

Ground Investigation Report

East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ

On behalf of Parsons Construction Ltd

Report Reference: GWPR5317/GIR/April 2023 V1.01			Status: Final
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V1.01			
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REPORT REFERENCE	GWPR5317/GIR/April 2023. The conditions and limitations of this geotechnical report can be viewed within Appendix A, with the aims of the investigation provided within Appendix B. A technical glossary has also been provided within Appendix C.
SITE DETAILS	The site comprised a ~8,600m² roughly rectangular shaped plot of land, with a north-west to south-east orientation, situated ~100m east of Knowles Road. The site was located in Fair Oak, Eastleigh, within the county of Hampshire. A site location plan has been provided within Figure 2. The site mainly composed of hardstanding, however portions of the east and northern section of the site were soft landscaping. An access road comes into the site through the north-west corner. A view of the site development area has been provided within Figure 3, with an aerial view of the site provided in Figure 4.
PROPOSED DEVELOPMENT	At the time of reporting, April 2023, the proposed development was understood to comprise the construction of 4no. general industrial buildings (Use Class B2) containing 15 separate units, including landscaping, parking and associated works. A proposed development plan is displayed within Figure 1.
HISTORICAL MAPPING	At the first historical maps (1868) the site formed part of a larger undeveloped plot of land, most likely agricultural fields. The sites environs consisted of a sand pit ~90m south-west, and also East Horton Farm ~250m south-east, with the rest of the environs consisting of woodland ~100m south-west, and also agricultural fields. The 1896 maps show another sand pit ~110m south-west of the site, with the site itself remaining unchanged. The next significant change is first seen in the 1963 maps, with multiple large sand pits being opened up ~170m east of the site. As well as a piggery ~100m east. The 1993 maps show a large pond has formed ~90m south-east. The only onsite change throughout the historical maps is first shown in 2003, when a track has been built through the centre of the site, running from the western to the eastern boundary. By 2010, 3 separate buildings have been built ~50m east of the site. In subsequent years, an access road was shown in the 2023 maps. No other significant changes to the site or environs were recorded. Historical maps, obtained from GroundSure, can be viewed within Appendix D.
ANTICIPATED GEOLOGY AND HYDROGEOLOGY	The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on the London Clay Formation, classified as Unproductive Bedrock Strata. Based on this, it was anticipated that groundwater was perched on top of the London Clay Formation. The main groundwater table though is expected below the unproductive aquifer. A BGS borehole record in similar geology ~80m south-west of the site (ref.: SU51NW9) Drift to 1.80m bgl, overlying London Clay Formation to 4.40m bgl. No groundwater was noted.
SITE WORKS	Site works were undertaken on the 27th March 2023 and comprised the drilling of the 5No. Windowless Sampler Boreholes (WS1 – WS5) to depths of between 1.50 – 6.45m bgl with Standard Penetration

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Tests at 1.00m intervals. Boreholes were terminated early due to density of strata. A Super Heavy Dynamic Probe (DP5) was undertaken through the base of WS5 to a final depth of 6.10m bgl. WS5 refused as the sampler was bouncing at 1.50m, the location was moved 3m south and was still bouncing at 1.50m, possibly on the edge of concrete.

A trial hole location plan has been provided within Figure 1.

GROUND CONDITIONS ENCOUNTERED

A summary of the ground conditions encountered has been summarised in the following table. The trial hole logs can be seen within Appendix E.

Summary of Strata Encountered (WS1 – WS5)			
Strata	Top Depth (m bgl)	Base Depth (m bgl)	Thickness (m)
MADE GROUND: Dark Brown sandy, very gravelly CLAY. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint, brick and concrete (specific percentages are mentioned in the logs).	GL	0.40 – 2.00	0.40 – 2.00
MADE GROUND: Dark brown, black very sandy, clayey GRAVEL. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint, brick and concrete (specific percentages are mentioned in the logs)	GL	0.30 – 0.90	0.30 – 0.90
LONDON CLAY FORMATION (shallow): Light brown, orange, grey mottled slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine, sub-angular to sub-rounded of flint.	0.90 – 2.00	6.00	4.00 – 5.10
LONDON CLAY FORMATION (deep): Dark brown, dark grey slightly sandy CLAY. Sand is fine to medium. Occasional Selenite crystals.	3.90 – 4.35	6.00	1.65 – 2.10

GROUNDWATER

Groundwater was encountered at depths of between 1.20m – 3.00m bgl within WS1 – WS3. No groundwater strikes were recorded within WS4 or WS5. A summary can be seen in the following table.

Summary of Groundwater Strikes	
Trial Hole	Depth of Strike (m bgl)
WS1	1.20
WS2	2.20
WS3	3.00
WS4	Dry
WS5	Dry

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was undertaken in March 2023 when groundwater levels are likely to be falling from their annual maximum (highest elevation). Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site.

ROOTS

Fresh roots were proven to 0.80m bgl within WS1, WS2 and WS5 and 1.00m bgl within WS3 and WS4. The depths of root penetration can be seen tabulated below.

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Summary of Root Penetration	
Trial Hole	Fresh Root Depth (m bgl)
WS1	0.80
WS2	0.80
WS3	1.00
WS4	1.00
WS5	0.80

It should be noted that the accuracy of determining the depth of root penetration within narrow diameter boreholes is considered low. The site and its immediate environs were noted to contain a number of existing trees and vegetation. Therefore, it should be noted that roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

IN-SITU STRENGTH TESTING

A summary of the in-situ strength testing conducted has been summarised in the following table.

Interpretation of In-situ Geotechnical Testing Results					
Strata	SPT "N" Blow Counts/Equivalent SPT "N" Value from DP	Equivalent Undrained Shear Strength (Cu) (kPa)	Soil Type		Trial Hole/s
			Granular (Density)	Cohesive (Cu)	
Soft spots within London Clay Formation (Cohesive)	5 - 8	35 - 40	-	Low	WS1/1.00 - 4.00m bgl WS2/2.00 - 2.50m bgl WS4/3.00 - 4.00m bgl
London Clay Formation (Cohesive)	9 - 14	45 - 70	-	Medium	WS1/0.40 - >6.00m bgl WS2/2.00 - >6.00m bgl WS3/1.40 - >6.00m bgl WS4/0.90 - >6.00m bgl
Assumed Made Ground	~3 - 4	-	-		DP5/1.50 - 2.50m bgl
Assumed London Clay Formation (Cohesive)	~6 - 22	30 - 110	-	Low - High	DP5/2.50 - >6.00m bgl

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VOLUME CHANGE POTENTIAL AND MOISTURE DEFICITS

Atterberg Testing

A précis of Atterberg limit testing undertaken can be seen in the following table. The test results are presented within Appendix F.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
London Clay Formation	23 - 32	89 - 100	21 - 36	Cl - CH	Stiff - Firm	Medium	Medium
- NP - Non-plastic - BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results) - Soil Classification based on British Soil Classification System. - Consistency Index (Ic) based on BS EN ISO 14688-2:2018.							

Moisture Deficits

The results of the Atterberg Limit tests were analysed to determine the Liquidity Index of the samples, to give an indication as to whether the samples recovered showed a moisture deficit as well assessing their degree of consolidation. Liquid Limit analyses was undertaken to assess whether there were any potentially significant moisture deficits within the samples tested.

No Significant moisture deficit was detected in any of the samples, with the samples being between Overconsolidated - Heavily Overconsolidated.

FOUNDATION RECOMMENDATIONS

A summary of the findings from the site investigation, relevant to foundation recommendations, can be seen below:

- Foundations should be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.
- Foundations should be designed in accordance with soils of medium volume change potential.
- Given the presence of cohesive soils at shallow depth, special foundation precautions may be required to prevent possible future shrinkage/swelling of the soils affecting the integrity of the faces of foundations (underfloor void diameter/compressible material/void formers etc). A compressible layer must be provided to accommodate potential seasonal movement, based on NHBC guidance.
- Due to the shallow soils having volume change potential and Made Ground thickness is more than 600mm, a suspended slab is recommended. As a result of the buildings however being industrial, other options might also be looked at as well, like the excavation of a buffer zone / subbase and the use of dense granular soils of no VCP.
- The loads of proposed foundations should not exceed the allowable bearing capacity of the soils they are founding upon.
- If soft spots are encountered, they should be bypassed.
- Care should be taken not to overdig foundations as this may stress underlying soft spots, should they be present.

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- Foundations must not be placed within fresh root penetrated and/or desiccated soils with volume change potential. It is recommended that foundations are taken at least 300mm into non-fresh root penetrated strata if the soils have volume change potential, or into soils of no volume change potential.
- The influence of trees on or surrounding the site will need to be taken into account in final design.
- Any water ingress must be prevented from entering foundation trenches and excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate within the excavation for even a short period of time, an increase in heave occur. The shear strength will also be reduced, resulting in lower bearing capacities, resulting in increased settlements. Instability issues may arise within the foundation trenches, in case of perched water being present.

SHALLOW FOUNDATIONS

Based on the above, foundations should bypass any Made Ground/Topsoil and soft spots/loose granular soils, before extending 300mm below the proved depth of root penetration. Foundations would therefore be constructed on competent, moisture stable soils of the London Clay Formation. A tabulated summary showing the minimum foundation depth based on each trial hole can be viewed in the following table.

Summary of Minimum Foundation Depths			
Trial Hole	Minimum Foundation Depth (m bgl)	Founding Geological Formation	Reason
WS1	1.10	Cohesive London Clay Formation	Foundations should extend 300mm below the depth of root penetration (0.80m bgl), before founding on competent soils at a moisture stable depth.
WS2	2.50	Cohesive London Clay Formation	Foundations should bypass Made Ground and the soft spot at 2.00m bgl, before founding on competent soils at a moisture stable depth.
WS3	1.40	Cohesive London Clay Formation	Foundations should bypass Made Ground and found on competent, moisture stable soils.
WS4	1.30	Cohesive London Clay Formation	Foundations should extend 300mm below the depth of root penetration (1.00m bgl), before founding on competent soils at a moisture stable depth.
WS5	2.50	Cohesive London Clay Formation	Foundations should bypass Made Ground and the soft spot at 2.00m bgl, before founding on competent soils at a moisture stable depth.

The following allowable bearing capacities and load induced settlements were anticipated for the minimum foundation depth stated above.

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Allowable Bearing Capacities Calculated

Foundation Depth (m bgl)	Foundation Type	Limit State	Serviceability State	
		Allowable Bearing Capacity (kN/m ²)	Load (kN/m ²)	Settlement (mm)
WS1/1.10	5.00m long by 0.75m wide strip foundation	67.09	62	14.76
	5.00m long by 1.00m wide strip foundation	67.68	62	17.57
WS2/2.00	5.00m long by 0.75m wide strip foundation	66.06	60	9.54
	5.00m long by 1.00m wide strip foundation	66.59	60	11.28
WS2/2.50	5.00m long by 0.75m wide strip foundation	90.77	120	12.47
	5.00m long by 1.00m wide strip foundation	91.5	120	15.29
WS3/1.40	5.00m long by 0.75m wide strip foundation	78.9	75	11.65
	5.00m long by 1.00m wide strip foundation	79.5	75	13.91
WS4/1.30	5.00m long by 0.75m wide strip foundation	101.57	95	16.74
	5.00m long by 1.00m wide strip foundation	102.48	95	20.20
WS5/2.50	5.00m long by 0.75m wide strip foundation	80.07	75	9.60
	5.00m long by 1.00m wide strip foundation	80.70	75	11.55

PILED FOUNDATIONS

Based on the results of the intrusive investigation, a piled foundation scheme was unlikely to be required. However, if higher bearing capacities are needed, a piled foundation system would be deemed more suitable.

The construction of a piled foundation is a specialised job and the advice of a reputable contractor familiar with the type of ground encountered on this site, should be sought prior to finalising the foundation design. The actual pile working load will depend on the particular type of pile and method of installation adopted.

In general, for the cumulative pile capacity calculations, shaft friction over desiccated levels should be ignored and piles should not be terminated within desiccated soils where moisture recovery following could occur.

A deep borehole to ~20.00m bgl should be undertaken to confirm ground conditions and enable the analysis of usual pile designs.

EXCAVATIONS AND INSTABILITY

Shallow excavations in the Made Ground are likely to be marginally stable at best. Long, deep excavations, through these strata and into the underlying London Clay Formation are likely to become unstable.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

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SUB-SURFACE CONCRETE DESIGN	Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground' considering the pH of the soils. For the classification given below, the "mobile" and "brownfield" case was adopted given the geology encountered and the previous use of the site. This assessment was based on the results of chemical laboratory testing displayed within Appendix G, specifically relating to sulphates, pH and other water soluble chemicals. Made Ground No samples of the Made Ground were analysed for sulphates and pH. London Clay Formation The water-soluble sulphates in the London Clay Formation was noted to be 43.3-148mg/l, with a pH of 8.11-8.50, from chemical laboratory testing. The total potential sulphate (3x total sulphur) was <0.06%, from chemical laboratory testing. Therefore, sulphate concentrations measured in 2:1 water/soil extracts taken from the London Clay Formation and total potential sulphate concentrations, fell into Class DS-1 of the BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground'. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. It is prudent to note that pyrite nodules may be present within the London Clay Formation. Pyrite can oxidise to gypsum and this normally only occurs in the upper weathered layer, but excavation allows faster oxidation and water-soluble sulphate values can rapidly increase during construction. Therefore, rising sulphate values should be considered should ferruginous staining/pyrite nodules be encountered within the London Clay Formation.
ROADS AND HARDSTANDING	<u>Equilibrium CBR</u> Made Ground Where roads and hardstanding are to be founded on Made Ground, a CBR value of 1% should be adopted, as a result of the variable nature of Made Ground in terms of consistency, strength and compressibility. London Clay Formation - Cohesive Roads and hardstanding constructed on the cohesive London Clay Formation should be designed based on a CBR value of 4.0%. This is based on reference to Table C1 of TRL1132 and average construction conditions. Based on wet conditions a CBR of 2.5% should be adopted, with dry conditions a CBR of 4.5% being applicable. The London Clay Formation samples that were tested had high plasticity index values and were cohesive and therefore they were probably not frost susceptible, however due to the granular content it is prudent for them to be treated as frost susceptible. <u>Site testing</u> In-situ California Bearing Ratio (CBR) testing by dynamic cone penetrometer (DCP) was undertaken to determine the CBR values of the soils underlying the site to shallow depth in accordance with BS1377

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Part 9: 2016: 4.3 and a summary of the results is tabulated below. The full test results are presented in Appendix H.

In-situ CBR Test Results Summary via DCP

Test Location	Layer 1		Layer 2		Layer 3		Layer 4	
	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)
DCP1	65mm	8%	195mm	21%	150mm	40%	380mm	13%
DCP2	70mm	7%	160mm	66%	-	-	-	-

WASTE CLASSIFICATION

The excavation of foundations and other soils is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM3) document outlines the methodology for classifying wastes.

Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

Hazardous waste requires pre-treatment prior to removal. The site may need to be registered as a Hazardous waste producer should such waste be removed from the site.

DUTY OF CARE

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust is generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.

