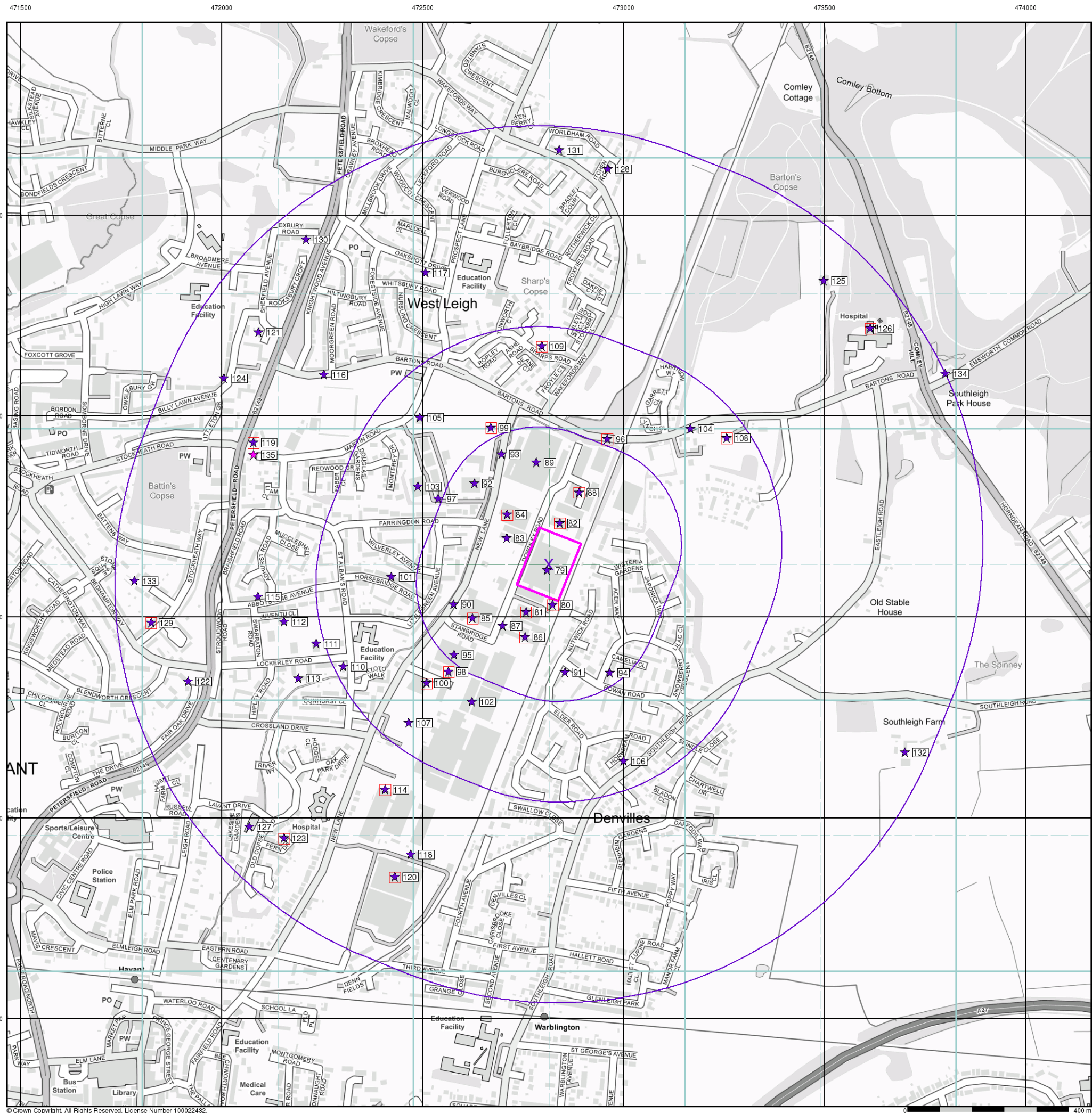




Industrial Land Use Map

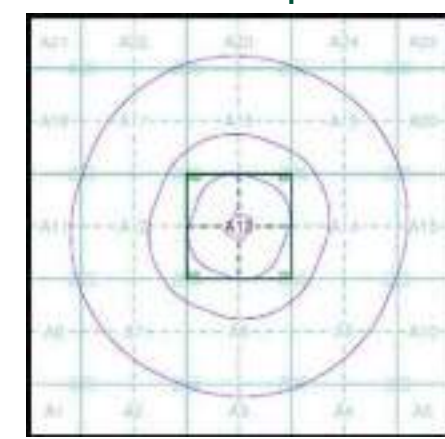
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- Gas Pipeline
- Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 1000

Site Details

Downley Road, HAVANT, PO9 2JD



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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



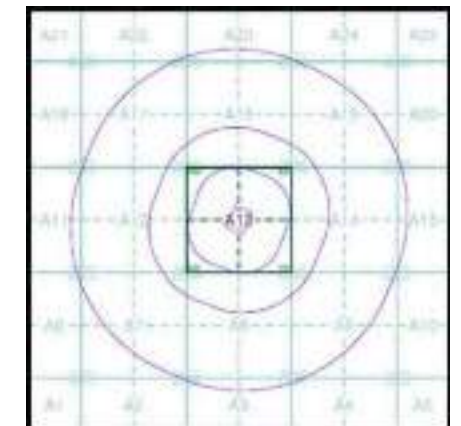
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

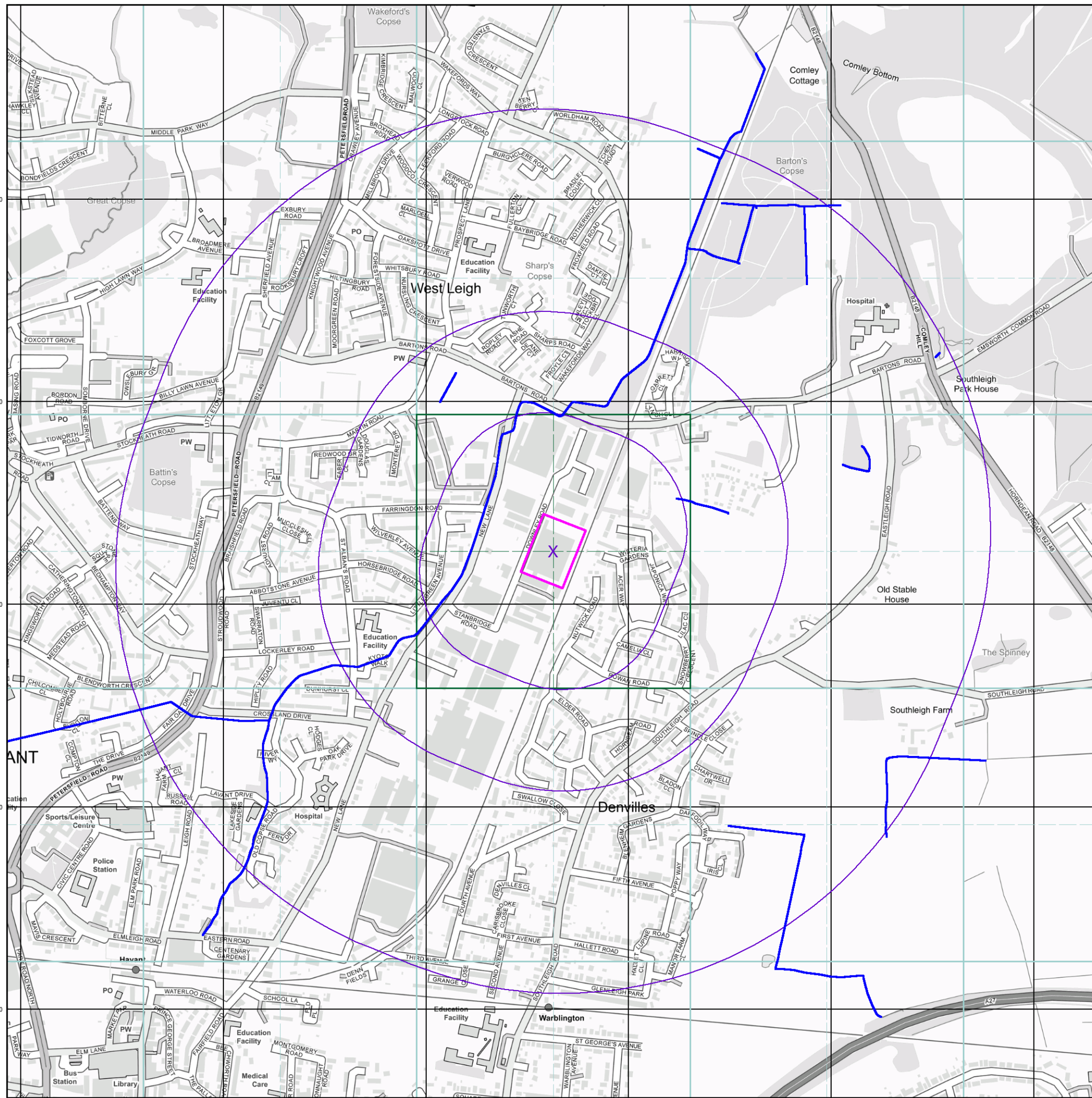
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 1000

Site Details

Downley Road, HAVANT, PO9 2JD



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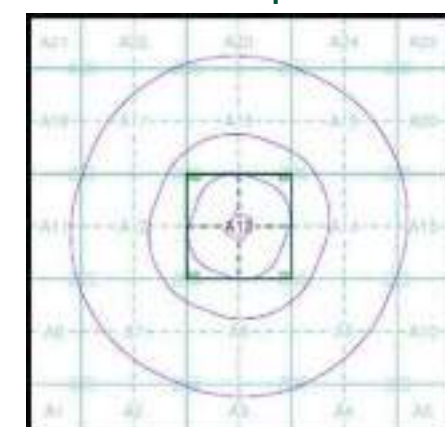
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

OS Water Network Data

- | | |
|--------------|-------------------------|
| Canal | Drain |
| Reservoir | Other |
| Foreshore | Lake |
| Marsh | Transfer |
| Tidal River | Lock Or Flight Of Locks |
| Inland River | Sea |

OS Water Network Map - Slice A



Order Details

Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 1000

Site Details

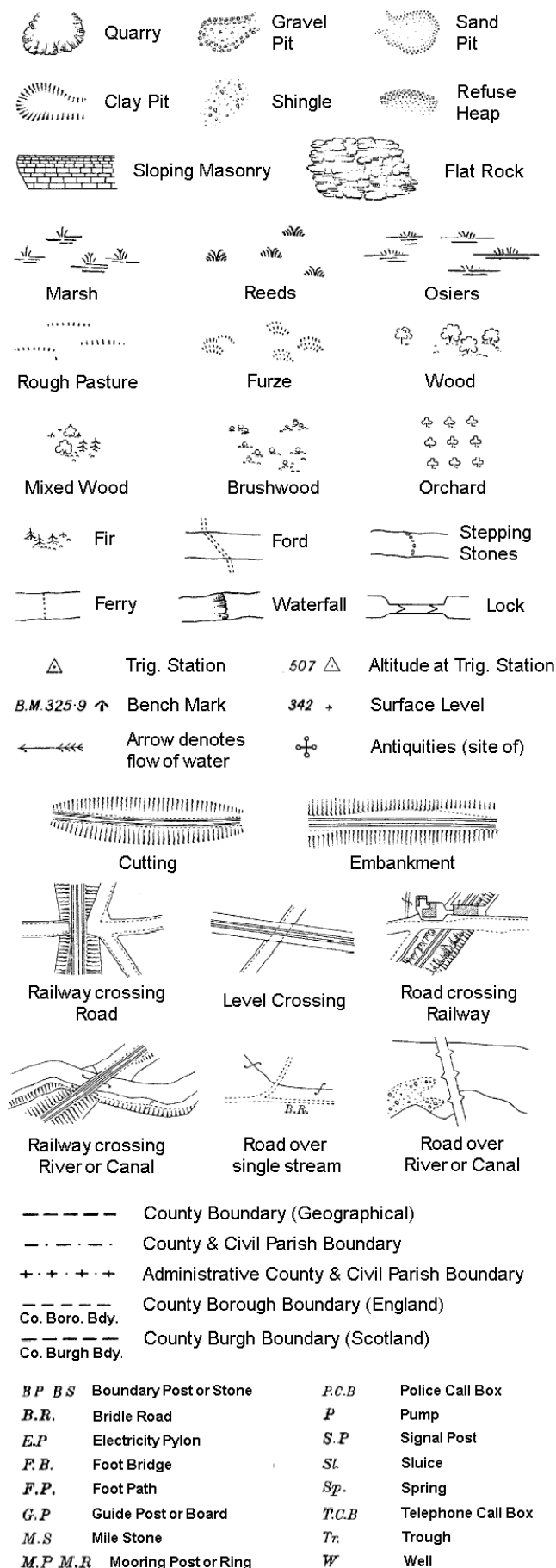
Downley Road, HAVANT, PO9 2JD



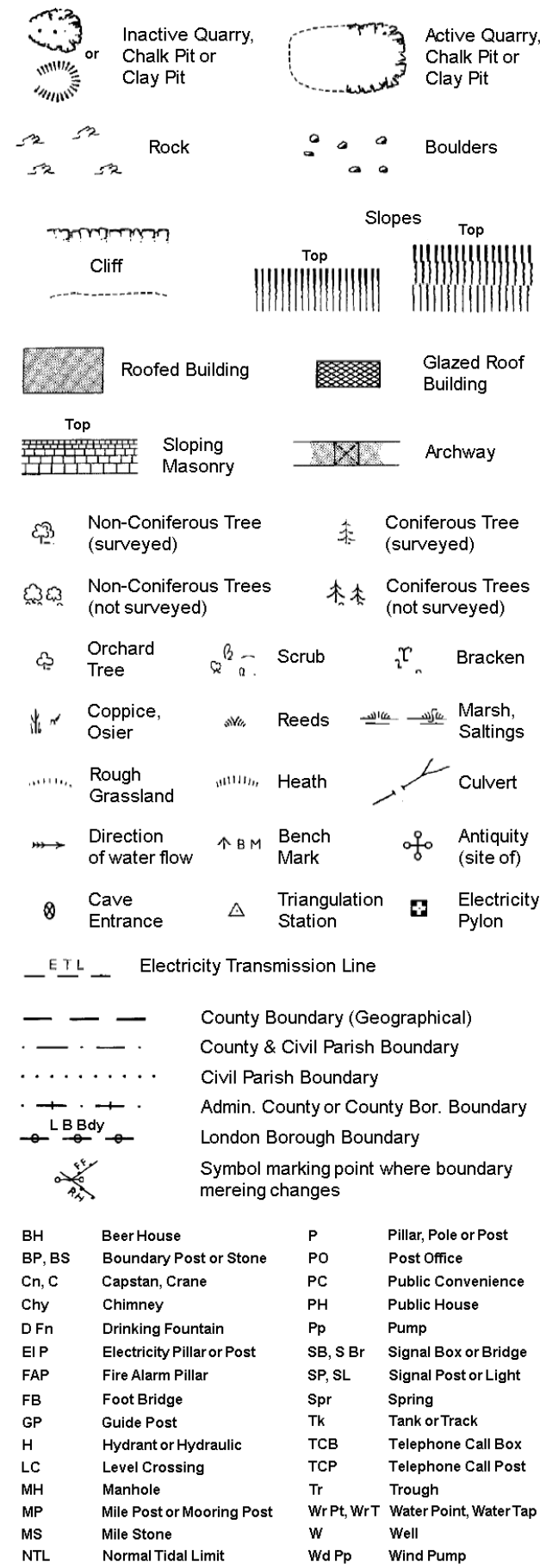
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Historical Mapping Legends

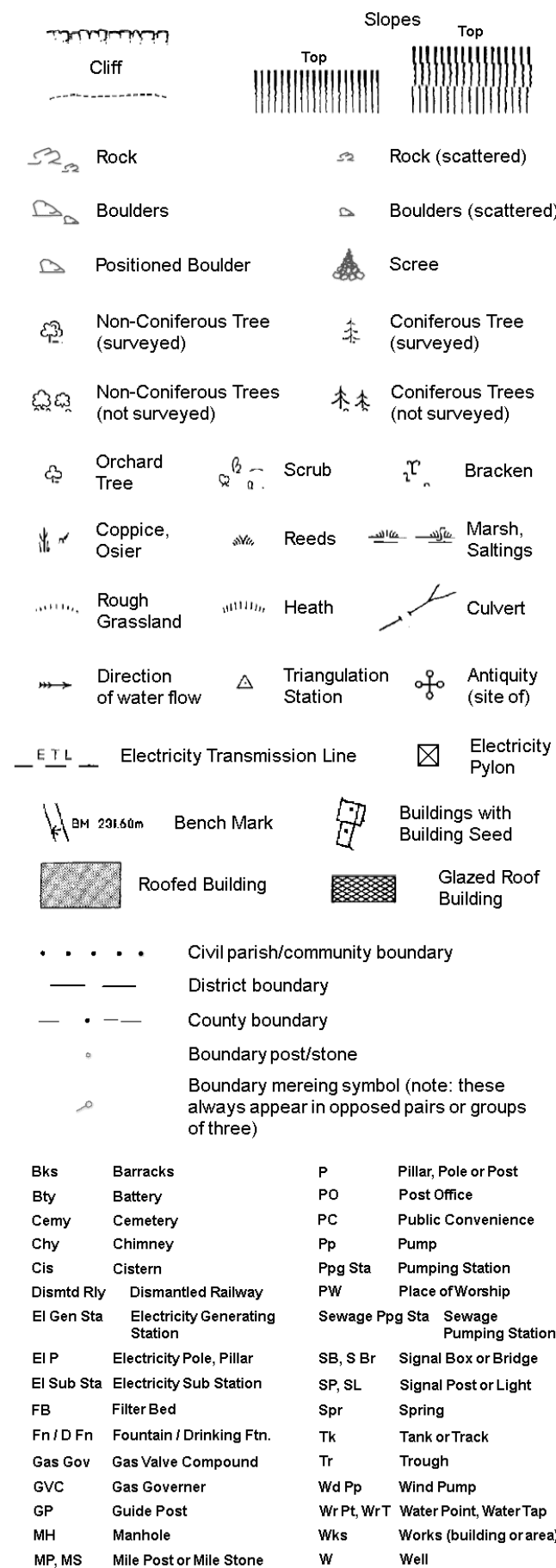
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



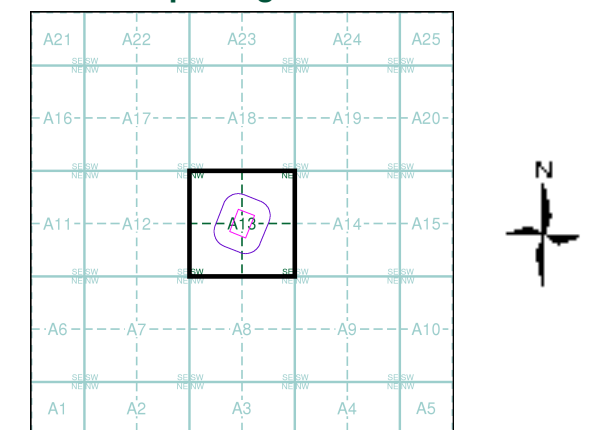
Large-Scale National Grid Data 1:2,500 and 1:1,250



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Hampshire & Isle Of Wight	1:2,500	1866	2
Hampshire & Isle Of Wight	1:2,500	1867	3
Hampshire & Isle Of Wight	1:2,500	1868	4
Hampshire & Isle Of Wight	1:2,500	1897	5
Hampshire & Isle Of Wight	1:2,500	1909	6
Hampshire & Isle Of Wight	1:2,500	1932	7
Ordnance Survey Plan	1:2,500	1953 - 1972	8
Ordnance Survey Plan	1:1,250	1960 - 1970	9
Ordnance Survey Plan	1:1,250	1969 - 1983	10
Ordnance Survey Plan	1:2,500	1972	11
Additional SIMs	1:1,250	1978 - 1991	12
Ordnance Survey Plan	1:1,250	1980	13
Additional SIMs	1:2,500	1990	14
Large-Scale National Grid Data	1:1,250	1993	15
Large-Scale National Grid Data	1:1,250	1995	16
Large-Scale National Grid Data	1:1,250	1996	17

Historical Map - Segment A13



Order Details

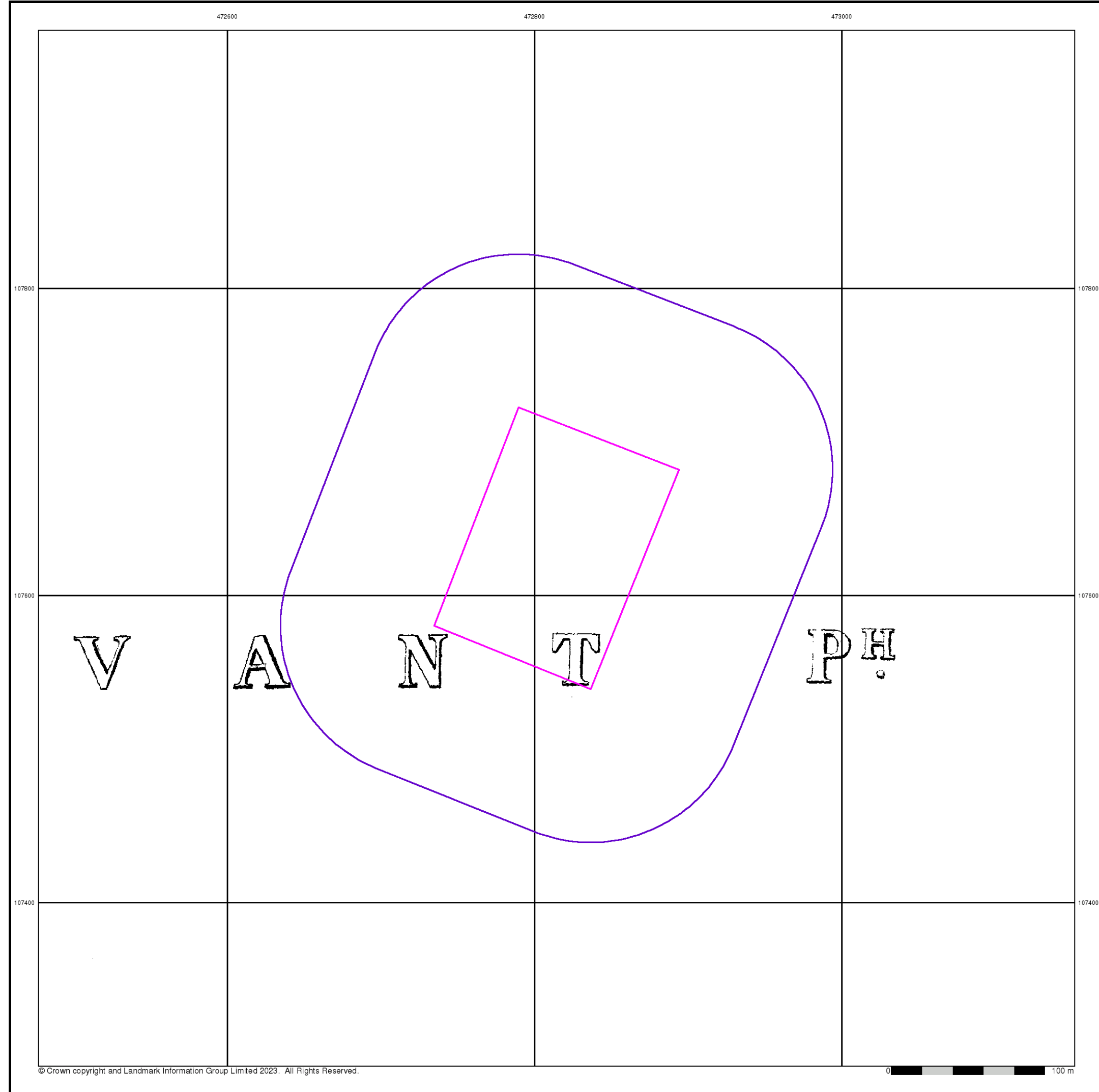
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

