



Desk Study Report

Project Name: Land at Ford Road, Arundel

Location: Land at Ford Road, Arundel,
West Sussex, BN18 9HN

Client: Earl of Arundel

Project ID: J14309

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SUMMARY

The site, which extends to approximately 9.68ha comprises two fields used for agriculture. At the time of the walkover the western field had been recently ploughed and planted with crops and the eastern field was grassed and used for grazing cattle. It is proposed to construct 90 No. residential units with associated parking and garden areas.

Geological records indicate the site to be underlain by superficial Head and possible Raised Marine Deposits along the easternmost boundary over London Clay Formation and Lambeth Group in the north-eastern corner.

A desk study was carried out and indicates that the site has a history of agricultural use with an allotment extending onto the north of the site between 1937 and 1947. The site is located within a generally agricultural and residential area.

An Unexploded Ordnance (UXO) risk assessment was undertaken by a specialist subcontractor as part of these works. A preliminary UXO risk rating of Low has been determined for hand dug excavation or limited mechanical excavation or trenching. A UXO risk rating of medium has been provided for drilling or sampling.

Based on the desk study search and walkover survey carried out onsite, the overall risk of onsite contamination associated with both historical and current land use is considered to be low to moderate. Furthermore, there is not considered to be a risk of offsite contamination migrating onto the subject site.

As part of a Phase 2 intrusive investigation it is recommended that sampling of any Topsoil or potential Made Ground and underlying soils, particularly within areas of proposed soft landscaping, is undertaken. Chemical analysis of the samples should be carried out in order to determine their suitability to be retained and whether there is a need for any additional assessment or remedial works.

Additionally, the Raised Marine Deposits below the site could also contain significant organic material and are considered a potential source of land gases. The risk from ground gas is considered low. Land gas and groundwater monitoring should be carried out onsite.

As with any site, areas of contamination not identified during investigation works may come to light during the course of redevelopment. Accordingly, a discovery strategy must be in place during the redevelopment to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner. Depending on the nature of any such contamination, it may prove necessary to reassess the remedial strategy for the site. The presence of contamination may affect the classification of waste soils, or the potential for their re-use.

A formal remediation strategy and verification plan should be agreed with the regulatory authorities prior to commencement of any remedial works.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of the Earl of Arundel and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd. believes are reliable. Nevertheless, Southern Testing Laboratories Ltd. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

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For and on behalf of Southern Testing Laboratories Limited



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TABLE OF CONTENTS

A	INTRODUCTION	1
1	Authority	1
2	Location	1
3	Proposed Construction	1
4	Object	1
5	Scope	1
B	DESK STUDY AND WALKOVER SURVEY	1
6	Desk Study	1
7	Site Walkover Survey	8
C	PRELIMINARY SITE MODELS	9
8	Conceptual Engineering Geological Ground Model	9
9	Conceptual Site Model	10
10	Conclusions and Recommendations	12

TABLE OF APPENDICES

APPENDIX A

Site Plans

APPENDIX B

Photographs

APPENDIX C

Preliminary UXO Risk Assessment

APPENDIX D

Phase 1 Desk Study – Historical Mapping

APPENDIX E

Phase 1 Desk Study – Environmental Database Search Results and Mapping

A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a signed Project Order Form (quote ref: Q192181) from Guy Dixon of Savills on behalf of the Earl of Arundel, dated 30th December 2019.

2 Location

The site is located to the west of Arundel, approximately 1.4km SW of Arundel Castle and 1.8km North of Ford Railway Station. The approximate National Grid Reference of the site is TQ 00648 06232. The site location is indicated on Figure 1 within Appendix A.

3 Proposed Construction

It is proposed to construct 90 No. residential units with associated parking and garden areas (as shown in appended Figure 3).

For the purposes of the contamination risk assessment, the proposed development land use is classified as Residential with consumption of Homegrown Produce, CLEA Model Ref [1] / C4SL Report Ref [2].

The gas sensitivity of the proposed development is rated as High CIRIA C665 Ref [3].

4 Object

This is a Phase 1 Desk Study and Walkover (risk estimation and evaluation) investigation (Tier 1).

The object of the investigation was to assess the likely nature and extent of soil, groundwater and soil gas contamination on the site.

5 Scope

This report presents our desk study findings, and our interpretation of these data.

A UXO risk assessment was included.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd. believes are reliable. Nevertheless, Southern Testing Laboratories Ltd. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of the Earl of Arundel and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report may not be appropriate to alternative development schemes.

B DESK STUDY AND WALKOVER SURVEY

6 Desk Study

A desk study has been carried out. Reference has been made to the following information sources.

- ✦ Online Geological Maps Ref [4] & Ref [5]
- ✦ Online Hydrogeological Maps Ref [6]
- ✦ Aerial Photographs
- ✦ Historical Ordnance Survey Maps
- ✦ Environmental Databases

- ✦ BGS Online Historical Borehole Records Ref [7]
- ✦ Search on Local Authority Planning Portal for planning history
- ✦ MAGIC website mapping Ref [8]
- ✦ Environment Agency / Gov.UK Website Flood Risk Ref [9]
- ✦ UK Radon Ref [10] and BRE Radon Ref [11]
- ✦ Google Earth (for old aerial photographs)

The environmental databases search report compiled for this desk study contains site-specific environmental data drawn from data sets that comprise publicly available information together with data from third parties, some of which is under review. Accordingly, Southern Testing Laboratories Limited does not warrant its accuracy, reliability or completeness.

The full report is included in Appendix D and E, a summary of the salient features is included in the following sections of this report.

6.1 Geology

The British Geological Survey Map No. 317 (Chichester sheet) indicates that the site geology consists of superficial Head and possible Raised Marine Deposits along the easternmost boundary overlying London Clay Formation and Lambeth Group in the north-eastern corner.

6.1.1 Head

Head is a superficial deposit comprising a poorly sorted and poorly stratified material formed mostly by solifluction and/or hillwash and soil creep. This is a polymict deposit of gravel, sand and clay depending on the local upslope geology, from which it is derived.

6.1.2 Raised Marine Deposits

Raised Marine Deposits comprise gravel (beach shingle), sand, silt and clay, commonly charged with organic debris mostly consisting of plant and shell material, now above the level of the present shoreline as a result of either earth movement or a general fall in sea level

6.1.3 London Clay

The London Clay mainly comprises blue-grey or grey-brown fissured clay and silty clay, which weathers to brown near the surface. It commonly contains thin courses of carbonate concretions ('cementstone nodules'), selenite crystals and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation.

Although slopes will stand in the clay at steep angles in the short term, the long-term stable slope angle is about 7° for grassed, or cleared slopes, and a few degrees more for wooded slopes.

This formation is known to contain pyrite.

6.1.4 Lambeth Group

The Lambeth Group comprises a vertically and laterally very variable sequence of multicoloured and mottled clays and sands. The sands are greenish yellow or brown, and generally alternate with the multicoloured mottled clays and sometimes bands of lignite. Pebble Beds, locally cemented into conglomerate, and some bands of concretionary ironstone may also be present. Shells are frequently found in the clays and are sometimes locally cemented into a limestone bed that may form an obstruction to pile borings. At the base of the formation there can be layer of greenish sands with flint pebbles where they rest directly above the Thanet Beds.

Clays within this group are known to contain pyrite.

6.2 Historical Borehole Records

A search of previous exploratory hole records both from the online British Geological Survey database [7] and Southern Testing in-house records, revealed numerous records within the near vicinity of this site, from the BGS source. No nearby STL boreholes were within the same mapped geology.

The nearby BGS borehole records from the easternmost part of the site indicate superficial deposits (Raised Marine Deposits) of soft clays, occasionally organic, over sands and gravels to around 8m depth, with groundwater encountered within the sand & gravel layers. Stiff to very stiff silty multi-coloured clays are indicated from around 8m depth in this area which is consistent with the Lambeth Group deposits mapped across the north eastern corner of the site.

BGS boreholes records located onsite and to the south of the site indicate Head deposits to approximately 4.0m to 5.0mbgl which consists silty clays with occasional layers of gravels or sands over London Clay. To the east of the site BGS boreholes indicate Raised Marine Deposits to around 7.5m to 8.0mbgl depth consisting of soft silty clays, sands and gravels, over London Clay/Lambeth Group. Chalk was encountered in one borehole at 29mbgl.

A summary of the nearest boreholes from the British Geological Survey database are listed below (accessed 8th January 2020).

BH Reference	Final Depth (mbgl)	Approximate Distance from site (m) & Direction	Remarks
TQ00NW153	1.4m	Onsite (central)	Trial pit. Soils encountered: Topsoil to 0.3m, over a stiff silty CLAY to 0.75m, over a stiff slightly sandy silty CLAY with flint gravel to 1.2m over a stiff very silty CLAY. No groundwater recorded.
TQ00NW119	8.0m	Onsite (central)	Cable percussive borehole. Soils encountered: Topsoil to 0.4m, over a soft to firm silty CLAY to 2.9m, over a stiff very silty CLAY to 5.0m, over very stiff slightly silty CLAY. No groundwater recorded.
TQ00NW121	20.0m	Onsite (eastern boundary)	Cable percussive borehole. Soils encountered: Topsoil to 0.35m, over a soft to firm silty CLAY to 5.0m, over medium dense silty SAND with flint gravel/cobbles to 7.5m, over stiff to very stiff slightly silty CLAY. Groundwater encountered at 5m which rose to 1.2m after 20 minutes.
TQ00NW152	2.0m	20m South	Trial Pit. Soils encountered: Topsoil to 0.1m, over stiff silty CLAY to 0.5m, over clayey silty sandy flint GRAVEL. No groundwater recorded.
TQ00NW118	10.0m	20m South	Cable percussive borehole. Soils encountered: Topsoil to 0.3m, over firm very sandy silty CLAY with gravel to 1.2m, over Medium dense, clayey silty very sandy flint GRAVEL to 4.1m, over stiff becoming very stiff silty CLAY with occasional fine gravel. Groundwater encountered at 2.5m depth, rose to 2.1m after 20 minutes.

BH Reference	Final Depth (mbgl)	Approximate Distance from site (m) & Direction	Remarks
TQ00NW122	30.5m	20m East	Cable percussive borehole. Soils encountered: Topsoil to 0.2m, over soft/very soft silty CLAY with shell fragments, organic pockets and some flint gravel to 4.9m, over Loose becoming medium dense SAND with flint gravel to 6.9m, over Stiff becoming very stiff closely fissured slightly silty CLAY to 29m (flint gravel from 26.7m), CHALK recovered as fine to coarse gravel in matrix of soft white putty chalk. Groundwater encountered at 4.5m which rose to 4.15m in 20 minutes and at 26.7m which rose to 1.0m overnight.
TQ00NW120	13.0m	20m East	Cable percussive borehole. Soils encountered: Topsoil to 0.25, over Soft/very soft silty CLAY with occasional gravel to 4.95m, over Loose becoming medium dense SAND with flint gravel and cobbles to 7.85m, over very stiff closely fissured sandy very silty CLAY. Groundwater encountered at 3.0m rising to 2.6m after 20 minutes.
TQ00NW123	13.0m	20m East	Cable percussive borehole. Soils encountered: Topsoil to 0.15, over Soft to firm silty CLAY with occasional gravel to 4.1m, over SAND with flint gravel to 4.8m, over, medium dense sandy flint GRAVEL to 7.9m, over stiff becoming very stiff closely fissured silty CLAY. Groundwater rose overnight to 0.55m.

6.3 Geological Hazards and Mining Activities

Data from various sources relating to potential geological hazards at the site are summarized below. The Hazard Potentials listed for the BGS data are as presented in the Envirocheck report, derived from various generic BGS sources, **which are not considered as site-specific**. It is important that this information is considered in context of the actual site topography, ground conditions encountered during future investigation, and development proposals.

Data Source	Hazard	Hazard Potential to Site	Remarks
BGS	Potential for Collapsible Ground Stability Hazard	Very Low	
	Potential for Compressible Ground Stability Hazard	No Hazard	Although soft clays reported within historic borehole records.
	Potential for Ground Dissolution Stability Hazard	No Hazard	
	Potential for Landslide Ground Stability Hazard	Very Low	
	Potential for Running Sand Ground Stability Hazard	Very Low	Although granular soils and shallow groundwater conditions are reported within historic borehole records.

Data Source	Hazard	Hazard Potential to Site	Remarks
	Potential for Swelling or Shrinkage Clay Ground Stability Hazard	Very Low to Moderate	The site is anticipated to be underlain by clay soils, including London Clay which is known to have a high volume change potential.
	Shallow Mining Hazard	Very Low	
	BGS recorded mineral site	Very Low	The nearest recorded BGS mineral site is 502m west of the site.
ARUP [Ref [12]]	Mining Instability	Very Low	
CCS [Ref [13]] KURG [Ref [14]]	Underground Openings	Unlikely	The nearest underground opening is listed approximately 1.5km north-east (0.7km from Arundel Castle) relating to ice wells/ice houses.

6.4 Radon Risk

With reference to the Envirocheck report, UK Radon Ref [10] and BRE Radon Ref [11] guidance: the site is located within an intermediate probability radon area with 1-3% of homes estimated to be at or above the Action Level. No radon protection is required on this site.

6.5 Hydrology and Hydrogeology

Data from the Environment Agency and other information relating to controlled waters is summarised below.

Data		Remarks	Possible Hazard to/from Site (Y/ N)
Aquifer Designation	Superficial Deposits	Head – Secondary Aquifer – undifferentiated	Y
	Superficial Deposits	Raised Marine Deposits – Secondary A Aquifer	Y
	Bedrock	London Clay Formation - Unproductive Stata	N
	Bedrock	Lambeth Group - Secondary A Aquifer	Y
Groundwater Vulnerability		High Groundwater Vulnerability.	Y
Abstractions	Surface Water	The nearest surface water abstraction is located 628m south-east of the site for general agriculture: spray irrigation.	N
	Groundwater	The nearest groundwater abstraction is located 893m south-east of the site for general agriculture: spray irrigation.	N
Source Protection Zones		The site is not located within a source protection zone.	N
Surface Water Features		The nearest surface water feature is a small stream located on the western boundary of the site. The River Arun is located approximately 300m east of the site.	Y
Groundwater Flood Risk		The site is not shown within or adjacent to an area mapped as being at risk.	N

Data	Remarks	Possible Hazard to/from Site (Y/ N)
Surface Water Flood Risk	The site is not shown within or adjacent to an area mapped as being at risk.	N
Marine / Fluvial Flood Risk	The eastern boundary of the site is shown within an area mapped as being at risk of extreme flooding from river or seas without defences.	Y
Reservoir Flood Risk	The site is not shown within or adjacent to an area mapped as being at risk.	N
Discharge Consents	The nearest discharge consents are located 28m and 36 south-west of the site and are associated with sewage discharge (final/treated effluent) into land at Priory Farm. Both discharge consents were revoked in March 1997.	N

The site is underlain by Head Deposits, Raised Marine Deposits and Lambeth Group which are all classified as secondary aquifers with high groundwater vulnerability. Therefore, the site would be classed as hydrogeologically sensitive. This means there is a potential risk to the site and the underlying aquifer from any potential mobile contaminants arising from either an on-site or an off-site source.