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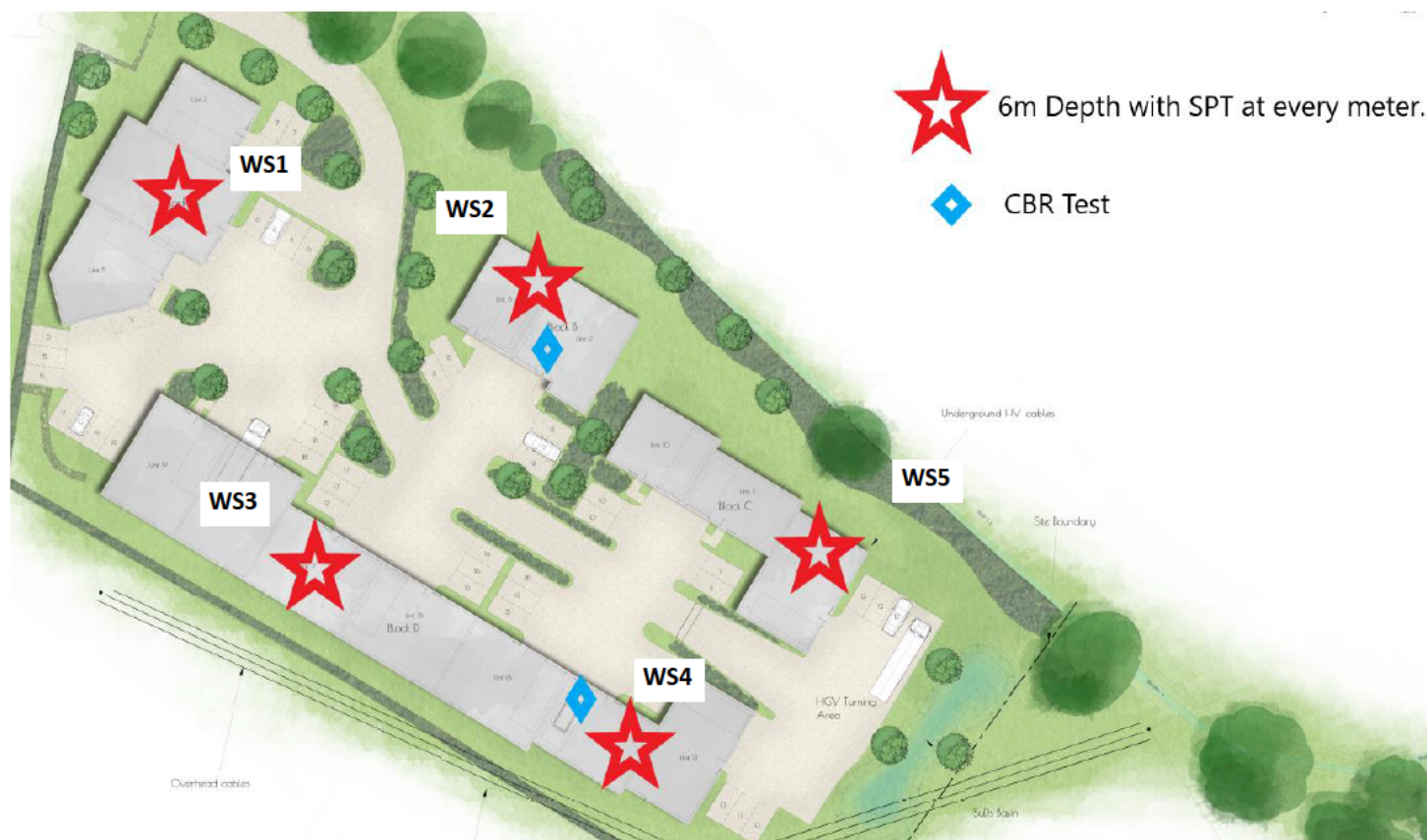
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FIGURES



 Site boundary



East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ

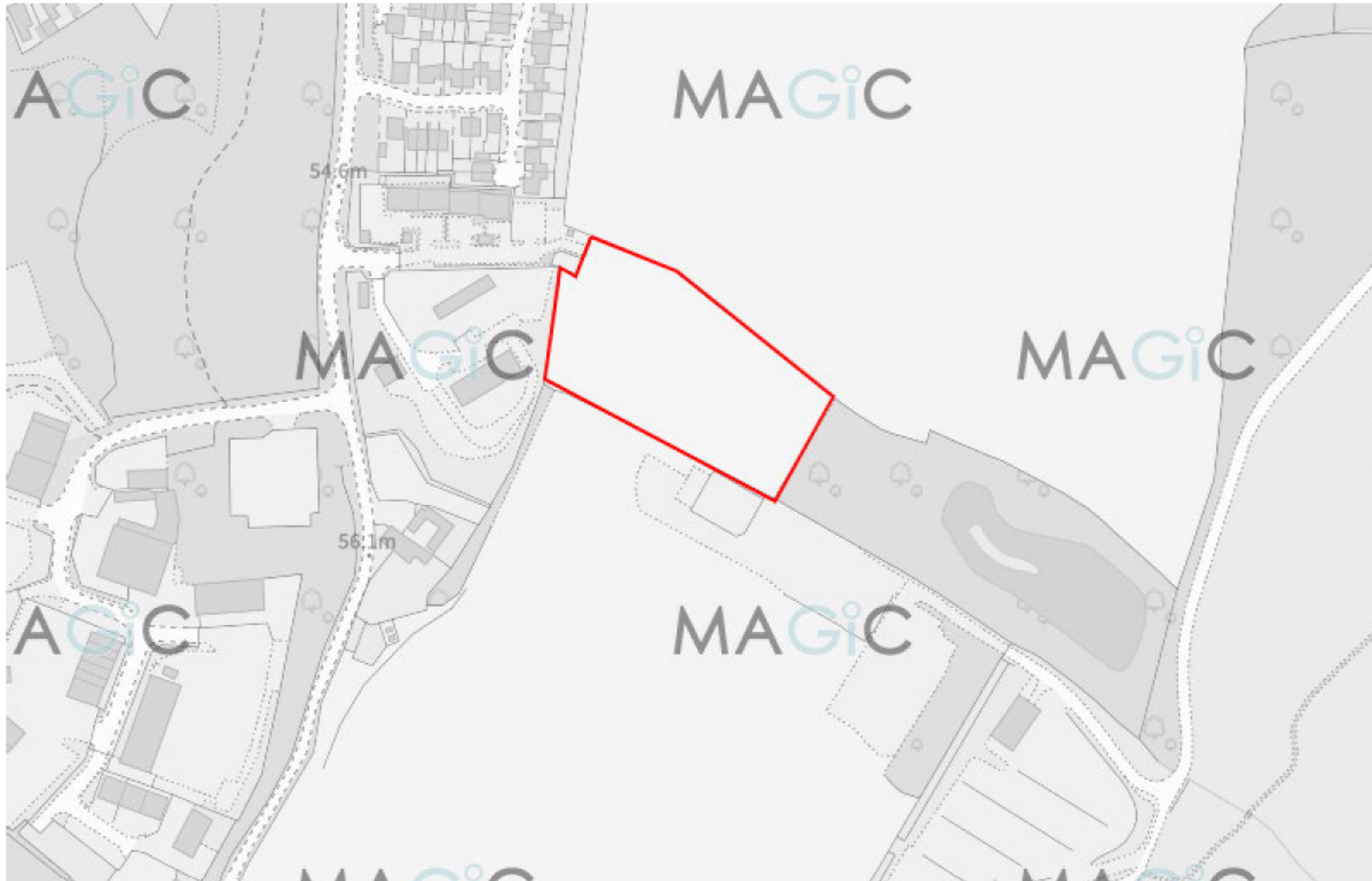
Parsons Construction Ltd

April 2023

Figure 1 – Proposed Development Plan

GWPR5317





 Site Boundary



Approximately 55m

East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ

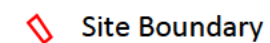
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Figure 2 – Site Location Plan

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Approximately 40m



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 Site Boundary



Approximately 40m

East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ

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Figure 4 – Aerial View of the Site

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APPENDIX A: Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

APPENDIX B: Scope of the Investigation

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes, along with DCP testing.

A full scale Environmental Desk Study and Contamination Assessment including a gas, vapour, radon or groundwater risk assessment were not part of the remit of this report.

The techniques adopted for the investigation were chosen considering the requirements of the client, anticipated ground conditions, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

APPENDIX C: Technical Glossary

TECHNICAL GLOSSARY

The list of possible definitions within the report may be seen below. Please note that some definitions may not be relevant to this report.

HYDROGEOLOGY:

A **Principal Aquifer** is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Secondary (B) Aquifers consist of deposits with predominantly lower permeability layers with may stoke and yield limited amounts of groundwater due to localised features such as fissures, think permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Aquifers (Undifferentiated) are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both a minor aquifer and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

FLOOD ZONES:

Environment Agency Flood Zone 2, defined as; land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Environment Agency Flood Zone 3 shows the extent of a river flood with a 1 in 100 (1% or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

Environment Agency Flood Zone 3 area that benefits from flood defences, defined as; land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year.

GROUNDWATER SOURCE PROTECTION ZONES (SPZS):

Inner Zone (SPZ1): This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.

Outer Zone (SPZ2): This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.

Total Catchment (SPZ3): This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Zone of Special Interest (SPZ4): This zone is where local conditions require additional protection.

IN-SITU STRENGTH GEOTECHNICAL TESTING:

Windowless Sample and/or Cable Percussion and/or Rotary Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50mm and an inside diameter of 35mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. The sample tube is driven 150mm into the ground and then the number of blows needed for the tube to penetrate each 75mm up to a depth of 450mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (SHDP) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).

APPENDIX D: GroundSure Historical Mapping

Site Details:

THE MAZELS, KNOWLE LANE,
HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1868

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1868
Revised 1868
Edition N/A
Copyright N/A
Levelled N/A

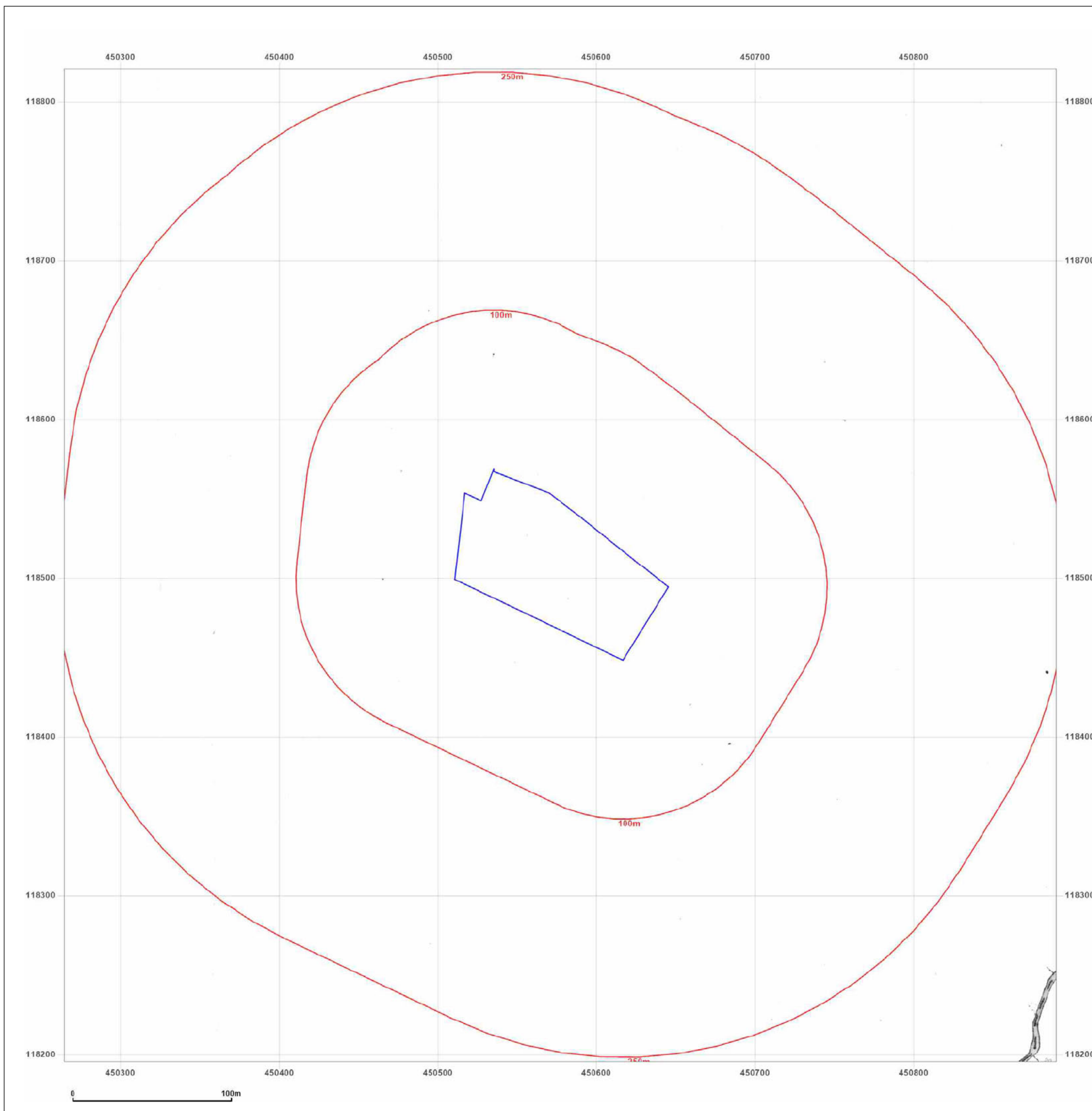


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Production date: 06 April 2023

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

THE MAZELS, KNOWLE LANE,
HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1869

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1869
Revised 1869
Edition N/A
Copyright N/A
Levelled N/A

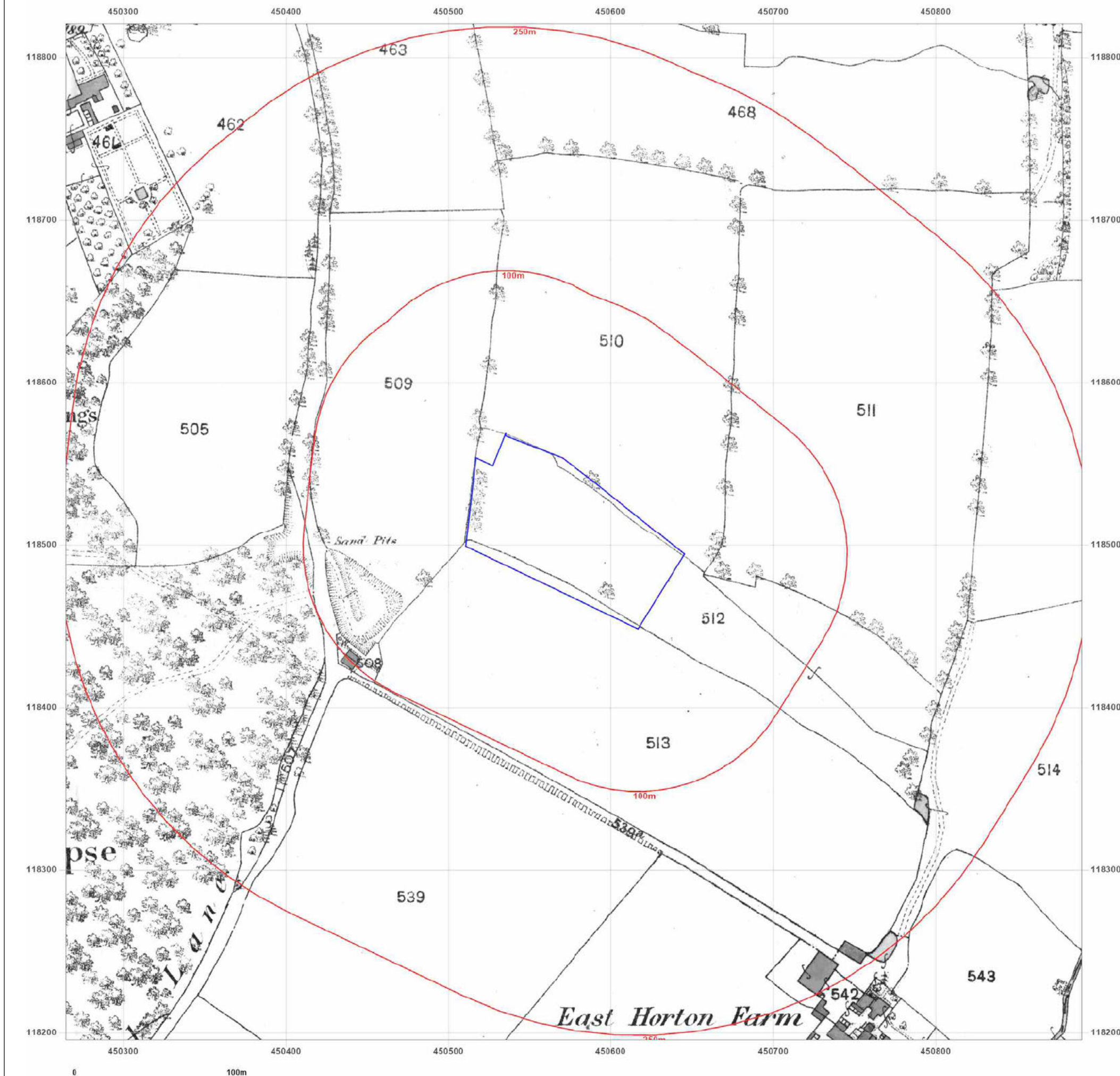


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Site Details:

THE MAZELS, KNOWLE LANE,
HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1896

Scale: 1:2,500

Printed at: 1:2,500



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

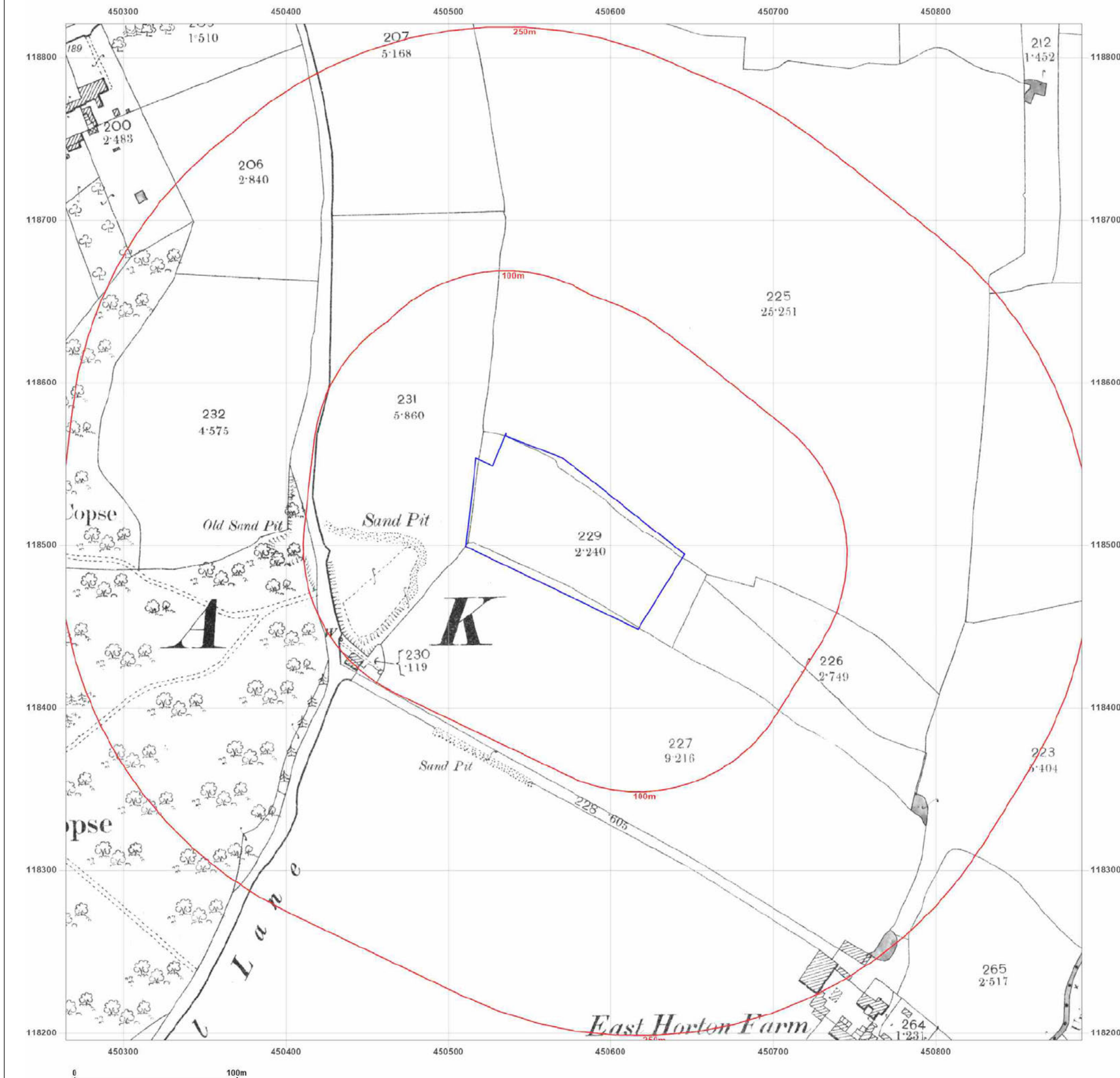


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Site Details:

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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1909

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1909
Revised 1909
Edition N/A
Copyright N/A
Levelled N/A

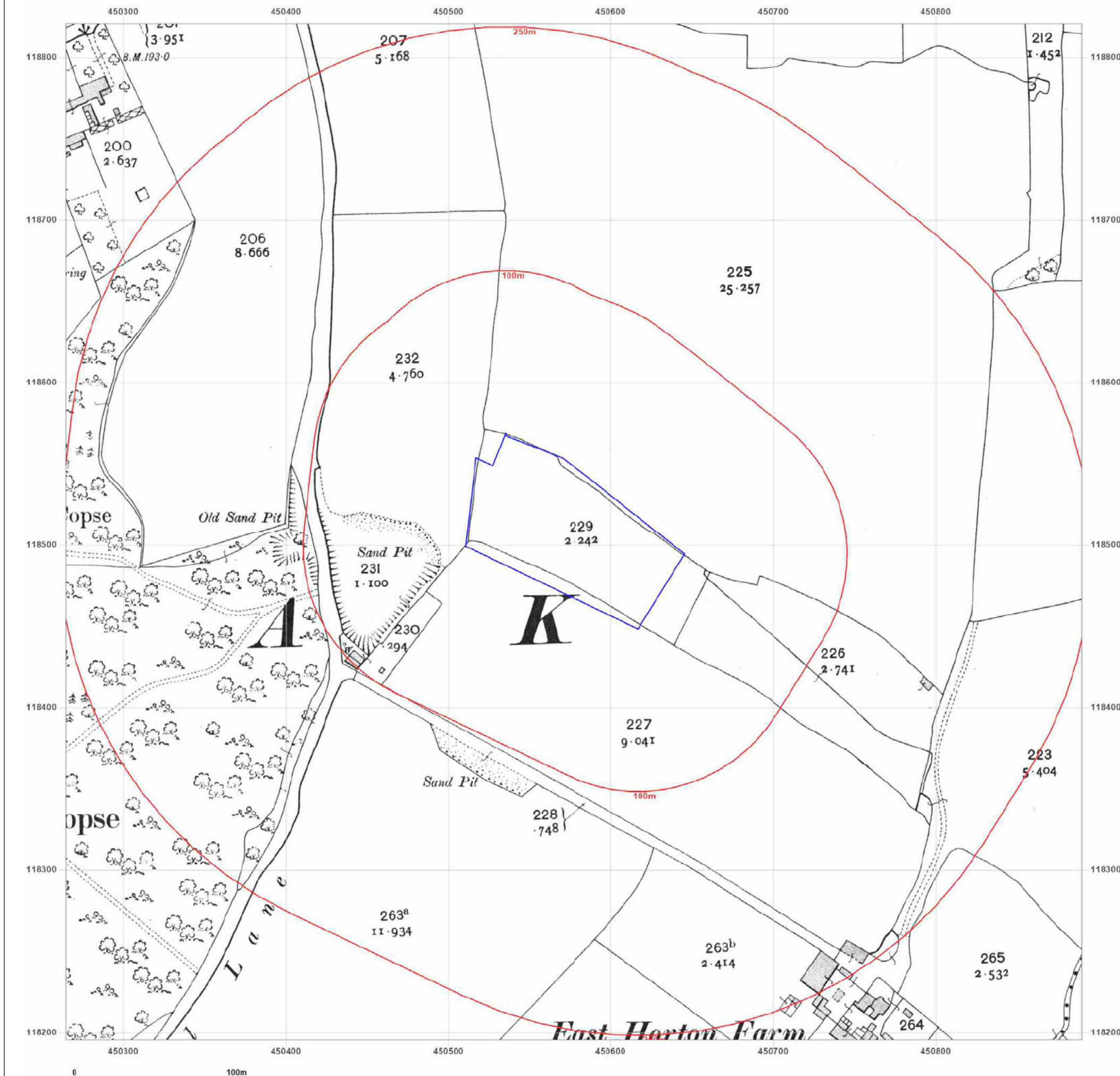


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Site Details:

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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1939

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1939
Revised 1939
Edition N/A
Copyright N/A
Levelled N/A

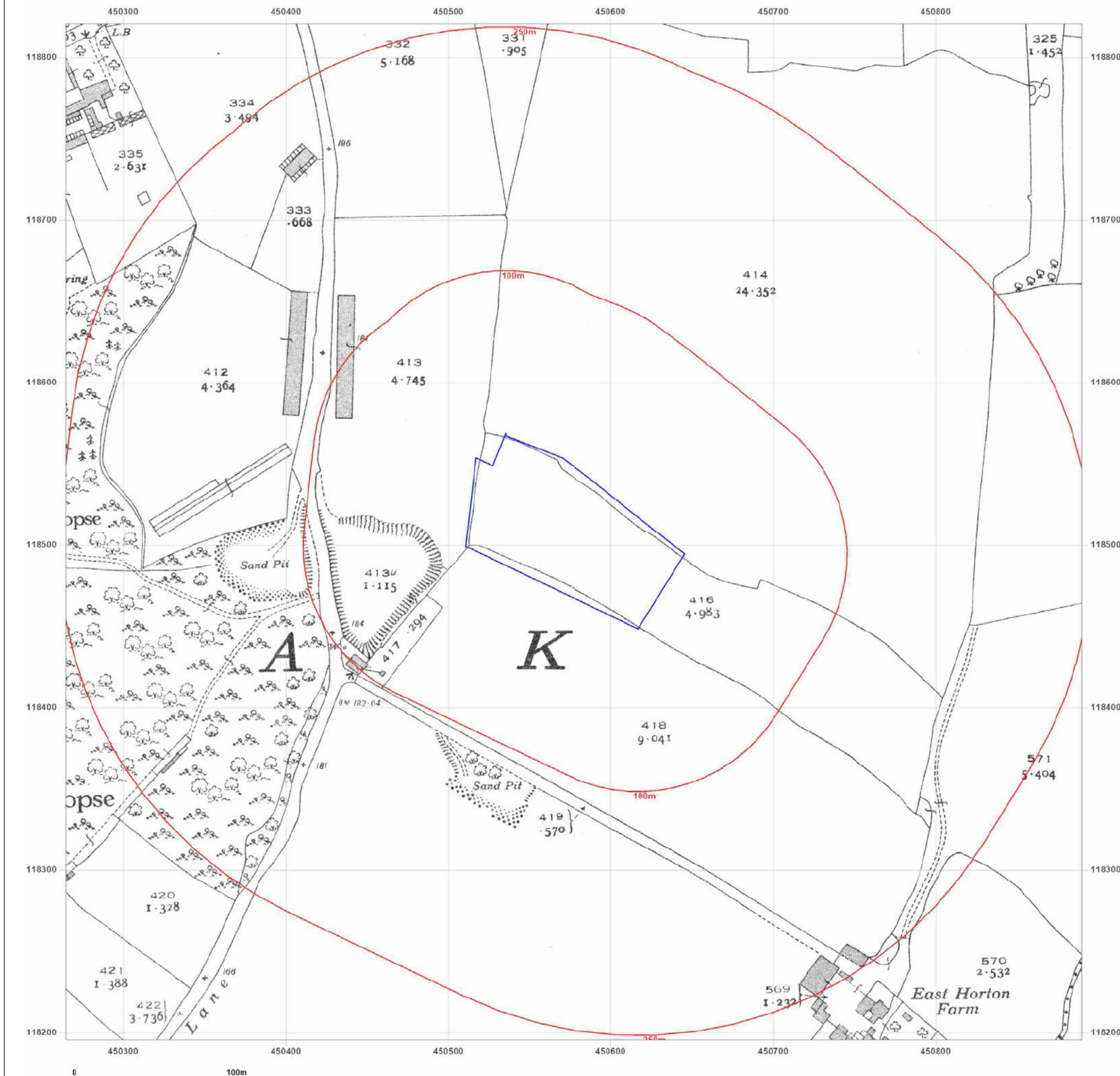


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1963

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1962
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