Site Details

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Hampshire & Isle Of Wight
Published 1866
Source map scale - 1:2,500

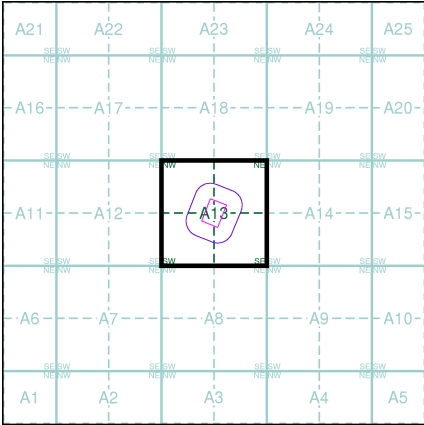
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

076_07
1866
1:2,500



Historical Map - Segment A13



Order Details

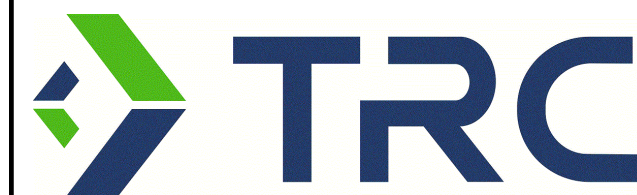
Order Number:	317423603_1_1
Customer Ref:	562241
National Grid Reference:	472810, 107630
Slice:	A
Site Area (Ha):	1.71
Search Buffer (m):	100

Site Details
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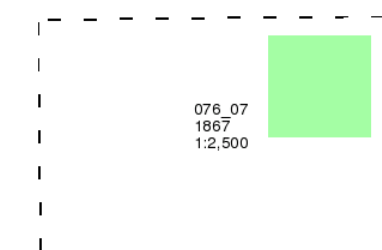
Hampshire & Isle Of Wight

Published 1867

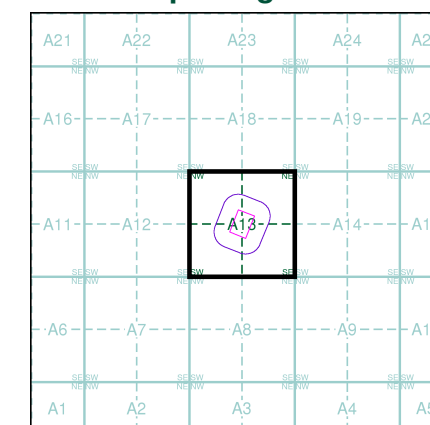
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

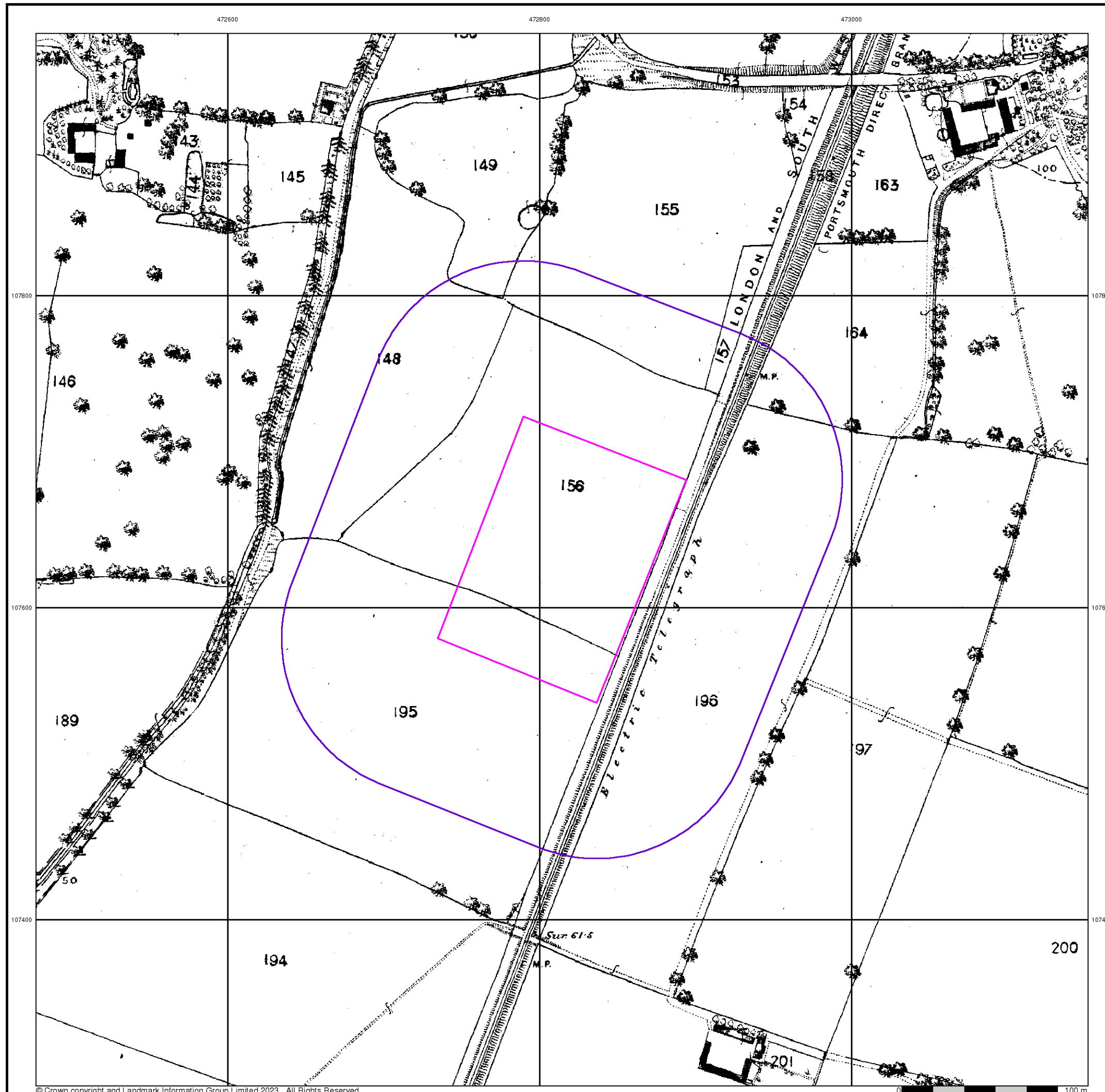
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Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

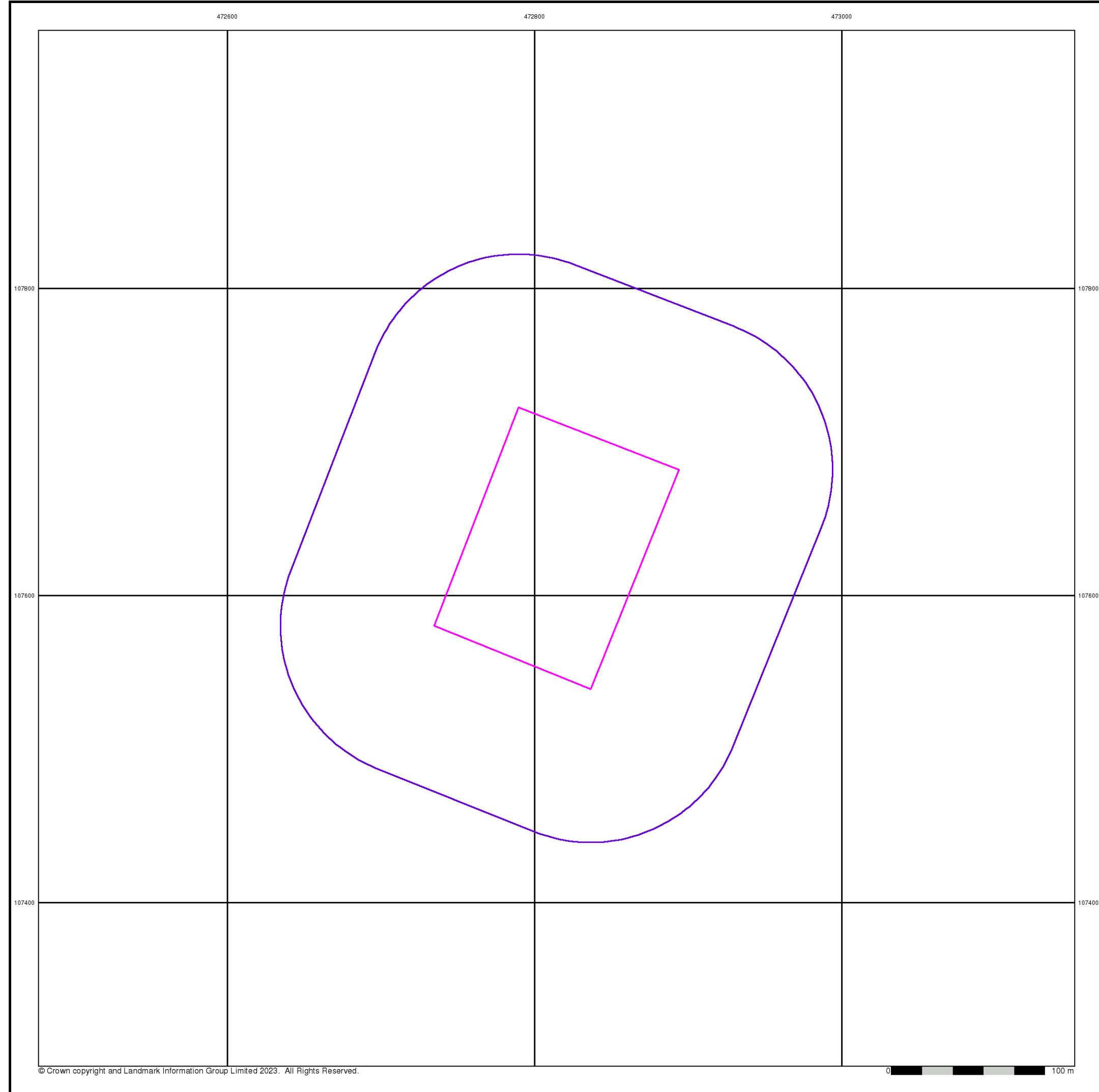
Site Details

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Hampshire & Isle Of Wight
Published 1868
Source map scale - 1:2,500

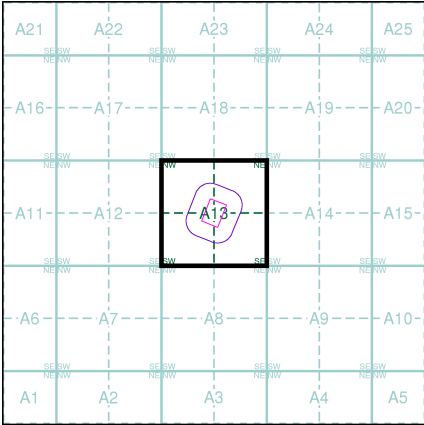
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

076_07
1868
1:2,500



Historical Map - Segment A13



Order Details

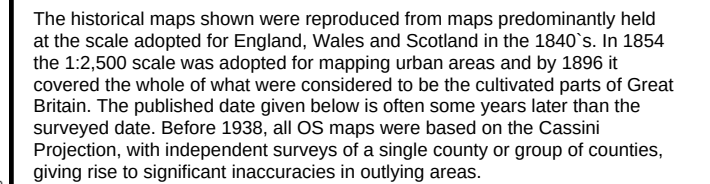
Order Number:	317423603_1_1
Customer Ref:	562241
National Grid Reference:	472810, 107630
Slice:	A
Site Area (Ha):	1.71
Search Buffer (m):	100

Site Details
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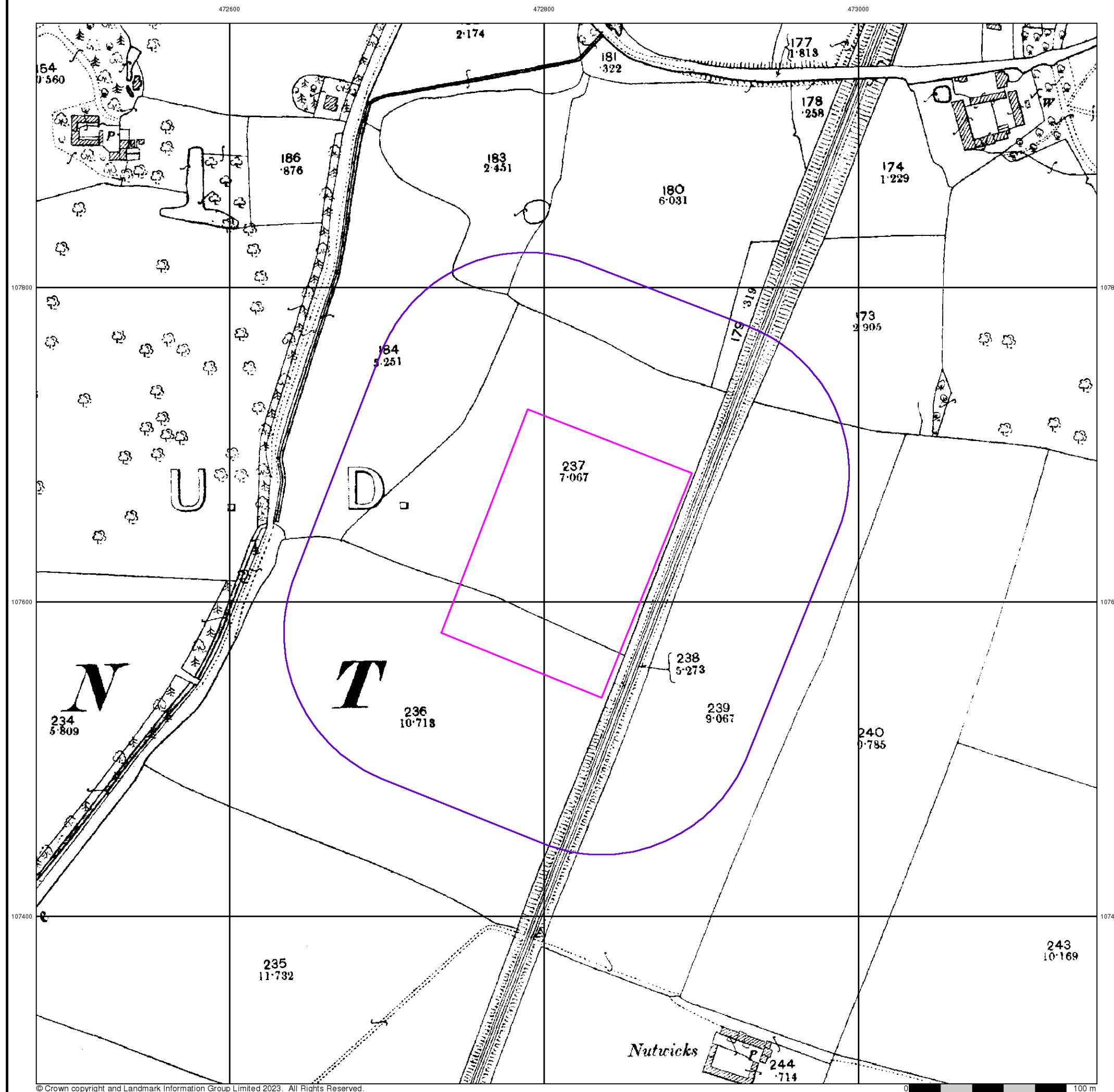


076_07
1897
1:2,500

A 5x5 grid map with columns labeled A1 to A5 and rows labeled A6 to A10. A path is highlighted in purple, starting from A1, moving right to A2, then up to A12, and finally right to A15. A black square is drawn around the intersection of A3 and A13, with the label A13 placed inside it.

Downley Road, HAVANT, PO9 2JD

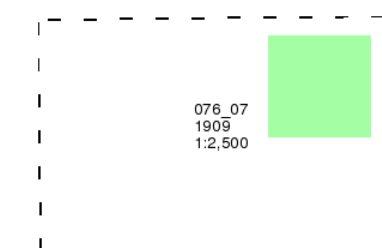
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



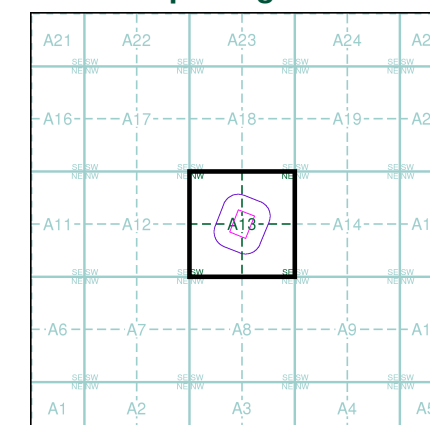


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

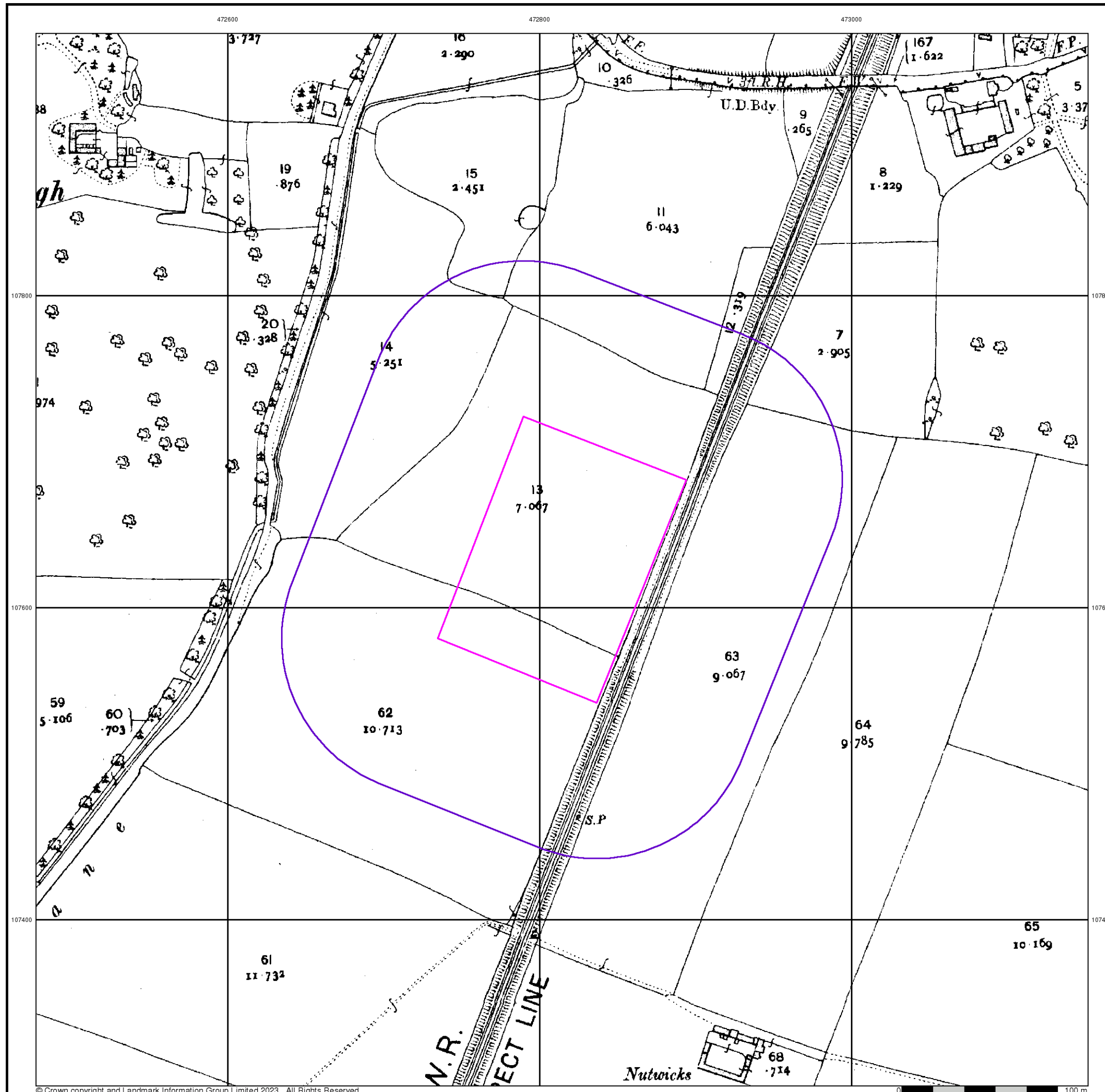
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National Grid Reference:	472810, 107630
Slice:	A
Site Area (Ha):	1.71
Search Buffer (m):	100

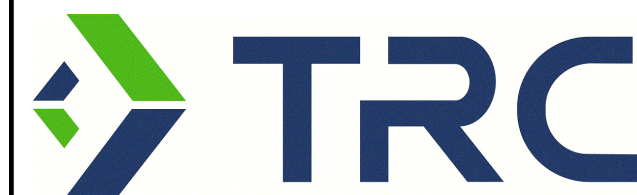
Site Details

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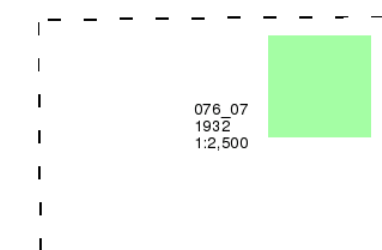
Hampshire & Isle Of Wight

Published 1932

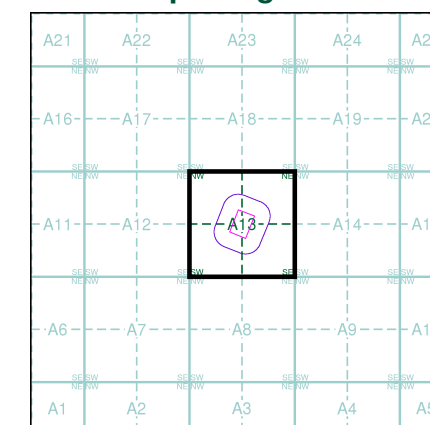
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