Nearby boreholes (section 6.2) indicates groundwater within sand or gravel layers associated with the head or raised marine deposits between approximately 2.5-5.0m depth. It is anticipated that the groundwater flow would follow the local topography, which in this instance would be in a south-easterly direction, towards the River Arun.

The easternmost part of the site is shown within an area mapped as being at risk of extreme flooding from the River Arun without defences. A flood risk assessment is recommended to be carried out for the site.

6.6 Historical Ordnance Survey Maps

Copy extracts of historical Ordnance Survey plans dating from 1876 to 2019 were obtained and are presented in Appendix D. A summary of the salient features is presented below.

In brief, since 1876 to 2019 the site has been mapped as agricultural land with an area of marsh adjacent to the eastern boundary. An allotment was shown, to the north of the site, extending within the site boundary between 1937 and 1947.

From 1876 the area surrounding the site was generally agricultural land with Old Priory Farm located adjacent to Priory Lane to the southern boundary. From 1937 residential development started to the north of the site and an allotment was located adjacent to the centre of the northern boundary. From 1994 the buildings of Old Priory Farm were labelled individually suggesting they have become residential buildings. From 1999 few residential building and agricultural land surrounds site to south, west and east and residential housing to north and north-west of site which is generally consisted with current mapping.

6.7 Environmental Databases

Data Source	Distance (m)	Direction	Details	Possible Hazard to Site (Y/N)
Historical Industrial Land Use (within 500m)	23	NW	Electrical substation facilities (1971-1980)	N
	50	S	Heat exchangers	N
	81	NE	Cleaning services - Domestic	N
	312	NE	Sewage (1899-1976)	N
	383	NE	Factory or works, use not specified (1974-1976)	N

Data Source	Distance (m)	Direction	Details	Possible Hazard to Site (Y/N)
	384	NE	Metal casting/foundries (1879-1952)	N
	384	NE	Car body repairs	N
	459	W	Quarrying of sand and clay, operation of sand and gravel pits (1880-1899)	N
Current Industrial Land Use (within 500m & listed as active)	434	NE	Carpet, curtain and upholstery cleaners	N
	489	N	Carpet, curtain and upholstery cleaners.	N
Current and Historical Landfills	None listed within 500m of the site.			N
Potentially infilled land (within 500m)	253	NE	Unknown filled ground (water), 1914	N
	304	NE	Unknown filled ground (water), 1914	N
	398	NE	Unknown filled ground (water), 1914	N
	459	W	Potentially infilled land (non-water), 1992	N
	465	NE	Unknown filled ground (water), 1914	N
Fuel Sites	None listed within 1km of the site.			N
Pollution Incidents (within 500m)	27	NE	Category 3, minor incident – Crude sewage into watercourse in Feb 1997.	N
	468	E	Category 3, minor incident - General biodegradable (other natural organic material) into River Arun in July 1999.	N
IPPC/LAPPC Authorisations	None listed within 1km of the site.			N
Hazardous Substances Consents	None listed within 1km of the site.			N
Sensitive Land Uses (within 250m of the site)	0	NW	Ancient & semi-natural woodland – Tottington Common.	Y
	0	NE	Nitrate Vulnerable zone, Sussex Chalk, Groundwater	Y
	42	NW	Ancient & semi-natural woodland – Tottington Common.	N
	43	NW	Ancient & semi-natural woodland – Tottington Common.	N
	45	NW	National Park – South Downs.	N
	149	W	Plantation on ancient woodland - Tottington Common.	N

No significant potentially contaminative sources have been identified from the environmental database search.

It should be noted, the site is located within an area of ancient & semi-natural woodland and within a nitrate vulnerable zone.

6.8 Planning Application History

A search of the Arun District Council planning website details no planning applications for the subject site.

(<https://www.arun.gov.uk/planning>, accessed 07/01/2020).

6.9 Ground Gas Risk

There are no current or historic landfills located within 500m of the site and there are no areas of potentially infilled land listed within 250m of the site.

However, there may be organic materials within the Raised Marine Deposits (alluvial). These typically generate methane and carbon dioxide but other gases, such as hydrogen sulphide can also be present. Therefore the potential risk to the site from land gases is considered to be low.

6.10 UXO Risk Management

The possibility of unexploded ordnance (UXO) being encountered on a site falls within the category of a potentially significant risk and should be address as a legal duty under the Construction (Design and Management) Regulations by the Client as early as possible in a project.

The CIRIA publication C681 Ref [15] has been developed to provide a consistent framework for the management of potential risk posed by UXO during site investigation and groundwork phases of construction. The process adopts a tiered approach, divided into four distinct stages; Preliminary risk assessment, Detailed risk assessment, Risk mitigation and Implementation.

The site has been subject to a preliminary unexploded ordnance (UXO) risk assessment, which was undertaken by MACC International Limited. A copy of their report is provided in Appendix C.

In summary, records were found that indicate Arundel did suffer multiple enemy bombing raids during WWII. The nearest known bomb strike occurred approximately 600m north-east of the site in a field where Arundel Baptist Church stands today. The exact location of strikes during several raids remains unknown. An item of UXO has been found within the general vicinity of the site footprint in recent years. In March 2018, a WWII mortar was found 600m north of the site at Canada Road, Arundel.

It has been determined that given the size and undeveloped nature of the site, further research is required to more accurately define the risk levels and this source of UXO contamination is consequently considered to be credible at a preliminary level.

On the basis of their preliminary findings, MACC International Limited have provided a preliminary UXO risk rating of Low for hand dug excavation or limited mechanical excavation or trenching. A UXO risk rating of medium has been provided for drilling or sampling.

It is recommended that a Detailed UXO Desk Top Study is commissioned to more accurately define the risk level and to complete detailed assessment on the mitigation requirements over the projects lifetime. Notwithstanding this, a preliminary UXO risk rating of medium has been determined for drilling and sampling and therefore, boreholes should be checked for UXO by an EOD Engineer equipped with specialist magnetometers ahead of the drilling bits.

7 Site Walkover Survey

A site walkover was carried out on 10th January 2020.

7.1 General Site Description and Boundaries

The site consisted two fields used for agriculture. At the time of the walkover the western field had been recently ploughed and planted for crops and the eastern field was grassed and used for grazing cattle. Both fields were accessed from Priory Lane.

A small ditch/stream bounded the site to the west and south and a further ditch/stream ran through the centre of the site which separates the two fields. An overhead electricity line ran across the northern part of the western field to

the allotment gardens. A further overhead electricity line ran across the south of the western field and then continues to the north of the eastern field again to the allotment gardens.

An area of marsh land was located along the eastern boundary of the site which was wet and had numerous reeds and grasses.

7.2 Topography and Drainage

The site slopes towards the east/south-east towards Ford Road. The western field slopes by approximately 2 degrees, with the eastern field sloping more steeply at around 5 degrees.

A small ditch/streams bounds the site to the west and the south. Another ditch/stream separates the two fields. The water flows towards the south and east/south-east.

Additionally, water stopcock covers were observed in the south-eastern corner of the site.

7.3 Vegetation

The site was bounded by mature trees, including oak and hedgerows. A further row of mature trees and brambles separate the two fields. A line of small trees and bushes ran east to west across the centre of the eastern site.

To the east of the site there were numerous reeds and grasses within the marsh area.

7.4 Buildings and Land Use on Site and Nearby

The site was bounded to the north by residential housing and an area of allotment gardens. To the north eastern corner there was an area used for storage, including storage containers, a shed and a parked van. An electrical substation was located approximately 20m to the west of the north-western corner of the site.

Similarly to the south of the site was further residential housing from the converted farm buildings. An SGN gas valve was located on the opposite side of Priory Lane.

To the west of the site were horse paddocks, and to the east were further fields adjacent to the river Arun.

7.5 Inaccessible Site Areas

All areas of the site were accessible at the time of the site walkover.

7.6 Site Photographs

A series of photographs showing the site is included in Appendix B.

C PRELIMINARY SITE MODELS

8 Conceptual Engineering Geological Ground Model

From the desk study information and walkover undertaken at this site the following conceptual ground model has been formulated.

Data Source	Comments
Geology	The recorded soils beneath the site comprise London Clay Formation, with the underlying Lambeth Group in the north-east corner of the site, with a covering of Head Deposits across a majority of the site and Raised Marine Deposits over the easternmost side of the site. Head deposits are anticipated to be in the region of 4-5m in thickness and the Raised Marine Deposits are anticipated around 7.5-8m in thickness. The boundary between the superficial deposits is likely to be irregular. An area of marsh land is located along the eastern boundary of the site, where the access road is proposed, which could comprise soft and waterlogged soils.

Data Source	Comments
Former Site Use	The site has a history of agricultural use and is located within an agricultural/residential area.
Groundwater	From nearby borehole records groundwater was recorded as relatively shallow within sand/gravel layers within the Head or Raise Marine Deposits. The superficial deposits are listed as secondary aquifers. Therefore it is possible that groundwater may be encountered during excavation and dewatering may be required. Long term groundwater monitoring would be required in order to determine the depth of groundwater below the site.
Surface Water	The nearest surface water features are small streams/ditches that bound the site to the west and south and also separate the two fields. The River Arun is located approximately 300m east of the site. The easternmost part of the site is mapped as being at risk of extreme flooding from the River Arun without defences. A flood risk assessment is recommended to be carried out for the site.
Potential Geo-hazards	Clay soils are anticipated beneath the site, including London Clay which is known for its high shrinkage/swelling properties.

On the basis of the available information the geotechnical categorisation for the proposed structure(s) is considered to fall within Geotechnical Category 2 – Conventional structure with no exceptional risk or difficult ground or loading conditions; Eurocode 7 Ref [16].

9 Conceptual Site Model

In the context of this report, the conceptual model summarises the potential pollutant linkages identified for the site and forms the basis of the risk assessment for the site. The preliminary model comprises the potential sources of contamination, receptors that could be harmed and exposure pathways identified from the desk study and walkover survey. These potential linkages form the basis upon which the investigation is designed and reported.

9.1 Potential Sources of Contamination

The site has a history of agricultural use and is located within an agricultural and residential area.

A few potentially contaminative uses have been identified on site.

9.1.1 On-Site Sources

Potential Source	Potential Contaminants
Agricultural land	Pesticides, herbicides and heavy metals
Previous allotment gardens	Pesticides, herbicides and possible Made Ground/reworked soil (heavy metals, asbestos containing materials, petroleum hydrocarbons, PAH compounds).
Raised Marine Deposits	Land gases

The site has historically and is still currently used for agriculture including growing crops and grazing animals. Therefore there is the potential that pesticides may have been used onsite and metals can be encountered from animal waste. The risk is considered low to moderate.

Between 1937 and 1947 the allotment gardens extending into the site boundary towards the centre of the site. Therefore there is the possibility that this area may be underlain by made ground or reworked soil. Such ground may contain a wide range of contaminants arising from the site itself or possibly from off-site sources where materials/soils have been imported onto the site. The risk is considered low.

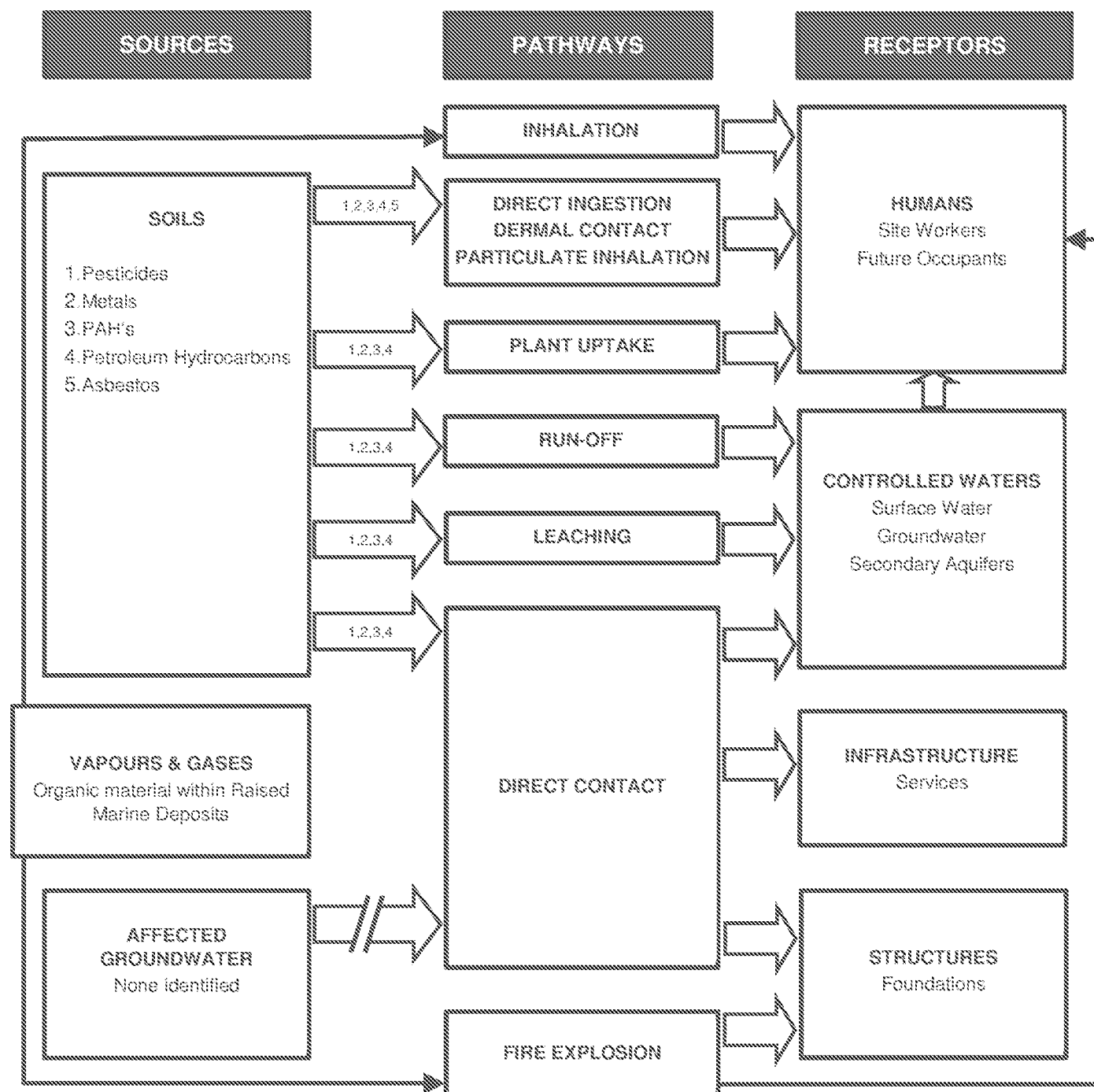
The Raised Marine Deposits below the site could also contain significant organic material and are considered a potential source of land gases. The risk from ground gas is considered low.

9.1.2 Off-Site Sources

No off-site sources of contamination have been identified from the desk study search or from the site walkover. Therefore, the site is not considered to be impacted by contamination migrating from beyond the site boundary.