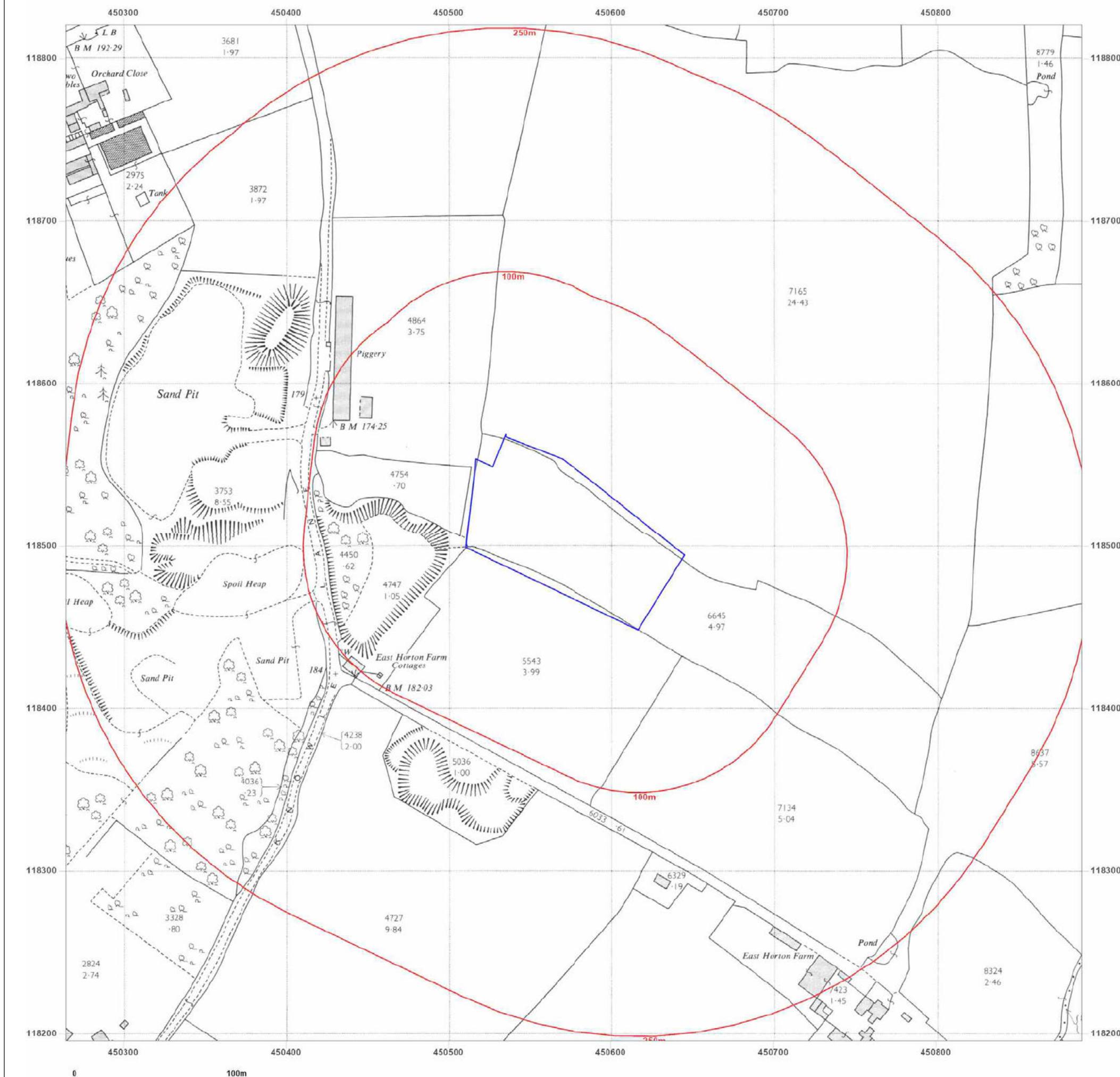


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1974

Scale: 1:2,500

Printed at: 1:2,500



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

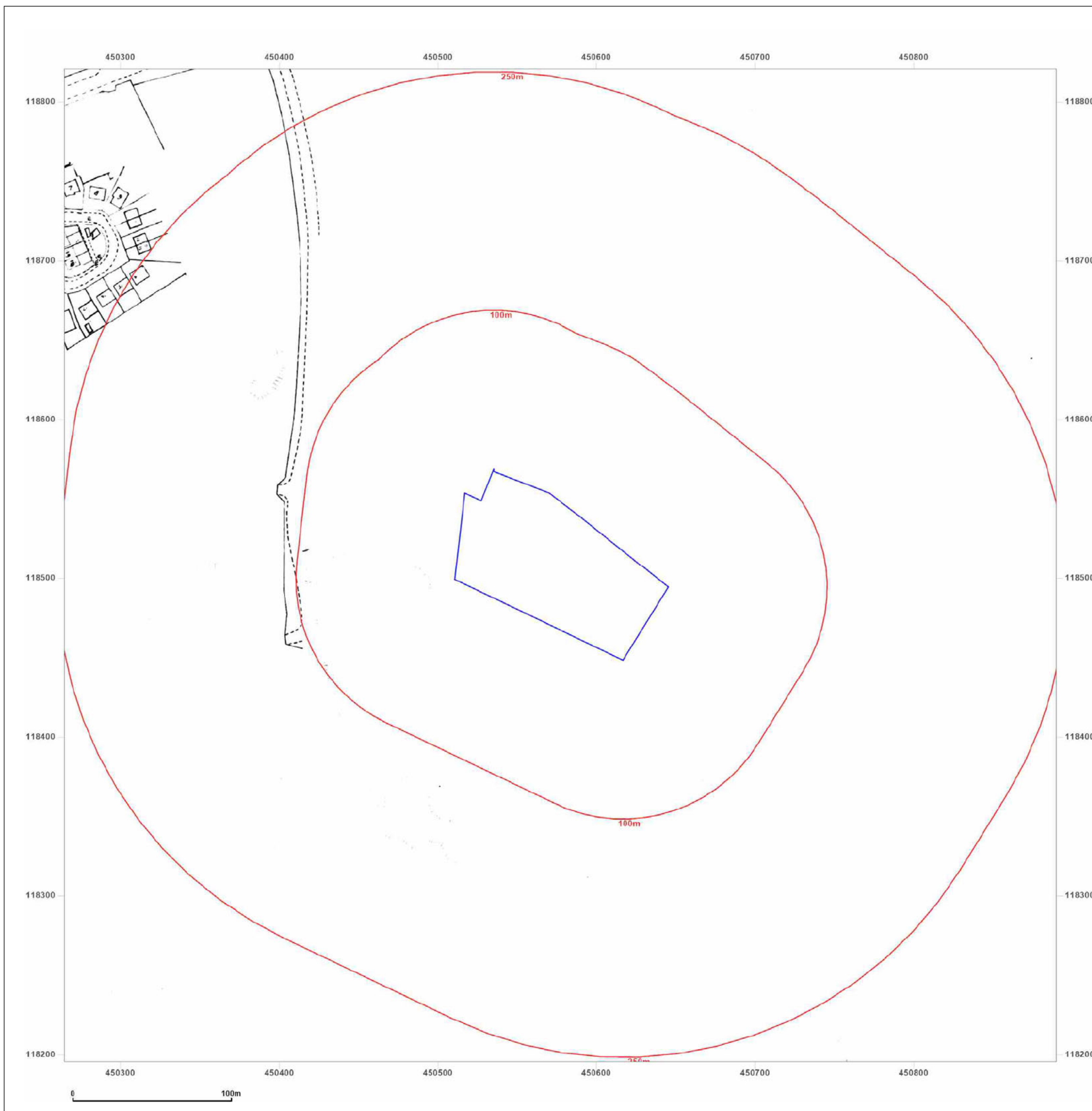


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

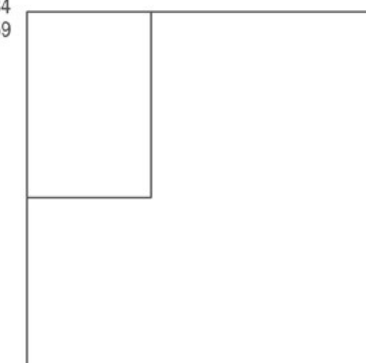
Map date: 1984

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1982
Revised 1982
Edition N/A
Copyright 1984
Levelled 1959



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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1988

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1952
Revised 1988
Edition N/A
Copyright 1988
Levelled 1952

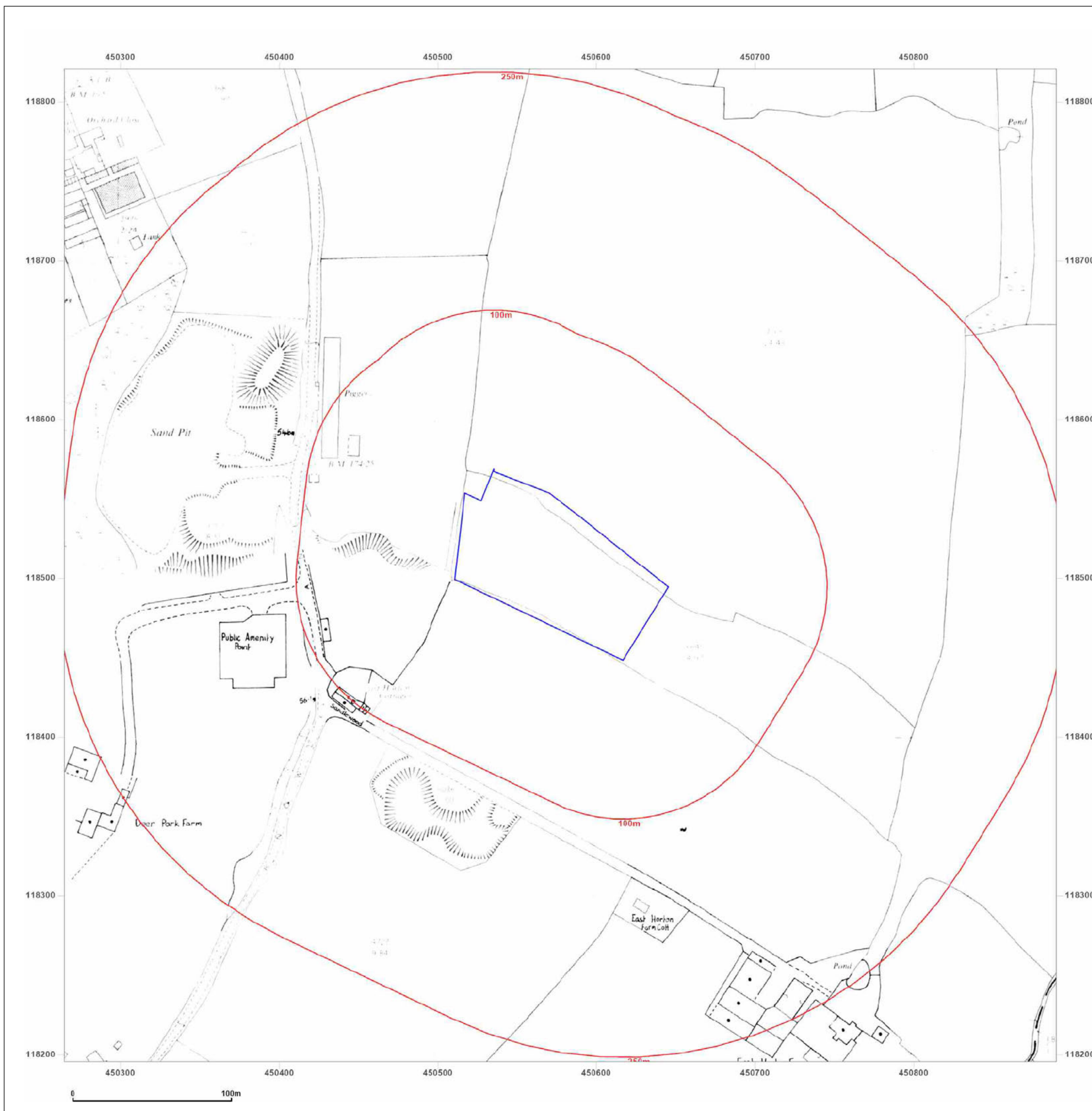


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



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

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

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

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



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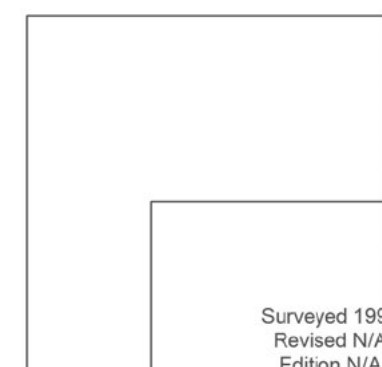
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Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



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

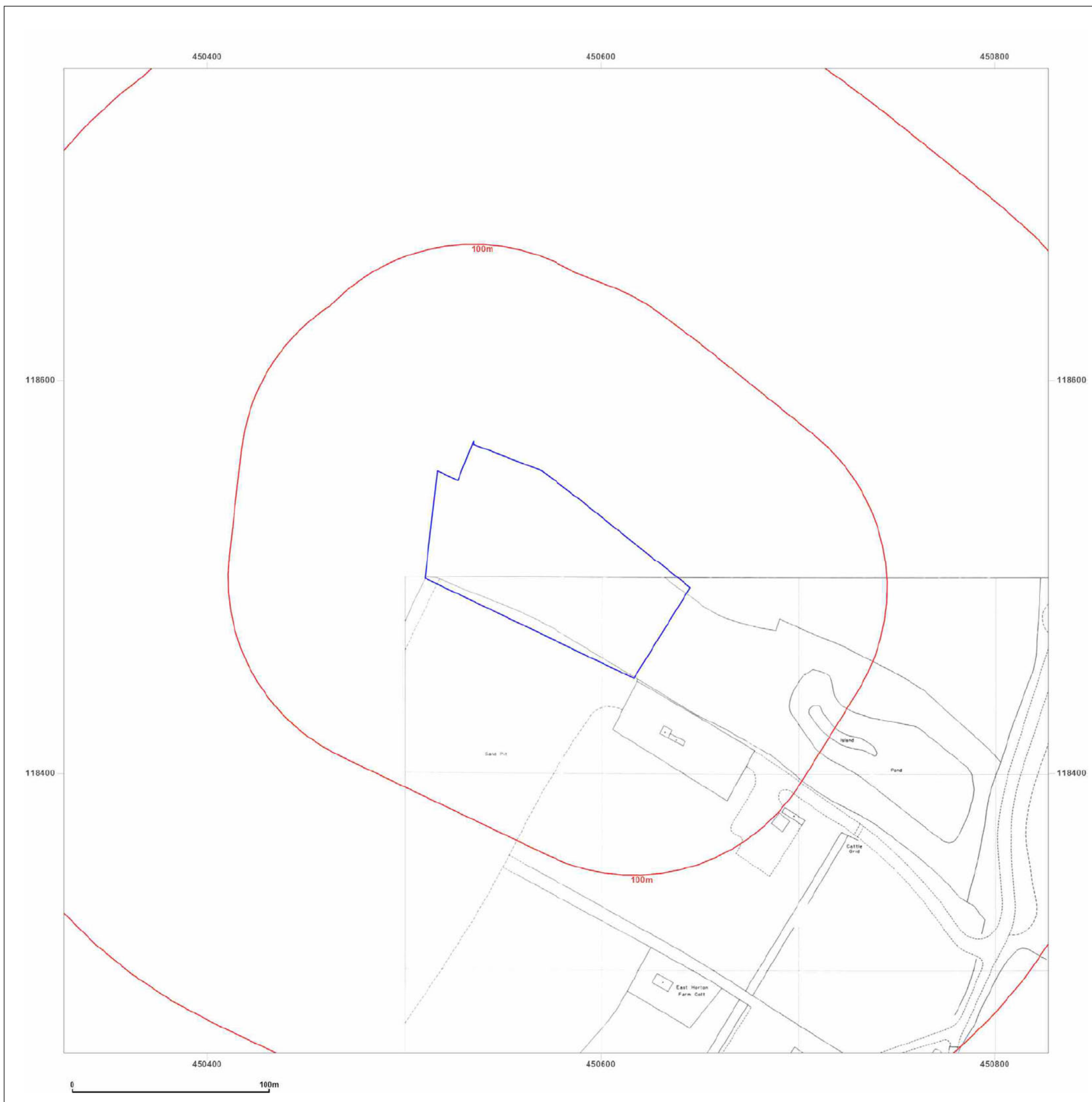


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Site Details:

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HORTON HEATH, SO50 7DZ

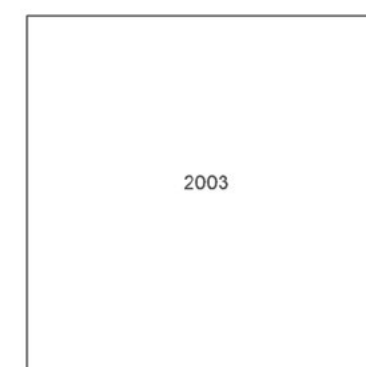
Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: LandLine

Map date: 2003

Scale: 1:1,250

Printed at: 1:1,250



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Site Details:

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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1868

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868
Revised 1868
Edition N/A
Copyright N/A
Levelled N/A

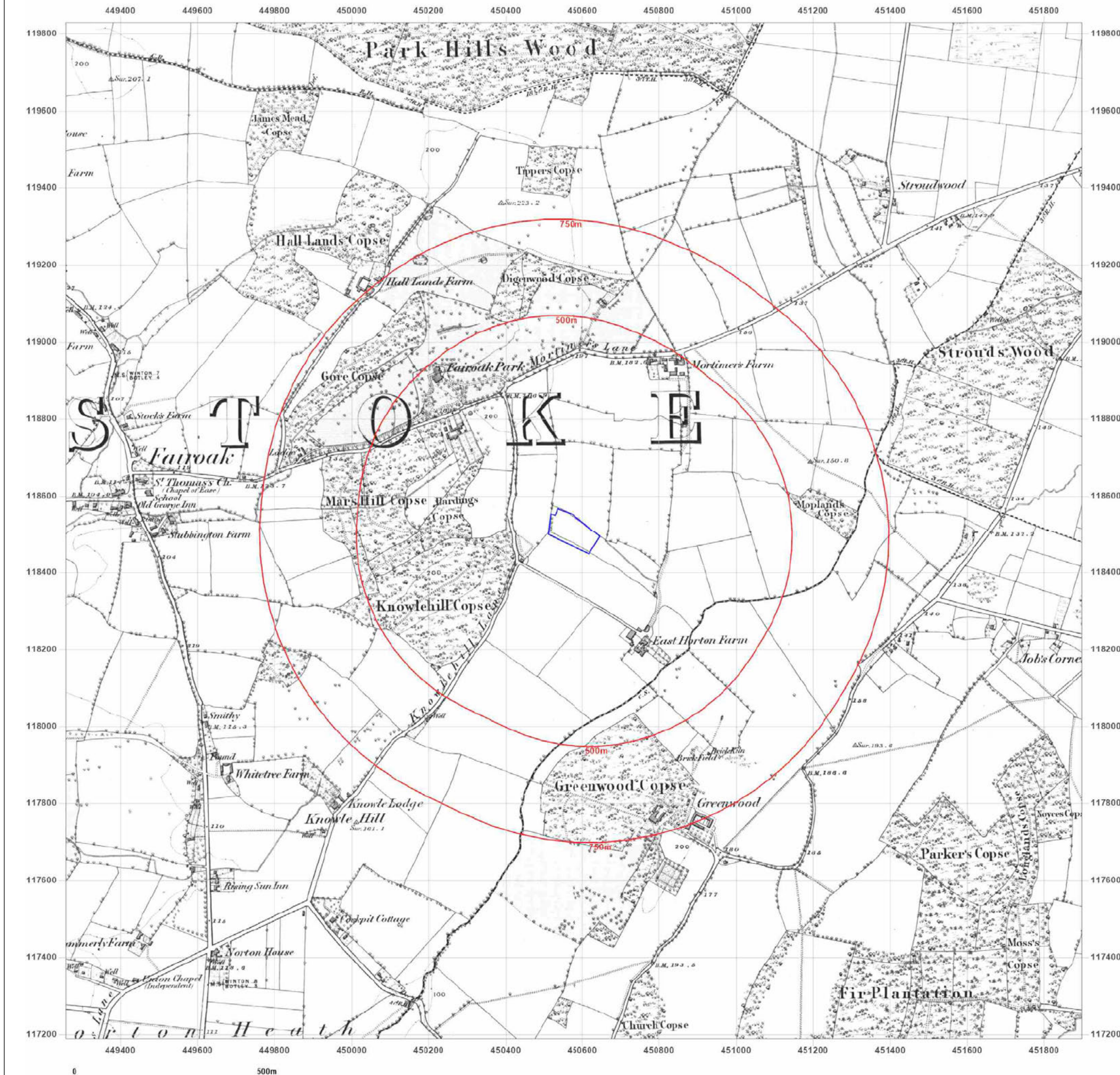


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Site Details:

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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1888

Scale: 1:10,560

Printed at: 1:10,560



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

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

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

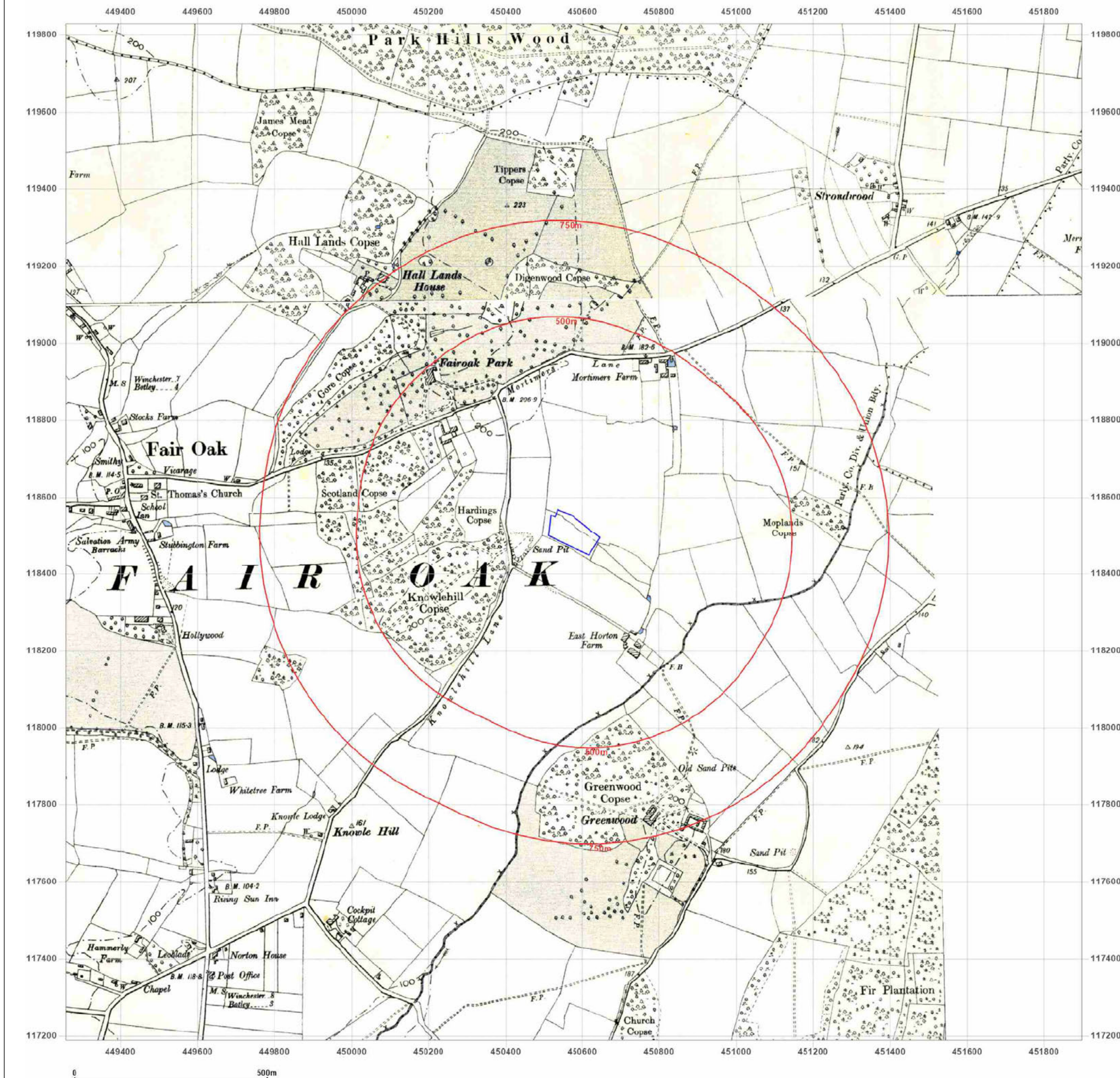


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Site Details:

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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1895-1896

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1868
Revised 1896
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1868
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1868
Revised 1895
Edition N/A
Copyright N/A
Levelled N/A

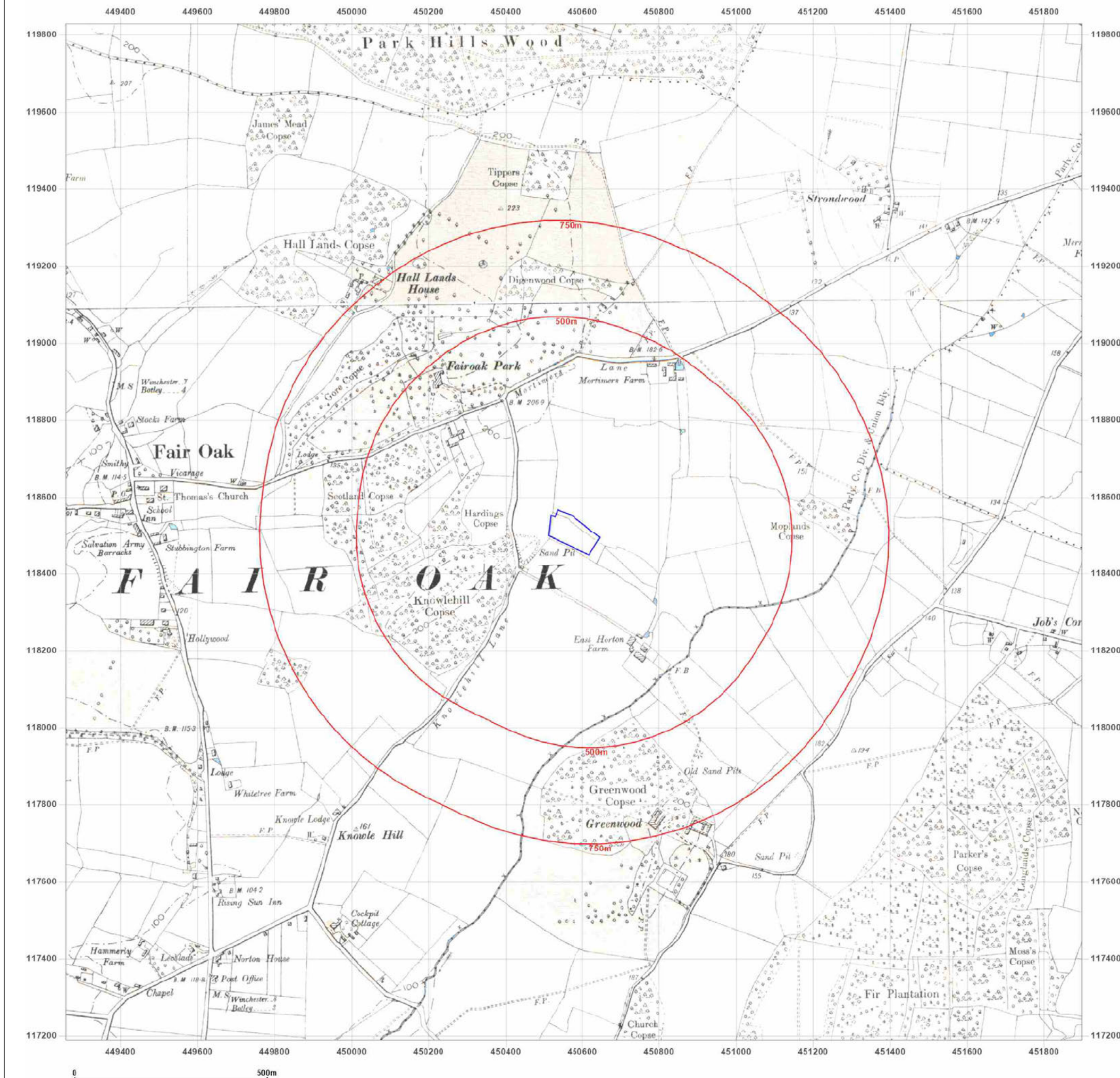


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1908-1910

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1868
Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1867
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1866
Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

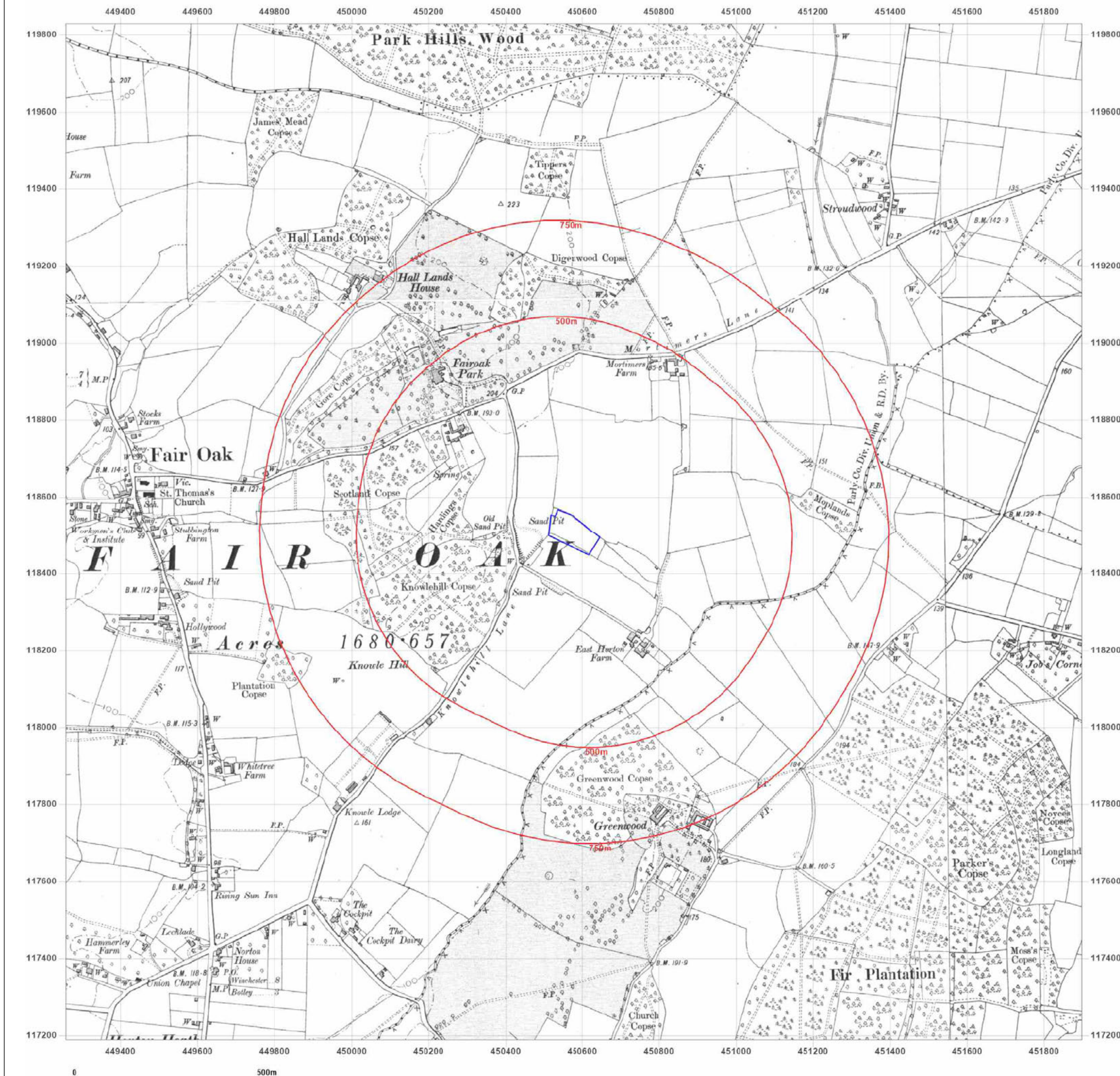


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: County Series

Map date: 1938-1939

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868
Revised 1939
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1867
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

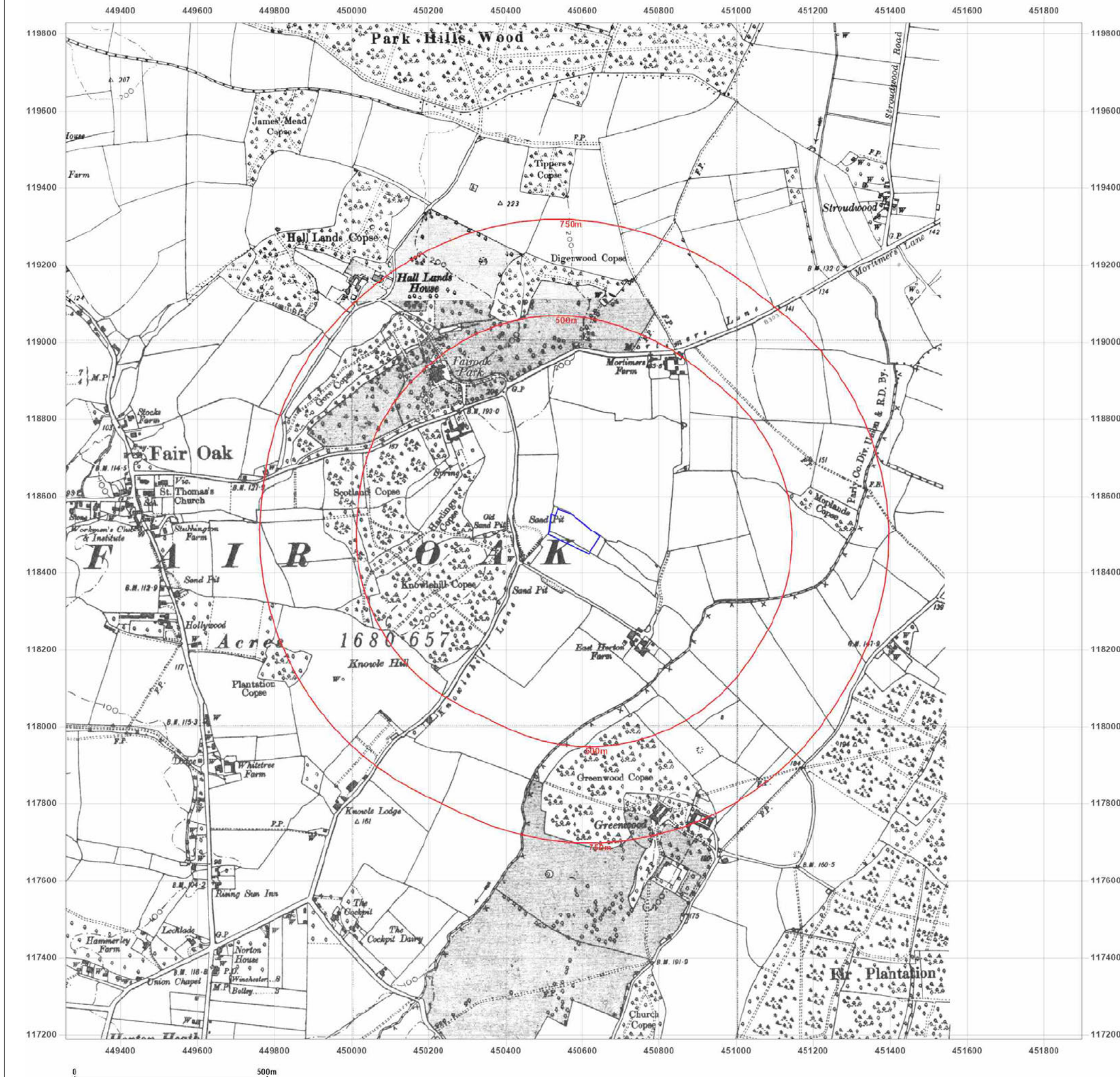


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HORTON HEATH, SO50 7DZ

Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: Provisional

Map date: 1957

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868
Revised 1957
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1957
Revised 1957
Edition N/A
Copyright N/A
Levelled N/A