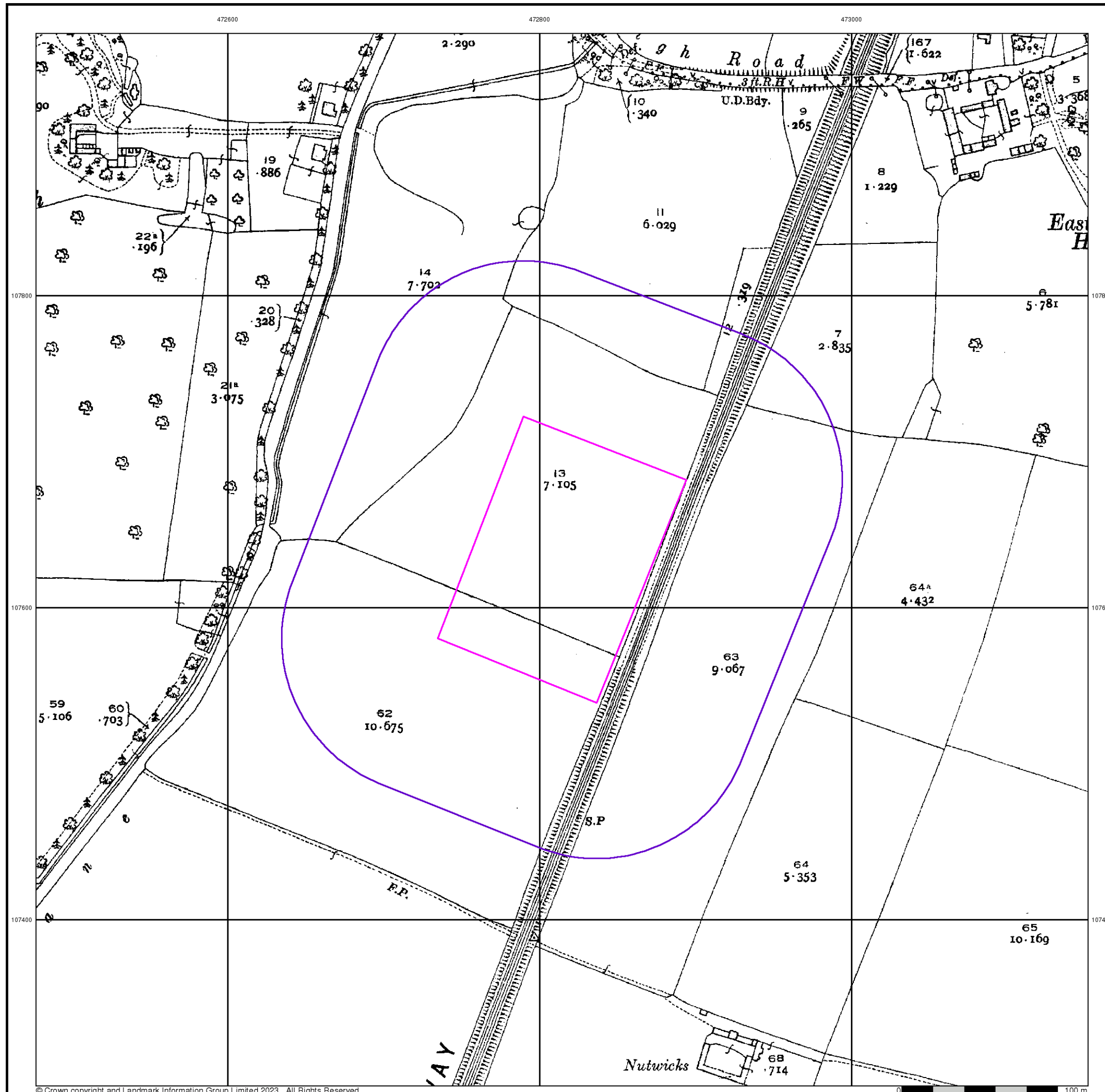
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Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

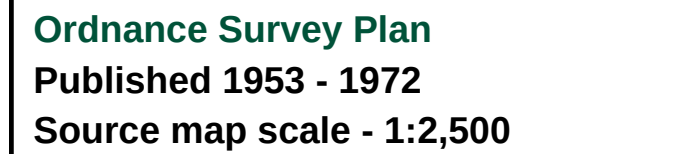
Site Details

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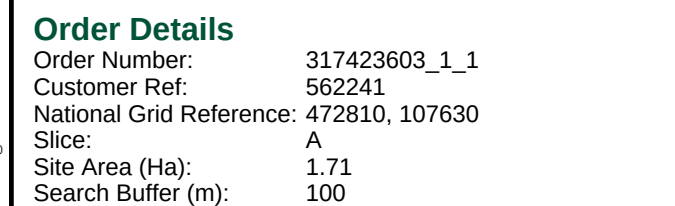


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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



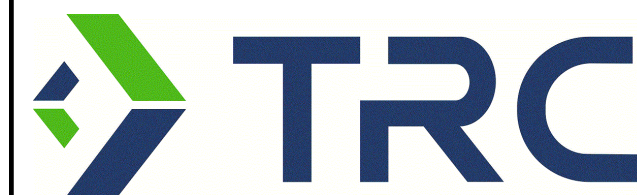


Map Name(s) and Date(s)



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Ordnance Survey Plan

Published 1960 - 1970

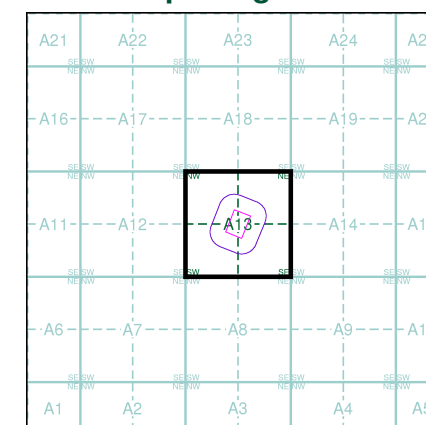
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

SU7207NW 1960 1:1,250	SU7207NE 1960 1:1,250	
SU7207SW 1960 1:1,250	SU7207SE 1960 1:1,250	SU7307SW 1970 1:1,250

Historical Map - Segment A13



Order Details

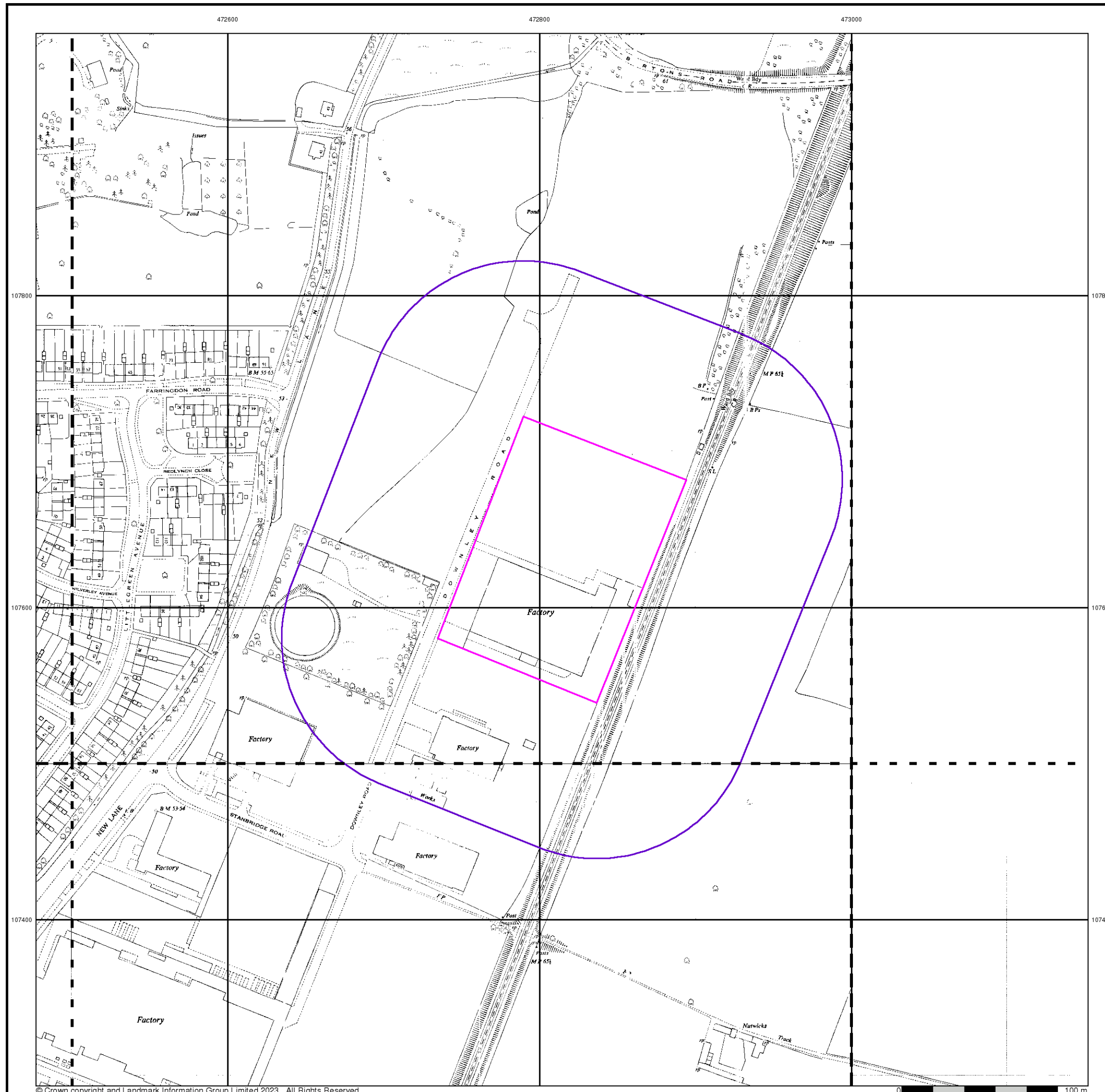
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

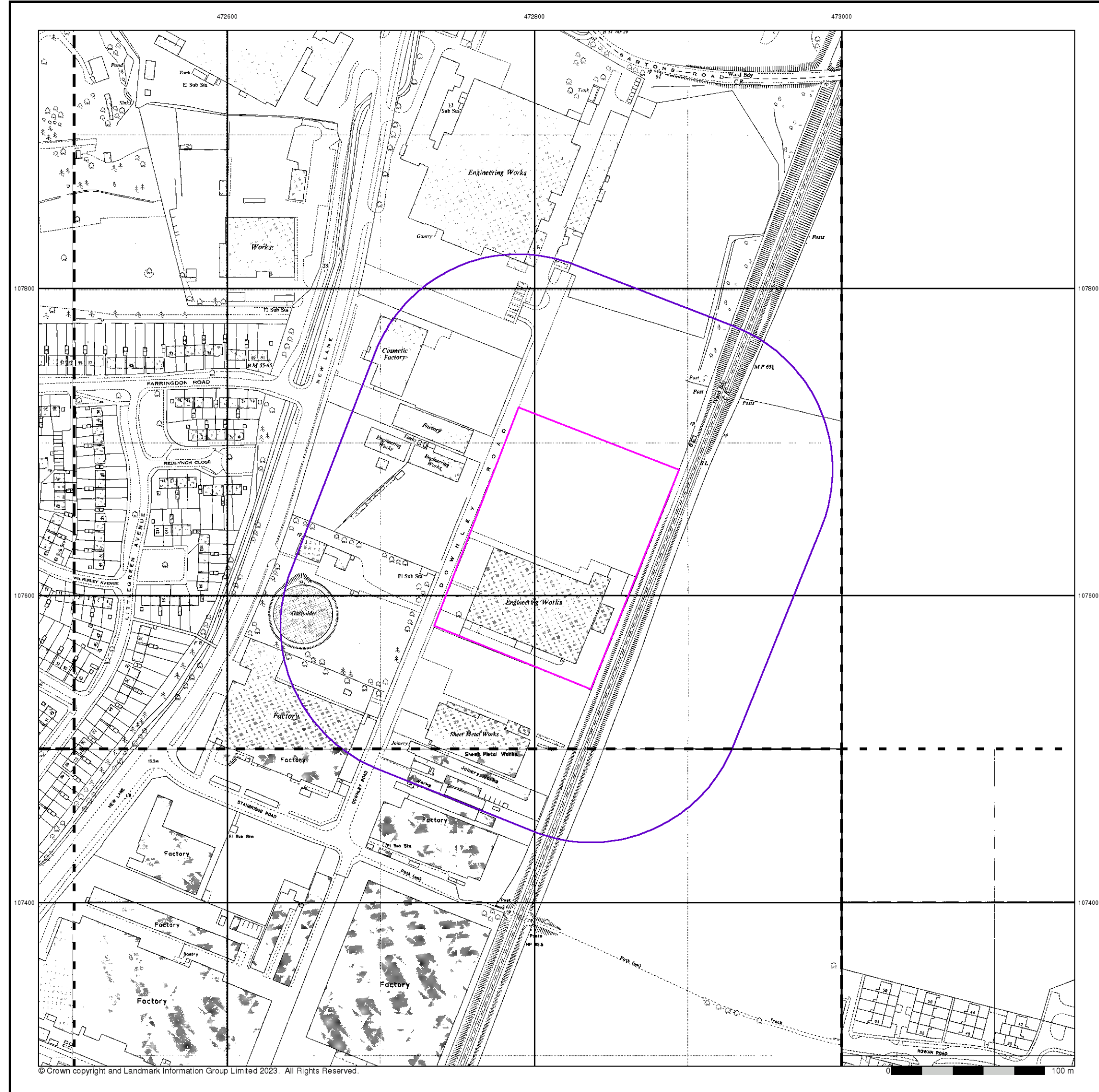
Site Details

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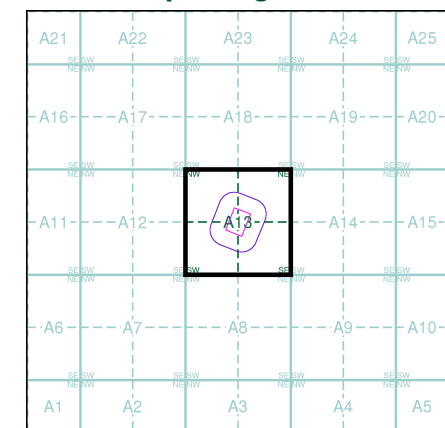
Ordnance Survey Plan
Published 1969 - 1983
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

SU7207NW 1973 1:1,250	SU7207NE 1969 1:1,250	
SU7207SW 1969 1:1,250	SU7207SE 1973 1:1,250	SU7307SW 1983 1:1,250

Historical Map - Segment A13



Order Details
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

Site Details
Downley Road, HAVANT, PO9 2JD

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INFORMATION GROUP
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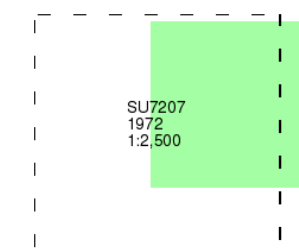
Ordnance Survey Plan

Published 1972

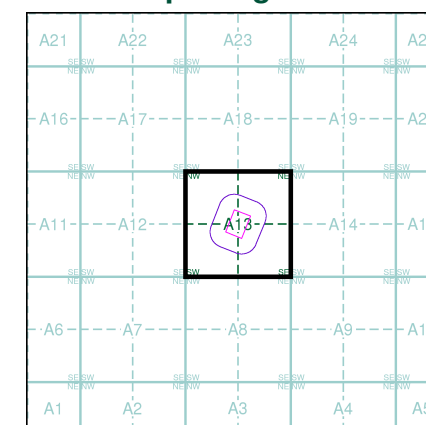
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

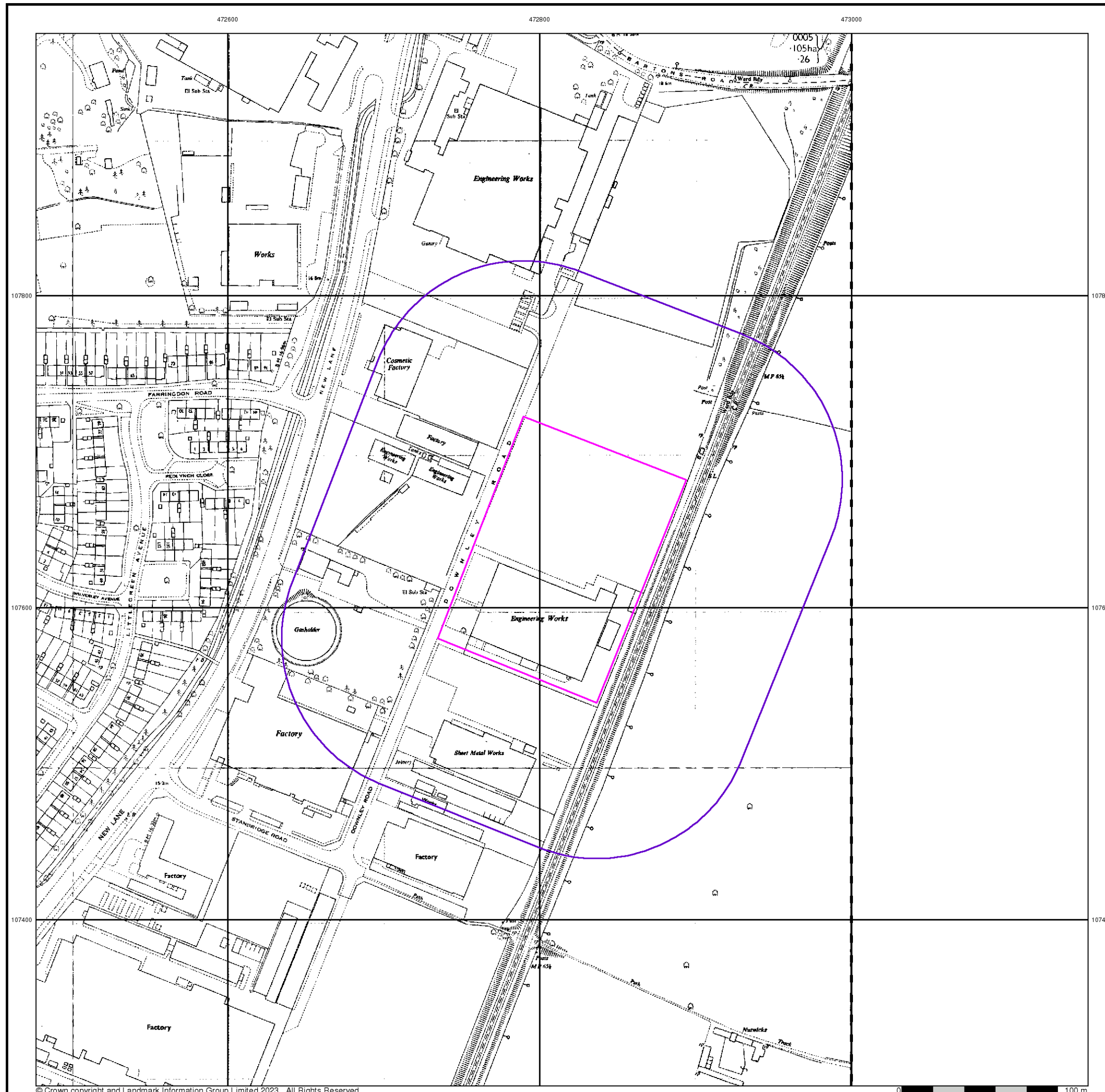
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Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

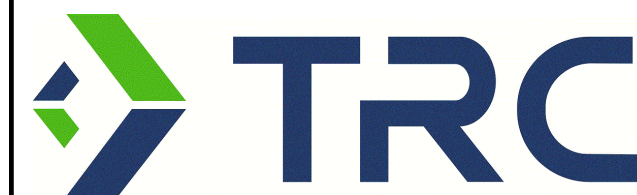
Site Details

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Additional SIMs

Published 1978 - 1991

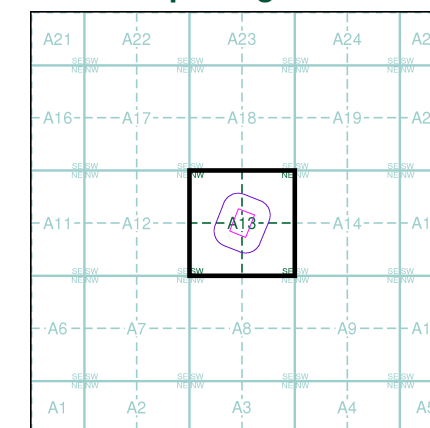
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SU7207NW 1991 1:1,250	SU7207NE 1978 1:1,250	
SU7207SW 1976 1:1,250	SU7207SE 1989 1:1,250	SU7307SW 1980 1:1,250

Historical Map - Segment A13



Order Details

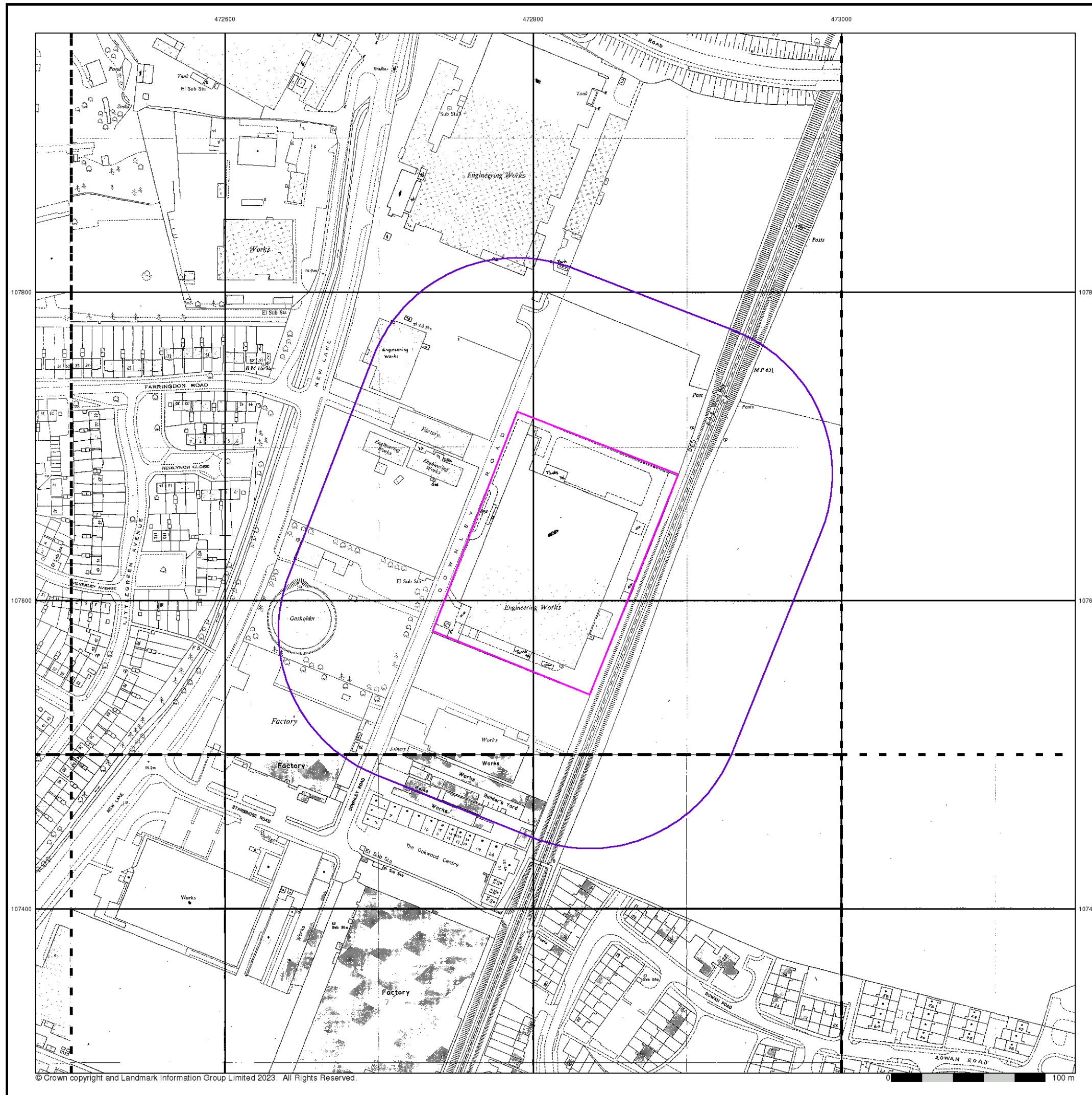
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