9.2 Pollutant Linkages and Conceptual Site Model Summary

The following diagram shows the potential pollutant linkages identified for the site and summarises the preliminary conceptual model:



// Denotes potential pollutant linkage not complete.

10 Conclusions and Recommendations

The site currently consists two fields used for agriculture. The western field had been recently ploughed and planted with crops and the eastern field was grassed and used for grazing cattle.

Based on the desk study search and walkover survey carried out onsite, the overall risk of onsite contamination associated with both historical and current land use is considered to be low to moderate. Furthermore, there is not considered to be a risk of offsite contamination migrating onto the subject site. Isolated areas of contamination cannot be ruled out at this stage.

However, as part of a Phase 2 intrusive investigation, it is recommended that sampling and analysis of the Topsoil and underlying soils, particularly within areas of proposed soft landscaping, is carried out in order to determine their suitability to be retained onsite and whether there is a need for any additional assessment or remedial works.

Additionally, there is considered to be a low risk from land gases due to potential organic material within the Raised Marine Deposits. Therefore, gas and groundwater monitoring should be undertaken onsite.

It should be noted that a preliminary UXO Risk Assessment carried out for the site indicate a low risk for hand digging and limited mechanical excavation and a medium risk for drilling or sampling. Therefore, attendance by a UXO engineer is likely to be required onsite during the intrusive investigation and boreholes should be checked for UXO by an EOD Engineer equipped with specialist magnetometers ahead of the drilling bits.

REFERENCES

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- [2] Contaminated Land: Applications in Real Environments (CL:AIRE), "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination," 2014.
- [3] CIRIA, "C665 Assessing risks posed by hazardous ground gases to buildings," 2007.
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- [11] Building Research Establishment (BRE), "BR211 Radon Guidance on protective measures for new buildings," 2015.
- [12] Ove Arup on behalf of the Department of Environment, "Review Of Mining Instability In Great Britain," 1990.
- [13] Chelsea Spelaeological Society, "Various Records, Journals and Special Publications".
- [14] Kent Underground Research Group, "Various Records, Journals and Special Publications".
- [15] CIRIA, "C681 Unexploded Ordnance (UXO) A guide for the construction industry," 2009.
- [16] BSI Standards, "Eurocode 7 Geotechnical Design," 2013.



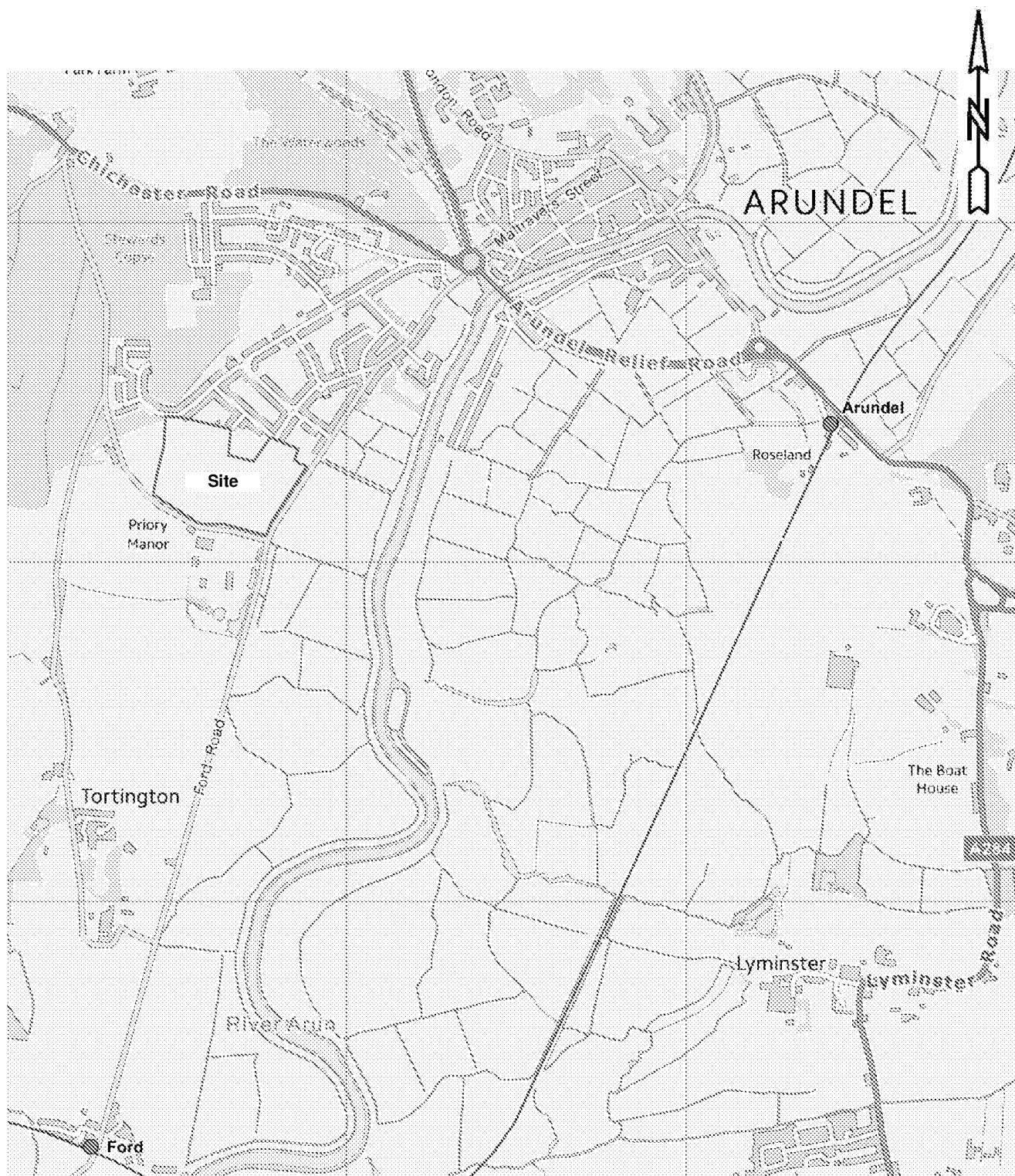
Southern Testing
Environmental & Geotechnical

ST Consult 
Environmental & Geotechnical

APPENDIX A

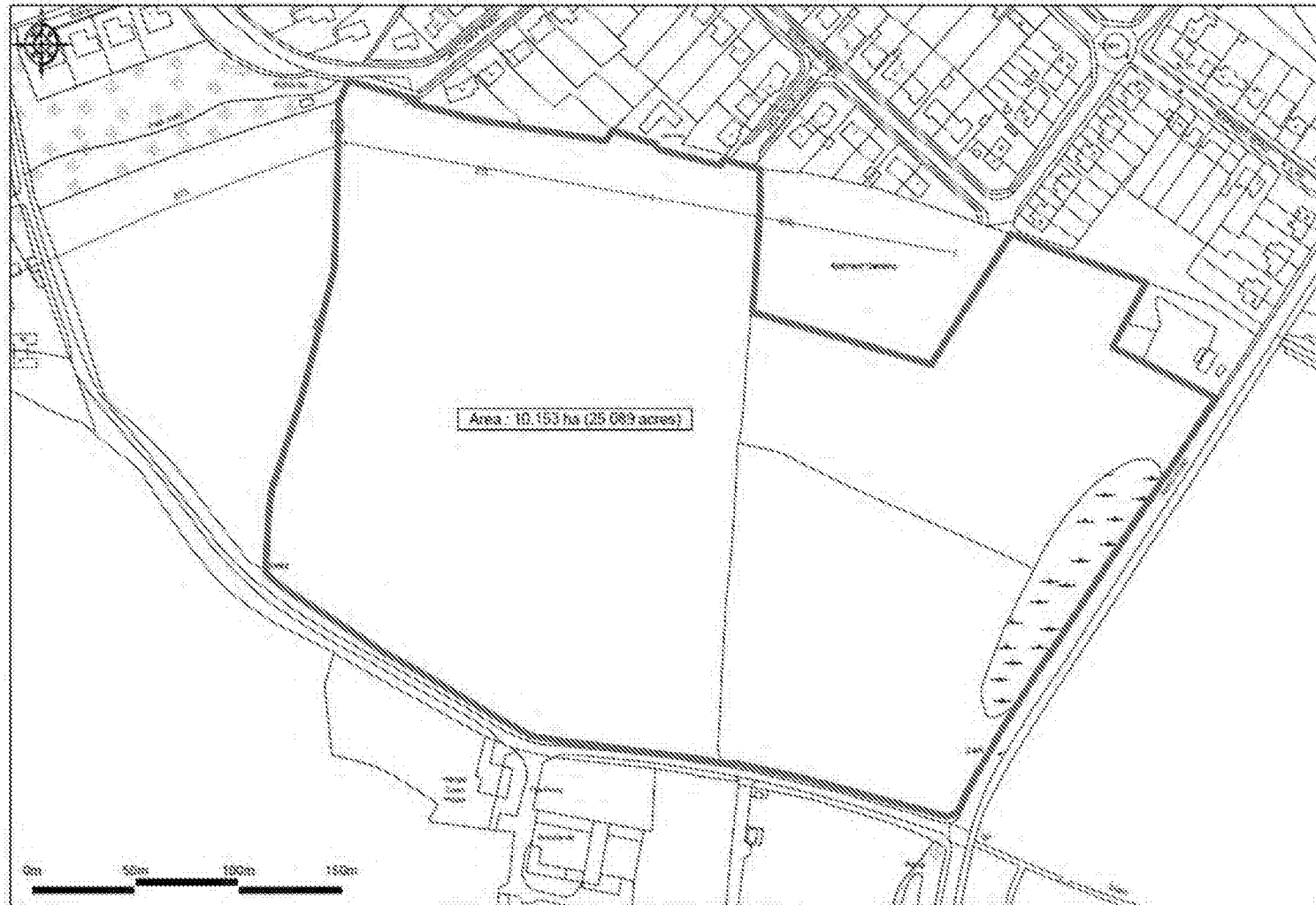
Site Plans





Contains Ordnance Survey Data © Crown Copyright and Database Right 2020.

Site:	Land at Ford Road, Arundel	Project ID	J14309
Figure 1	Site Location Plan	Date:	10/01/2020



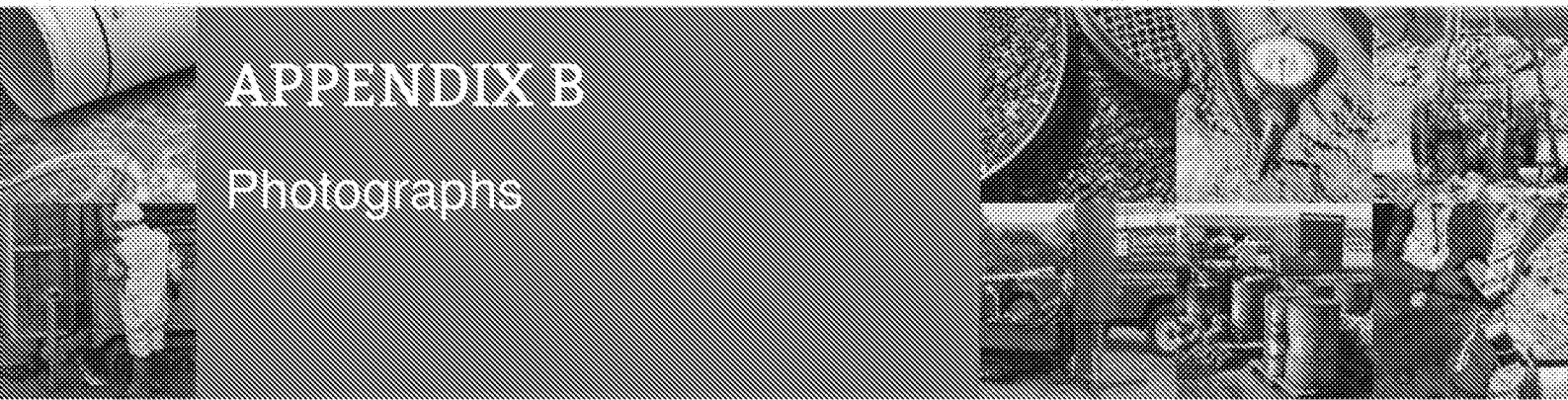
NB: Plan provided by Client.

Site:	Land at Ford Road, Arundel	Project ID	J14309
Figure 2	Site Plan	Date:	10/01/2020



NB: Plan provided by Client.

Site:	Land at Ford Road, Arundel	Project ID	J14309
Figure 3	Proposed Site Plan	Date:	10/01/2020



APPENDIX B

Photographs

B



Priory Lane adjacent to southern boundary, looking east.



Priory Lane adjacent to southern boundary, looking east.



Priory Lane adjacent to southern boundary, looking west.



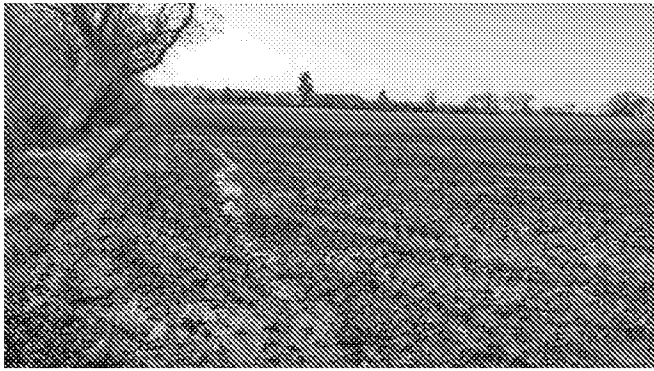
Priory Lane adjacent to south-eastern boundary, looking east.



Entrance to western field, looking north.



Eastern boundary of western field, looking north.



Overview of eastern side of western field, looking south.



Northern boundary of western field, looking west.



Northern boundary of western field, looking east.



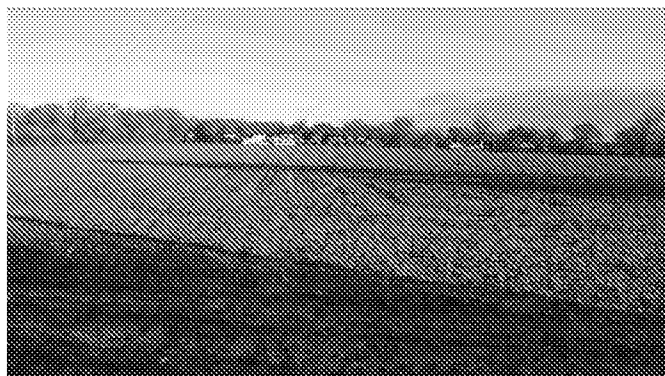
Western boundary of western field, looking south.



Western boundary of western field, looking north.



Southern boundary of western field, looking east.



