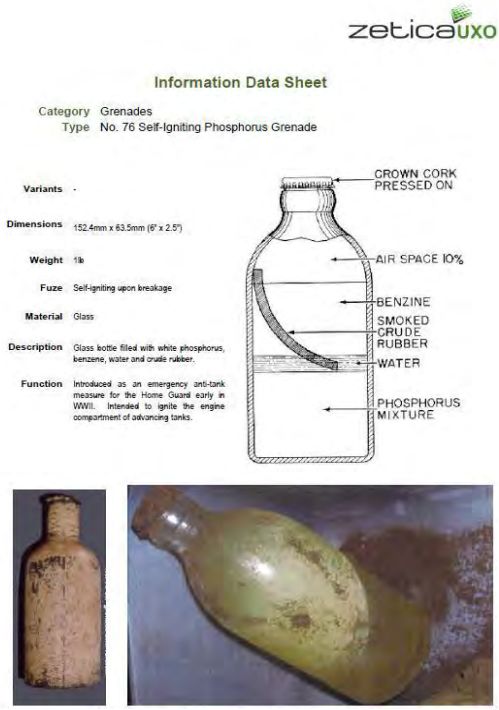
In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

Plate	Photograph of the No. 76 SIP grenade



Source: Zetica Ltd

Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

A2.11 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

A2.12 Effects and Consequences

There have been a limited number of recorded incidents in the UK since WWII where bombs have detonated during engineering works, though a significant number of bombs have been discovered. Incidents involving smaller ordnance are, however, relatively common in the UK.

In the UK, there are no recorded incidents since the decade after WWII, of a UXB accidentally detonating. In recent years, bombs have been found that have fuze mechanisms that have started to operate indicating that given the right conditions a UXB may still function.

In June 2008 the UXB uncovered in the Lea Valley caused difficulty to No. 33 Regiment (Explosive Ordnance Disposal) Royal Engineers because the fuze mechanism started to operate.

The 1,000kg 'Hermann' bomb, the first of this size to be found in over 30 years, took 5 days to deactivate. This demonstrates that larger bombs can be found and any risk mitigation measures should provide the option to deal with this size of device. Since WWII, UXBs have been found on a regular basis in London.

Since WWII, UXBs have been found on a regular basis throughout Britain. Some of the most recent cases are described below.

In May 2009 1No. 50kg WWII bomb was found on a building site in Bexhill-on-Sea, Sussex, and on the 16th August 2009, 1No. 250kg WWII bomb was found near Ebberston, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8th March 2010 1No. 500kg WWII bomb was found at Bowers Marsh in Essex by Zetica EOC operatives following a Zetica desk study concluding a high risk of UXB on the site. The bomb was demolished in situ by members of the Army Royal Logistics Corps (RLC).

The Plate below is a photograph of the bomb in situ.

Plate	Photograph of the 500kg WWII UXB at Bowers Marsh, 8th March 2010

Source: Zetica Ltd

On the 23rd February 2011, 1No. WWII UXB was found on a building site in Notte Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.

On the 22nd July 2012, a landslip in the cliffs at Mappleton in the East Riding of Yorkshire exposed over 1,000No. UXO items, including practice bombs, mortars, rockets, shells and grenades. The cliff was part of a former bombing and artillery range, used during WWII and until the 1970s.

UXO items were removed by Explosive Ordnance Disposal (EOD) officers from Catterick and MoD staff from Leconfield. 15No. controlled explosions were undertaken by the Royal Engineers (RE) to detonate the more volatile items in situ, while other less hazardous UXO devices were left in place to be dealt with at a later date.

1No. WWI bomb (shown in the Plate below) was found on the Isle of Sheppey on the 2nd August 2012 during a geophysical survey following desk study research by Zetica Ltd which had established that a previously unknown WWI bombing range existed on the site. A further WWI bomb was found in the same location in August 2015.

Plate	Photograph of WWI bomb, Isle of Sheppey, 2nd August 2012

Source: Zetica Ltd

On the 23rd March 2015, 1No. WWII 500kg UXB was found on a building site in The Grange, Bermondsey. The bomb was made safe by EOD personnel and removed for demolition.

On the 21st May 2015, 1No. 50kg UXB was found on a building site near Wembley Stadium, London Borough of Brent. The bomb was made safe by EOD personnel and removed for demolition.