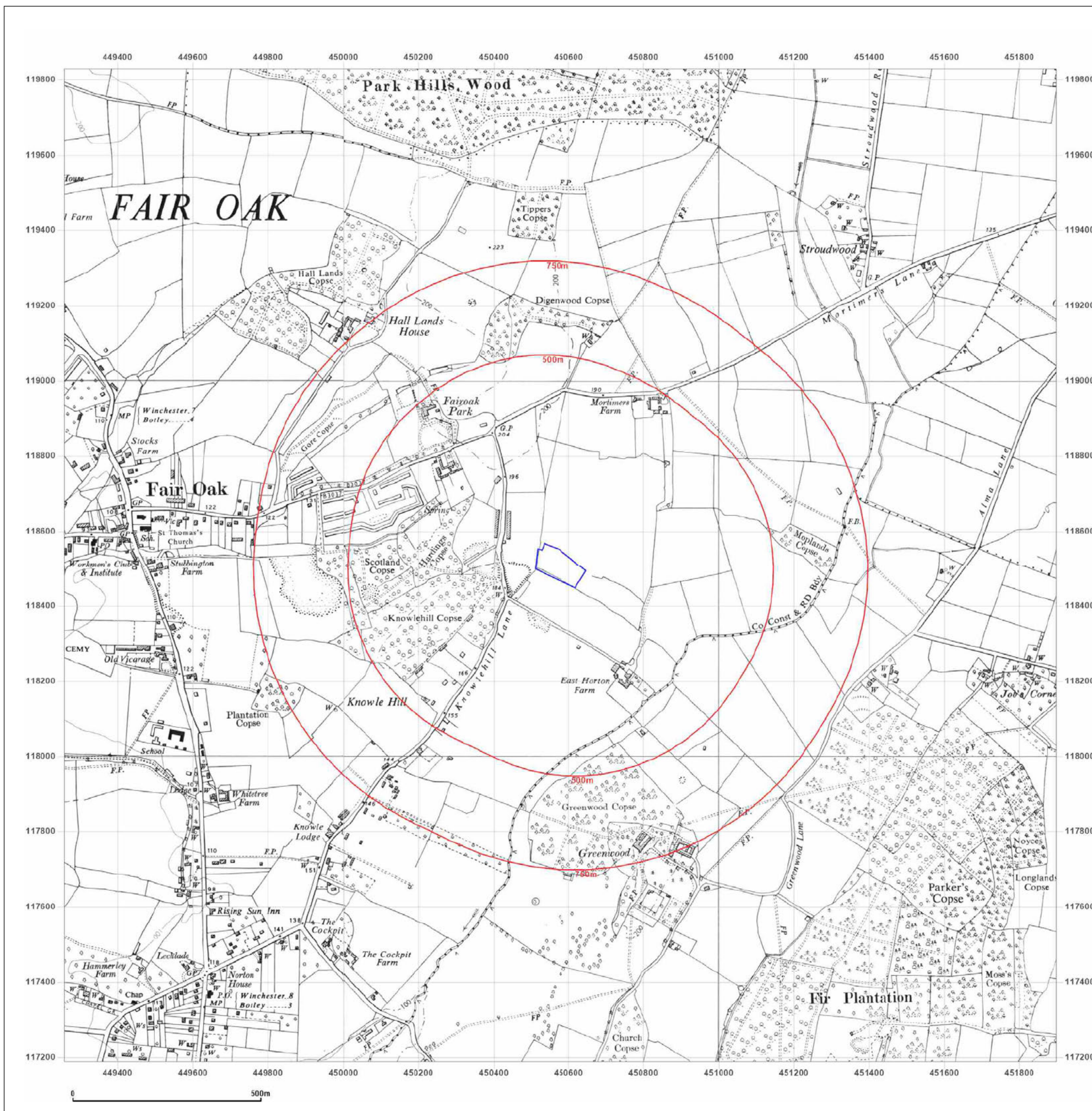


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: Provisional

Map date: 1968

Scale: 1:10,560

Printed at: 1:10,560



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

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

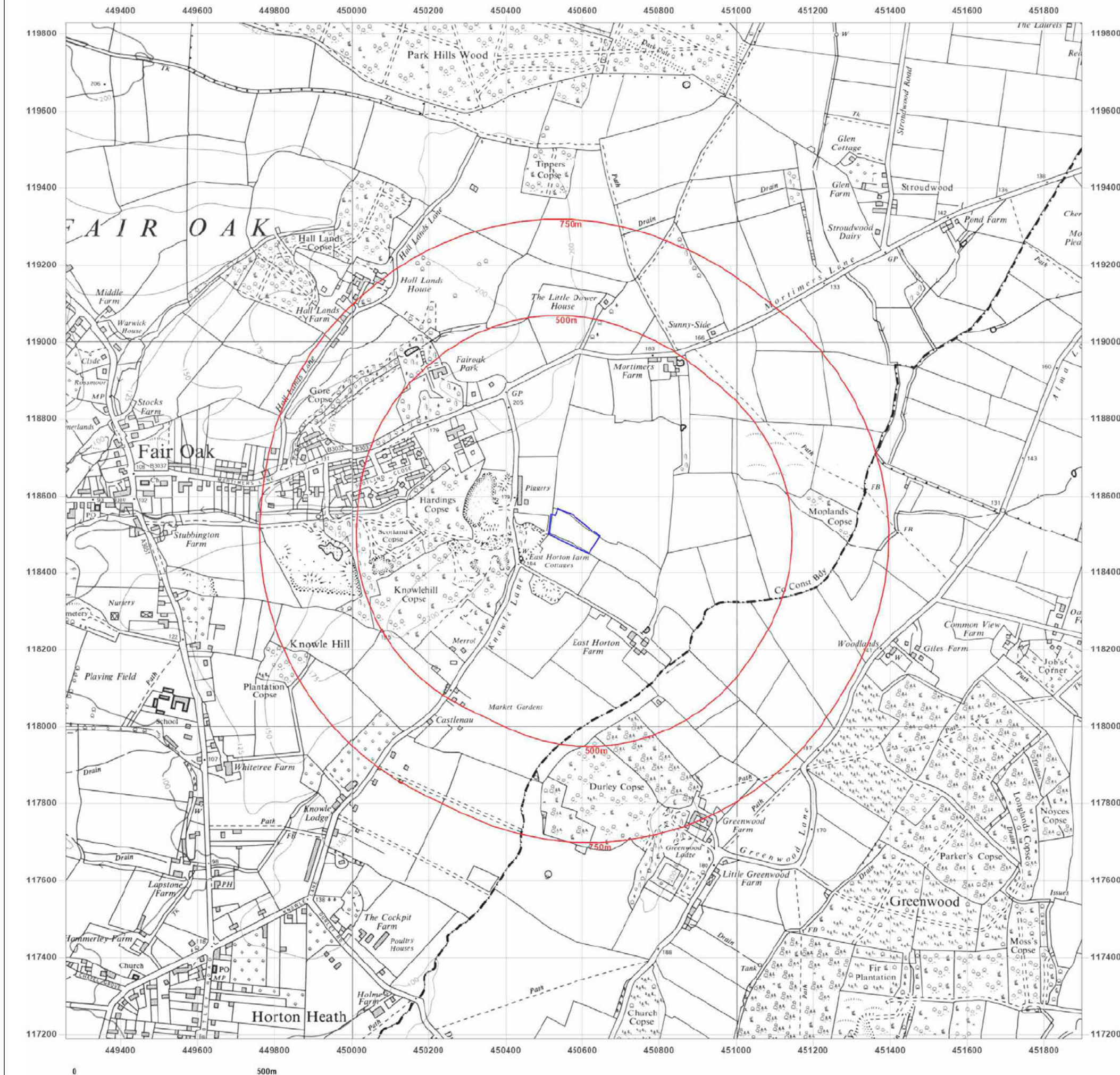


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Site Details:

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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1981-1985

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1980
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1963
Revised 1985
Edition N/A
Copyright N/A
Levelled N/A

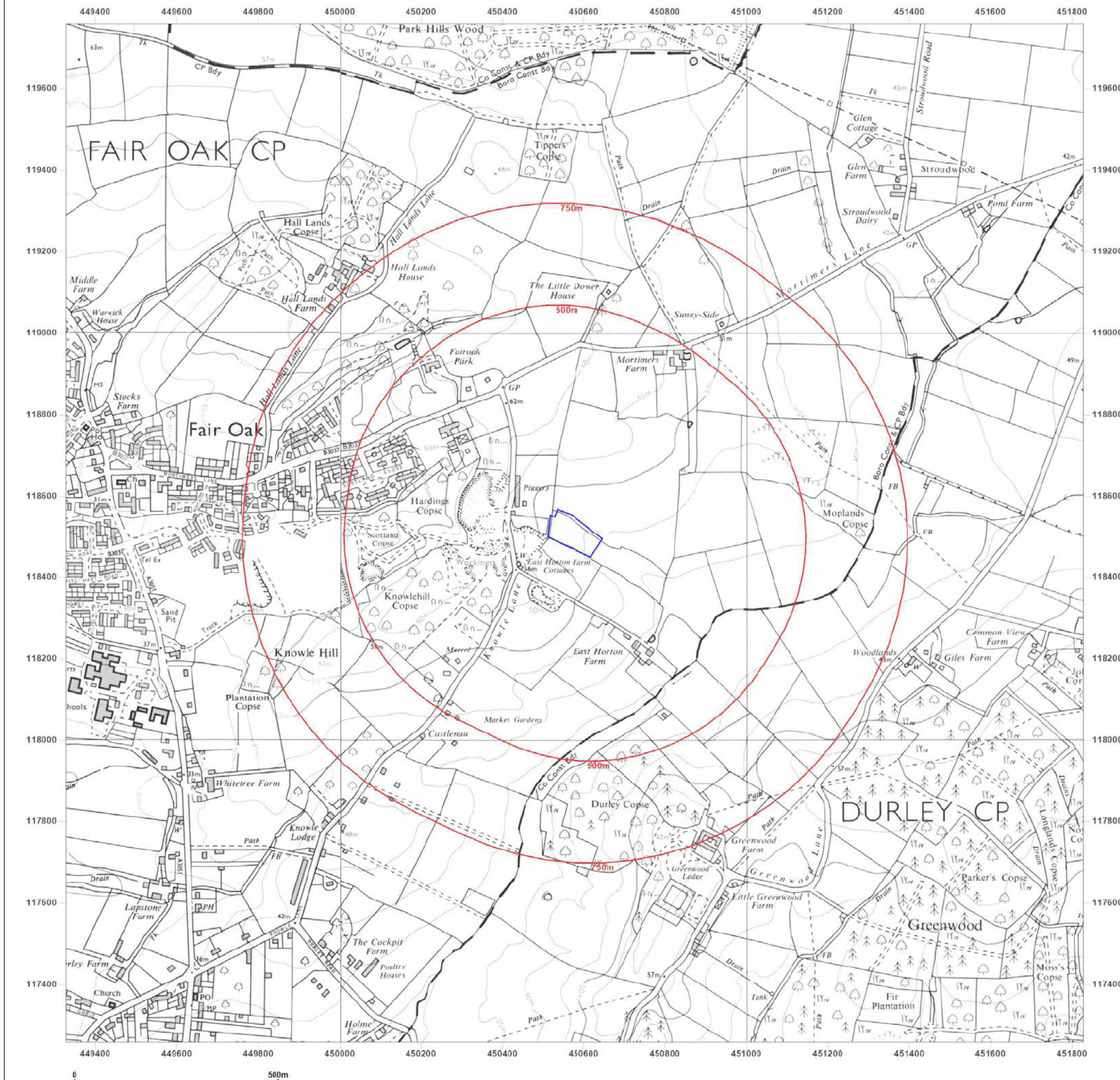


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 1989

Scale: 1:10,000

Printed at: 1:10,000



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

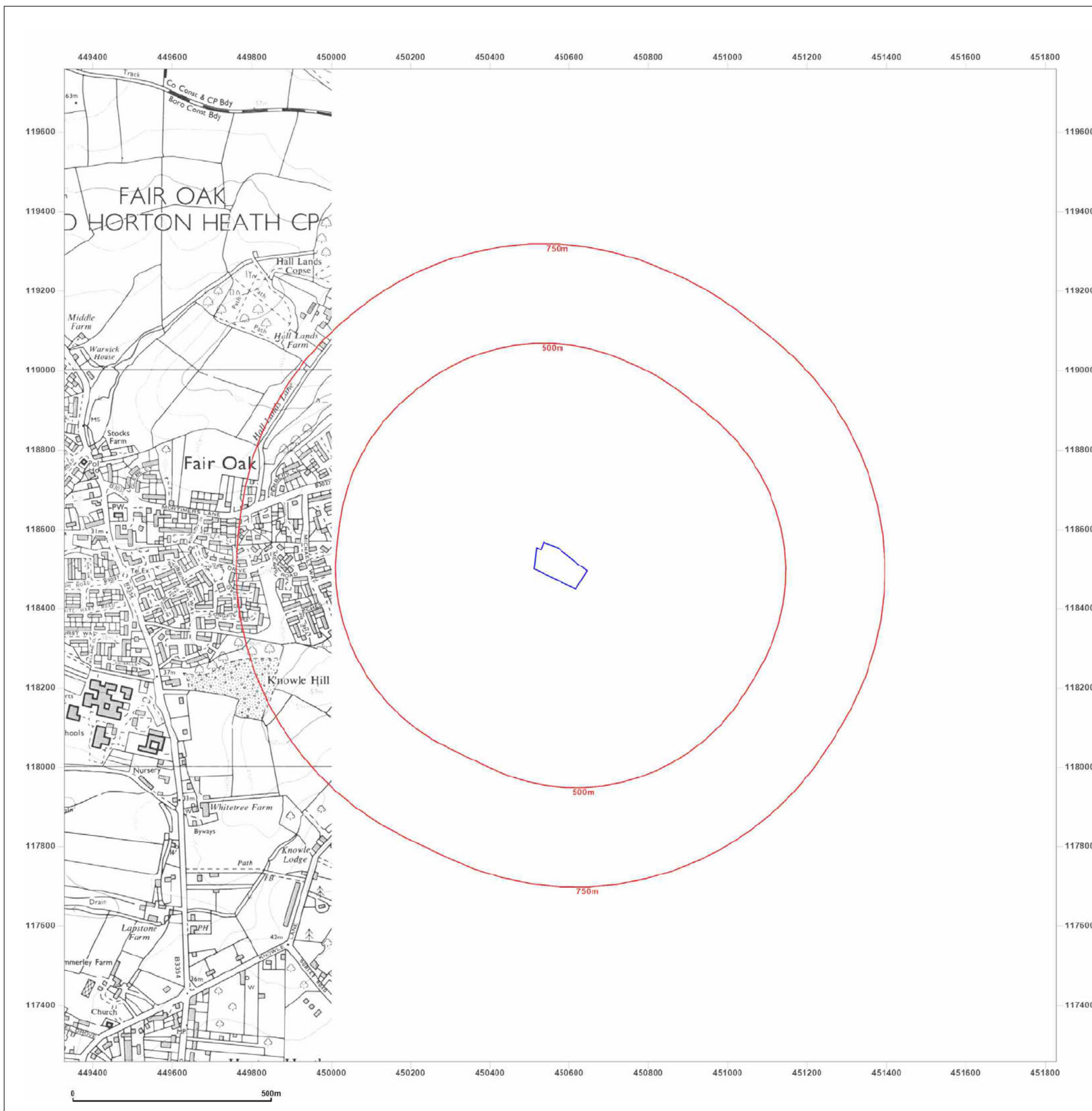


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Client Ref: gwpr5317
Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 2001