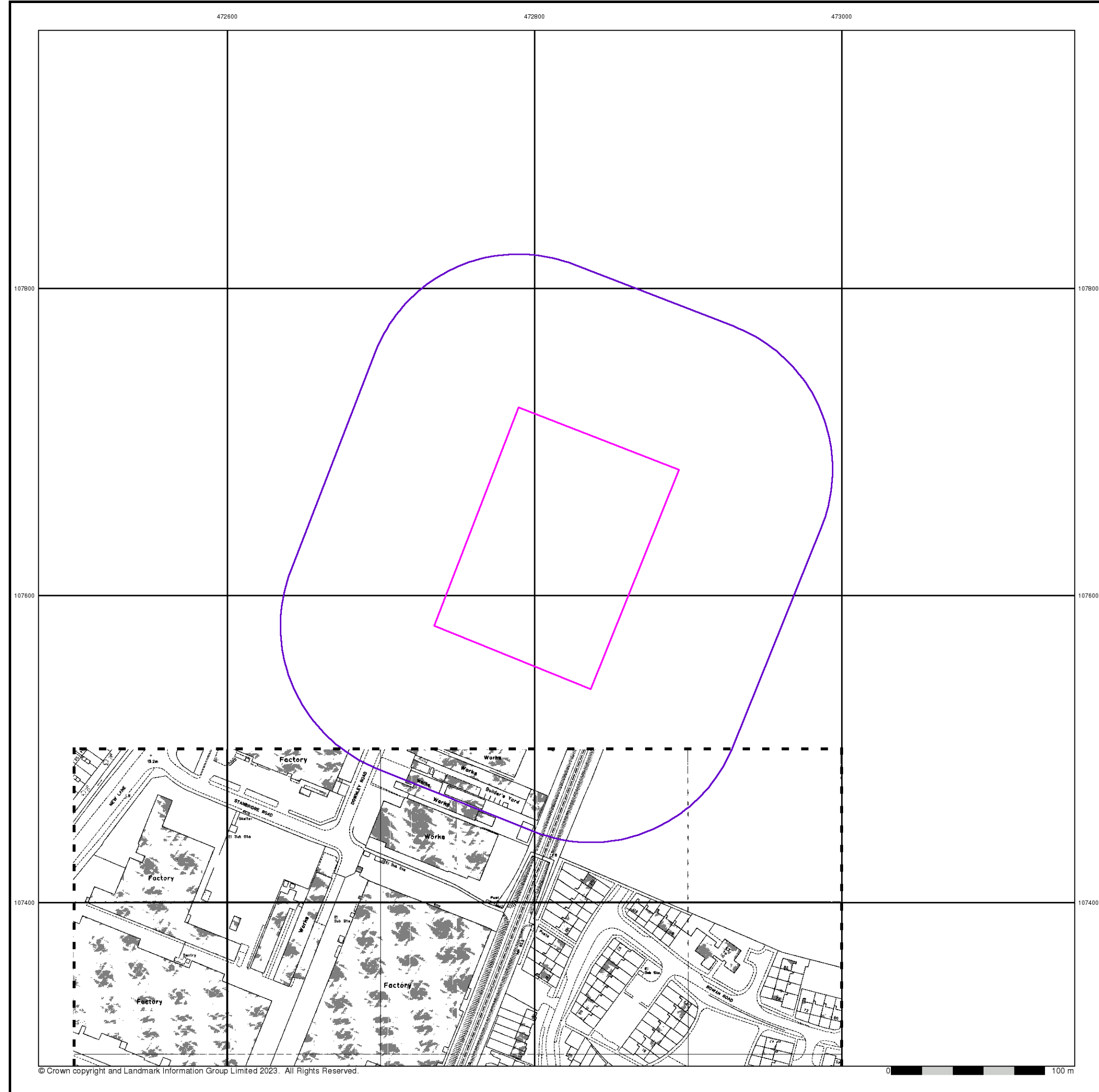
Site Details

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Fax: 0844 844 9951
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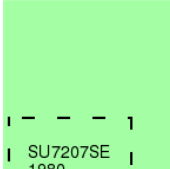
Ordnance Survey Plan

Published 1980

Source map scale - 1:1,250

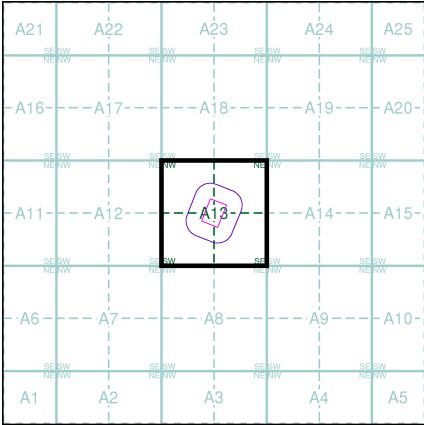
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



SU7207SE
1980
1:1,250

Historical Map - Segment A13



Order Details

Order Number:	317423603_1_1
Customer Ref:	562241
National Grid Reference:	472810, 107630
Slice:	A
Site Area (Ha):	1.71
Search Buffer (m):	100

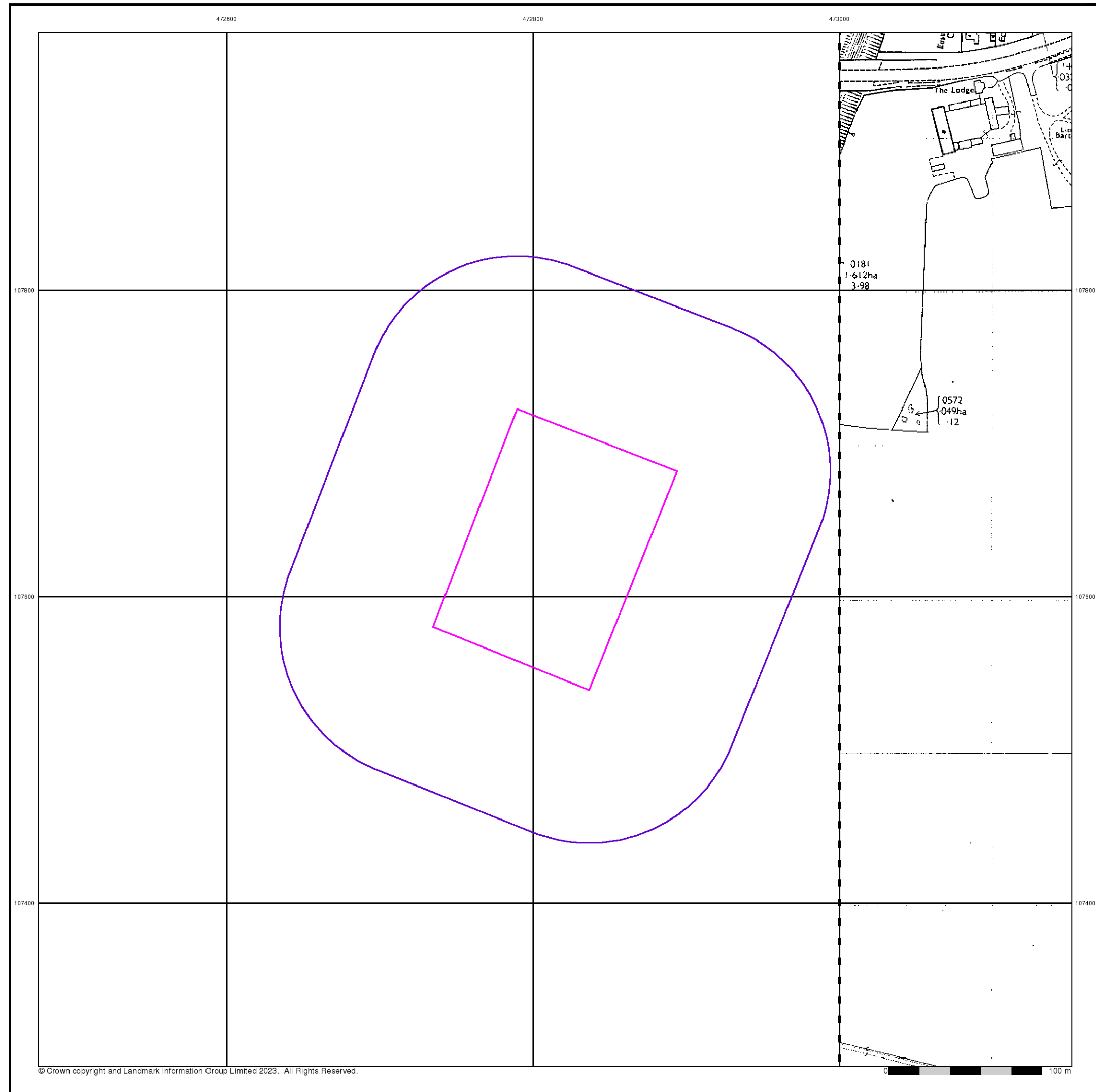
Site Details

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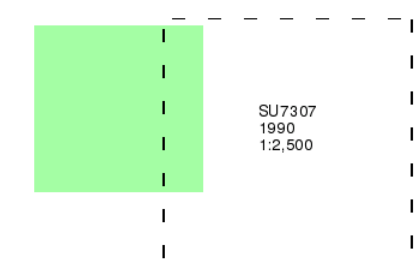
Additional SIMs

Published 1990

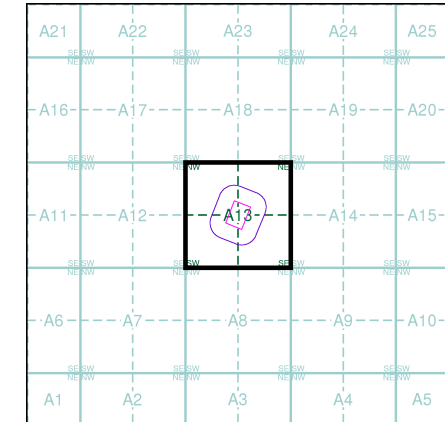
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

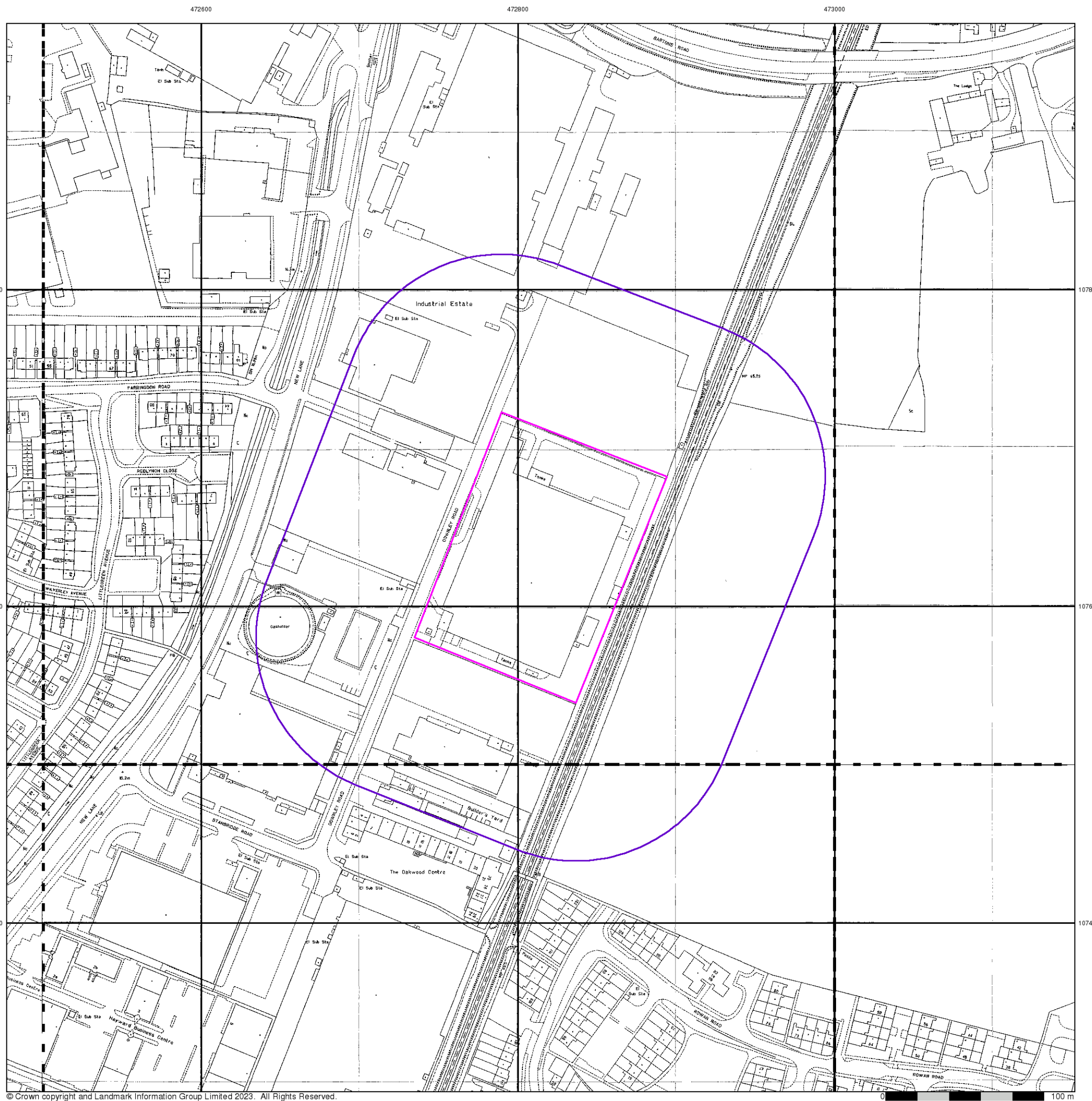
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Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

Site Details

Downley Road, HAVANT, PO9 2JD



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Large-Scale National Grid Data

Published 1993

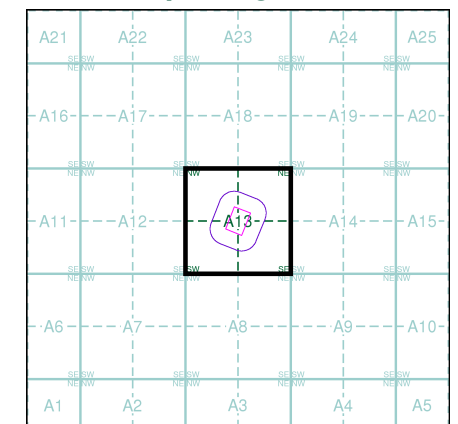
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SU7207NW 1993 1:1,250	SU7207NE 1993 1:1,250	SU7307NW 1993 1:1,250
SU7207SW 1993 1:1,250	SU7207SE 1993 1:1,250	SU7307SW 1993 1:1,250

Historical Map - Segment A13



Order Details

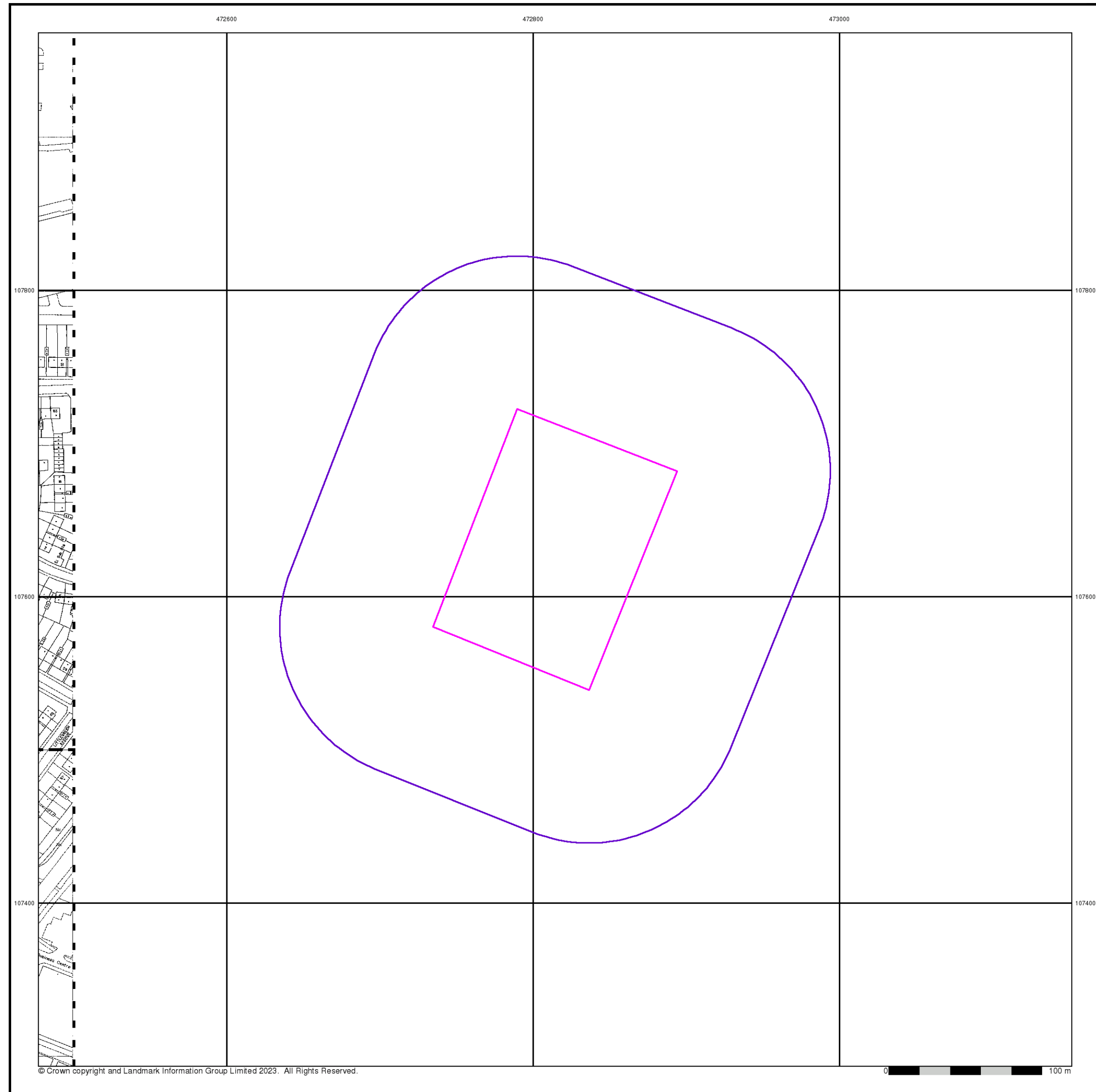
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Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
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Site Details

Downley Road, HAVANT, PO9 2JD

Landmark
INFORMATION GROUP

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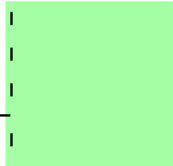
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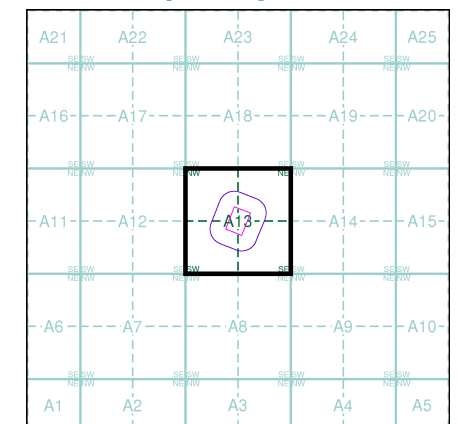
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SU7207NW	
1995	
1:1,250	
SU7207SW	
1995	
1:1,250	

Historical Map - Segment A13



Order Details

Order Number: 317423603_1_1
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Slice: A
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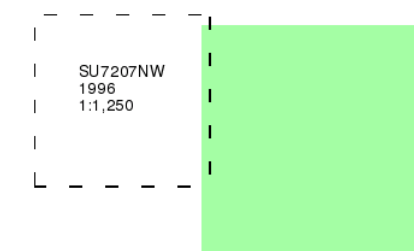
Large-Scale National Grid Data

Published 1996

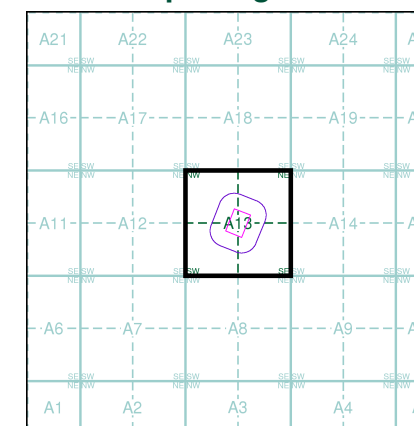
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

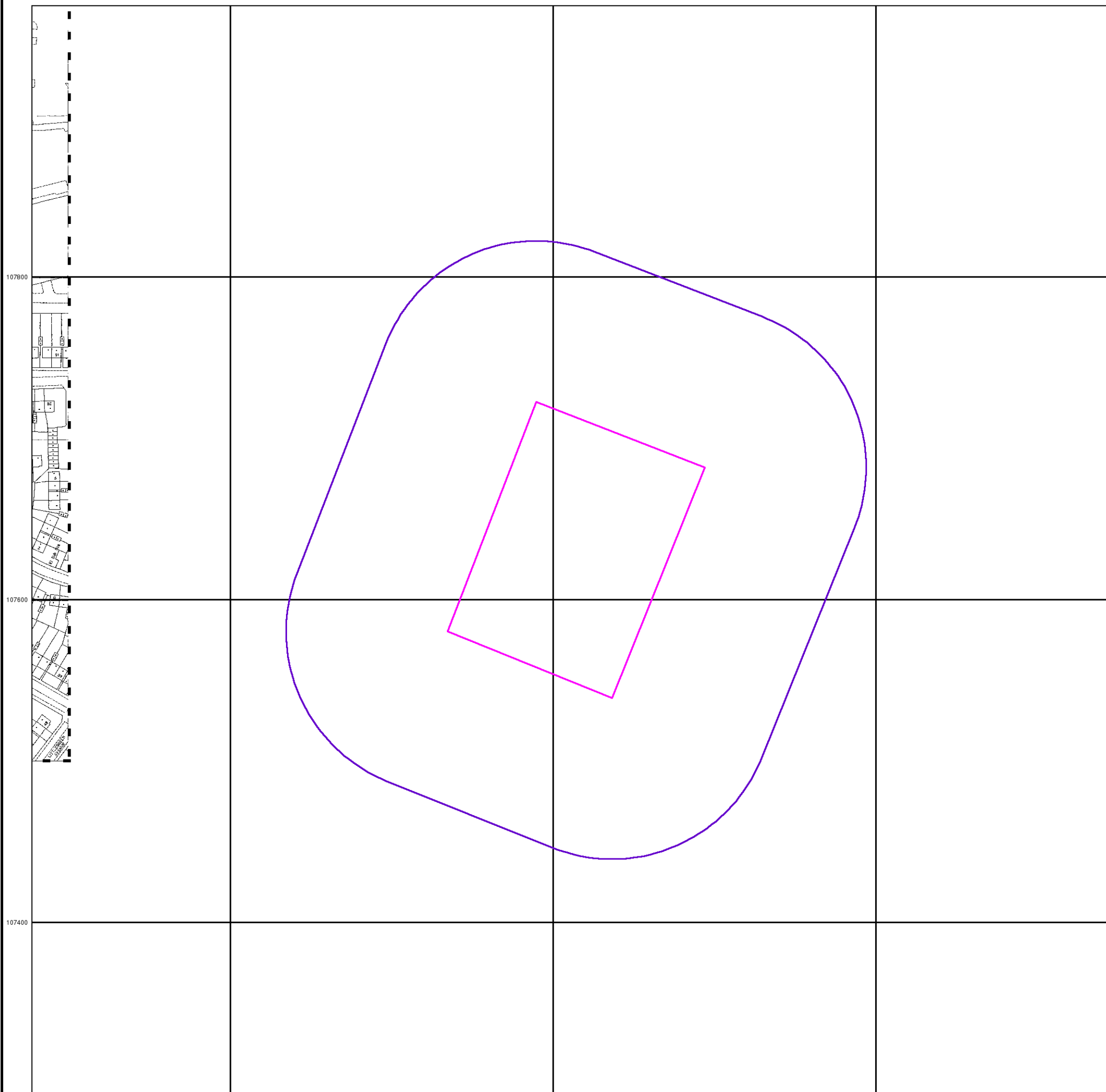
Order Number: 317423603_1_1
Customer Ref: 562241
National Grid Reference: 472810, 107630
Slice: A
Site Area (Ha): 1.71
Search Buffer (m): 100