On the 10th August 2015, 1No. 250kg UXB was found under the basement of a building site at Bethnal Green, London Borough of Tower Hamlets. It was made safe and removed by an EOD team from the RLC.

On the 21st September 2015, 1No. UXB was uncovered on a construction site in Cheylesmore, Coventry, by the operator of a mechanical digger. It was destroyed in situ by an EOD team from the RLC.

In January 2016, Zetica discovered 3No. 500lb British UXB at a former airfield in Cambridgeshire. These were destroyed in controlled explosions. The Plate below is a photograph of one of the bombs.

Plate	Photograph of a recently excavated WWII British 500lb GP bomb

Source: Zetica Ltd

On the 12th May 2016, 1No. 250kg UXB was found on a building site in Bath. It was made safe and then taken to a local quarry for demolition.

In September 2016 1No. 500kg UXB and 1No. torpedo were discovered during dredging works in Portsmouth Harbour. An additional 250kg HE bomb was discovered on the 16th November 2016. These devices were towed out to sea and destroyed in controlled explosions.

On the 19th January 2017, 1No. 50kg UXB was found during dredging works along the River Thames Victoria Embankment in Central London. The device was towed to Tilbury in Essex where it was destroyed in a controlled explosion.

On the 25th January 2017, 1No. 250kg UXB and 1No. mortar shell were found in King's Forest, Thetford. They were destroyed in a controlled explosion.

On the 2nd March 2017, 1No. 250kg German UXB was found on a building site in Brondesbury Park in the London Borough of Brent. It was defuzed by an EOD team and removed to a safe location where it was destroyed in a controlled explosion.

On the 15th May 2017, 1No. suspected 250kg German UXB was found on a building site in Aston, Birmingham. Due to the corrosion of the fuzes, the UXB was destroyed in situ on the 17th May 2017.

There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.

In June 2010, 3No. members of a bomb disposal team were killed, and 6No. others injured, whilst attempting to defuze an unexploded WWII bomb in Goettingen, Central Germany.

The bomb, the second found in Goettingen in the space of a few days, was unearthed at a depth of 7.5m during excavations for a sports stadium.

In September 2008, 17No. people were injured and considerable damage occurred to adjacent buildings when a bomb exploded on a construction site in Hattingen, Germany.

In October 2006 during road works on a motorway near Aschaffenburg in Bavaria, southern Germany, a bomb was struck by a machine and detonated. The plant driver was killed and 5No. others injured, including passing motorists.

In a similar incident in October 2004 in Linz, Austria a bomb exploded injuring 3No. workers and causing considerable damage to plant. In the same month, a WWII bomb under a back garden in Vienna, Austria, was detonated without warning by a minor earth tremor, after remaining undiscovered for over 60 years.

Incidents involving UXO are also reported from the marine areas around the North Sea. For example, on 6th April 2005, 3No. Dutch fishermen were killed when they accidentally trawled up a WWII UX bomb which exploded when it hit the deck.

More recently, an unexploded HE bomb was trawled from the sea floor off South Shields on the 25th February 2015 but caused no damage.

Further details of similar finds can be found at http://zeticauxo.com/news/.

The effects of a partial or full detonation of ordnance are usually shock, blast, heat and shrapnel damage. A 50kg buried bomb can damage brick / concrete structures up to a distance of approximately 16m away. Unprotected personnel on the surface up to 70m away from the blast could also be seriously injured. Larger ordnance would obviously be more destructive.

Explosives rarely lose effectiveness with age, although over time mechanisms such as fuzes and gaines can become more sensitive and therefore more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of a detonation of explosive ordnance are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved.

Appendix 3 Abbreviations	
AA	Anti-Aircraft
ACPO	Association of Chief Police Officers
AFV	Armoured Fighting Vehicle
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
ATA	Assault Training Area
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
BTA	Battle Training Area
CBRN	Chemical, Biological, Radiological and Nuclear
CMD	Conventional Munitions Disposal
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HSE	Health and Safety Executive
JSEODOC	Joint Services EOD Operations Centre

IB	Incendiary Bomb
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
PUCA	Pick Up and Carry Away
RAF	Royal Air Force
SAA	Small Arms Ammunition
SIP	Self-Igniting Phosphorous
TEP	Time Expired Pyrotechnics
USAAF	United States Army Air Forces
UXB	Unexploded Bomb
UXO	Unexploded Ordnance

Appendix 4 Glossary & Definitions	
Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Camouflet	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.

Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.
Explosive Substances and Articles (ESA)	Explosive substance are solid or liquid substance (or a mixture of substances), which is either: • capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. • designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction. Explosive article is an article containing one or more explosive substances.
Fuze	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
High Explosive	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
Munition	Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:- • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.
Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.

Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.

Appendix 5 Bibliography

Birtles P, World War 2 Airfields, 1999

Bodleian Library, German Invasion Plans for the British Isles 1940, 2007

Brooksbank, B.W.L, London Main Line Damage, 2007

Bulloch G, Steeds J E, Green K, Sainsbury M G, Brockwell J S & Slade N J, Land Contamination: Technical Guidance on Special Sites: MoD Land

Bulloch G, Steeds J E, Green K, Sainsbury M G, Brockwell J S, & Slade N J, R&D Technical Report P5-042/TR/03, Land Contamination: Technical Guidance on Special Sites: Explosives Manufacturing & Processing Sites

Castle I, London 1914-17: The Zeppelin Menace, 2008

Castle I, London 1917-18: The Bomber Blitz, 2010

Christopher J, Balloons at War, 2004

CIRIA C681, Unexploded Ordnance, a Guide for the Construction Industry, 2009

Clarke N J, Luftwaffe Target Reconnaissance, German aerial Photography 1939-1942, 1996

Clarke N J, Luftwaffe Aerial Reconnaissance Photographs of England, Scotland and Wales, 2012

Cocroft W D, Dangerous Energy, 2000

Cocroft W D & Thomas R J, Cold War, 2003

Department of the Environment, Sampling Strategies for Contaminated Land, Department of the Environment: Contaminated Land Research Report, CLR Report No. 4, 1994.

Dobinson C S, Twentieth Century Fortifications in England, Volume I 1, Anti-Aircraft artillery, England's air defence gun sites. 1914 – 46. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 2, Anti-Aircraft artillery, site gazetteer, WWI. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I. 3. Anti-Aircraft artillery, 1914-46, Site gazetteer, WWII HAA & ZAA. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 4, Anti-Aircraft artillery, Site gazetteer, WWII LAA. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume I 5, Anti-Aircraft artillery, Sources. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume II, Anti-Invasion defences of WWII. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume III, Bombing decoys of WWII, England's passive air defence 1939-45. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Volume VIII, Civil defence in WWII, Protecting England's Civil Population. Council for British Archaeology, 1996

Dobinson C S, Twentieth Century Fortifications in England, Supporting paper AA/1 Searchlight sites in WWII. Council for British Archaeology, 1996

Dobinson C S, Fields of Deception, Britain's Bombing Decoys of World War II, 2000

Dobinson C S, AA Command, 2001

Evans M, Forrest H, Haynes D, Young R, Draper R, Sarangi J & Murray V, Discovery of WWII Special Incendiary Phosphorous (SIP) Grenades in a Wiltshire garden, Chemical Hazards and Poisons Report, 2007

Fegan T, The Baby Killers, 2002

Forty G, British Army Handbook 1939-1945, 2006

Front Line 1940-41, The Official Story of the Civil Defence of Britain, 1942

Groves C, The Home Guard of Britain, 1943

Halpenny B B, Action Stations: 8. Military Airfields of Greater London, 1984

Home Guard Manual, 1941

Innes G B, British Airfields of the Second World War, 1995

Morris J, German Air Raids on Britain 1914-1918, 1993

Osborne M, Defending Britain, Twentieth-Century military structures in the landscape, 2004

Price A, Blitz on Britain 1939-45, 2000

Ramsey W, The Blitz Then and Now, Vol 1, 1987

Ramsey W, The Blitz Then and Now, Vol 2, 1988

Ramsey W, The Blitz Then and Now, Vol 3, 1990

Ramsey W, The East End Then and Now, 1997

Rawson A, British Army Handbook 1914-1918, 2006

Wyatt J R, Unexploded Bombs (UXB) in the Thames Marshes, 2000

Established for over 25 years, Zetica's services include

- ☑ Desk studies
- ☑ Unexploded ordnance risk assessments and risk mitigation
- ☑ Topographic surveys
- ☑ Utility services detection
- ☑ Environmental and engineering geophysical surveys
- ☑ Transport infrastructure surveys
- ☑ Pipeline & cable route surveys
- ☑ Intrusive ground investigations

More details are available at

www.zetica.com


zeticauxo