Scale: 1:10,000

Printed at: 1:10,000



2001

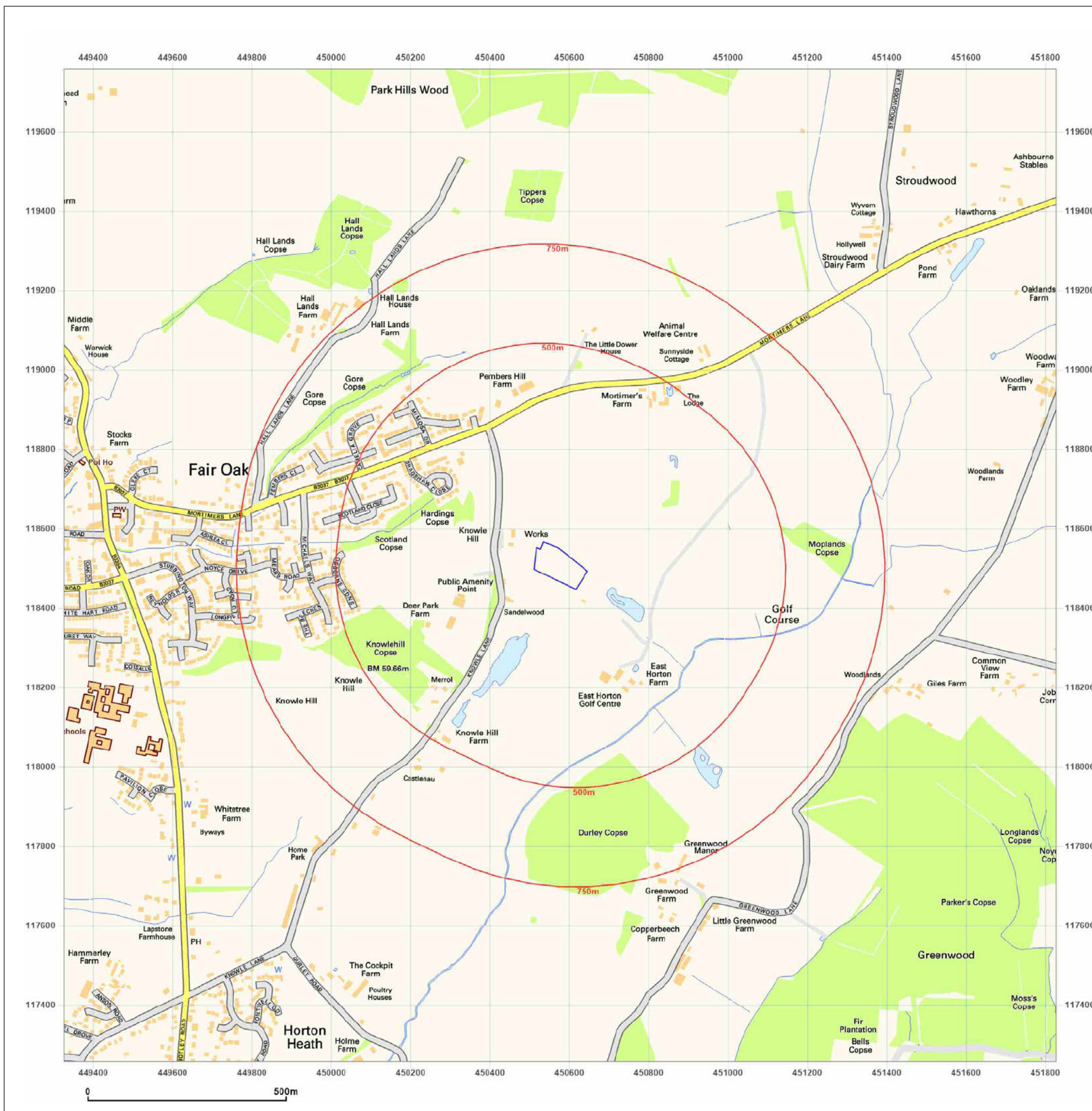


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Site Details:

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HORTON HEATH, SO50 7DZ

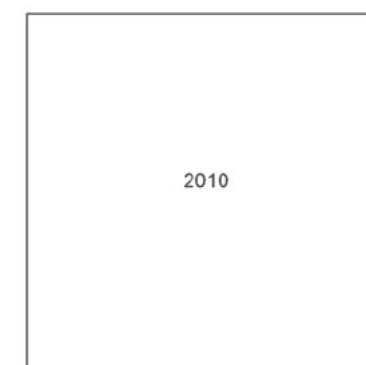
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Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000

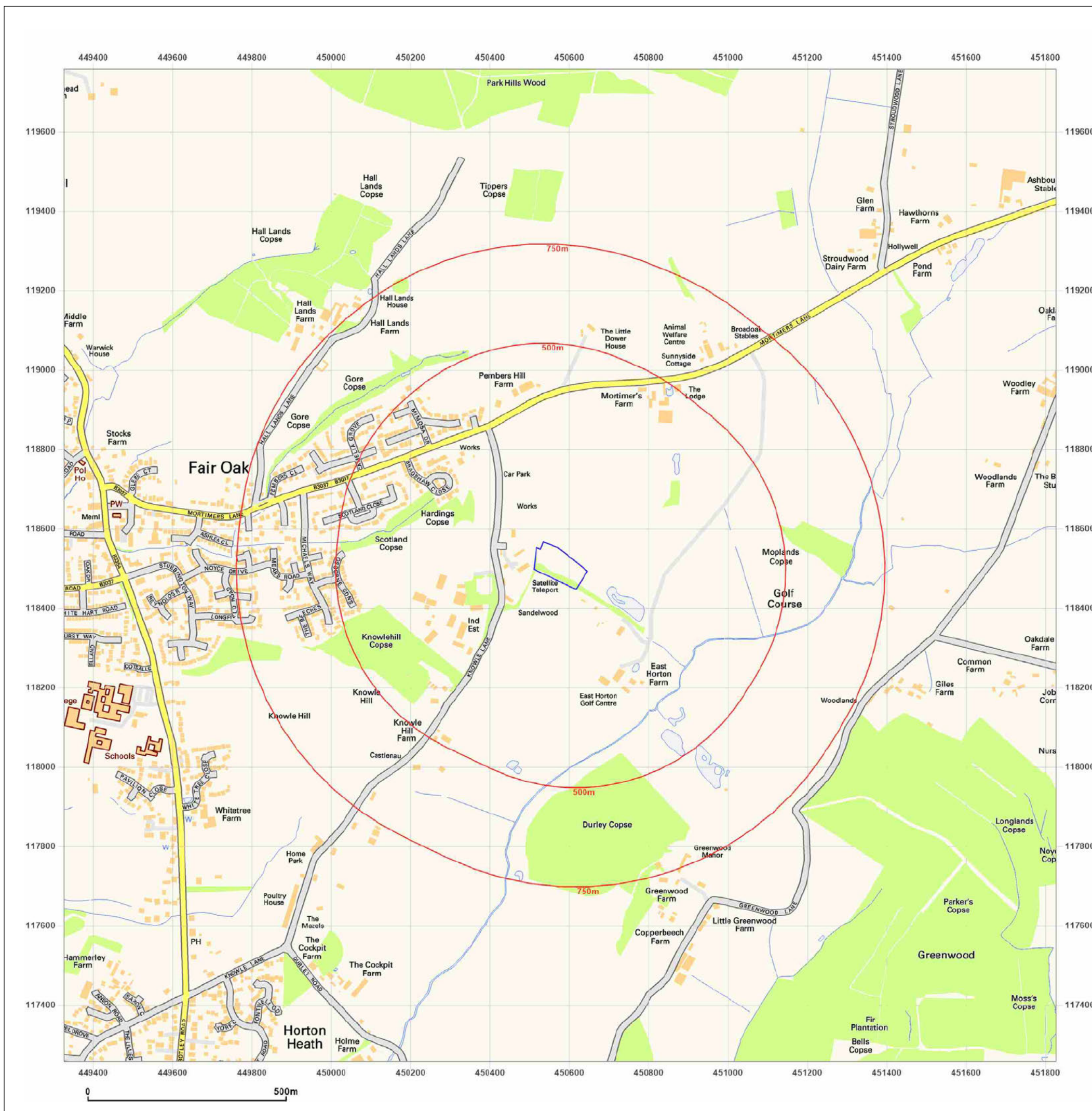


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HORTON HEATH, SO50 7DZ

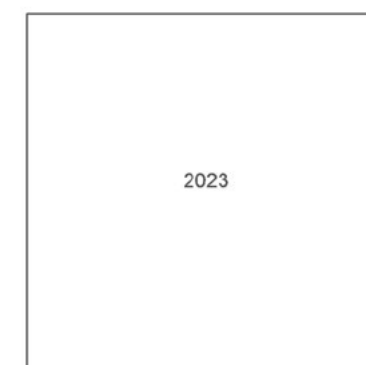
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Report Ref: GS-G51-8A3-4IW-I5K
Grid Ref: 450577, 118508

Map Name: National Grid

Map date: 2023

Scale: 1:10,000

Printed at: 1:10,000

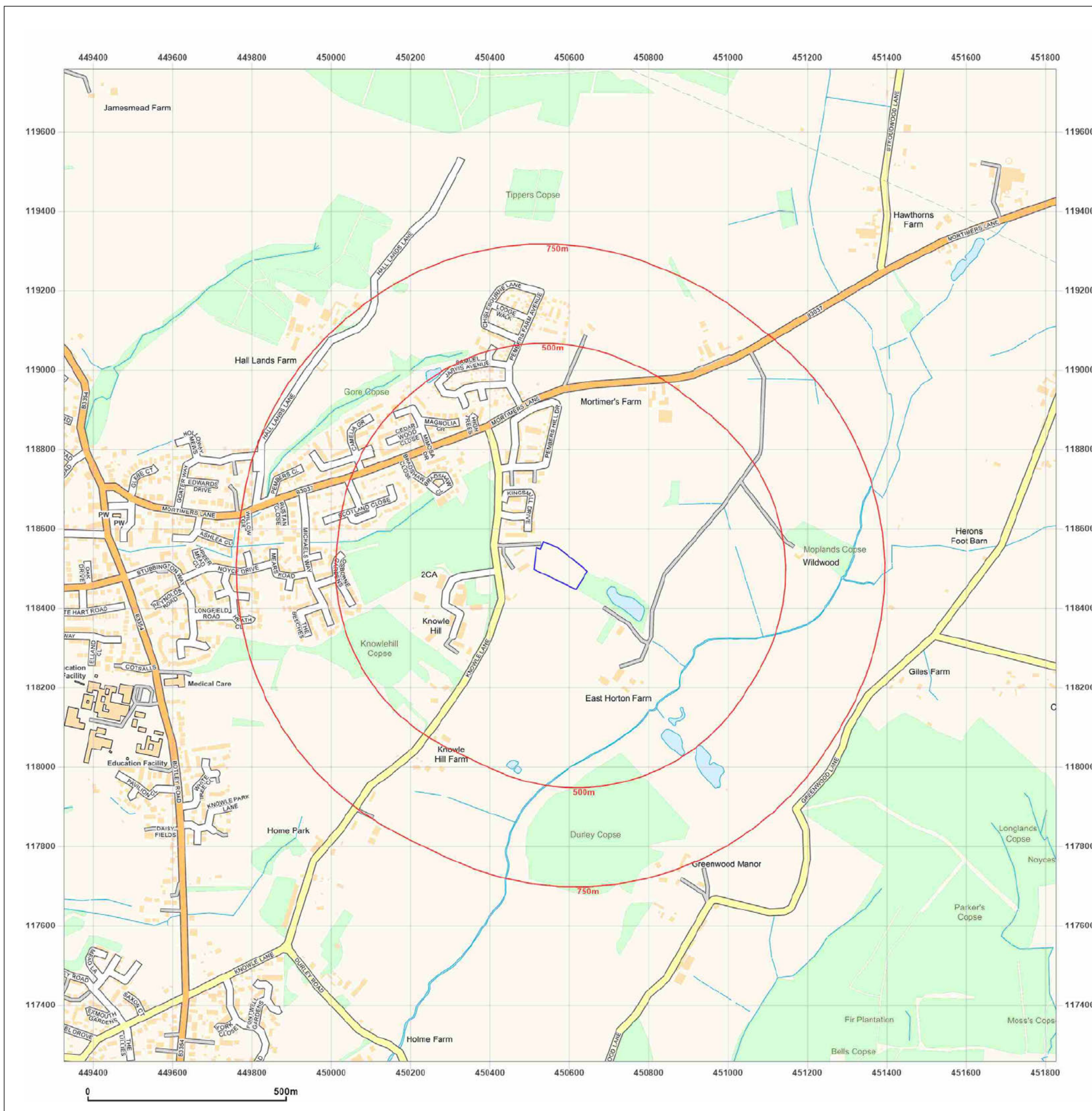


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APPENDIX E: Trial Hole Logs



Date: 27/03/2023

Contractor:

Crew Name:

Drilling Equipment:	
---------------------	--

Page Number
Sheet 1 of 1



Date: 27/03/2023

Contractor:

Crew Name:

Drilling Equipment:

Page Number
Sheet 1 of 1

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

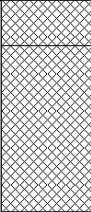
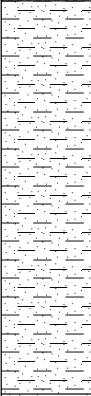
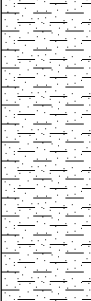
Water strike at 2.20m bgl.





Percussion Drilling Log

Project Name: East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ		Client: Parsons Construction Ltd		Date: 27/03/2023	
Location: East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ		Contractor:			
Project No. : GWPR5317		Crew Name:		Drilling Equipment:	
Borehole Number WS3	Hole Type WLS	Level	Logged By	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D	N=7 (2,1/1,2,2,2)	0.30			Dark brown, black very sandy, clayey GRAVEL. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint (85%), brick (5%) and concrete (10%). Dark Brown very sandy, very gravelly CLAY. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint (85%), brick (5%) and concrete (10%).	1
		0.50	D						
		0.80	D						
		1.00	D						
		1.00	SPT						
		1.50	D	N=10 (2,2/2,3,3,2)	1.40			Light brown, orange, grey mottled sandy CLAY. Sand is fine to medium. LONDON CLAY FORMATION.	2
		2.00	D						
		2.00	SPT						
		2.50	D						
		3.00	D						
		3.00	SPT	N=12 (2,3/3,3,3,3)	4.00			Brown, grey very sandy CLAY. LONDON CLAY FORMATION.	4
		3.50	D						
		4.00	D						
		4.00	SPT						
		4.50	D						
		5.00	D	N=12 (3,2/3,3,3,3)	6.00			End of Borehole at 6.000m	6
		5.00	SPT						
		5.50	D						
		6.00	D						
		6.00	SPT						

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Roots to 1.00m bgl

Water Strike at 3.00m bgl





Date: 27/03/2023

Contractor:

Drilling Equipment:

Page Number
Sheet 1 of 1



Percussion Drilling Log

Project Name: East Horton Business Park,
Knowle Lane, Fair Oak, SO50 7DZ
Location: East Horton Business Park, Knowle
Lane, Fair Oak, SO50 7DZ

Client: Parsons Construction Ltd

Date: 27/03/2023

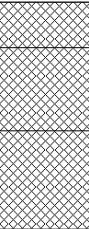
Contractor:

Project No. : GWPR5317

Crew Name:

Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS5	WLS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
		Depth (m)	Type	Results								
		0.20	D	N=3 (1,1/0,1,1,1)	0.30			Brown very sandy, GRAVEL. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint (85%), brick (5%) and concrete (10%).	1			
		0.50	D					Dark brown, black very sandy, clayey GRAVEL. Sand is fine to medium, gravel is fine to medium, sub-angular to sub-rounded of flint (85%), brick (5%) and concrete (10%).				
		0.80	D		0.85			Brown slightly sandy, very gravelly CLAY. Sand is fine to medium, gravel is fine to coarse, sub-angular to sub-rounded of flint (85%), brick (5%), concrete (5%) and chalk (5%).				
		1.00	D									
		1.00	SPT	N=9 (4,2/2,3,2,2)	1.50			End of Borehole at 1.500m				
		1.50	D									
		1.50	SPT									2
									3			
									4			
									5			
									6			
									7			
									8			
									9			
									10			

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Roots to 0.80m bgl
Sampler bouncing at 1.50m, location moved 3m south and still bouncing at 1.50m, possibly on the edge of concrete.