Site Details

Downley Road, HAVANT, PO9 2JD

Landmark
INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Annex C: Site Photographs

Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
1	09/10/23 -		
Description Ground floor of the Site building			

Photo No.	Date	
2	09/10/23 -	
Description		
Ground floor of Site building		

Photograph Log

Client: Royal London Property Fund		Site Location: Downley Road, Havant	Project No.: 562241.0000.0000
Photo No. 3	Date 09/10/23 -		
Description Ground floor of Site building			

Photo No.	Date	
4	09/10/23 -	
Description Ground floor of Site building		

Photograph Log

Client: Royal London Property Fund		Site Location: Downley Road, Havant	Project No.: 562241.0000.0000
Photo No. 5	Date 09/10/23 -		
Description Ground floor of Site building			

Photo No.	Date	
6	09/10/23 -	
Description		
First floor office space		

Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
7	09/10/23 -		
Description			
First floor office space			

Photo No.	Date		
8	09/10/23 -		
Description			
First floor office space			

Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
9	09/10/23 -		
Description Possible asbestos on ground floor			
Photo No.	Date		
10	09/10/23 -		
Description Fire extinguishers			

Photograph Log

Client: Royal London Property Fund		Site Location: Downley Road, Havant	Project No.: 562241.0000.0000
Photo No. 11	Date 09/10/23 -		
Description Propane tanks			

Photo No.	Date	
12	09/10/23 -	
Description		
Propane tanks		

Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
13	09/10/23 -		
Description Propane tanks			

Photo No.	Date	
14	09/10/23 -	
Description Intermediate Bulk Containers		

Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
15	09/10/23 -		
Description Intermediate Bulk Containers			

Photo No.	Date		
16	09/10/23 -		
Description Drums			

Photograph Log

Client: Royal London Property Fund		Site Location: Downley Road, Havant	Project No.: 562241.0000.0000
Photo No. 17	Date 09/10/23 -		
Description Drum			



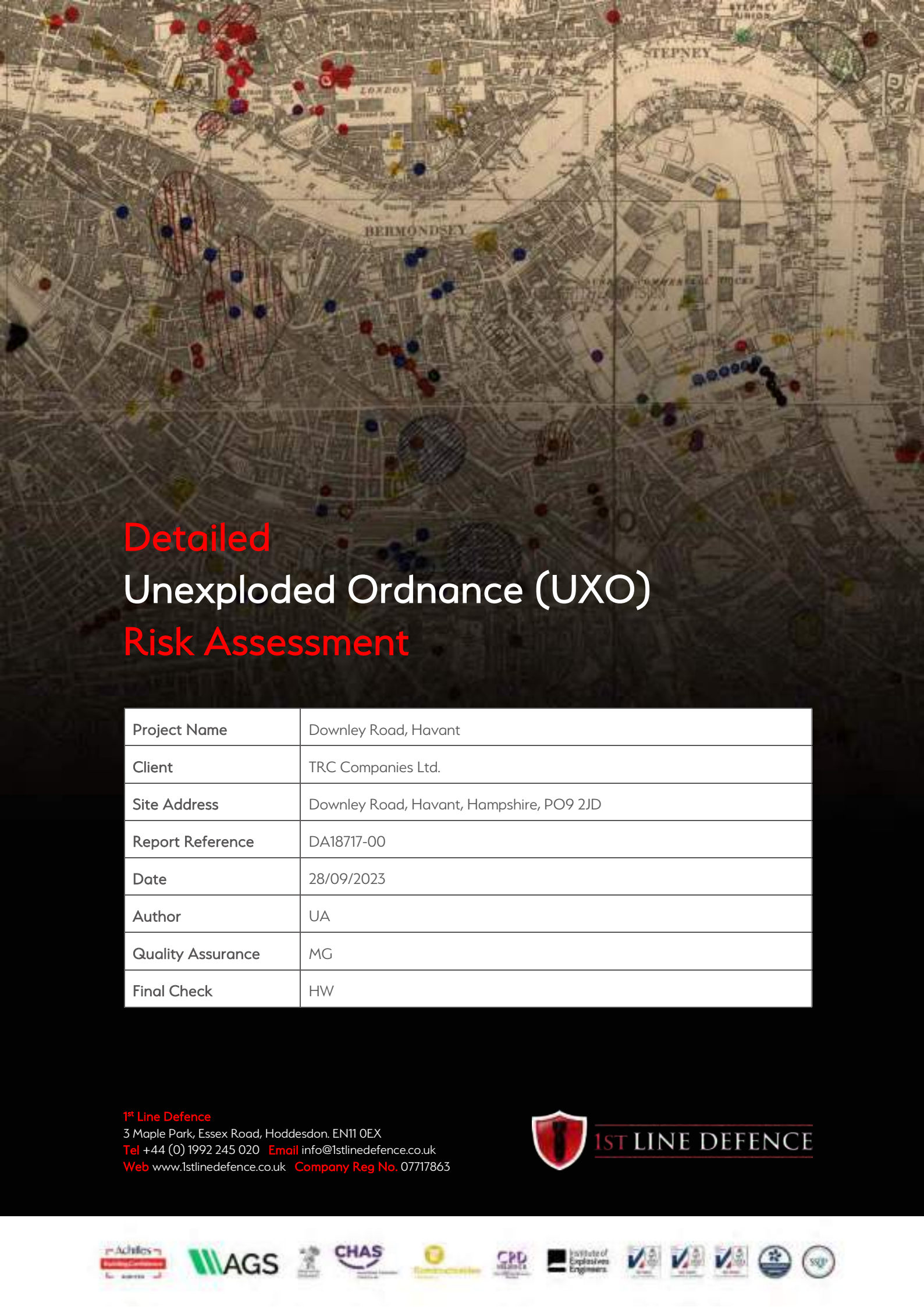
Photo No.	Date	
18	09/10/23 -	
Description		
Tank yard		



Photograph Log

Client:		Site Location:	Project No.:
Royal London Property Fund		Downley Road, Havant	562241.0000.0000
Photo No.	Date		
19	09/10/23 -		
Description Electricity Substation			

Annex D: Detailed UXO Risk Assessment



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Downley Road, Havant
Client	TRC Companies Ltd.
Site Address	Downley Road, Havant, Hampshire, PO9 2JD
Report Reference	DA18717-00
Date	28/09/2023
Author	UA
Quality Assurance	MG
Final Check	HW

1st Line Defence

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1ST LINE DEFENCE



Executive Summary

Site Location and Description

The site is located within Havant, Hampshire. Recent aerial imagery indicates that the site is currently occupied by a large commercial property and its associated carpark, along with hardstanding ground, grassland, and trees.

To the north, the site is bound by a carpark and commercial structures, to the east by a narrow row of trees adjacent to a rail line, to the south by commercial properties and hardstanding ground and to the west by Downley Road.

The site is approximately centred on the OS grid reference: **SU 72822 07623**.

Proposed Works

The exact extent of works proposed at this stage was not available at the time of writing but is understood to comprise site investigation works, including cable percussive drilling and window sampling.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation - Clay, silt and sand. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period.

Superficial deposits on the majority of the site are recorded as River Terrace Deposits - Sand, silt and clay. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period. The superficial deposits on a small section of the western section are recorded as Head - Clay and gravel. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period.

Site-specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is an overall **Low Risk** from both German air-delivered UXO and Allied UXO at the site of proposed works. This assessment is based on the following factors:

The Risk from German Air-Delivered UXO

- During WWII, the site was situated within the Urban District of Havant and Waterloo. According to official Home Office bombing statistics, Havant and Waterloo was subject to an overall low-moderate density of bombing, with an average of 35 bombs recorded per 1,000 acres. The majority of bombing in the region can likely be attributed to the proximity of Havant to Portsmouth, which Luftwaffe target photography confirms was a strategic target for bombing.
- Written records record no bombing directly on the site area, despite recording a number of bombing incidents in the site's wider surroundings. The closest recorded incident was a H.E bomb strike on Helmsley House, approximately 365m north-east of the site on 18th April 1941.
- Given the lack of on-site bombing recorded, it is considered unlikely that the site would have sustained any bomb damage. This is supported by post-war aerial photography which does not show any signs of bomb damage, such as cratering or scattered earth.
- Wartime OS mapping indicates that the site was occupied by undeveloped agricultural land. Generally, this type of ground condition could be unfavourable to the detection of UXO. However, as the site was located adjacent to a railway track, it is anticipated that it may have been subject to at least some degree of access.
- In summary, no HE bombing was recorded within the site boundary or its immediate vicinity across the available written sources. The closest incident found was recorded to have been approximately 365m north-east of the site on Helmsley House, West Leigh Road. While it cannot be completely discounted that an item of ordnance could have fallen on site unnoticed, due to its open composition and the presence of bombing incidents in the wider vicinity, this probability is not considered to be above the 'background' level of risk for the region. As a result of the aforementioned factors, proactive risk mitigation

measures are not considered a necessity on this occasion and the site has accordingly been assessed as being at a **Low Risk** of UXO contamination.

The Risk from Allied UXO

- West Leigh Royal Navy Camp, a satellite of HMS Vernon, was located 500m to the north-west of the site area. Whilst a military camp, the site was accommodation for navy personnel, and was comprised of nissen huts, hardstanding access ways and a parade ground. The Admiralty Mine Research establishment was also located in the vicinity at West Leigh House. Whilst the exact nature of operations cannot be confirmed, this installation was not typical of those handling ordnance, being comprised of nissen huts and temporary structures,. Accordingly, the presence of both of these camps within the vicinity of the site area is not considered to increase the risk of contamination from UXO on-site.
- Both Air Ministry and Hampshire Air Raid Diary reports highlight that a Martin Maryland Mk.I crash landed in the vicinity of Leigh Park whilst on a delivery run from Hayling Island. Whilst the exact location of this crash could not be confirmed, the Leigh Park area is approximately 1km to the north-west of the site boundary. Whilst this aircraft had the capacity to carry a large quantity of HE bombs, it is considered unlikely that these were carried on a delivery run. Given the distance between this crash site and the site area this incident is not considered to raise the risk of Allied UXO contamination on-site.
- Overall, there is no evidence that the site itself had any former military occupation or usage that could have led to contamination with items of Allied ordnance. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are analogous to those regarding aerial delivered ordnance.

Post-WWII Redevelopment

- A comparison between wartime OS mapping and recent aerial imagery indicates that a large commercial structure and associated features, including car parking has been developed on site in the post-war era.
- The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Downley Road, Havant site:

Activity	Recommended Risk Mitigation Measure
All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded

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1st Line Defence Limited®

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Downley Road, Havant

Client: TRC Companies Ltd.

1. Introduction

1.1 Background

1st Line Defence has been commissioned by TRC Companies Ltd to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at the Downley Road, Havant site.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1 Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the Downley Road, Havant site. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2 Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3 Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and Hampshire Archives.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by TRC Companies Ltd.
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

3. Background to Bombing Records

3.1 General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2 German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'

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

3.3 Allied Records

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

4. UK Regulatory Environment and Guidelines

4.1 General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2 CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

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

4.3 The 1974 Health and Safety at Work etc. Act

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

4.4 CIRIA C681

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

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII air bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5 Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1 Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2 The Authorities

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

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

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

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

6. The Site

6.1 Site Location

The site is located within Havant, Hampshire.

To the north, the site is bound by a carpark and commercial structures, to the east by a narrow row of trees adjacent to a rail line, to the south by commercial properties and hardstanding ground and to the west by Downley Road.

The site is approximately centred on the OS grid reference: **SU 72822 07623**.

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

6.2 Site Description

Recent aerial imagery indicates that the site is currently occupied by a large commercial property and its associated carpark, along with hardstanding ground, grassland, and trees.

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

7. Scope of the Proposed Works

7.1 General

The exact extent of works proposed at this stage was not available at the time of writing but is understood to comprise site investigation works, including cable percussive drilling and window sampling.

8. Ground Conditions

8.1 General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation - Clay, silt and sand. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period.

Superficial deposits on the majority of the site are recorded as River Terrace Deposits - Sand, silt and clay. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period. The superficial deposits on a small section of the western section are recorded as Head - Clay and gravel. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period.

8.2 Site-Specific Geology

Site-specific geotechnical data was not provided by the client during the production of this report.

9. Site History

9.1 Introduction

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

9.2 Ordnance Survey Historical Maps

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

Pre-WWII		
Date	Scale	Description
1932	1:2,500	Pre-war OS mapping dated 1932 indicates that the site was occupied by undeveloped land. To the north, south, and west, the site was bound by further undeveloped land and to the east by the <i>Southern Railway</i> line.

Post-WWII		
Date	Scale	Description
1953-72	1:2,500	Post-war OS mapping dated 1953-72 indicates no changes on site as it continues to be occupied and surrounded by undeveloped land, with a railway track to the east.
1960-70	1:2,500	Post-war OS mapping dated 1960-70 indicates that the site was now occupied by a <i>Factory</i> , as well as undeveloped land. To the north, the site continues to be bound by undeveloped land, and to the east by a railway track. To the south, the site was bound by undeveloped land and a <i>Factory</i> , and to the west by a circular industrial feature (likely a gas holder) and <i>Downley Road</i> .

10. Introduction to German Air Delivered Ordnance

10.1 General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German air delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2 Generic Types of WWII German Air Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German air delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Appendices i-iii**.

Generic Types of WWII German Air Delivered Ordnance		
Type	Frequency	Likelihood of Detection
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex E). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

10.3 Failure Rate of German Air Delivered Ordnance

It has been estimated that 10% of WWII German air delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex F**.

10.4 UXB Ground Penetration

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

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1 The J-Curve Principle

J-curve is the term used to describe the characteristic curve commonly followed by an air delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex E**).

10.4.2 WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

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

10.4.3 Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters should be used:

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

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

10.5 V-Weapons

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

Although these weapons caused considerable damage their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today since even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and the risk dealt with at the time. Therefore, any V-weapons that are referenced within this report are referenced not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

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

11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex G**. This source does not record any WWII bombing incidents to have affected Havant.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the Urban District of Havant and Waterloo

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the Urban District of Havant and Waterloo, which sustained a low-medium density of bombing. Bombing in the region can be attributed in part to the proximity of Havant to Portsmouth, which became a strategic target for the Luftwaffe, due its position as the foremost port of the Royal Navy. Portsmouth was not only the home of many of the battleships of the Royal Navy, such as HMS Iron Duke and the destroyer flotilla, but also was headquarters for several major military operations throughout the war such as Operation Dynamo, the evacuation of Dunkirk and Operation Overlord, the Normandy invasion.

Portsmouth endured a particularly heavy bombing campaign, with especially heavy raids taking place on 10th January, 10th March and 27th April 1941. Accordingly, Portsmouth Airport, approximately 8km to the south-west of the site, is highlighted on Luftwaffe reconnaissance photography (see **Annex H**) which confirms its status as a target. Wider surrounding areas would often be affected by the presence of such targets, largely due to the inaccuracy of aerial bombing on adjacent areas to avoid having to return to base with ordnance still on board – known as 'tip and run' raids. Much of the bombing on the region can be attributed to these potential targets and any bombing inflicted upon the civilian population.

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

Records of bombing incidents are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German air delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Urban District of Havant and Waterloo between 1940 and 1945.

Record of German Ordnance Dropped on the Urban District of Havant and Waterloo		
Area Acreage		12,074
Weapons	High Explosive bombs (all types)	375
	Parachute mines	39
	Oil bombs	9
	Phosphorus bombs	4
	Fire pots	0
	Pilotless aircraft (V-1)	1
	Long range rocket bombs (V-2)	0
Total		428
Number of Items per 1,000 acres		35.4
Source: Home Office Statistics		
This table does not include UXO found during or after WWII.		

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

11.4. Havant and Waterloo District Air Raids 1939-1944

A diary of Air Raid incidents compiled by Havant authorities during WWII were consulted at Hampshire Record Office, Winchester. These reports recorded information such as the date, time, type and damage caused by major bomb incidents in Havant. Recorded incidents in proximity to the site have been transcribed in the table below and are presented in **Annex 11-14**.

Havant and Waterloo District Air Raids 1939-1944	
Date	Comments
5 th October 1940	U.X.B Eastleigh Road Havant <i>Eastleigh Road is situated approximately 760m east of the site.</i>
8 th October 1940	No UXBs reported & 1 bomb Eastleigh Road to be dealt with <i>Eastleigh Road is situated approximately 760m east of the site.</i>
8 th October 1940	H.E bombs 4 th Avenue Denvilles <i>4th Avenue is situated approximately 570m south-east of the site.</i>
9 th October 1940	Removal of U.X.B 4 th Avenue Denville <i>4th Avenue is situated approximately 570m south-east of the site.</i>



9 th October 1940	HE's & UXB 4 th Avenue Denvilles & H.E Meadow Lands <i>4th Avenue is situated approximately 570m south-east of the site.</i>
9 th October 1940	Removal of UXB. 4 th Avenue & 1 Bomb Eastleigh Road. <i>4th Avenue is situated approximately 570m south-east of the site.</i>
9 th October 1940	Situation report of 4 th Avenue Denvilles <i>4th Avenue is situated approximately 570m south-east of the site.</i>
9 th October 1940	U.X.B. 4 th Avenue Denvilles – Area closed & evacuated H.E N.E Denville House <i>4th Avenue is situated approximately 570m south-east of the site.</i>
21 st November 1940	UXB A.A. Shell 4 th Avenue Denvilles. <i>4th Avenue is situated approximately 570m south-east of the site.</i>
18 th March 1941	UXB South Leigh & East Leigh Road Havant <i>This incident occurred approximately 550m south-east of the site.</i>
19 th March 1941	UXB Southleigh Road Havanet <i>Southleigh Road was situated approximately 550m south-east of the site.</i>
19 th March 1941	Re to UXB Eastleigh & Southleigh Road Havant <i>This incident occurred approximately 550m south-east of the site.</i>
25 th March 1941	UXB South Leigh Road Havant Removed <i>Southleigh Road was situated approximately 550m south-east of the site.</i>
19 th March 1941	At 0320 fifteen U.X.B's were dropped near the junction of South Leigh Road and East Leigh Road, Havant one of them cracking a gas main another damaging the roof of a car shed. <i>This incident occurred approximately 550m south-east of the site.</i>
21 st August 1942	2 H.E Southleigh Farm, South Leigh Road, Block by debris. <i>This incident occurred approximately 890m south-east of the site.</i>
18 th April 1941	At 00.15 on 18.4.41 H.E Bomb on Helmsley House, West Leigh Road, Havant. Square N. 7. Cottage demolished and Helmsley House badly damaged. 1 male dead. 1 child missing. 2 women and 3 children slightly injured. <i>This incident occurred approximately 365m north-east of the site.</i>

11.5. Havant ARP Incident Records

Bomb incident records were also obtained from the Hampshire Record Office. This record was compiled by local Air Raid Precaution (ARP) personnel and volunteers during the war. Whilst no record could be found that directly refers to the site area, incidents in the wider vicinity are highlighted below.

Havant ARP Incident Records	
Date	Comments
19th February 1941	At 12.35 on the 18th an enemy bomber flew over Havant at a low altitude and was engaged by the ground posts with machine guns, some of the spent bullets falling in the streets.
19th March 1941	At 03.20 fifteen U.X.B's were dropped near the junction of South Leigh Road and East Leigh Road, Havant, one of them cracking a gas main another damaging the roof of a cart shed.

11.6. Air Raid Damage Files

Air Raid Damage Files for Hampshire were obtained from the National Archives. These files recorded information such as the date, size of crater, size of bomb, location and extent of damage concerning bomb incidents.

This record set was checked and no references to the site were found within it.

11.7. WWII-Era Aerial Photography

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

WWII-Era Aerial Photography	
Date/Title	Description
19 th April 1946	Post-war aerial photography dated 1946 indicates that the site was occupied and surrounded by open agricultural ground, with a railway track to the east. This photograph does not show any visible signs of bomb damage, such as cratering or scattered earth, on site or in its immediate vicinity, although a potential bomb crater has been highlighted to the north-east (see Annex J2). Likewise, the railway track to the east does not appear to have sustained any damage either.

11.8 Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

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

11.9 Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) no longer processes commercial requests for information. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, TRC Companies Ltd will be advised.

11.10. Evaluation of German Air Delivered UXO Records

German Air Delivered UXO Records Summary	
Factors	Conclusion
Density of Bombing <i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.</i>	During WWII, the site was situated within the Urban District of Havant and Waterloo. According to official Home Office bombing statistics, Havant and Waterloo was subject to an overall low-moderate density of bombing, with an average of 35 bombs recorded per 1,000 acres. Available records indicate numerous bomb incidents to have affected the general area of Havant, which can likely be attributed to the proximity of Havant to Portsmouth, which Luftwaffe target photography confirms was a strategic target for bombing. Available written records record no bombing directly on the site area. The closest recorded incident was a H.E bomb strike on Helmsley House, approximately 365m north-east of the site on 18th April 1941.
Damage <i>If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.</i>	Given the lack of on-site bombing, it is unlikely that the site would have sustained any bomb damage. This is confirmed by post-war aerial photography which does not show any signs of bomb damage, such as cratering or scattered earth on-site.
Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	Wartime OS mapping indicates that the site was occupied by undeveloped land. Generally, this type of ground condition could be unfavourable to the detection of UXO as entry holes could have been as small as 20cm in diameter and easily overlooked or covered by disturbed soil.
Access Frequency <i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.</i>	As the site was located adjacent to a railway track, it is anticipated that it may have been subject to at least some degree of access. Frequent access increases the likelihood of any evidence of UXO being spotted, reported, and dealt with.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

12. Introduction to Allied Ordnance

12.1 General

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

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Although not located on site, several military features are noted to have been situated within the wider area, including a camp associated with the Royal Navy Torpedo School, and the Admiralty Mine Research Establishment. Additionally, an RAF aircraft accident is noted to have occurred in the general vicinity of the site.

The site may also have been at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2 Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.3 Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	Description			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LAA Ammunition	Gun type	Calibre	Shell Weight	Shell Dimensions
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	Rockets were commonly designed to destroy heavily armoured military vehicles (anti-tank weapon). The device contains an explosive head (warhead) that can be accelerated using internal propellants to an intended target. Anti-aircraft rocket batteries were also utilised as part of air defence measures.			

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding air delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Air Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Appendix iv**.

12.4 Land Service Ammunition

The term LSA covers items of ordnance that are propelled, placed, or thrown during land warfare. These items may be filled or charged with explosives, smoke, incendiary, or pyrotechnics and can be divided into five main groups:

Land Service Ammunition (LSA)	
Item	Description
Mortar Rounds	A mortar round is normally nosed-fused and fitted with its own propelling charge. Its flight is stabilised by the use of a fin. They are usually tear-drop shaped (though older variants are parallel sided), with a finned 'spigot tube' screwed or welded to the rear end of the body which houses the propellant charge. Mortars are either High Explosive or Carrier (i.e. smoke, incendiary, or pyrotechnic).
Grenades	A grenade is a short range weapon designed to kill or injure people. It can be hand thrown or fired from a rifle or a grenade launcher. Grenades either contain high explosive or smoke producing pyrotechnic compounds. The common variants have a classic 'pineapple' shape.
Projectiles	A projectile (or shell) is propelled by force, normally from a gun, and continues in motion using its kinetic energy. The gun a projectile is fired from usually determines its size. A projectile contains a fuzing mechanism and a filling. Projectiles can be high explosive, carrier or Shot (a solid projectile).
Rockets	Rockets were commonly designed to destroy heavily armoured military vehicles (anti-tank weapon). The device contains an explosive head (warhead) that can be accelerated using internal propellants to an intended target. Anti-aircraft rocket batteries were also utilised as part of air defence measures.
Landmines	A landmine is designed to be laid on or just below the ground to be exploded by the proximity or contact of a person or vehicle. Landmines were often placed in defensive areas of the UK to obstruct potential invading adversaries.