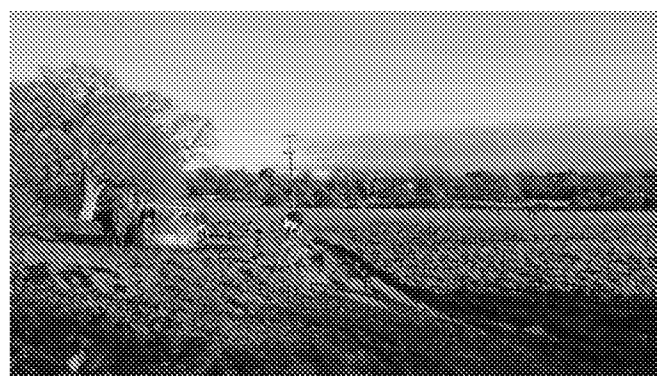
Overview of western field, looking north.



Southern boundary of western field, looking west.



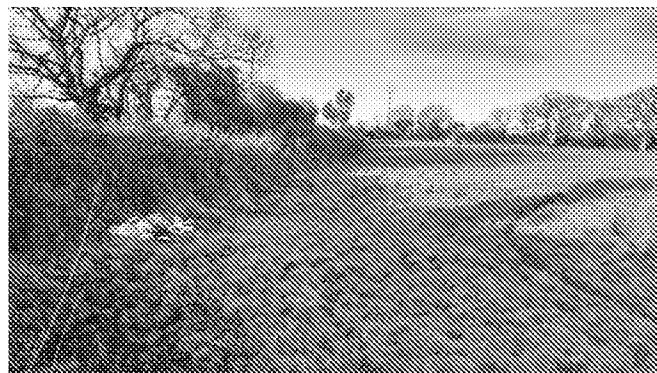
Entrance to eastern field, looking north.



South-western corner of eastern field, looking north.



Southern boundary of eastern field, looking east.



Southern boundary of eastern field, looking west.



Eastern boundary of eastern field, looking north.



Water covers located to south-eastern side of site.



Marsh area along eastern boundary of site, looking north-east.



Marsh area along eastern boundary of site, looking south.



North-eastern corner of site, looking north.



North-east of eastern field, looking north-east.



Northern boundary of eastern field looking west.



Allotment gardens adjacent to northern boundary, looking north-west.



Western boundary of eastern field, looking south.



Overview of east field from north-western corner of eastern field, looking south-east.



Hedge line to centre of eastern field, looking north-west.



Gas valve to south of Priory Lane.

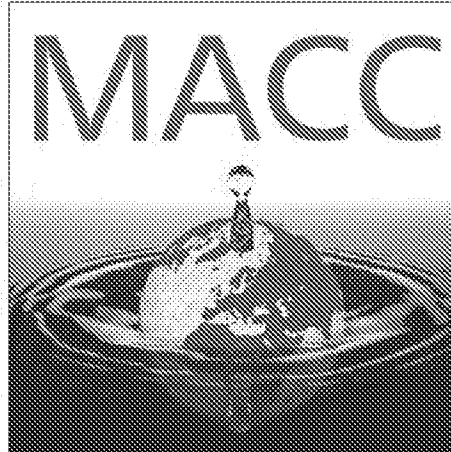


Electrical substation located approx. 20m west of north-western corner of the site.



APPENDIX C

Preliminary UXO Risk Assessment



PRELIMINARY UNEXPLODED ORDNANCE RISK ASSESSMENT

**Land at Ford Road
Arundel, BN18 9ER**

Prepared for: Southern Testing Ltd

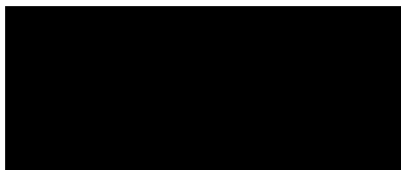
Project Number: 6303

Version: 1.0

Dated: 10/01/2020

MACC International Limited
Camilla Court
Nacton Ipswich
IP10 0EU

Telephone Number:
Fax Number:
Email:



Registered in England Company Registration Number 3014471

CONTENTS

Title	Pages
Front Cover	
Distribution	i
Contents Page	ii
References	iii
Terms and Definitions	iv - v
Introduction	1
Determining the Likelihood of Encounter	1
Future Intentions	1
Historical Information	2
Determining the Nature of Risk	3
Environmental Impact from UXO	3
Risk Assessment	4
Assessment Findings	5
Recommendations for Risk Mitigation	5
Intent	6
Annexes:	
A. Site Drawing	

REFERENCES

Publications

Sources of information used in the compilation of this assessment included:

German Air Raids on Britain 1914-18. Morris 1925
Unexploded Ordnance (UXO) – A guide for the Construction Industry. CIRIA C681
Dangerous Energy. Cocroft 2000
The Blitz Then and Now Volumes 1 to 3. Ramsey 1987
Advanced German Weapons WW2. Ford 2000
Dealing with Munitions in Marine Aggregates. UMA 2008
United Nations International Mine Action Standards (IMAS). UN 2010
Military Engineering Volume XII. War Office 1956
German Bomb Fuzes. USN 1945
Fields of Deception & Anti Aircraft Command. Dobinson 1988
Target Reconnaissance Photography. Luftwaffe 1939-44

Internet Information

Additional information was provided through the following credible internet sites, their assistance is credited where appropriate:

Army EOD Incidents
RAF EOD Incidents & Air Situation Reports 1939-45
Luftwaffe Strategy & Tactics
Luftwaffe Bomber Specifications
WO Defence Arrangements 1939-45
News Reports Witness Accounts 1939-45
Latest News Reports

Project Information

Site and project information was provided by Southern Testing Ltd.

TERMS AND DEFINITIONS

Anti Aircraft Ammunition (AAA)

High Explosive shells ranging from 30mm to 155mm used by air defence batteries to attack or deter enemy air attack.

Air Dropped Munition

A bomb or container dropped from an aircraft which is designed to detonate at a pre determined altitude, on impact or using a delay mechanism; after impact.

Air Dropped Sub-Munitions (Bomblet)

Small sub-munitions dispensed from a larger carrier which may be fixed to the aircraft or dropped as a single container munition which was designed to open above the target spreading its contents over a large area. Some designs are extremely dangerous and fitted with anti-handling devices.

Area Clearance

This is the term used for the systematic clearance of explosive ordnance from land, including military property, firing and bombing ranges, airfields and training areas. When the land is a former wartime battle ground, the term used is Battle Area Clearance (BAC)

Blast Zone

This term refers to the area around an explosive detonation where the explosive overpressure (Blast) can cause damage, injury or death.

Explosive Ordnance (EO)

All manufactured or improvised items designed to contain explosive, propellant, pyrotechnic and fissionable material or biological or chemical agents or pre-cursors which when coupled with an initiation or dispersal system are designed to cause damage, injury or death.

Explosive Ordnance Disposal (EOD)

A series of recognised procedures and protocols which are used by specialists in the detection, identification, evaluation, risk assessment, render safe, recovery and disposal of any item of explosive ordnance or improvised explosive device.

Fragmentation Zone

This is the term which refers to the danger area in which a piece of an item of explosive ordnance will travel on detonation. This zone is normally greater than the blast zone.

Geophysical Survey

The use of magnetometers, ground penetrating radar or other geophysical data gathering systems, which is then used for evaluation, risk assessment and to quantify further mitigation requirements.

High Explosive (HE)

High explosives react/detonate at a rate of around 9,000 metres per second, to all intents and purposes, instantaneously.

Incendiary Bomb (IB)

Incendiary bombs ranged from 1kg in size to 500kg the larger sizes were designated as Oil Bombs. Fills range from Thermite mixtures, Phosphorus, Kerosene or other pyrotechnic mixtures.

Intrusive Search

This term refers to the process of introducing a specialist magnetometer by pushing or drilling the sensor in to the ground to a pre determined depth, thus allowing construction activities such as: piling, soil testing and deep intrusive ground works to be conducted safely.

Land Service Ammunition (LSA)

LSA is a term that refers to all items containing explosives, pyrotechnic or noxious compounds which are placed, thrown or projected during land battles.

Oil Bomb (OB)

Large airdropped bomb or modified ordnance container containing flammable material and accelerant, these weapons normally range in weight from 250 – 500kg.

Parachute Mine (PM)

Air-dropped mine designed to detonate at a pre set altitude above the ground. Essentially a large blast bomb with an explosive content of 1600 kg commonly fitted with anti-handling or anti-removal fuzes.

Unexploded Bomb (UXB)

Any air dropped bomb that has failed to function as designed.

Unexploded Ordnance (UXO)

Explosive ordnance that has been primed, fused, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded either through malfunction or design or for any other cause.

War Office (WO)

This was the United Kingdom Government department responsible for defence of the realm, forerunner of the Ministry of Defence (MoD).

White Phosphorus (WP)

Munitions filled with WP are designed for signalling, screening and incendiary purposes. They achieve their effect by dispersing WP, which burns on contact with the air.

1 INTRODUCTION

1.1 Instruction & Scope

MACC International Ltd was commissioned by Southern Testing Ltd to conduct a Preliminary Unexploded Ordnance (UXO) Risk Assessment for a parcel of land at Ford Road, Arundel, BN18 9ER (See Annex 'A'). The scope of the assessment is to determine the likelihood of an uncontrolled encounter with UXO within the context of ground investigations.

1.2 Methodology & Purpose

The methodology used in the assessment complies with the United Nations (IMAS) standards, the CIRIA C681 "Unexploded Ordnance (UXO) – A guide for the Construction Industry" and the recognised best practice advocated by the Health and Safety Executive (HSE). The quality and environmental aspects of the assessment comply with UKAS Accredited ISO 9001:2008 and ISO 14001:2004 standards. The purpose of the assessment is that of evaluation and to provide an aid in decision making by our client.

2 DETERMINING THE LIKELIHOOD OF ENCOUNTER

2.1 Aim, Research Restrictions & Indemnity

This assessment has drawn upon archive records which are within the public domain; however, these are acknowledged to be incomplete. Consequently, some incidents may have occurred where the records no longer exist or could not be located. The Secretary of State of the United Kingdom and MACC International Ltd does not accept responsibility for the accuracy or completeness of the information contained within the records. Some records regarding the UXO situation on some sites may not yet be within the public domain. Consequently, such information was not available for evaluation by MACC International Ltd.

2.2 Relevant Publications & Credible Internet Information

Published sources of information used in the compilation of this assessment are listed within the reference section of this assessment including those provided by the client. Additional information was provided through credible internet sites, their assistance is credited where appropriate and details are listed within the reference section of this assessment.

3 FUTURE DEVELOPMENT

Future intentions for the site were not disclosed. It has however known that Geo-environmental investigations will be conducted prior to the commencement of any subsequent building works.

4 HISTORICAL INFORMATION

4.1 British Archives

Prior to 1942 the United Kingdom did not operate a national recording system for EO/UXO incidents or military use of land. The records compiled during 1939-1942 were conducted under local arrangements and were only as detailed and accurate as the availability of time, personnel and the ease of access to information would allow. In April 1942 the Ministry of Home Security instigated a training programme for all personnel maintaining bomb census records, these standardised national records and greatly improved the accuracy of the information.

4.2 Manned Air Raids & Unmanned Rocket Attack Reports

Records were found to indicate that Arundel did suffer multiple enemy bombing raids during WWII. The nearest known bomb strike occurred c.a.600m north-east of the site in a field where Arundel Baptist Church stands today; however, the exact location of strikes during several raids remains unknown. Given the size and undeveloped nature of the site, further research is required to more accurately define the risk levels and this source of UXO contamination is consequently considered to be credible at a preliminary level.

4.3 Other Sources of UXO Contamination

Although military use of the site footprint was not confirmed, large areas of woodland and open land surrounding Arundel were requisitioned by the War Office during WWII. There was also a military presence within the town with army camps established on parkland throughout the war.

An item of UXO has been found within the general vicinity of the site footprint in recent years. In March 2018, a WWII mortar was found c.a.600m north of the site in a garden at Canada Road, Arundel.

5 DETERMINING THE NATURE OF RISK

5.1 General

While HE bombs are very unlikely to detonate if left undisturbed it remains inherently dangerous and may function if subjected to suitable stimuli. The most common of these stimuli is shock, friction or heat which may cause the fuze to function or unstable explosive materials (Picrate Acid) to explode. However, in the case of incendiary bombs containing White Phosphorus (WP) exposure of the WP to the air will result in its violent ignition and combustion.

5.2 Bomb Trajectory & Ground Penetration

During WWII the Ministry of Home Security undertook a major assessment on bomb penetration depths using 1,328 actual bomb impact events to provide statistical analysis of penetration potential. As a result they determined the expected behaviour of a range of bomb weights through different geological strata around the Capital. Their findings remain the only empirical gained figures to have been gathered to date for England. A number of factors will influence the behaviour of a bomb on impact with the target and its trajectory through the ground. Relevant factors include: Height and speed of release of the bomb, aerodynamic qualities of the bomb, the angle of flight and impact and the nature of impact surface and sub soil. In determining the potential bomb penetration depths into the ground, historic geotechnical information and typical bomb characteristics were used. The maximum bomb penetration depth is estimated at 10.5 metres from the 1941 ground levels.

5.3 Bombs have been known to strike outside a building footprint and travel below the surface coming to rest within the building footprint. As did the recent 250kg HE bomb found within a cellar in Bethnal Green. The expected offset from impact point is estimated to be 3.0-5.0 metres.

6 ENVIRONMENTAL IMPACT FROM UXO

6.1 Ground Contamination & Health Risk vectors

While it is acknowledged that there is a potential risk of ground contamination arising from explosive fillings which may leach from a damaged bomb casing into the surrounding soil. The amount of explosive material within the most common bombs is not considered sufficient to pose a significant environmental risk. Nevertheless, it should be noted that the following components are commonly used in the manufacture of a high explosive bomb and may pose a localised contamination risk to health: metals including; Lead, Zinc, Brass, Copper, Steel, Mercury, Silver Fulminate and Aluminium. Other chemical Compounds including; Trinitrophenol, Trinitrotolulene, Trimethylene Trinitramine, Ammonium, Sodium Nitrate, Nitro-glycerine and White Phosphorus. It is recommended that specialist medical advice be sought to identify specific risks to health posed by these chemical compounds.

7 RISK ASSESSMENT

7.1 Risk Source

Records were found to indicate that Arundel did suffer enemy bombing during WWII and the exact location of many strikes remains unknown. Records are acknowledged to be incomplete and may include omissions and errors; the possibility that items of UXO may have found their way onto the site and remain there to the present day is considered credible.

7.2 Risk Pathway

The risk pathway is considered to be any ground intrusive earth works carried out while undertaking geo-environmental investigations or building work.

7.3 Consequence

The consequences of a UXB detonation on site during construction works are considered to be a factor of the size of the blast and the proximity of assets and individuals to the point of detonation. These will include potential to kill or seriously injure personnel destroy or damage high value site assets, nearby public and private property and infrastructure.

7.4 Risk Rating

Table 1 Risk Level

PRELIMINARY UXO RISK RATING			
Hand dug excavations	3 x 1 = 3	1 x 5 = 5	3 x 5 = 15
Limited mechanical excavations or trenching	3 x 2 = 6	2 x 5 = 10	6 x 10 = 60
Drilling or Sampling	3 x 3 = 9	3 x 5 = 15	9 x 15 = 135

1= Minimal5=significant

LOW0-100

MEDIUM100-200

HIGH200+

8 ASSESSMENT FINDINGS

8.1 Risk Levels

The assessment has determined the preliminary UXO risk within the site footprint. When viewed from likelihood versus consequence standpoint; it is considered prudent to recommend a suitable degree of UXO mitigation to permit the work to proceed in the safest “acceptable” manner in compliance with current legislation and best practices.