APPENDIX F: Geotechnical Laboratory Testing



Laboratory Report



Contract Number: 65689

Client Ref: **GWPR5317**

Client PO: **GWPR5317**

Date Received: **03-04-2023**

Date Completed: **06-04-2023**

Report Date: **06-04-2023**

Client: **Ground and Water Limited**

Unit 2, The Long Barn,

Norton Farm,

Selbourne Road,

Alton,

Hampshire

GU34 3NB

This report has been checked and approved by:

Paul Evans

Director

Contract Title: **East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ**

For the attention of: **Adam Young**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	5
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (Human Resources/ Health and Safety Manager)

GEO Site & Testing Services Ltd

Units 3-4, Heol Aur, Dafen, Llanelli, Carmarthenshire, Wales SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND
PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)**

Contract Number	65689	
Project Name	East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ	
Date Tested	05/04/2023	
	DESCRIPTIONS	

[illegible]

Operator

Clayton Jenkins

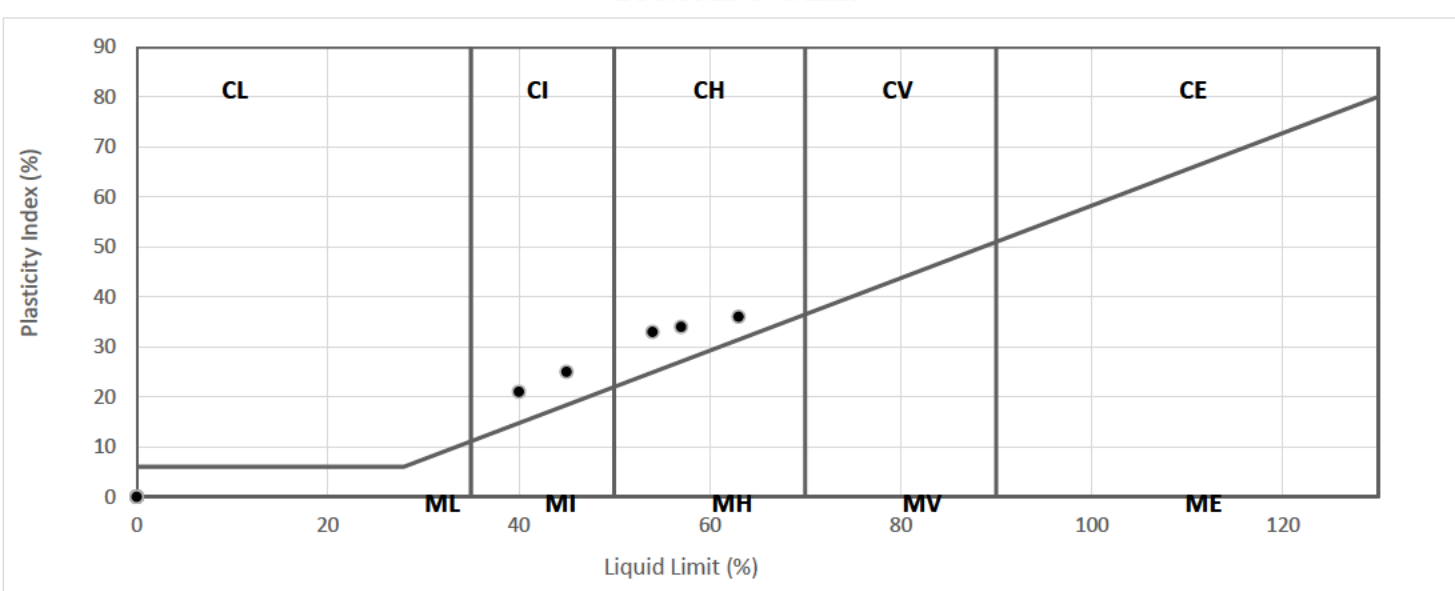
**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND
PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)**

Contract Number	65689	
Project Name	East Horton Business Park, Knowle Lane, Fair Oak, SO50 7DZ	
Date Tested	05/04/2023	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:2015+A1:2020



Operator

Clayton Jenkins

APPENDIX G: Chemical Laboratory Testing



Ground and Water Ltd
Head Office
2 The Long Barn
Norton Farm, Selborne Road
Alton
Hampshire
GU34 3NB

Attention: Adam Young

CERTIFICATE OF ANALYSIS

Date of report Generation:	06 April 2023
Customer:	Ground and Water Ltd
Sample Delivery Group (SDG):	230331-72
Your Reference	GWPR5317
Location:	East Horton Business Park, Knowle Lane, Fair Oak,
Report No:	684843
Order Number:	GWPR5317

We received 3 samples on Friday March 31, 2023 and 3 of these samples were scheduled for analysis which was completed on Thursday April 06, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By

Sonia McWhan

Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 230331-72
Client Ref.: GWPR5317

Report Number: 684843
Location: East Horton Business Park, Knowle Lane, Fair Oak,

Superseded Report

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
27774222	WS1		2.00 - 2.00	27/03/2023
27774215	WS2		1.00 - 1.00	27/03/2023
27774220	WS4		2.50 - 2.50	27/03/2023

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 230331-72

Report Number: 684843

Superseded Report

Client Ref.: GWPR5317

Location: East Horton Business Park, Knowle Lane, Fair Oak,

Results Legend



Test



No Determination Possible

Sample Types -

S - Soil/Solid
 UNS - Unspecified Solid
 GW - Ground Water
 SW - Surface Water
 LE - Land Leachate
 PL - Prepared Leachate
 PR - Process Water
 SA - Saline Water
 TE - Trade Effluent
 TS - Treated Sewage
 US - Untreated Sewage
 RE - Recreational Water
 DW - Drinking Water Non-regulatory
 UNL - Unspecified Liquid
 SL - Sludge
 G - Gas
 OTH - Other

Lab Sample No(s)

27774222
27774215
27774220

Customer
Sample Reference

WS1
WS2
WS4

AGS Reference

Depth (m)

2.00 - 2.00
1.00 - 1.00
2.50 - 2.50

Container

1kg Cardboard
Container
1kg Cardboard
Container
1kg Cardboard
Container

Sample Type

S
S
S

Ammoniacal N as NH4 in 2:1 extract

All

NDPs: 0
Tests: 2

X
X

Anions by Kone (soil)

All

NDPs: 0
Tests: 2

X
X

Magnesium (BRE)

All

NDPs: 0
Tests: 2

X
X

NO3, NO2 and TON by KONE (s)

All

NDPs: 0
Tests: 2

X
X

pH

All

NDPs: 0
Tests: 3

X
X
X

Sample description

All

NDPs: 0
Tests: 3

X
X
X

Total Sulphate

All

NDPs: 0
Tests: 3

X
X
X

Total Sulphur

All

NDPs: 0
Tests: 2

X
X



CERTIFICATE OF ANALYSIS

Validated

SDG: 230331-72
Client Ref.: GWPR5317

Report Number: 684843
Location: East Horton Business Park, Knowle Lane, Fair Oak,

Superseded Report

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
-----------	----------	------	-----------------	--------	-------------	--------	------------	-------------	-------

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
27774222	WS1	2.00 - 2.00	Light Brown	Sandy Clay	Stones	None
27774215	WS2	1.00 - 1.00	Dark Brown	Silty Clay	Stones	None
27774220	WS4	2.50 - 2.50	Light Brown	Silty Clay	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

SDG: 230331-72
Client Ref.: GWPR5317

Report Number: 684843

Superseded Report

Location: East Horton Business Park, Knowle Lane, Fair Oak,

Results Legend			Customer Sample Ref	WS1	WS2	WS4			
#	ISO17025 accredited.								
m	m/CERTS accredited test.								
aq	Aqueous / settled sample.								
disc.filt	Dissolved / filtered sample.								
tot.unfilt	Total / unfiltered sample.								
*	Subcontracted - refer to subcontractor report for accreditation status.								
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery								
(F)	Trigger breach confirmed								
1-4a	Sample deviation (see appendix)								
Component	LOD/Units	Method							
Moisture Content Ratio (% of as received sample)	%	PM024	13	14	17				
Sulphur, Total	<0.02 %	TM132		0.0523	<0.02				
				#	#				
pH	1 pH Units	TM133	8.11	8.43	8.5				
			M	M	M				
Sulphate, acid soluble (total)	<0.0048 %	TM221	0.00836	0.0904	0.00981				
			M	M	M				
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243		0.148	0.0433				
				M	M				
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243		0.0288	0.0103				
				M	M				
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243		0.000591	0.00115				
Ammoniacal N as NH4 in 2:1 extract BRE	0.000 g/l	TM248		0.00422	0.0017				
Magnesium (BRE)	<0.008 g/l	TM282		<0.008	<0.008				



CERTIFICATE OF ANALYSIS

Validated

SDG: 230331-72
Client Ref.: GWPR5317

Report Number: 684843
Location: East Horton Business Park, Knowle Lane, Fair Oak,

Superseded Report

Table of Results - Appendix

Method No	Description
PM024	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM132	ELTRA CS800 Operators Guide
TM133	Determination of pH in Soil and Water using the GLpH pH Meter
TM221	Determination of Acid Extractable Sulphate in Soils by ICP OES
TM243	Mixed Anions In Soils By Kone
TM248	Determination of Ammonium BRE (2:1 Extract) on solids
TM282	Extraction of Magnesium by BRE Method

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



CERTIFICATE OF ANALYSIS

Validated

SDG: 230331-72
Client Ref.: GWPR5317

Report Number: 684843
Location: East Horton Business Park, Knowle Lane, Fair Oak,

Superseded Report

Test Completion Dates

Lab Sample No(s)	27774222	27774215	27774220
Customer Sample Ref.	WS1	WS2	WS4
AGS Ref.			
Depth	2.00 - 2.00	1.00 - 1.00	2.50 - 2.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Ammoniacal N as NH4 in 2.1 extract		04-Apr-2023	04-Apr-2023
Anions by Kone (soil)		05-Apr-2023	05-Apr-2023
Magnesium (BRE)		04-Apr-2023	04-Apr-2023
NO3, NO2 and TON by KONE (s)		05-Apr-2023	05-Apr-2023
pH	04-Apr-2023	04-Apr-2023	04-Apr-2023
Sample description	01-Apr-2023	01-Apr-2023	01-Apr-2023
Total Sulphate	06-Apr-2023	06-Apr-2023	06-Apr-2023
Total Sulphur		04-Apr-2023	04-Apr-2023



CERTIFICATE OF ANALYSIS

SDG: 230331-72
Client Ref: GWPR5317

Report Number: 684843
Location: East Horton Business Park, Knowle Lane, Fair Oak,

Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anorthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX H: DCP Layer Strength Analysis Report

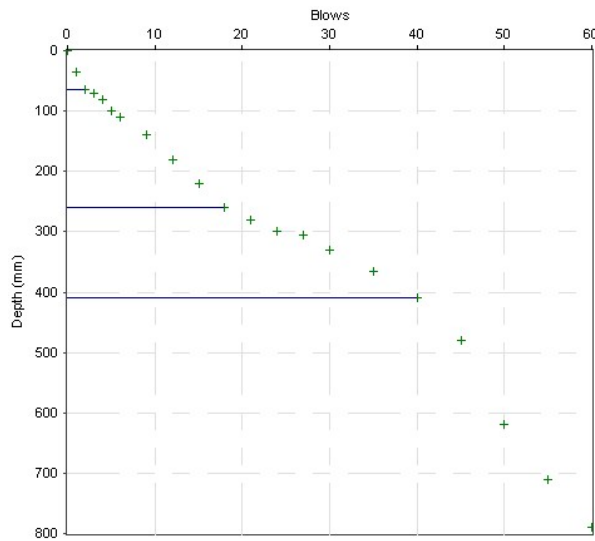
DCP Layer Strength Analysis Report

Project Name: DCP Data

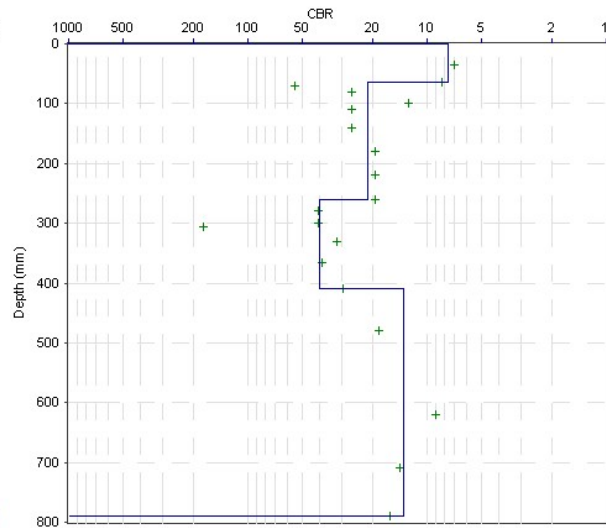
Chainage (km): 1.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 150
 Test Date: 26/04/2023

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	32.50	8	65	65
2	12.19	21	195	260
3	6.82	40	150	410
4	19.00	13	380	790

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

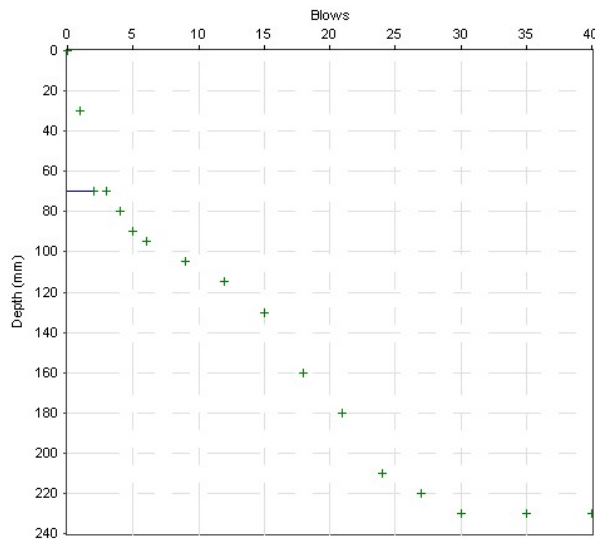
DCP Layer Strength Analysis Report

Project Name: DCP Data

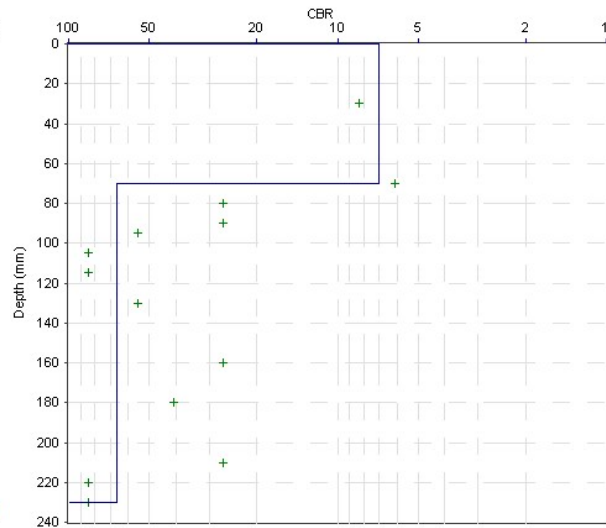
Chainage (km): 2.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 150
 Test Date: 26/04/2023

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 2.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	35.00	7	70	70
2	4.21	66	160	230

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by