In the UK unexploded or partially exploded mortars and grenades are the most common items of LSA encountered, as they could be transported and utilised anywhere. They are mostly encountered in areas used for military training and are often found discarded on or near historical military bases.

Images of the most commonly found items of LSA are presented in **Appendices v - vii**.

12.5 Small Arms Ammunition

The most common type of ordnance encountered on land used by the military are items of Small Arms Ammunition (SAA). SAA refers to the complete round or cartridge designed to be discharged from varying sized hand-held weapons such as rifles, machine guns and pistols. SAA can include bullets, cartridge cases and primers/caps. Example images of the most SAA are presented in **Appendix viii**.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

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

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

13.2. Leigh Park Aircraft Accident 1940

Reports suggest that an RAF Martin Maryland bomber aircraft crash-landed in the vicinity of Leigh Park, approximately 1.1km north-west of the site. These records were obtained from Hampshire archives, RAF Hendon Archives and hamshireairfields.co.uk respectively. Transcripts of the associated records are presented below.

West Leigh, Havant Aircraft Accident- ARP Incident Report	
Date	Description
24 th December 1940	At 3.30 a British bomber crashed and caught fire near Leigh Park, Havant, the crew being killed.

13.2.1 RAF Hendon Flying Accident Card

The Flying Accident Card for Martin Maryland AR737 was obtained from the RAF Hendon Archives. This card was completed by the Air Ministry and details specifics concerning the aircraft incident. The accident card notes that AR737 which was noted to be conducting a delivery run, "crashed 4 mins after take-off- take off normally. Drifted to 360° and turned too fast to make circuit of aerodrome, lost height after straightening out. Struck ground and exploded. Engines sounded to be turning normally- Officer Commanding. C.J Acely- Typical of many accidents in which pilot has flown downhill into ground"

The Air Ministry Flying accident card for AR737 is presented in **Annex K**.

13.2.2. Martin Maryland Mk.I Specification

Martin Maryland Mk.I Specification	
Type	Two Engine Medium Bomber
Dimensions	Span: 18.7m Length: 14.2m Height: 5.0m Wing area: 49.96m ²
Powerplant	Two Pratt & Whitney R-1830-S1C3-G 'Twin Wasp' radial engines, 1,050hp (783 Kw) each
Performance	Maximum speed: 489 km/h (304 mph) at 3,962m (13,000 ft.) Service Ceiling: 8,991m (29,500 ft.)
Armament	Four 7.7mm (.303 cal) Browning machine-guns in outer wings with 750 rounds per gun, two 7.7mm (.303 cal) Vickers 'K' machine guns with 5x 97 round magazines each and up to 907 kg (2,000 lbs.) of bombs
Weight	Maximum Loaded Weight 6,939 kg (15,297 lbs.)

See **Annex L** for imagery of the armaments of the Martin Maryland Mk.I.

13.2.3. The Clean-Up Operation

The extent of the clean-up operation at the Maryland AR737 aircraft accident site is not known as a record of the salvage operation could not be located during the production of this report. It is not known whether the clean-up was dealt with by the RAF or local authorities. If such an operation was undertaken by untrained personnel it may have been haphazard in nature.

13.2.4. Evaluation of Aircraft Accident Records

Exact conclusions about the fate of AR737 are restricted by the limitations of available historical records. The specification of the aircraft indicates that six .303 cal. machine-guns and up to 907 kg of bombs could have been on board. It does not appear likely that any bombs were actually stored on board in this instance, given the aircraft was in use for a delivery run, although this cannot be explicitly discounted. Flares and a loaded pistol could have been additionally been on board for signalling in the event that radio telecommunications stopped working.

Whilst the exact location is not explicitly stated, the Leigh Park area of the crash is considered to be too far from the site of proposed works to pose any significantly elevated risk of encountering unexploded ordnance related to the incident.

13.3. West Leigh Camp- HMS Vernon

During WWII a camp was constructed at West Leigh to house Royal Navy personnel from the Navy Torpedo School at HMS Vernon, a concrete shore establishment located in Portsmouth Harbour. The camp can be observed in 1946 aerial photography, and appears to be comprised of blocks of nissen huts, associated access ways and a hardstanding parade ground. Whilst the exact nature of operations conducted at the camp are not known, it is not anticipated that the proximity of the camp to the collective site area poses any elevation of risk from encountering UXO, owing to the nature of the camp as accommodation for HMS Vernon.

The camp was situated approximately 500m west from the collective site area, a visual overlay of the camp is presented in **Annex J3**.

13.4. West Leigh House- Admiralty Mine Research Establishment

West Leigh House, situated approximately 550m adjacent to West Leigh Camp, was known to house part of the Admiralty Mine Research Establishment, which was tasked with research into maritime mines and mining operations. The site can be seen in 1946 aerial photography, and appears to be comprised of the house and grounds as well as several temporary huts constructed in the west. The exact nature of operations conducted here during the war could not be identified, however due to both the distance between the house and the site, as well as the proximity to the accommodation at West Leigh Camp, it is anticipated that this establishment does not present any elevation of risk from items of UXO.

A visual overlay of the establishment is presented in **Annex J3**.

13.5 Evaluation of Contamination Risk from Allied UXO

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

Allied UXO Records Summary	
Sources of Allied UXO Contamination	Conclusion
Military Camps <i>Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.</i>	Records indicate that both a Royal Navy Camp and an Admiralty Research Establishment was located within the general area of the site. The Royal Navy camp at West Leigh, was a satellite camp for the Torpedo Training School HMS Vernon located in Portsmouth. It appears that the main purpose of the camp was to house personnel and administration for the School in Portsmouth. This is corroborated by 1946 RAF aerial photography which shows the site to be comprised of blocks of nissen huts, access ways and a hardstanding parade ground. Accordingly the nature of the camp as well as the distance between this installation and the site area does not present any elevated risk of contamination by items of UXO. Whilst it was not possible to confirm the exact nature of operations conducted at the Admiralty Mine Research Establishment during WWII, the composition of the site; nissen huts and temporary structures, as opposed to the concrete magazines and armoured buildings associated with ordnance handling, does not present an indication of the presence of ordnance. Thus, similarly the presence of this feature does not present an elevated risk of UXO contamination.
Military Aircraft Accidents	Havant ARP and Air Ministry Accident records indicate that a military aircraft incident affected an area 1.1km to the north-west of the collective site area It is not thought likely that this crash would have directly increased the risk from Allied Military Ordnance on site, given the distance between the crash and the site footprint.
Anti-Aircraft Defences <i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i>	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 1.4km north of the site. Despite this distance the maximum effective range of an AA projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are generally analogous to those regarding German air delivered ordnance.
Home Guard Activity <i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i>	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.
Defensive Positions <i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i>	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.

Training or firing ranges <i>Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.</i>	No evidence of training or firing ranges could be found within the site or surrounding area.
Defensive Minefields <i>Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.</i>	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture <i>Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.</i>	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields <i>Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.</i>	The site was not situated within the perimeters or vicinity of a military airfield.

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German air delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, Havant and Waterloo Air Raid War Diaries, Air Ministry Aircraft Accident Cards, ARP Incident Reports and 1947 RAF aerial photography. The record set is generally of good quality providing a relatively complete set of records, which whilst not entirely comprehensive, provide a good picture of incidents to have affected Havant.
German Air-Delivered Ordnance	- During WWII, the site was situated within the Urban District of Havant and Waterloo. According to official Home Office bombing statistics, Havant and Waterloo was subject to an overall low-moderate density of bombing, with an average of 35 bombs recorded per 1,000 acres. The majority of bombing in the region can likely be attributed to the proximity of Havant to Portsmouth, which Luftwaffe target photography confirms was a strategic target for bombing. - Written records record no bombing directly on the site area, despite recording a number of bombing incidents in the site's wider surroundings. The closest recorded incident was a H.E bomb strike on Helmsley House, approximately 365m north-east of the site on 18th April 1941. - Given the lack of on-site bombing recorded, it is considered unlikely that the site would have sustained any bomb damage. This is supported by post-war aerial photography which does not show any signs of bomb damage, such as cratering or scattered earth. - Wartime OS mapping indicates that the site was occupied by undeveloped agricultural land. Generally, this type of ground condition could be unfavourable to the detection of UXO. However, as the site was located adjacent to a railway track, it is anticipated that it may have been subject to at least some degree of access. - In summary, no HE bombing was recorded within the site boundary or its immediate vicinity across the available written sources. The closest incident found was recorded to have been approximately 365m north-east of the site on Helmsley House, West Leigh Road. While it cannot be completely discounted that an item of ordnance could have fallen on site unnoticed, due to its open composition and the presence of bombing incidents in the wider vicinity, this probability is not considered to be above the 'background' level of risk for the region. As a result of the aforementioned factors, proactive risk mitigation measures are not considered a necessity on this occasion and the site has accordingly been assessed as being at a Low Risk of UXO contamination.
Allied Ordnance	- West Leigh Royal Navy Camp, a satellite of HMS Vernon, was located 500m to the north-west of the site area. Whilst a military camp, the site was accommodation for navy personnel, and was comprised of nissen huts, hardstanding access ways and a parade ground. The Admiralty Mine Research establishment was also located in the vicinity at West Leigh House. Whilst the exact nature of operations cannot be confirmed, this installation was not typical of those handling ordnance, being comprised of nissen huts and temporary structures. Accordingly, the presence of both of these camps within the vicinity of the site area is not considered to increase the risk of contamination from UXO on-site. - Both Air Ministry and Hampshire Air Raid Diary reports highlight that a Martin Maryland Mk.I crash landed in the vicinity of Leigh Park whilst on a delivery run from Hayling Island. Whilst the exact location of this crash could not be confirmed, the Leigh Park area is approximately 1km to the north-west of the site boundary. Whilst this aircraft had the capacity to carry a large quantity of HE bombs, it is considered unlikely that these were carried on a delivery run. Given the distance between this crash site and the site area this incident is not considered to raise the risk of Allied UXO contamination on-site.

	Overall, there is no evidence that the site itself had any former military occupation or usage that could have led to contamination with items of Allied ordnance. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are analogous to those regarding aerial delivered ordnance.
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15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

A comparison between wartime OS mapping and recent aerial imagery indicates that a large commercial structure and associated features, including car parking has been developed on site in the post-war era.

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

16. The Likelihood of UXO Encounter

16.1 Introduction

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

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

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

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

16.2 Encountering Air Delivered Ordnance

Since an air delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

16.3 Land Service/Small Arms Ammunition Encounter

Items of LSA and SAA are mostly encountered in areas previously used for military training. Such items could have been lost, burnt, buried or discarded during being in use by the military. Due to this, LSA are most likely to be encountered at relatively shallow depths – generally in the top 1m below ground level. Therefore, such items are most likely to be encountered during open excavation works. In some cases, there is the potential that LSA or SAA may be present on the surface of the ground – especially in areas with active military use or were recently in use by the MoD.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Air Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

17.3. Land Service /Small Arms Ammunition Initiation

Items of LSA generally do not become inert or lose their effectiveness with age. Time can cause items to become more sensitive and less stable. This applies equally to items submerged in water or embedded in silts, clays, or similar materials. The greatest risk occurs when an item of ordnance is struck or interfered with. This is likely to occur when mechanical equipment is used or when unqualified personnel pick up munitions.

If left alone, an item of LSA will pose little/no risk of initiation. Therefore, if it is not planned to undertake construction/intrusive works at the site, the risk of initiation of any LSA that may be present would be negligible. Similarly, those accessing a contaminated area would be at minimal risk if they do not interfere with any UXO present on the ground. Clearly for many end uses, however, the presence of UXO anywhere on a site would not be acceptable as it could not be guaranteed that the items will not be handled, struck or otherwise affected, increasing the likelihood of initiation.

Items of SAA are much less likely to detonate than LSA or UXBs, but can be accidentally initiated by striking the casing, coming into contact with fire, or being tampered with/dismantled. It is likely that the detonation of an item of SAA would result in a small explosion, as the pressure would not be contained within a barrel. Detonation would only result in local overpressure and very minor fragmentation from the cartridge case.

18. Consequences of Initiation/Encounter

18.1 Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production.

18.2 Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1 Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2 Assessed Risk Level

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

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

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

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

20. Proposed Risk Mitigation Methodology

20.1 General

The following risk mitigation measures are recommended to support the proposed works at the Downley Road, Havant site:

Recommended Risk Mitigation Measures	
Activity	Recommended Risk Mitigation Measure
All Works	UXO Risk Management Plan It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. Site Specific UXO Awareness Briefings to all personnel conducting intrusive works. As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

28/09/2023

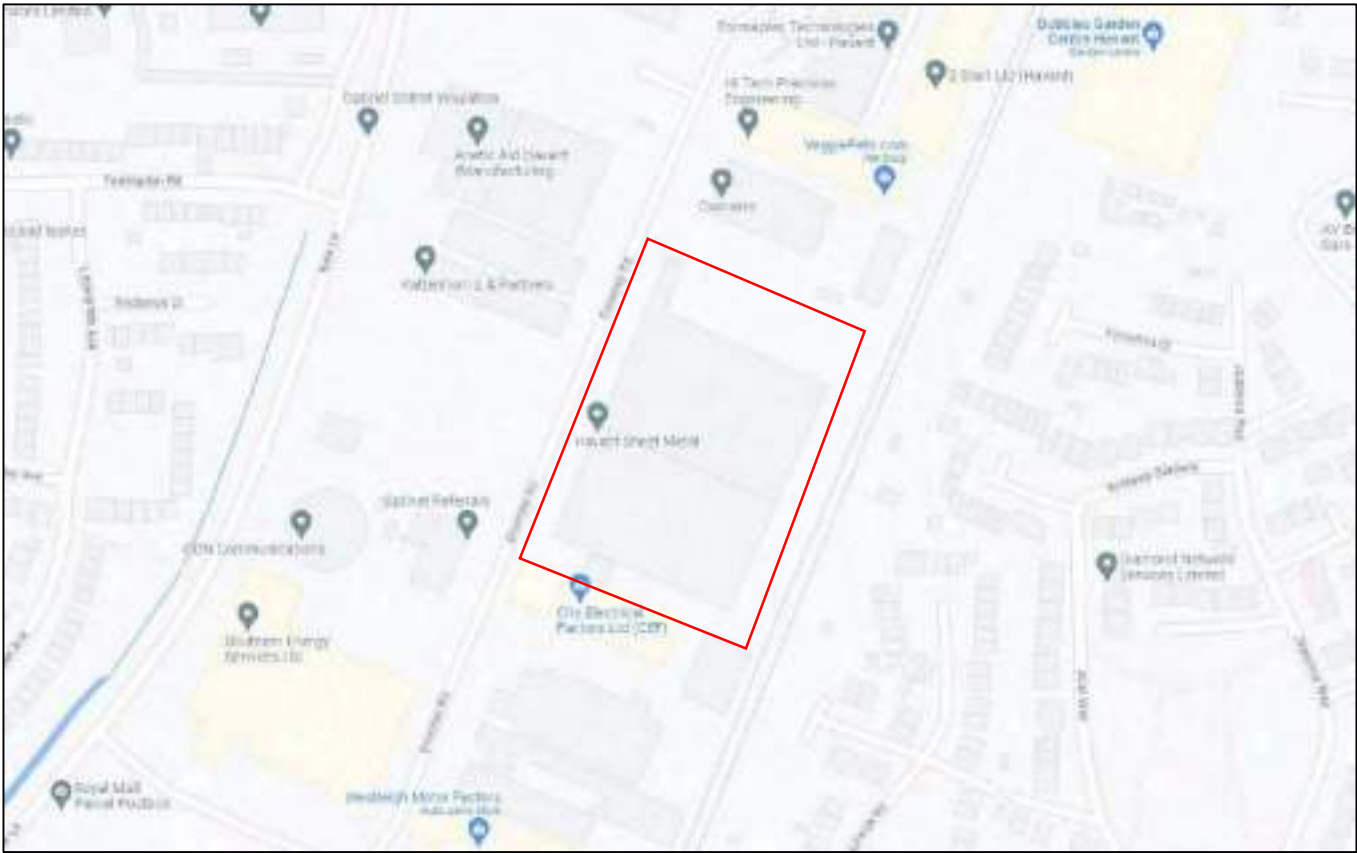
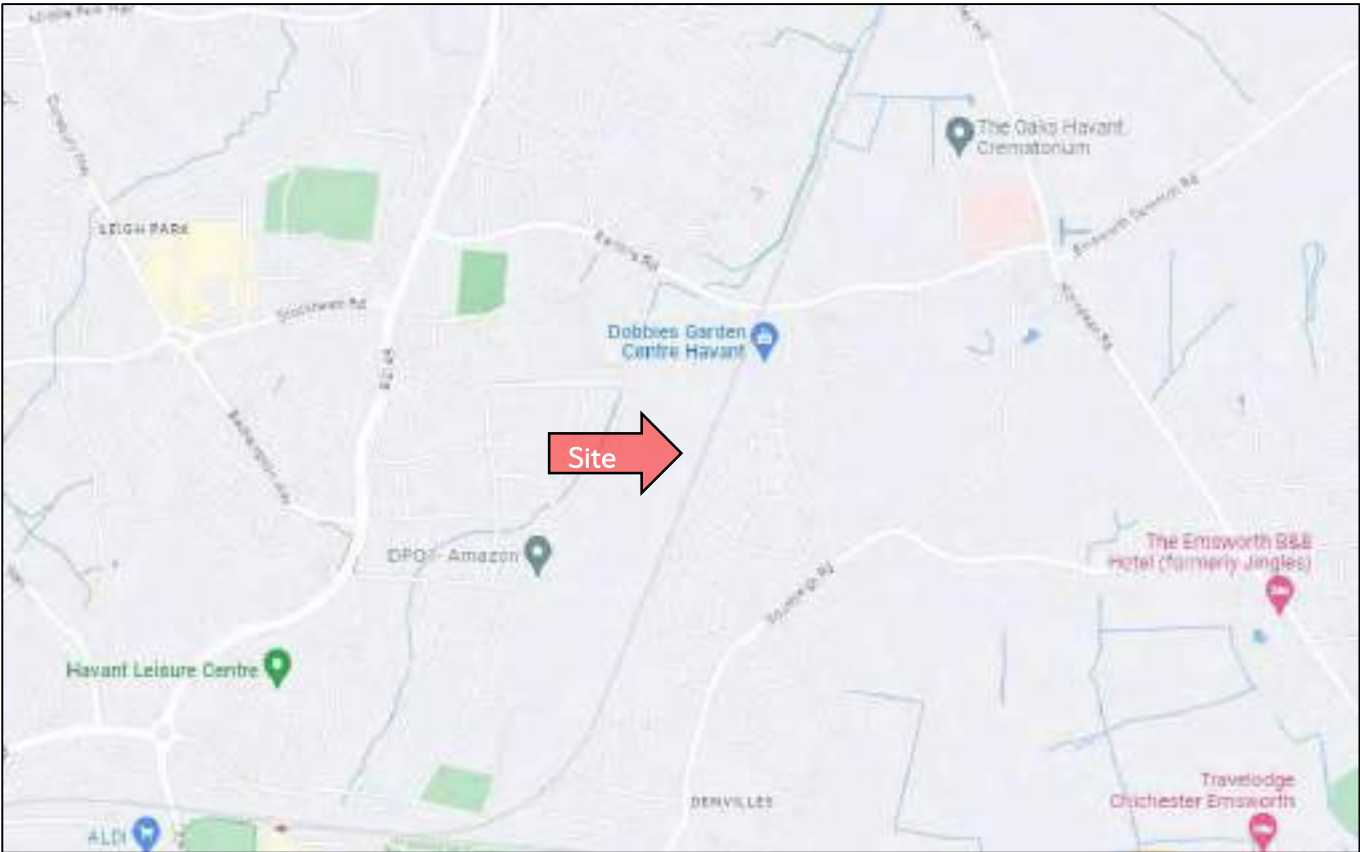
This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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Tel: +44 (0)1992 245 020

Client: TRC Companies Ltd.