9 RECOMMENDATIONS FOR RISK MITIGATION

9.1 It is recommended that a Detailed UXO Desk Top Study is commissioned to more accurately define the risk level and to complete detailed assessment on the mitigation requirements over the project's lifetime.

9.2 Alternatively, the preliminary risk levels are accepted and the following mitigation measures are carried out as a minimum requirement:

All Risk Levels

- Risk Communication & Safety Planning: Stakeholders should be made aware of the UXO risk levels within the project boundary and the possible impact an encounter may have on the project and third parties. Consequently, a UXO Safety Plan should be drawn up and included with the overall project safety planning.
- Safety Training: In keeping with CDM Regulations concerning all sub-surface hazards, UXO Safety Induction Training should be provided to everyone working or visiting the site. The training should be commensurate with the individual's responsibilities and duties on site. The training should be provided by a competent individual (preferably a trained EOD Engineer) and delivered as a separate module of the Site Safety Induction Course or as a Toolbox Talk.

Additional mitigation requirements for the medium risk activities within post-war unworked ground:

- Drilling & Sampling: These activities should be checked for UXO by an EOD Engineer equipped with specialist magnetometers ahead of the drilling/sampling bits.

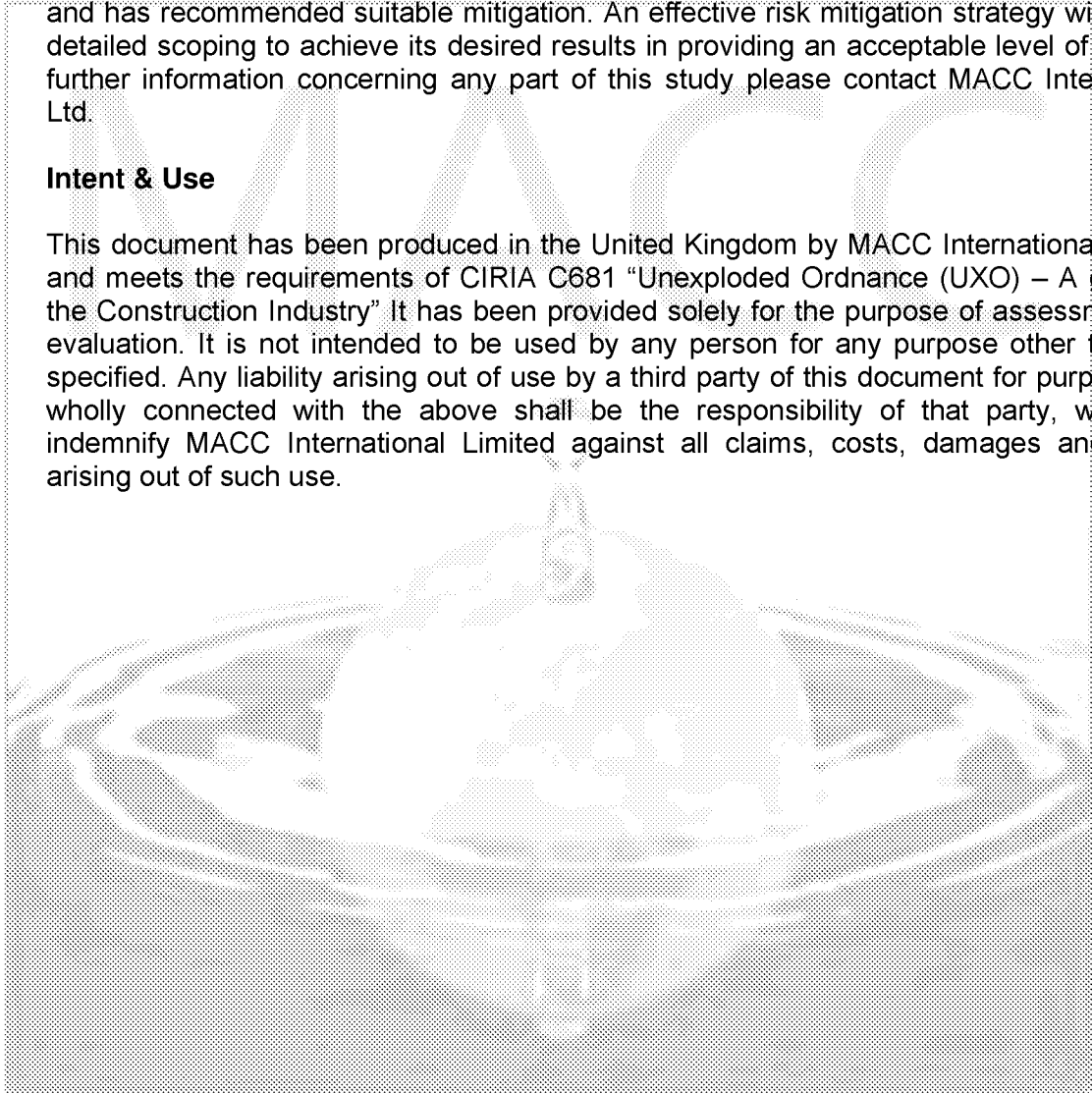
10 POST MITIGATION RISK

10.1 Overview

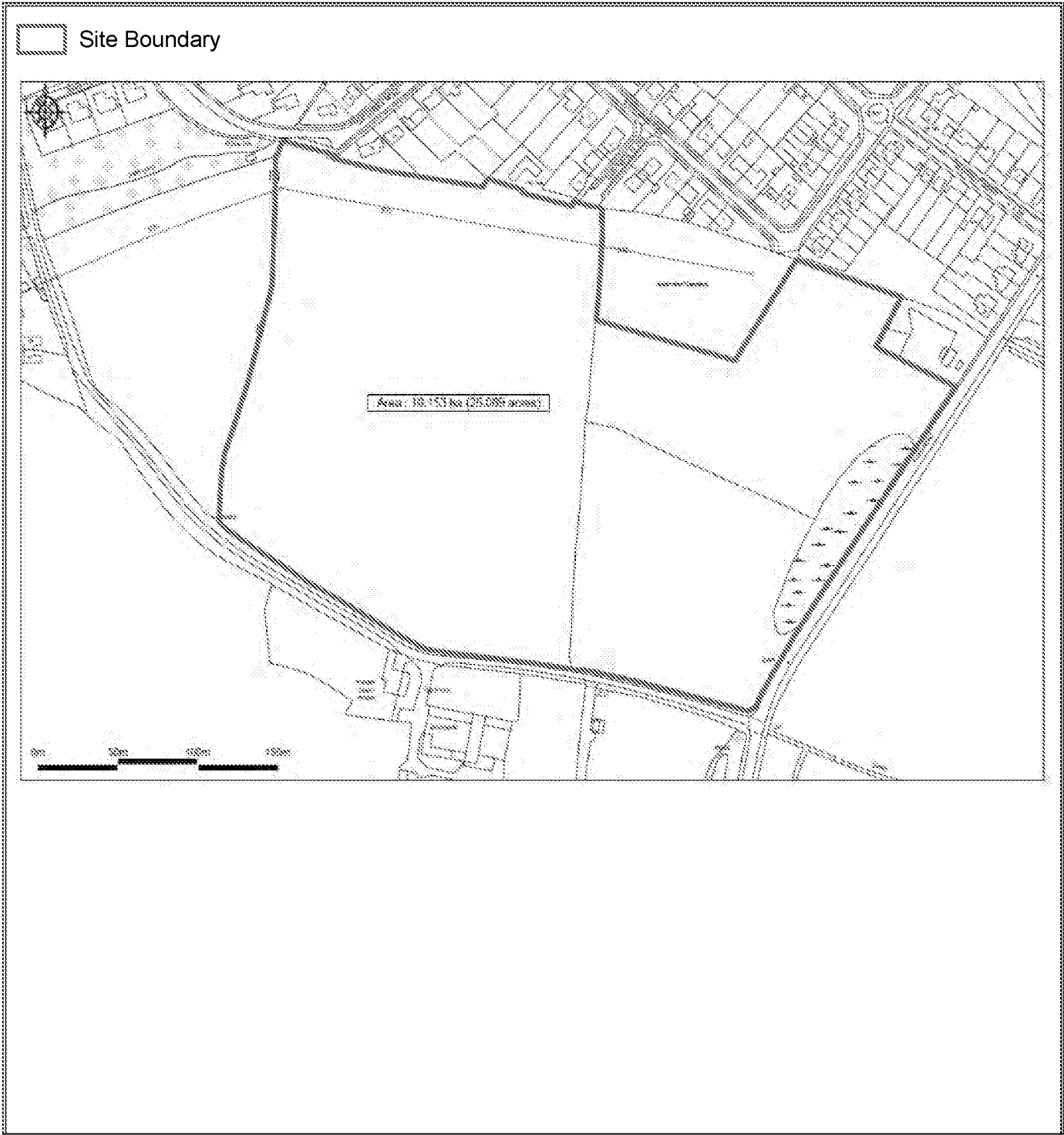
Prudent execution of the recommended risk mitigation strategy will reduce the risk, however it is emphasised that zero risk is not achievable given the possible variables. The study has confirmed the UXO risk level based on the nature of the work to be undertaken and has recommended suitable mitigation. An effective risk mitigation strategy will require detailed scoping to achieve its desired results in providing an acceptable level of risk. For further information concerning any part of this study please contact MACC International Ltd.

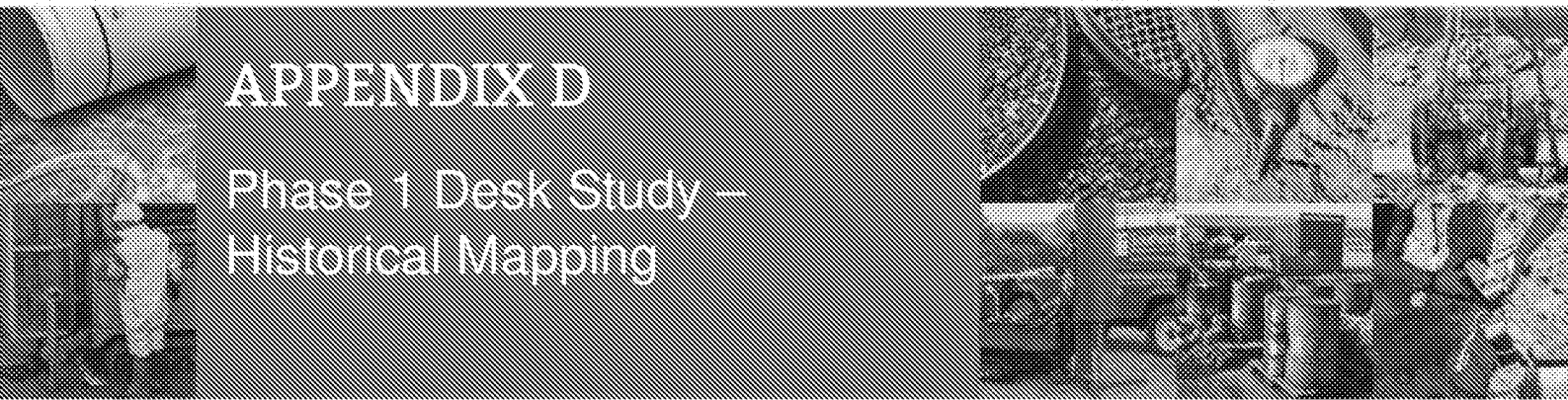
10.2 Intent & Use

This document has been produced in the United Kingdom by MACC International Limited and meets the requirements of CIRIA C681 "Unexploded Ordnance (UXO) – A guide for the Construction Industry" It has been provided solely for the purpose of assessment and evaluation. It is not intended to be used by any person for any purpose other than that specified. Any liability arising out of use by a third party of this document for purposes not wholly connected with the above shall be the responsibility of that party, who shall indemnify MACC International Limited against all claims, costs, damages and losses arising out of such use.