Project: Downley Road, Havant

Ref: DA18717-00

Source: Google Maps

— Approximate site boundary





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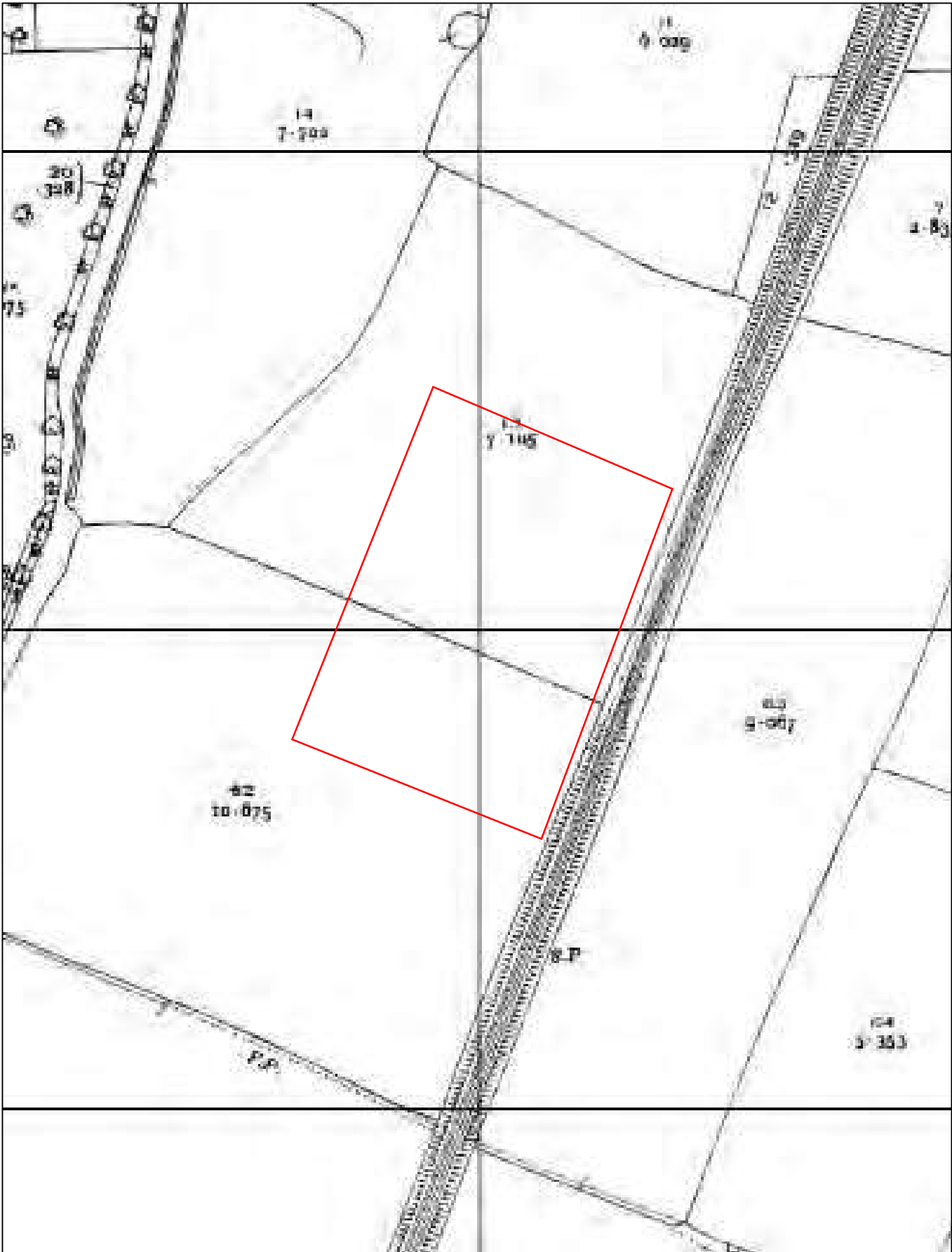
Ref: DA18717-00

Source: Google Earth

— Approximate site boundary







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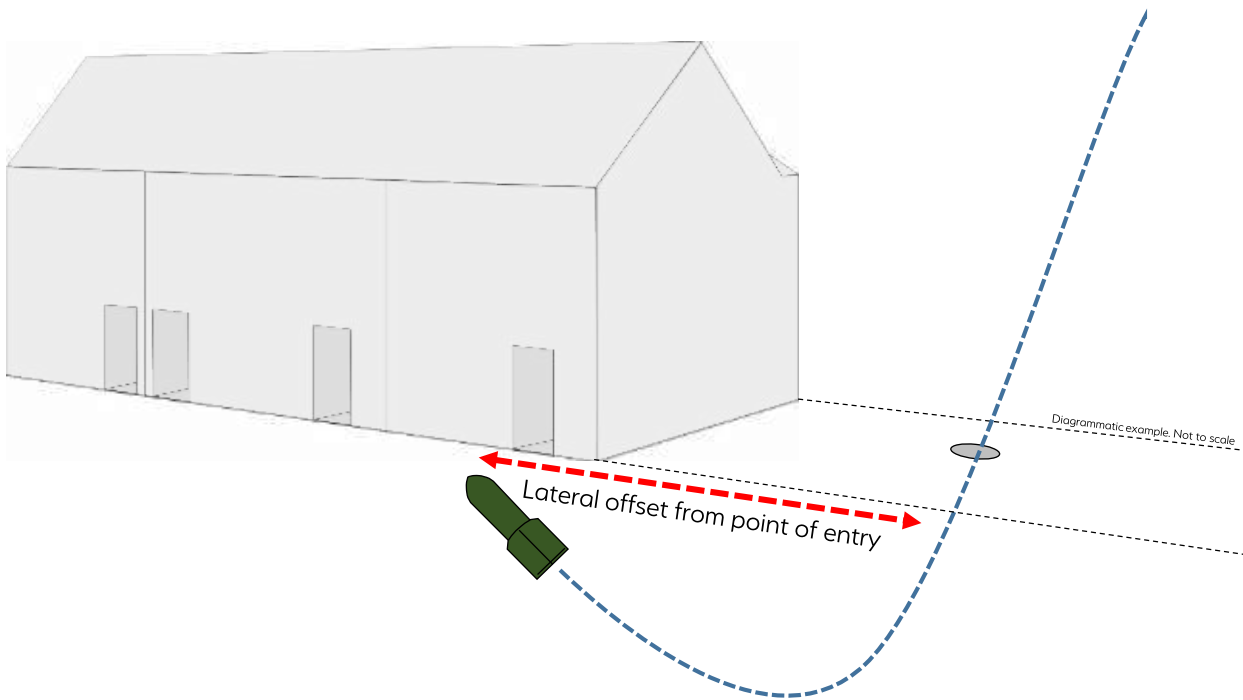
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— Approximate site boundary





Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

The photograph **above** shows a 250kg unexploded bomb found in Bermondsey in 2015, pointing upwards, demonstrating 'J-curve'.



One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

BBC

NEWS

Bermondsey bomb: World War Two device safely removed



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

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

Two primary schools were closed and hundreds of homes were evacuated as a precaution.

A cordon and 655ft (200m) exclusion zone was lifted at about 18:35 GMT as the bomb was removed to a quarry in Kent to be detonated, police said.

The Metropolitan Police force said the device was a SA 250kg WWII German air-dropped bomb, known to the Army's Royal Logistic Corps bomb disposal experts.

250kg German HE Bomb, March 2015

BBC

NEWS

WW2 bomb found near London City Airport blown up



An unexploded World War Two bomb found near London City Airport has been detonated.

The 500kg device was discovered at the King George V Dock on Sunday during planned work at the airport.

It was closed and all flights were cancelled on Monday after an exclusion zone was put in place.

The detonation, which took place off Shoeburyness, Essex, was postponed on Tuesday because of high winds and dangerous conditions for divers.

The 1.5m-long German bomb - which was found in a bed of silt, 35m underwater - was carefully removed from the Thames and placed in a secure location a mile away from the coast of Essex.

500kg German HE Bomb, February 2018

BBC

NEWS



Exeter WW2 bomb is detonated after homes evacuated

More than 2,600 households and 12 university halls of residence were cleared before the 2,200lb (1,000kg) device was destroyed on Saturday.

Police said the blast left a crater about the size of a double-decker bus.

Police have reported large pieces of metal debris hitting buildings and said some properties in the 100m (330ft) exclusion zone had sustained "structural damage".



1000kg German HE bomb, February 2021

BBC

NEWS



Great Yarmouth: Huge blast after unplanned WW2 bomb detonation

A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.

Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT.

People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away.

There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said.

Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe.

250kg German HE Bomb, February 2023



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Source: BBC News

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

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



BASF Provides Some Details

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

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

1st March 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

WWII bomb injures 17 at Hattingen construction site



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

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

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

19th September 2013

BBC NEWS

World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Dana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006



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WW2 bomb found in Portsmouth harbour

🕒 22 February 2017 | 🇬🇧

f 📧 🐦 ✉️ ➦ Share



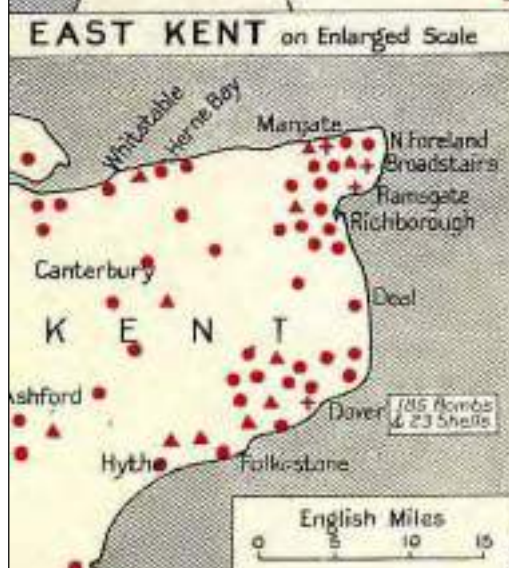
A World War Two bomb containing 290lb (131kg) of "high explosives" has been found in Portsmouth harbour.

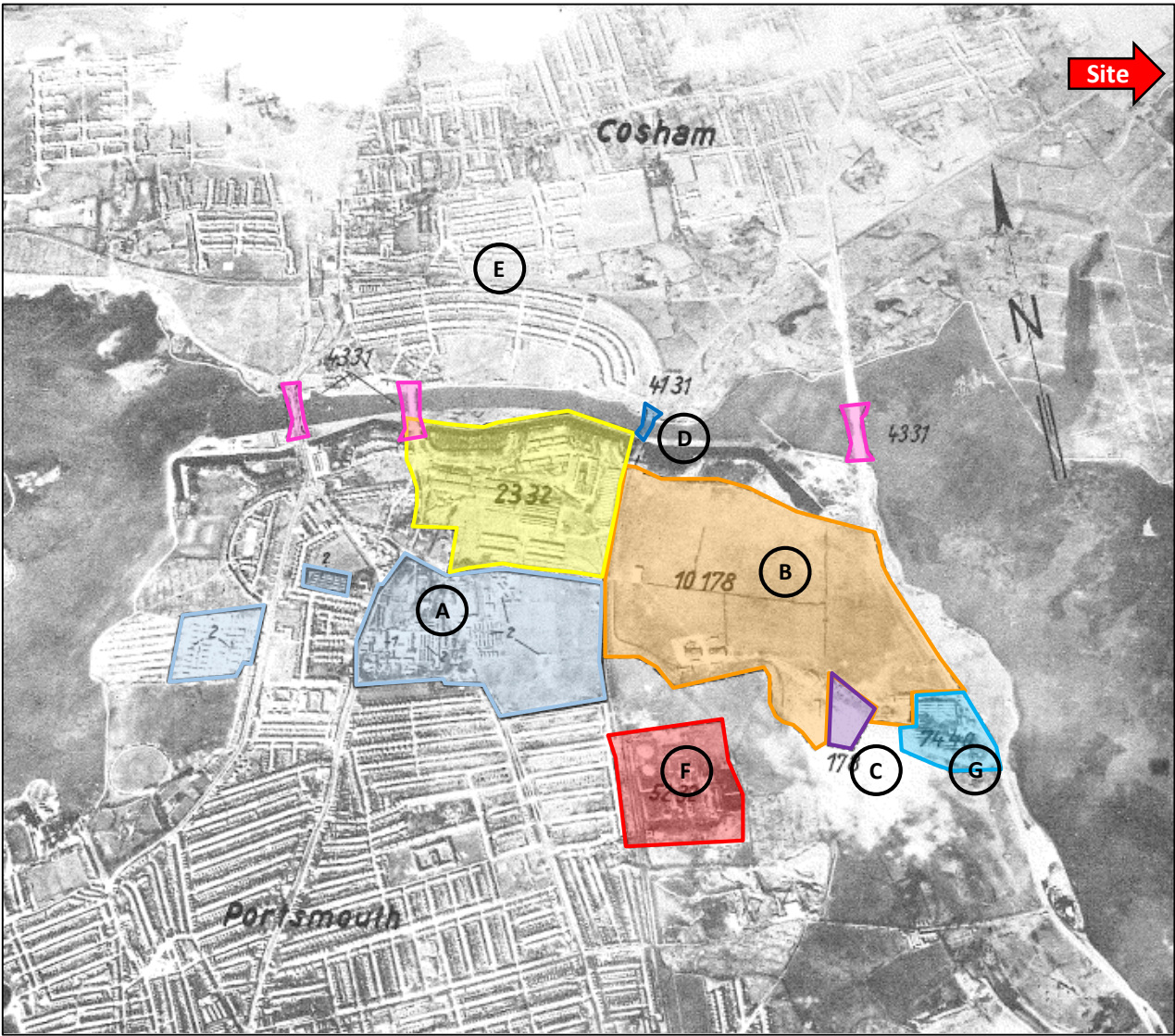
The ordnance was discovered by a dredger in the water at about 03:00 GMT, the Royal Navy said.

Specialist divers at the scene said the bomb posed a "very serious threat". It was towed out to sea and detonated.

All ferries were stopped and trains between Portsmouth and Southsea station and Portsmouth Harbour were suspended, but have since started running again.

There were also extensive road closures in the area, affecting access to Gunwharf Quays.





Hampshire – Portsmouth, Hilsea and Cosham

- A. GB 138 – Barracks building & total flat area
- B. GB 10 178 – Portsmouth airport
- C. GB GB 17 8 – Bearing system
- D. 41 31 – Railway bump
- E. GB 43 31 – 2 Road bridges & 1 Street embankment
- F. GB 52 32 – Hilsea Gasworks
- G. GB 74 40 – Airframe factory

The site located approximately 4.2km north-east of the extremity of the photograph.



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Ref: DA18717-00

Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

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Luftwaffe Photograph, 12th April 1939



Portsmouth
Gosport and Portsmouth
Fortifications

The site located approximately 9.51km north-west of Gosport and Portsmouth.



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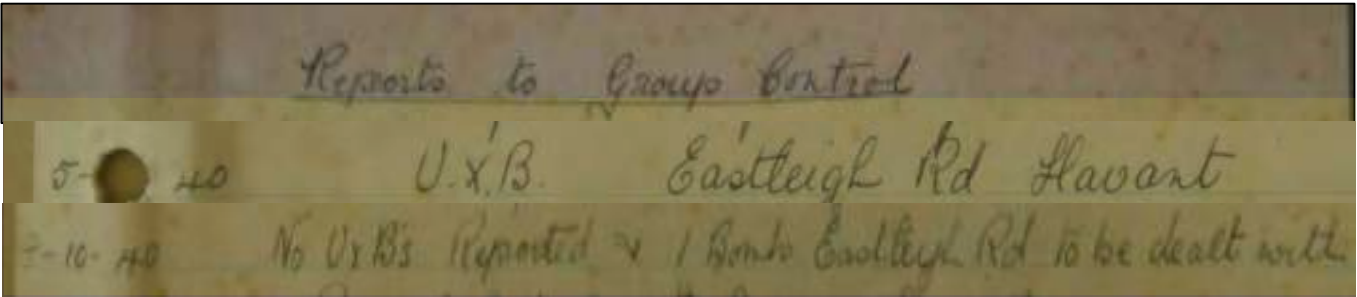
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Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

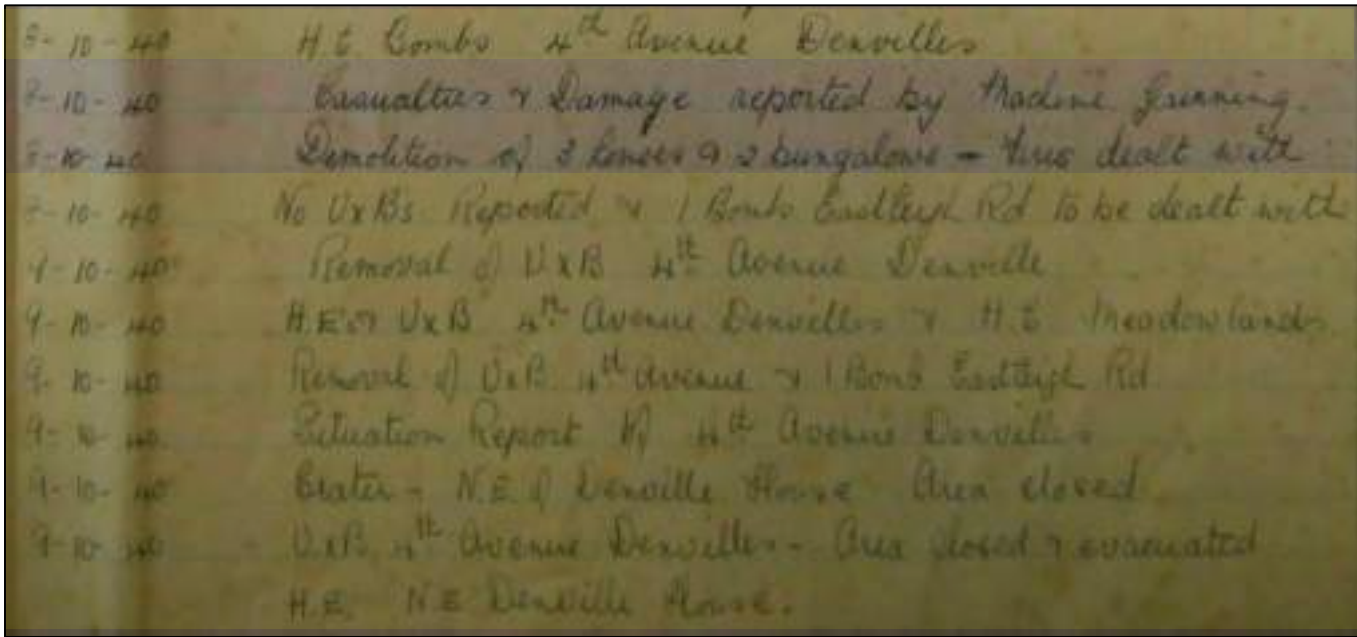
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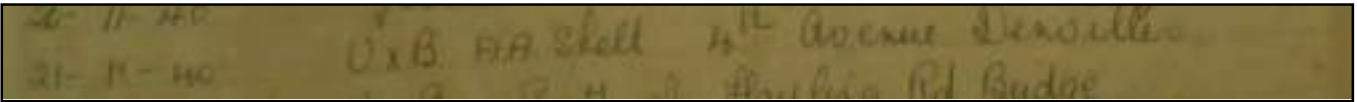




Above:
5-10-40: U.X.B Eastleigh Road Havart
8-10-40: No UXBs reported & 1 bomb Eastleigh Road to be dealt with
Eastleigh Road is situated approximately 760m east of the site.



Above:
8-10-40: H.E Bombs 4th Avenue Denvilles
9-10-40: Removal of U.X.B 4th Avenue Denville
9-10-40: HE's & UXB 4th Avenue Denvilles & H.E Meadow Lands
9-10-40: Removal of UXB. 4th Avenue & 1 Bomb Eastleigh Road.
9-10-40: Situation report of 4th Avenue Denvilles
9-10-40: Crater – N.E. of Denville House. Area closed.
9-10-40: U.X.B. 4th Avenue Denvilles – Area closed & evacuated
H.E. N.E Denville House
4th Avenue is situated approximately 570m south-east of the site.



21-11-40: UXB AA Shell 4th Avenue Denvilles
4th Avenue is situated approximately 570m south-east of the site.



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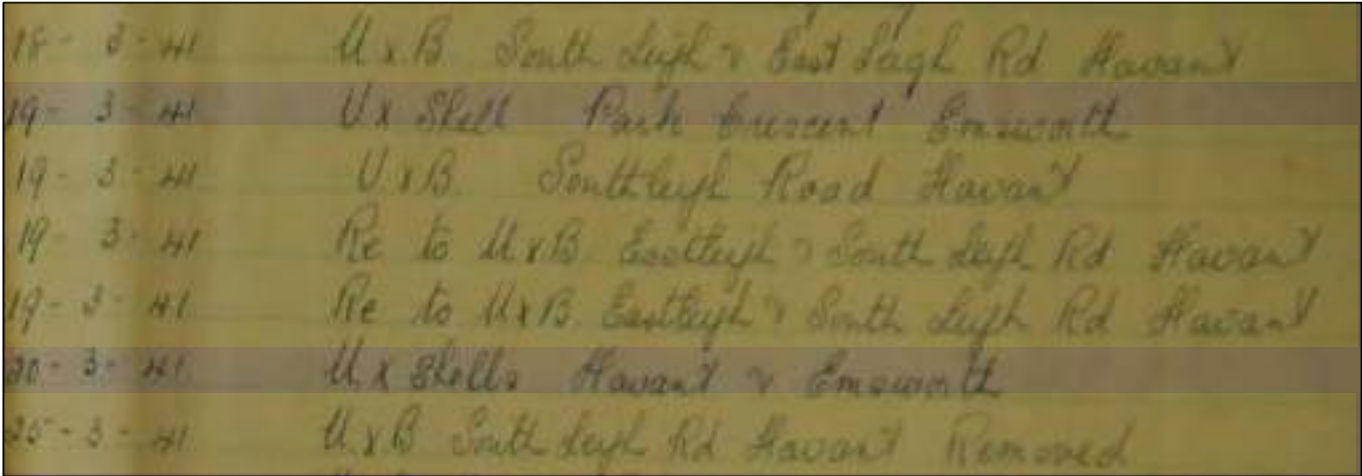
Project: Downley Road, Havant

Ref: DA18717-00

Source: Hampshire Archives

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18-3-41: UXB South Leigh & East Leigh Road Havant

19-3-41: UXB Southleigh Road Havant

19-3-41: Re to UXB Eastleigh & South Leigh Road Havant

25-3-41: UXB South Leigh Road Havant Removed



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19th March, 1941.

At 0100 two H.E. bombs were dropped at Hambrook about two miles east of Emsworth causing damage to one house no casualties. At 0320 fifteen U.X.B's were dropped near the junction of South Leigh Road and East Leigh Road, Havant one of them cracking a gas main another damaging the roof of a cart shed. At 0415 one H.E. was dropped on the Golf Links at Hayling and about the same time a string of H.E and incendiary bombs were dropped in the sea off Eastney and Fort Cumberland.

Approximately 550m south-east of the site.

21st August, 1942. Report No. 255.

Between 2300 and 2330 H.E. Bombs were dropped as follows:-

- 4 H.E. Lower Drayton and near Railway some damage slight casualties
- 4 H.E. Ranelagh Road Havant, some damage 2 slight casualties.
- 2 H.E. Southleigh Farm, South Leigh Road, Block by debris.
- 2 H.E. Near Hayling Railway about 1 mile north of South Hayling Station.
- 3 H.E. Jellicoe Avenue, Alverstoke some damage and casualties one fatal.

Approximately 890m south-east of the site.

ARP/M3

MESSAGE FORM

Date	Time at which receipt or despatch of message was completed	Telephonist's Initials
ADDRESS TO:—		
TEXT OF MESSAGE—		
<u>HAVANT.</u>		
7. At 00.15 on 19. 4. 41 H.E. Bomb on Helmsley House, West Leigh Road, Havant. Square S. 7. Cottage demolished and Helmsley House badly damaged. 1 male dead. 1 child missing, 2 women and 3 children slightly injured.		

Approximately 365m north-east of the site.



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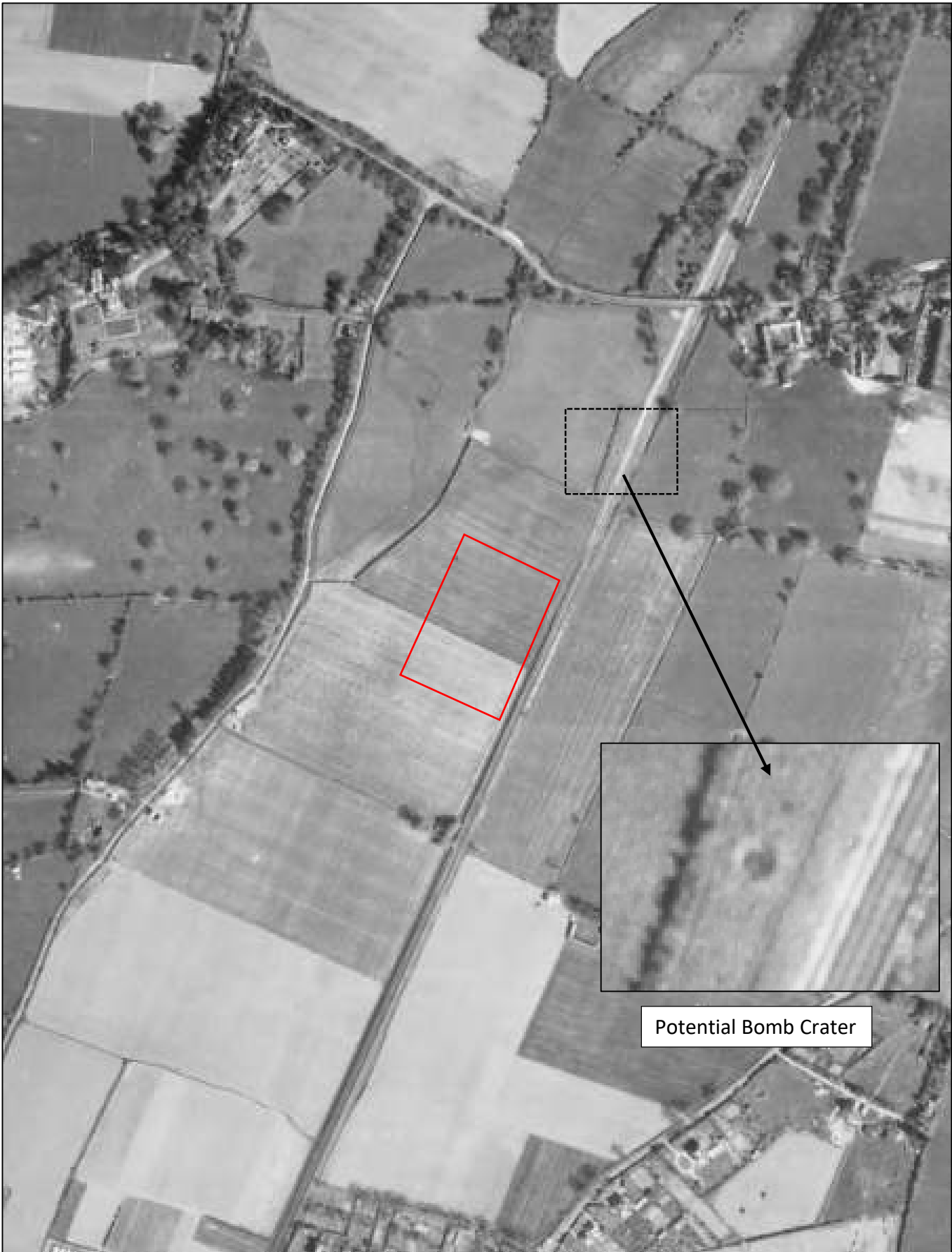
Project: Downley Road, Havant

Ref: DA18717-00

Source: National Monuments Record Office (Historic England)

 **Approximate site boundary**





Potential Bomb Crater



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— Approximate site boundary





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Source: National Monuments Record Office (Historic England)

Approximate site boundary



Category P.A., A.O. or P.B.		No. 597 (H) FATAL				FLYING ACCIDENT CARD		A.M. Form 1180	
Date	D	M	Y	Unit	Group	Command			
28 Jan 40			40	O.A.F. Flight		Munk			
Signal No.	AG 20.2621			A : B : C	0330	Duty	Fire in air or impact		
TSAC No.	121			A	NIGHT		Fitted		
A.I.B. No.	20			K	I	Defensive F.H.		Used	
Coll. No.	A/145588/40			3		Thomson, blind - Munk		Para-chute	
Aircraft	Wasp			SHEWAN MARTIN		AR 137		Flotation Gear	
Place	High Park.			Wasp		215700		Fitted	
Nature of Accident	Crashed 4 mins after T.O. - T.O. usually			215700		W		Worked	
- climbed to 800' and turned to port to make circuit				215700		W		Lives saved	
of dome - lost height after straightening out, struck				215700		W		A/c saved	
gnd. and exploded - engines seemed to be				215700		W		Cause	
running normally (p.c.)				215700		W		F2	
accident in which pilot has fallen downhill into ground				215700		W		(03c)	



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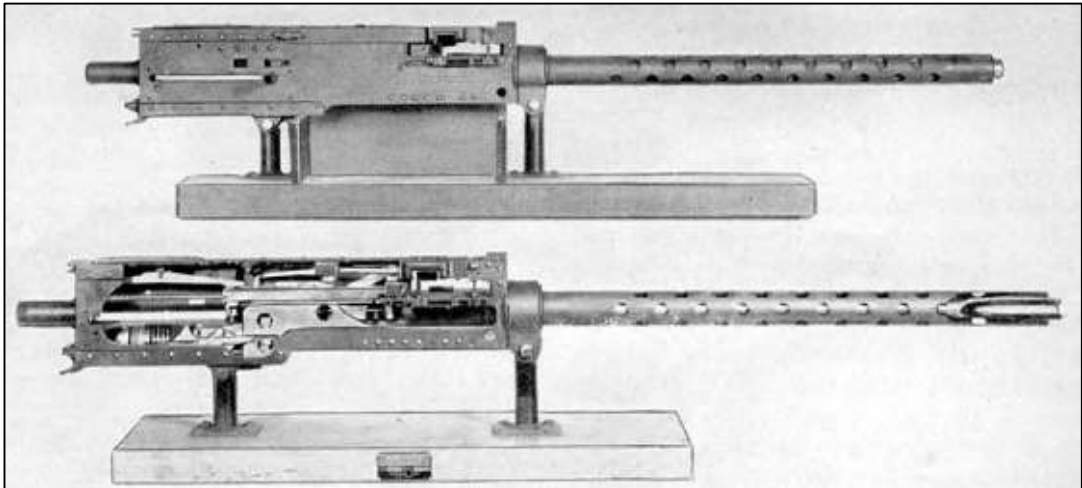
Source: RAF Hendon Archives



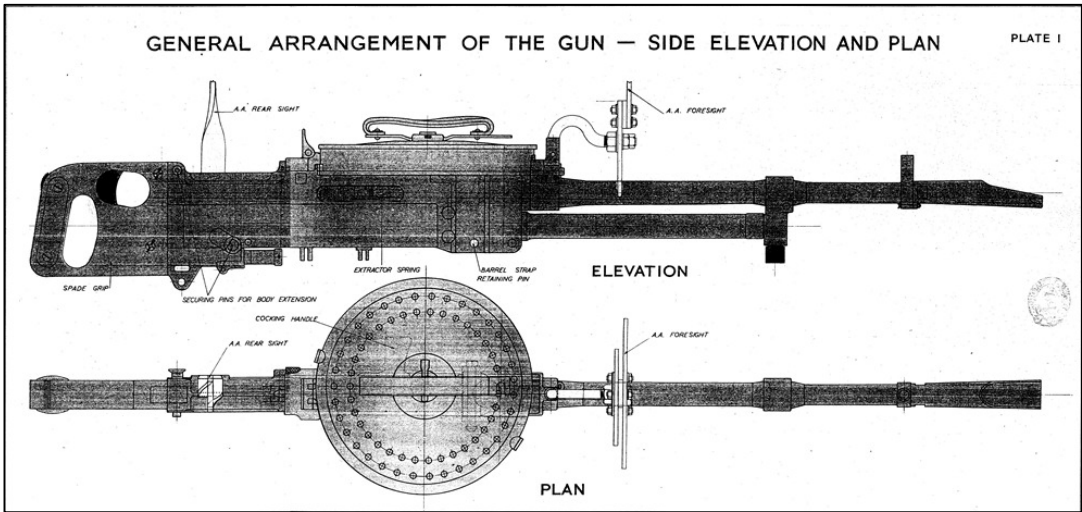
Martin Maryland Mk.I



A Maryland Mk.I in North Africa, the Vickers 'K' dorsal position is clearly visible.



US M1919 Browning machine gun, chambered in .303 for RAF service



Vickers 'K' machine gun, chambered in .303

SC 50kg High Explosive Bomb

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

SC 250kg High Explosive Bomb

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

SC 500kg High Explosive Bomb

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



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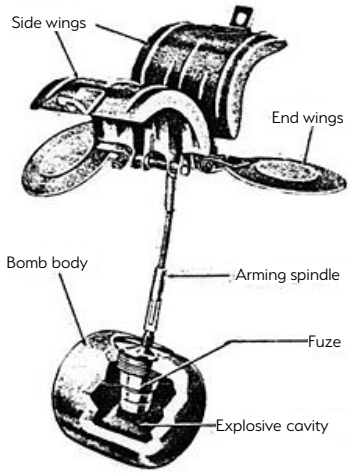
Project: Downley Road, Havant

Ref: DA18717-00

Source: Various sources

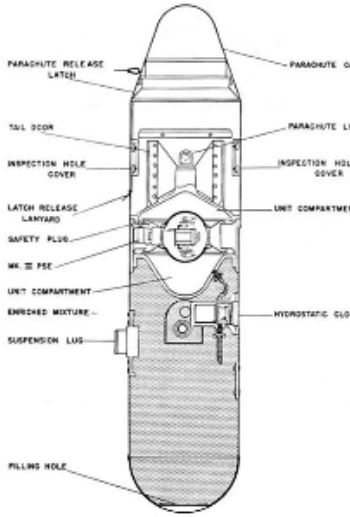
SD2 Anti-Personnel 'Butterfly Bomb'

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



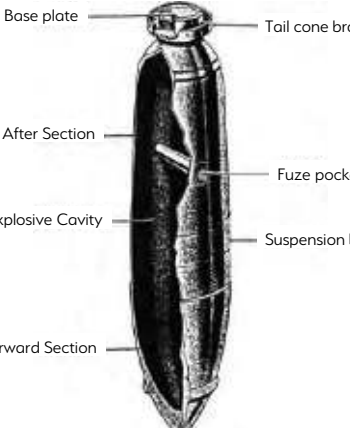
Parachute Mine (Luftmine B / LMB)

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



SC 1000kg High Explosive Bomb

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





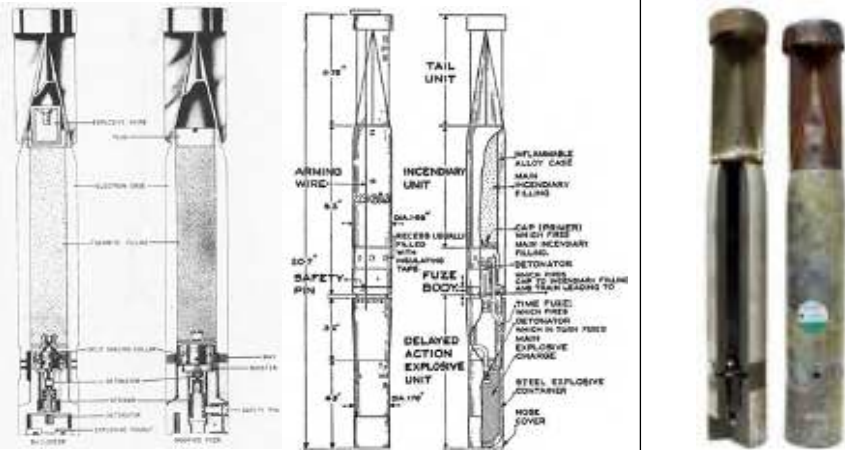
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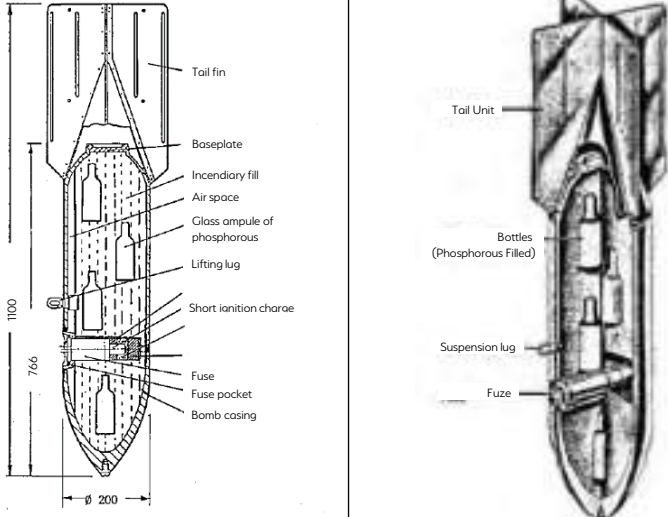
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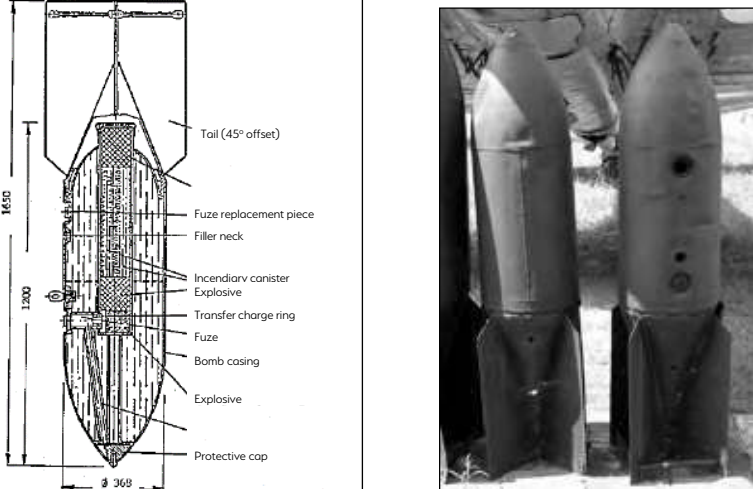
Project: Downley Road, Havant

Ref: DA18717-00

Source: Various sources

1kg Incendiary Bomb		
Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)	
Explosive Weight	Approx. 680g (1.5lb) Thermit 8-15gm Explosive Nitropenta	
Fuze Type	Impact fuze	
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)	
Body Diameter	50mm (1.97in)	
Use	As incendiary – dropped in clusters on towns and industrial complexes.	
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.	

C50 A Incendiary Bomb		
Bomb Weight	Approx. 41kg (90.4lb)	
Explosive Weight	Approx. 0.03kg (0.066lb)	
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%	
Fuze Type	Electrical impact fuze	
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)	
Use	Against any targets where an incendiary effect is required.	
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture.	

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



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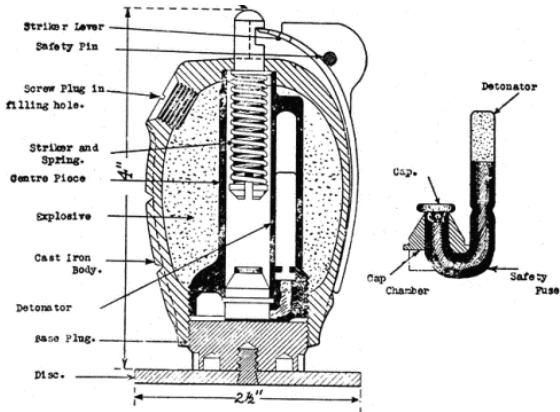
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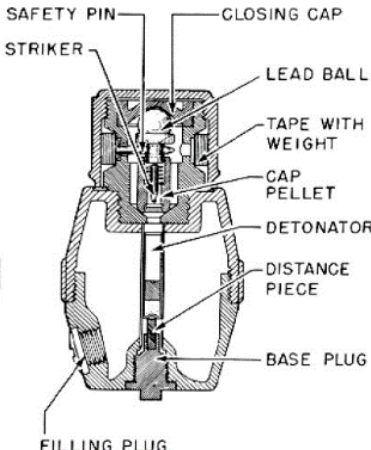
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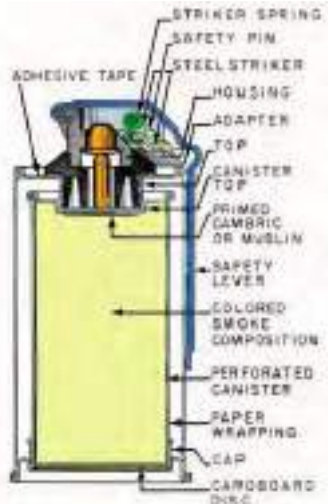
Source: Various sources

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The diagrams illustrate the internal components of a shell and its fuze assembly. The top diagram shows a cross-section of a shell with labels: SHELL H.E., NO. 2 Mk I, G.E. (Gas Escape), and TNT. The middle diagram shows a cross-section of a shell with labels: G.E., TNT BOOSTER, ADAPTER, and TNT. The bottom diagram shows a cross-section of a shell with labels: SHELL H.E., NO. 1 Mk I, G.E., IGNITOR, VENTURI, DEL. OR SEL., and CONTACTS. The right diagram shows a cross-section of a shell with labels: SHELL H.E., PIN, IGNITOR, IGNITER, CORDEX, LEADS, BRASS DISC, and TAIL PROPELLING 3 IN. NO. 1 MK I.

No. 36 'Mills' Grenade			
Weight	Approx. 765g filled (1lb 11.25oz)		
Explosive Weight	71g (2oz) filling.		
Fuze Type	4-7 second delay hand-throwing fuze. No. 6 Detonator		
Dimensions	95 x 61mm (4 x 2.4in)		
Use	Fragmentation explosive at approx. 30m range 100m range of damage.		
Remarks	First introduced in 1915, its classic grooved, cast-iron 'pineapple' design was designed to provide uniform fragmentation. The detonator is inserted before use after removing the base plug.		
			

No. 69 Grenade		
Weight	Approx. 383g (13.5oz)	
Fill Weight	93g (3.25 oz) of either Amatol, Baratol or Lyddite	
Fuze Type	'All-ways' fuze. Comprised of a safety cap, a weighted streamer attached to a steel ball bearing and a safety bolt designed to detonate from any point of impact.	
Dimensions	115 x 60mm (4.5 x 2.4 in)	
Use	A blast grenade for use as an offensive weapon. Detonator was inserted before use.	
Remarks	Introduced December 1940 and made from the plastic Bakelite as opposed to conventional metals. Detection is difficult due to this low metal content.	
		

No. 83 Smoke Grenade			
Weight	Approx. 680g (1.5lb)		
Explosive Weight	Approx. 170-200g. (6-7 oz)		
Fuze Type	Originally used a friction system using a match head composition. Later developed to a striker lever ignition system.		
Dimensions	Approx. 62 x 140mm (2.44 x 5.5 in)		
Use	Use as a target or landing zone marking device and as a screening method for troop / unit movement.		
Remarks	This basic design stayed relatively unchanged up to the 1980's. The letters CCC were often etched into the body of the grenade in the colour of the smoke.		
			



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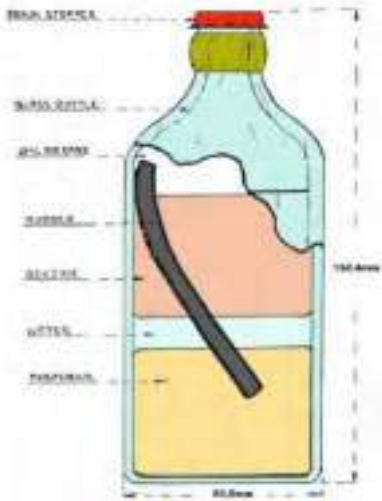
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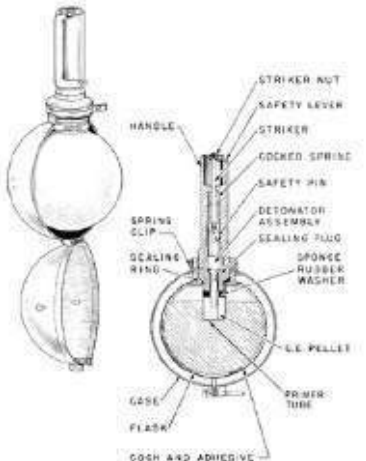
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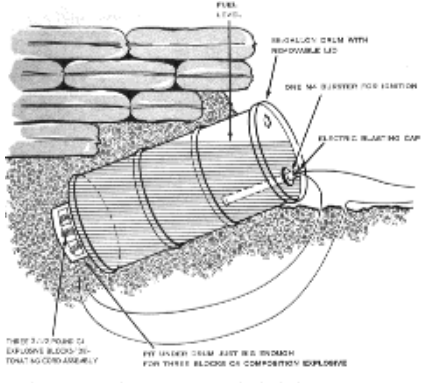
Source: Various sources

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No. 76 Self Igniting Phosphorous (SIP) Grenade			
Weight	Approx. 1lb 3oz		
Filling	White Phosphorous and Benzene		
Design	The filling was contained in a ½ pint sized glass bottle with water and a strip of rubber. Over time the rubber dissolved to create a sticky which would self ignite when the bottle broke.		
Use	Originally intended as an anti-tank incendiary weapon deployed by hand. Designed to be produced cheaply without consuming materials needed to produce armaments on the front line.		
Remarks	The Home Guard hid caches of these grenades during the war. Not all locations were officially recorded and some caches were lost and encountered post-war. In all cases, the grenades are still found to be dangerous.		

No. 74 Grenade ("Sticky Bomb") Mk1			
Weight	Approx. 1.1kg (2.25lb)		
Filling	Approx. 600g Nobel's No.283 (Nitro-glycerine) (1.33lb)		
Design	A glass ball on the end of a Bakelite (plastic) handle. The inside of the ball would contain the explosive filling and the outside a very sticky adhesive coating.		
Use	An anti-tank grenade primarily issued to the home guard. It required the user to come in very close proximity of the target and smash the glass explosive container against it.		
Remarks	Timer fuze was located in the handle. This would explode after 3-6 secs.		

Flame Fougasse Bomb			
Weight	Various		
Filling	Initially a mixture of 40% petrol and 60% gas. Ammonal provided the propellant charge.		
Design	Usually constructed from a 40-gallon drum dug into a roadside and camouflaged.		
Use	As an improvised anti-tank bomb. When triggered the Fougasse could project a beam of burning sticky fuel in a fixed direction from up to 3m (10ft) wide and 27m (30yards) long.		
Remarks	A highly unorthodox weapon designed by the Petroleum Warfare Department to address a critical lack of weapons in 1940. 50,000 are estimated to have been distributed around the UK.		



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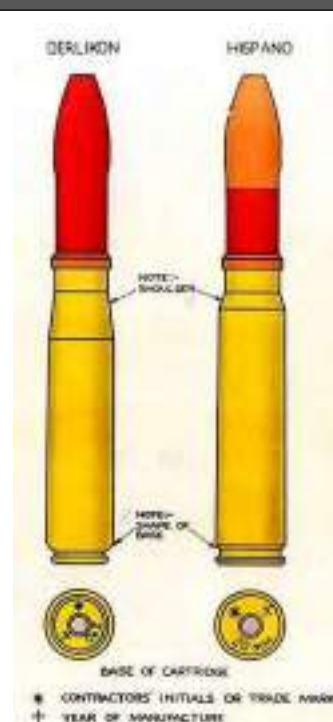
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Ref: DA18717-00

Source: Various sources

The following table summarizes the information provided in the image:

Bullet / Shell
7.62mm B&W 13mm MG 131 BT09K FW190AB
7.7mm spitzer MKI Hurricane MKII others.
12.7mm jap. USSF
12.7mm classic Browning P-40, P-47, P-51
18mm MG 151 BT09F
Type 99-1 cannon 28mm
MGFF cannon BT09E BT10C Jen-7
Mg 151 cannon 20mm FW190
Hs-5 cannon 20mm jap.
ShtVAK 30mm Il-2, yakk others.
20x101RB
Hispano 20mm cannon various mk IIB
Ho-3 cannon 28mm Jap.
VFA cannon yak Il-2
MK 108 can BT09GA, others
MK FW



Bullet Diameter	7.92mm
Case length	56.44mm
Overall length	78.11mm
Type	Rifle Ammunition
Propellant	Originally black powder. Later Cordite followed by Nitrocellulose
Remarks	First produced in 1889 and still in use today, the .303inch cartridge has progressed through ten 'marks' which eventually extended to a total of around 26 variations.



BRITISH	
NATURE OF SHELL	HE FILLING COLOUR
H.E. TRACER	TNT
H.E.	TNT
PROJ. PRACTICE	
PROJ. TRACER	
H.E. INCENDIARY	TNT
INCENDIARY TRACER	TNT

AMERICAN	
NATURE OF SHELL	HE FILLING COLOUR
H.E. TRACER	PETROL
H.E. TRACER	PETROLITE
H.E.	PETROL
H.E.	PETROLITE
H.E. INCENDIARY	PETROL
H.E. INCENDIARY	PETROLITE

Labels for HE/INCENDIARY/TRACER: CLOSING DISC, PERCUSSION FUSE, REAR DISC, DETONATOR, PAPER DISC, HE FILLING, WADDLED CLOTH DISC, INCENDIARY FILLING, TRACER COMPOSITION, FIRING COMPOSITION, CLOSING DISC, BASE PLUG.

Labels for PROJECTILE TRACER: WEIGHTING, BORAX, TRACER COMPOSITION, FIRING COMPOSITION, CLOSING DISC, BASE PLUG.

Labels for HE/INCENDIARY: CLOSING DISC, PERCUSSION FUSE, REAR DISC, DETONATOR, PAPER DISC, HE FILLING, WADDLED CLOTH DISC, INCENDIARY FILLING, BASE PLATE.

Scale: MILLIMETRES 0 40 80



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