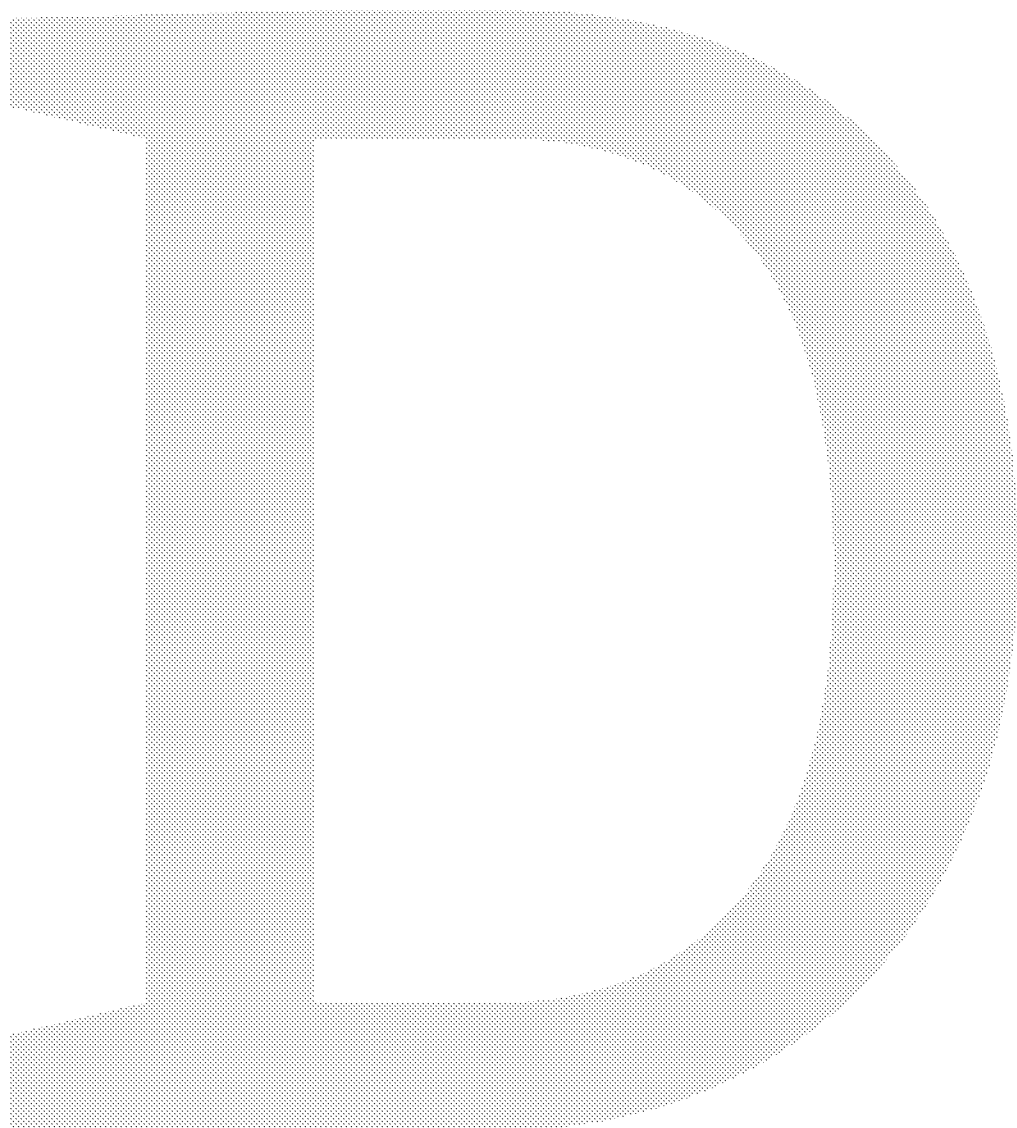
SITE MAPPING





APPENDIX D

Phase 1 Desk Study – Historical Mapping

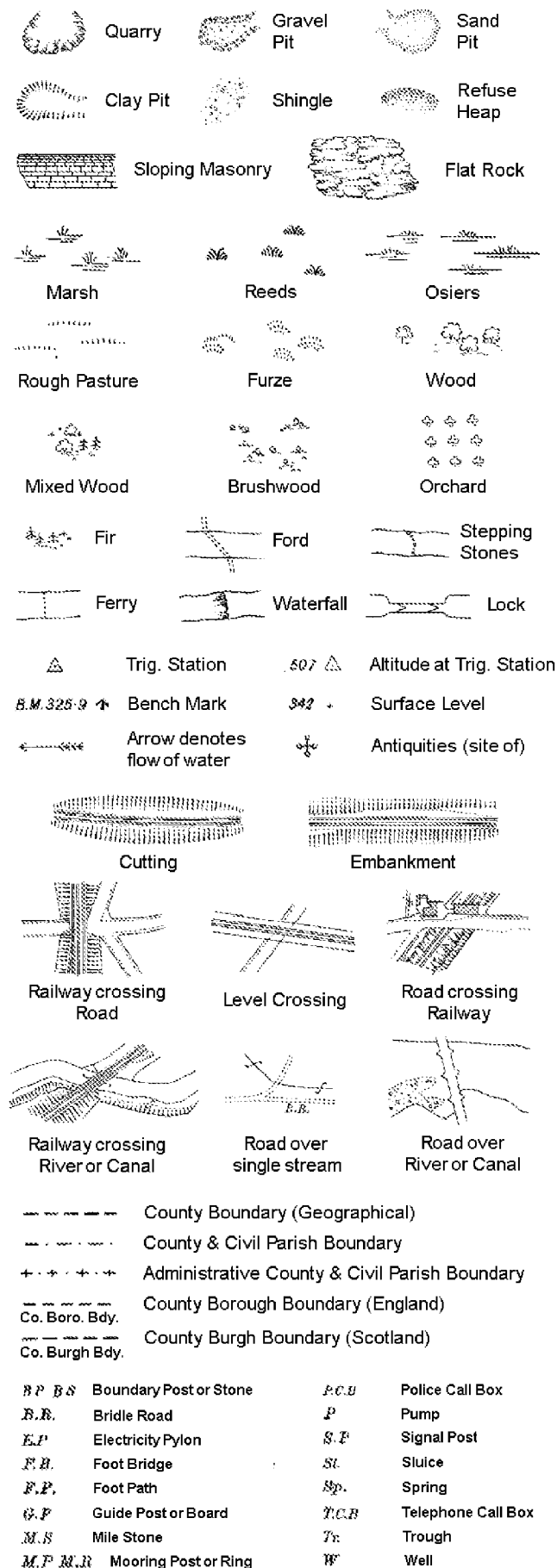


Historical Ordnance Survey Map Interpretation				
Date	Scale	Features On Site	Features Off Site	Significant Potential Contamination Sources
1876	1:2,500	The site consists of three fields bounded by hedgerows/trees.	Further fields/agricultural land surrounds the site with Old Priory Farm located adjacent to the southernmost boundary. A wooded area is shown adjacent to the north-western corner of the site.	Agricultural land
1897	1:2,500	No significant changes.	No significant changes.	Agricultural land
1912	1:2,500	No significant changes.	No significant changes.	Agricultural land
1937-1940	1:2,500	Allotment gardens shown to extend into the northern part of the site.	Residential development to the north east of the site. An allotment gardens to the centre of the northern boundary of the site.	Agricultural land Allotments
1947	1:10,560 Aerial Image	Allotment gardens shown to north of site. Remainder of site consists three field separated by hedgerows/trees.	No significant changes.	Agricultural land
1971-1972	1:2,500	Allotment garden no longer within site boundary. Marsh area shown along eastern boundary.	Further residential development to the north and north west of the site.	Agricultural land
1980	1:2,500	No significant changes.	No significant changes.	Agricultural land
1994	1:2,500	No significant changes.	Priory farm to south no longer labelled, now each building individual labelled, possibly converted to residential housing.	Agricultural land
1999	1:2,500 Aerial Image	Site used as agricultural land.	Farm to south and agricultural land surrounds site to south, west and east. Residential housing to north and north west of site.	Agricultural land
2000	1:10,000	No significant changes.	No significant changes.	Agricultural land
2006	1:10,000	No significant changes.	No significant changes.	Agricultural land
2019	1:10,000	No significant changes.	No significant changes.	Agricultural land

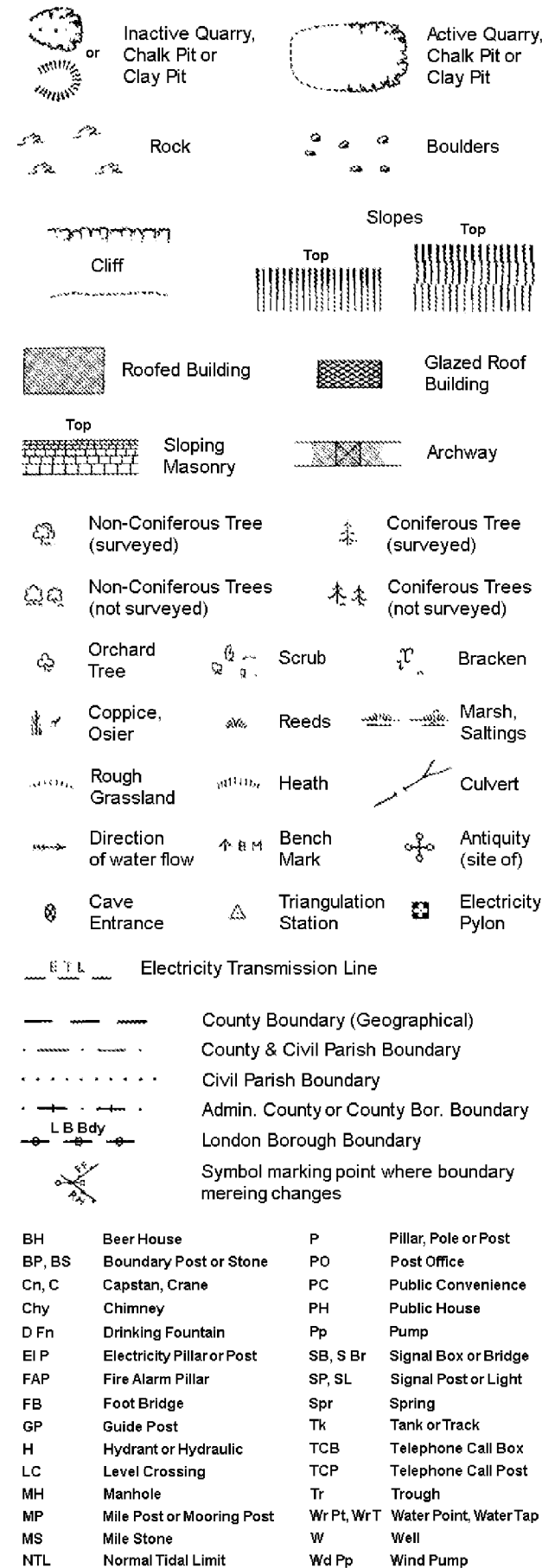
NOTE: Additional maps at 1:10,560 and 1:10000 scale of similar age have been obtained. These maps are appended but do not provide much additional information.

Historical Mapping Legends

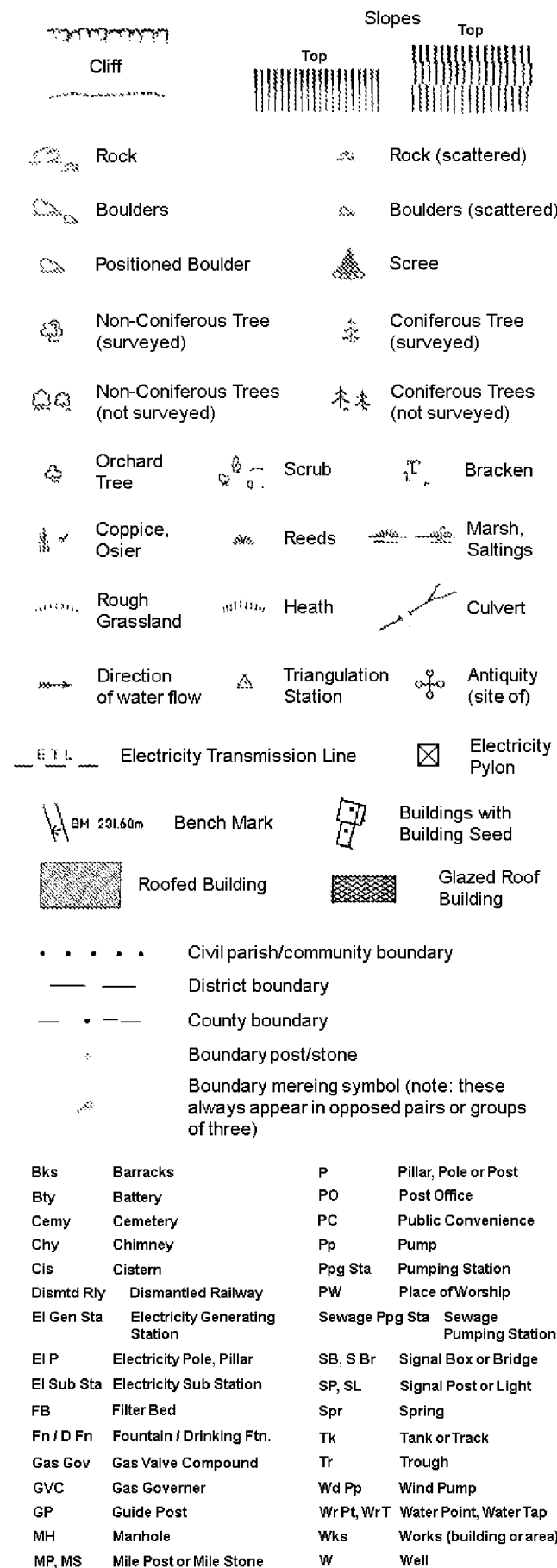
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



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



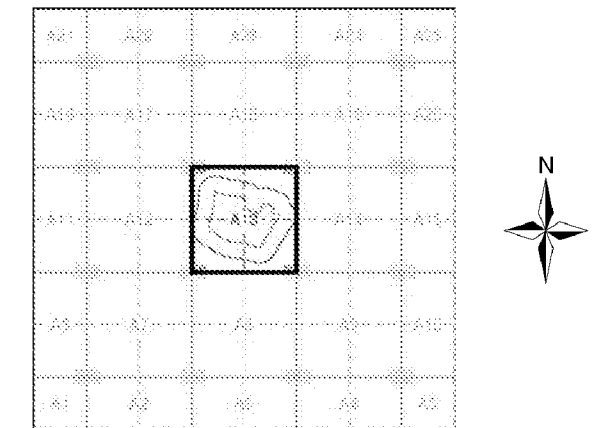
Large-Scale National Grid Data 1:2,500 and 1:1,250



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Sussex	1:2,500	1876	2
Sussex	1:2,500	1897	3
Sussex	1:2,500	1912	4
Sussex	1:2,500	1937 - 1940	5
Ordnance Survey Plan	1:2,500	1971 - 1972	6
Ordnance Survey Plan	1:2,500	1980	7
Large-Scale National Grid Data	1:2,500	1994	8
Historical Aerial Photography	1:2,500	1999	9

Historical Map - Segment A13



Order Details

Order Number: 229394024_1_1
Customer Ref: J14309 / VF
National Grid Reference: 500640, 106260
Slice: A
Site Area (Ha): 10.17
Search Buffer (m): 100

Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER

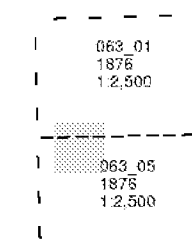
Sussex

Published 1876

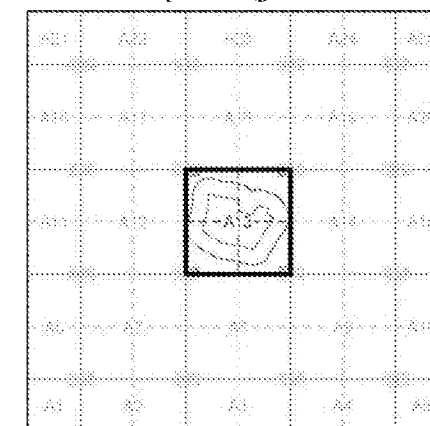
Source map scale - 1:2,500

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

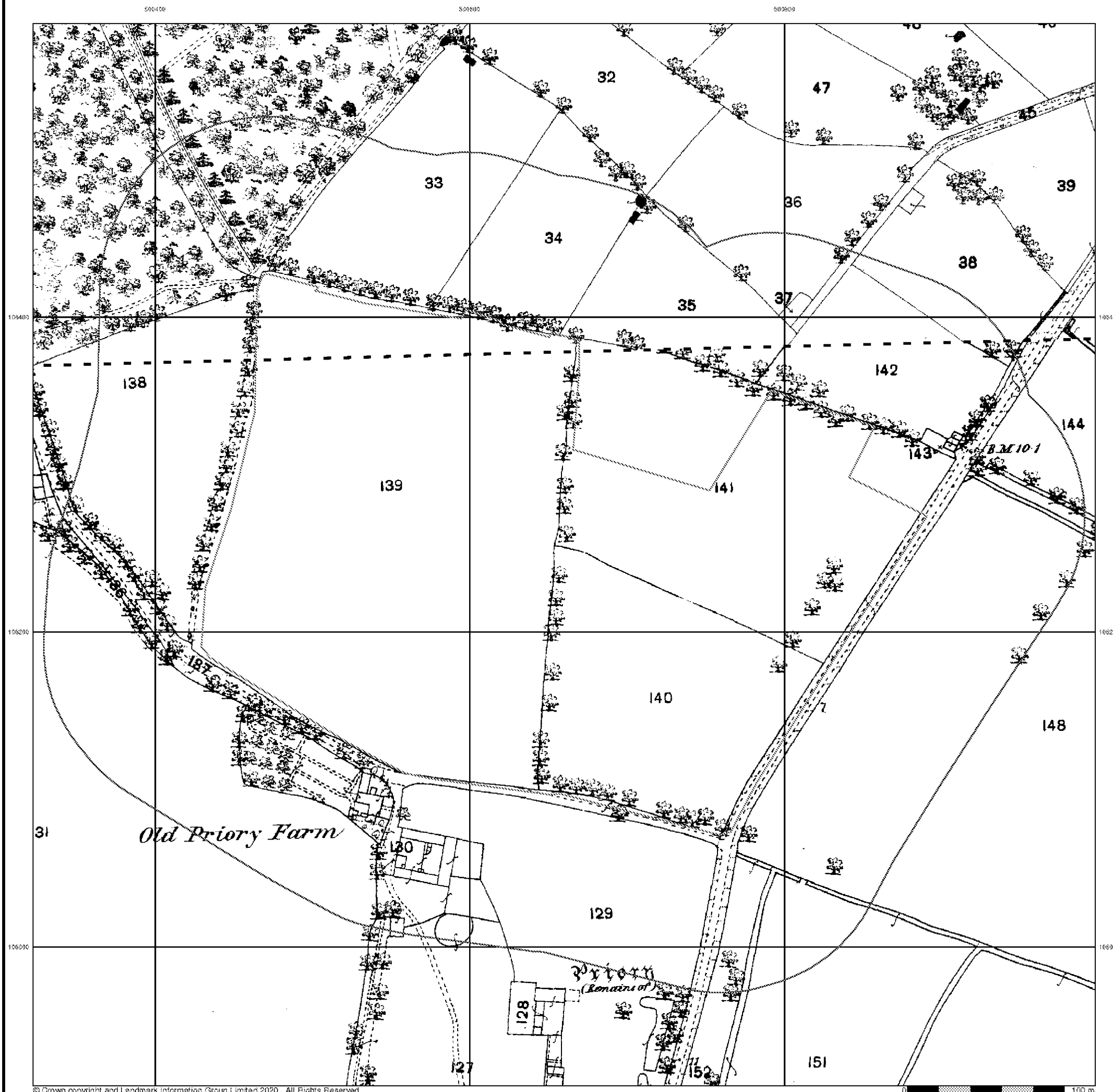


Order Details

Order Number: 229394024_1_1
Customer Ref: J14309 / VF
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Slice: A
Site Area (Ha): 10.17
Search Buffer (m): 100

Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER



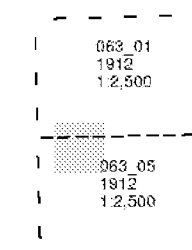
Sussex

Published 1912

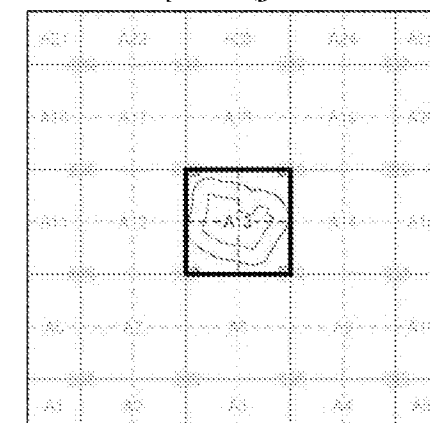
Source map scale - 1:2,500

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

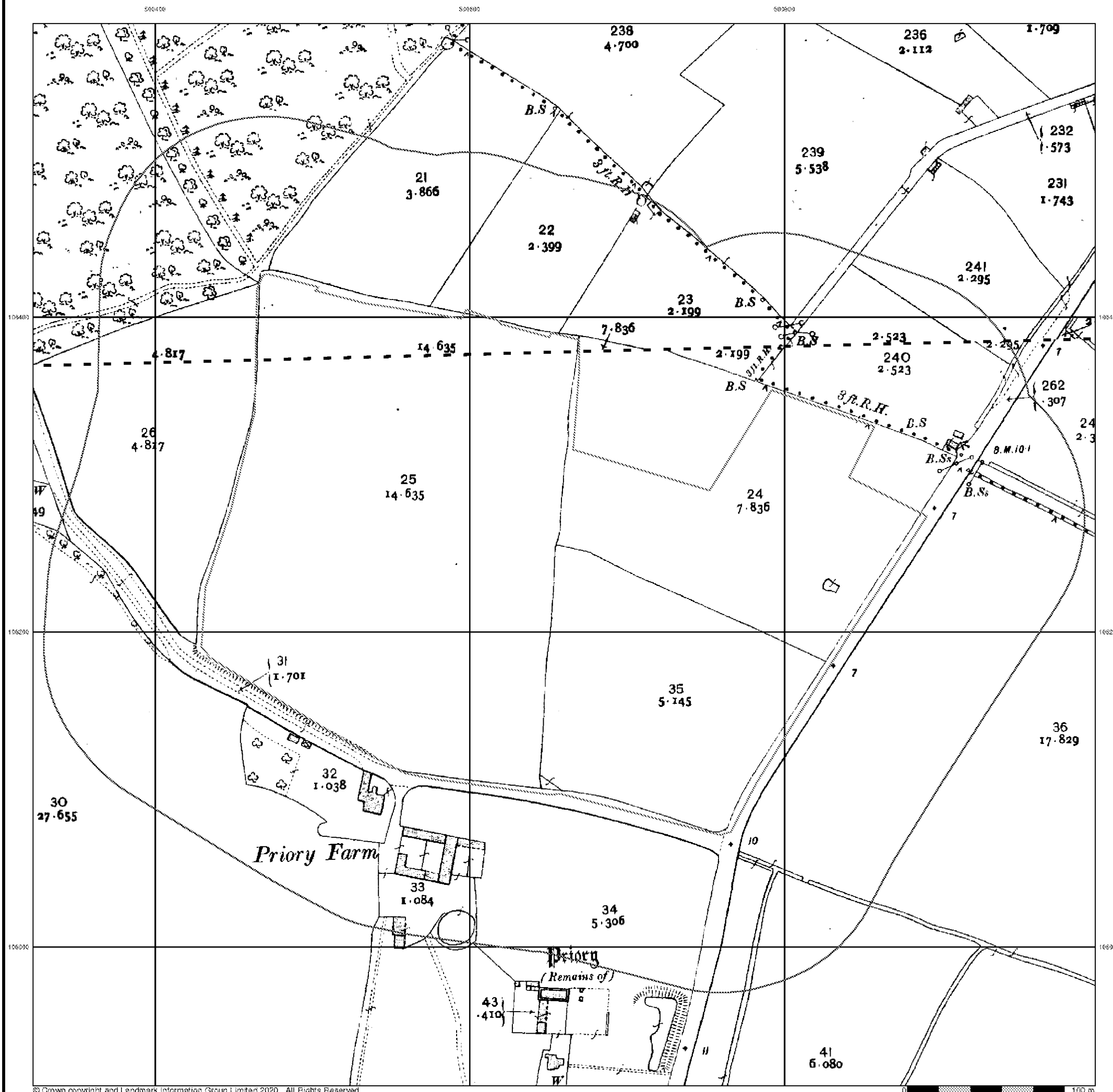
Order Number: 229394024_1_1
Customer Ref: J14309 / VF
National Grid Reference: 500640, 106260
Slice: A
Site Area (Ha): 10.17
Search Buffer (m): 100

Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER

Landmark
INFORMATION GROUP

Tel: 0844 844 9852
Fax: 0844 844 9851
Web: www.envisirocheck.co.uk



Sussex

Published 1937 - 1940

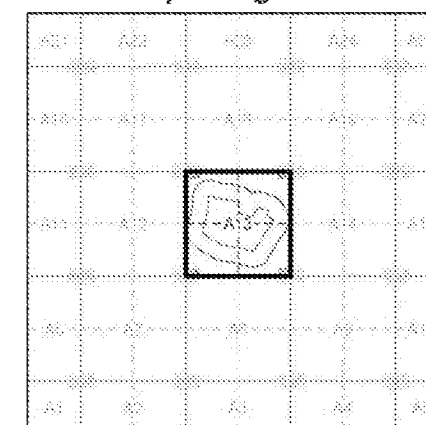
Source map scale - 1:2,500

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)

063_01	1937	1:2,500
063_05	1940	1:2,500

Historical Map - Segment A13

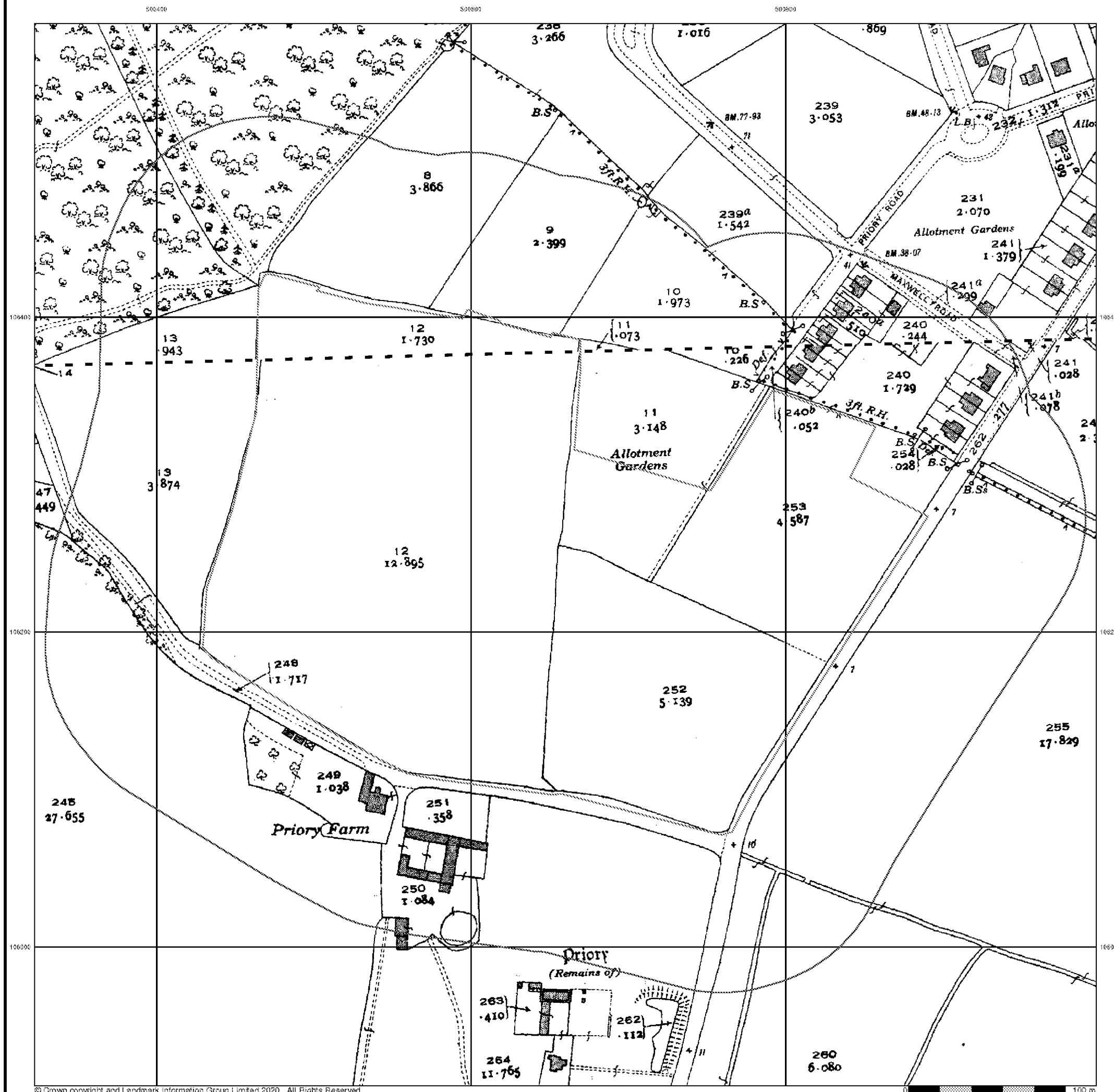


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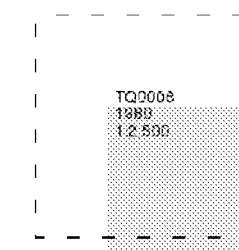
Ordnance Survey Plan

Published 1980

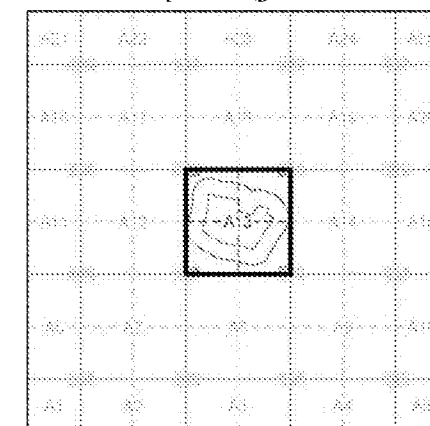
Source map scale - 1:2,500

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

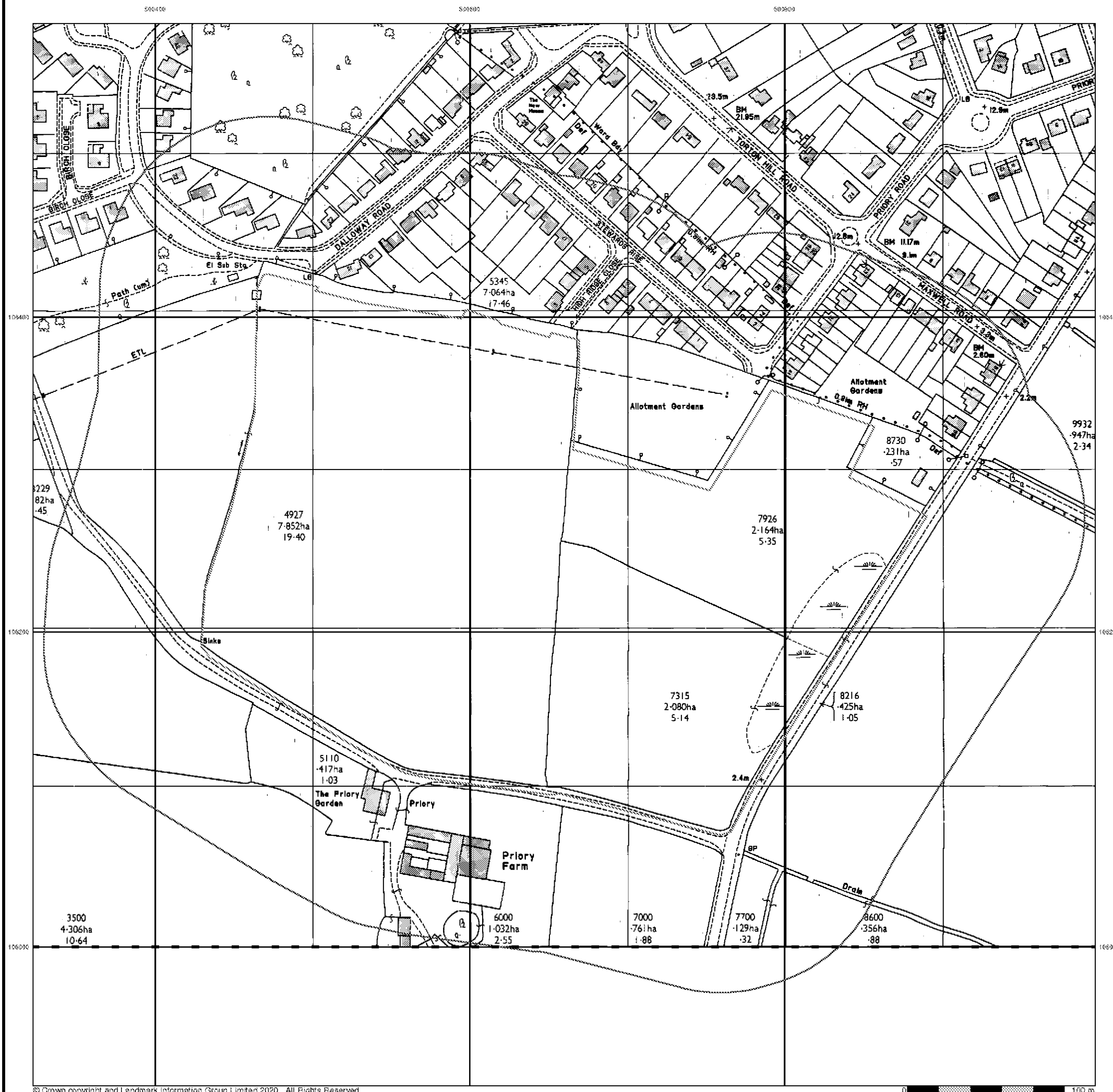


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Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER



Large-Scale National Grid Data

Published 1994

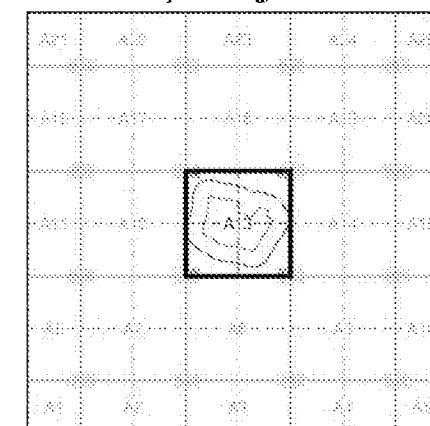
Source map scale - 1:2,500

'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)

TC00006	1994	1:2,500
TC00005	1994	1:2,500

Historical Map - Segment A13



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Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER

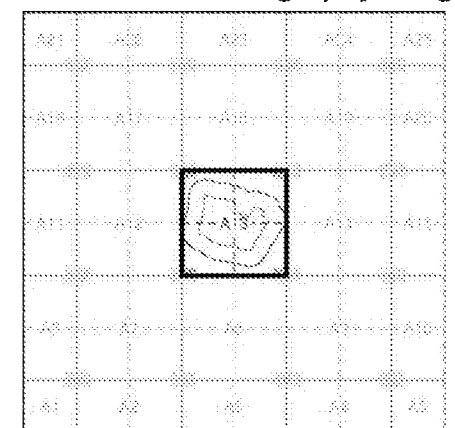


Historical Aerial Photography

Published 1999

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13



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Site Details

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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

	Gravel Pit		Sand Pit		Other Pits
	Quarry		Shingle		Orchard
	Osiers		Reeds		Marsh
	Mixed Wood		Deciduous		Brushwood
	Fir		Furze		Rough Pasture
	Arrow denotes flow of water		Trigonometrical Station		
	Site of Antiquities		Bench Mark		
	Pump, Guide Post, Signal Post		Well, Spring, Boundary Post		
	•285 Surface Level				
	Sketched Contour		Instrumental Contour		
	Main Roads		Minor Roads		
	Sunken Road		Raised Road		
	Road over Railway		Railway over River		
	Railway over Road		Level Crossing		
	Road over River or Canal		Road over Stream		
	County Boundary (Geographical)				
	County & Civil Parish Boundary				
	Administrative County & Civil Parish Boundary				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	Rural District Boundary				
	Civil Parish Boundary				

Ordnance Survey Plan 1:10,000

	Chalk Pit, Clay Pit or Quarry		Gravel Pit
	Sand Pit		Disused Pit or Quarry
	Refuse or Slag Heap		Lake, Loch or Pond
	Dunes		Boulders
	Coniferous Trees		Non-Coniferous Trees
	Orchard		Scrub
	Bracken		Heath
	Marsh		Reeds
	Building		Glasshouse
	Sloping Masonry		Pylon
	Cutting		Embankment
	Road Under		Road Over
	Level Crossing		Foot Bridge
	Standard Gauge Multiple Track		Standard Gauge Single Track
	Siding, Tramway or Mineral Line		Narrow Gauge
	Geographical County		Administrative County, County Borough or County of City
	Municipal Borough, Urban or Rural District, Burgh or District Council		Borough, Burgh or County Constituency
	Civil Parish		
	BP, BS Boundary Post or Stone		Police Station
	Church		Post Office
	Club House		Public Convenience
	Fire Engine Station		Public House
	Foot Bridge		Signal Box
	Fountain		Spring
	Guide Post		Telephone Call Box
	Mile Post		Telephone Call Post
	Mile Stone		Well

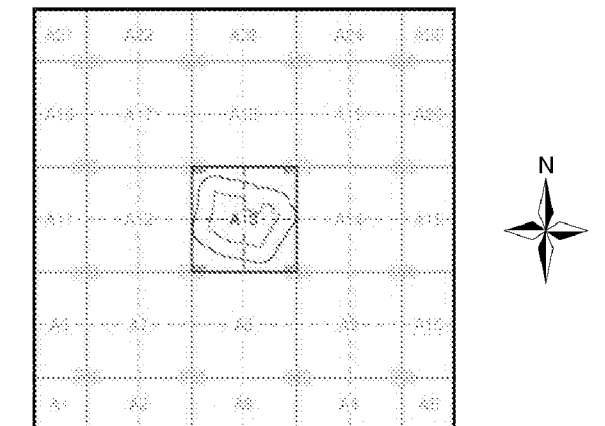
1:10,000 Raster Mapping

	Gravel Pit		Refuse tip or slag heap
	Rock		Rock (scattered)
	Boulders		Boulders (scattered)
	Shingle		Mud
	Sand		Sand Pit
	Slopes		Top of cliff
	General detail		Underground detail
	Overhead detail		Narrow gauge railway
	Multi-track railway		Single track railway
	County boundary (England only)		Civil, parish or community boundary
	District, Unitary, Metropolitan, London Borough boundary		Constituency boundary
	Area of wooded vegetation		Non-coniferous trees
	Non-coniferous trees (scattered)		Coniferous trees
	Coniferous trees (scattered)		Positioned tree
	Orchard		Coppice or Osiers
	Rough Grassland		Heath
	Scrub		Marsh, Salt Marsh or Reeds
	Water feature		Flow arrows
	Mean high water (springs)		Mean low water (springs)
	Telephone line (where shown)		Electricity transmission line (with poles)
	Bench mark (where shown)		Triangulation station
	Point feature (e.g. Guide Post or Mile Stone)		Pylon, flare stack or lighting tower
	Site of (antiquity)		Glasshouse
	General Building		Important Building

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Sussex	1:10,560	1879 - 1880	2
Sussex	1:10,560	1899	3
Sussex	1:10,560	1914	4
Sussex	1:10,560	1914	5
Sussex	1:10,560	1914	6
Sussex	1:10,560	1914	7
Sussex	1:10,560	1938 - 1951	8
Historical Aerial Photography	1:10,560	1947	9
Historical Aerial Photography	1:10,560	1947	10
Sussex	1:10,560	1952	11
Ordnance Survey Plan	1:10,000	1961 - 1962	12
Ordnance Survey Plan	1:10,000	1962 - 1967	13
Ordnance Survey Plan	1:10,000	1974 - 1979	14
Ordnance Survey Plan	1:10,000	1976	15
Ordnance Survey Plan	1:10,000	1980 - 1982	16
Ordnance Survey Plan	1:10,000	1992 - 1993	17
10K Raster Mapping	1:10,000	2000	18
10K Raster Mapping	1:10,000	2006	19
VectorMap Local	1:10,000	2019	20

Historical Map - Slice A



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Site Details

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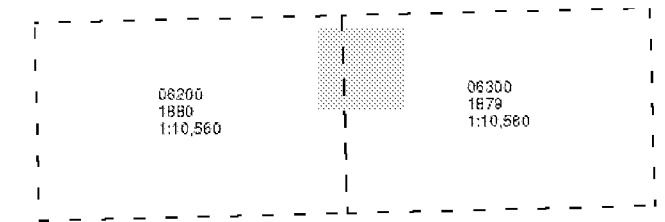
Sussex

Published 1879 - 1880

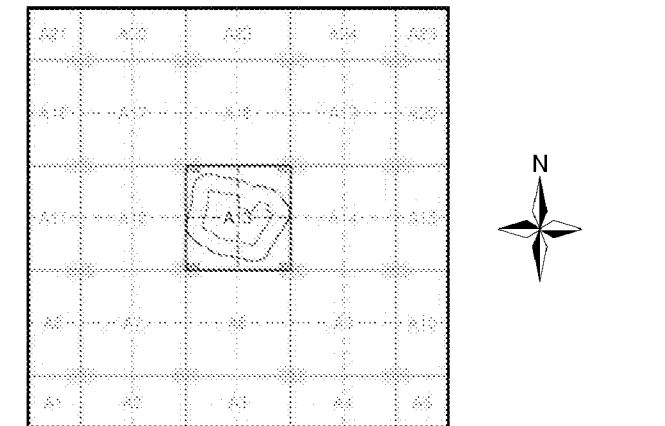
Source map scale - 1:10,560

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; these maps were used to update the 1:10,560 maps. The published date given therefore 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. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

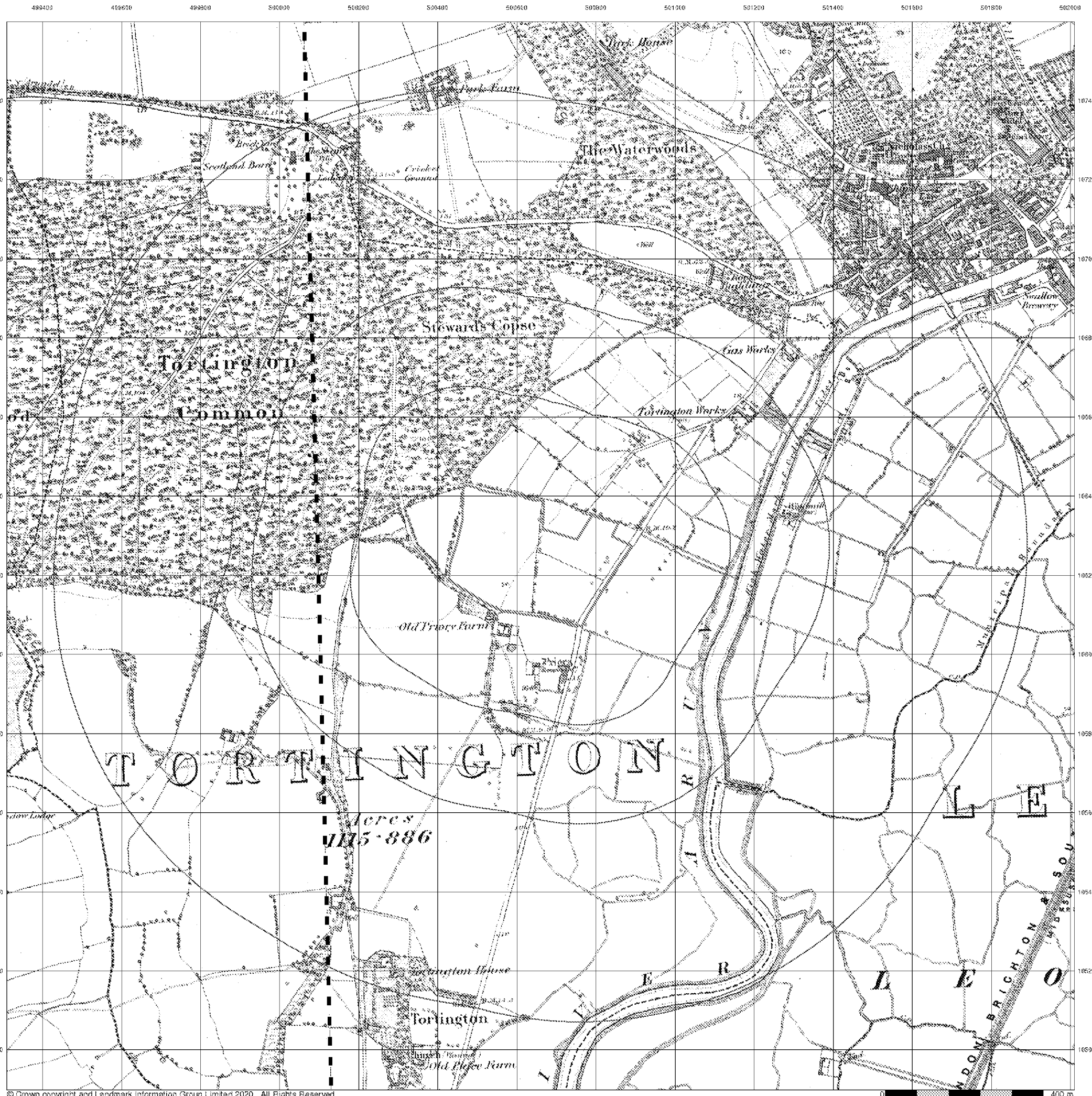


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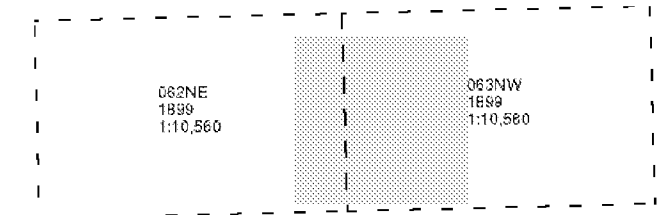
Sussex

Published 1899

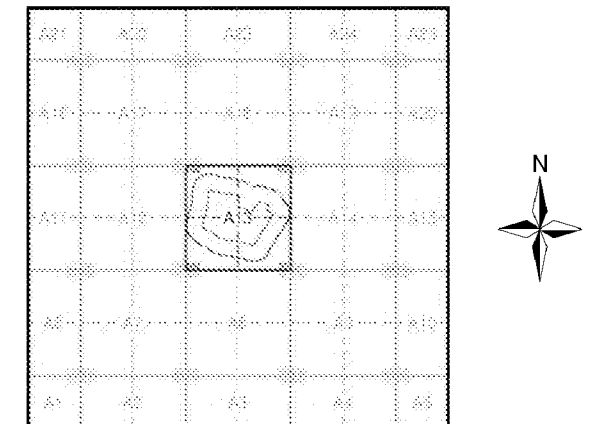
Source map scale - 1:10,560

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Historical Map - Slice A

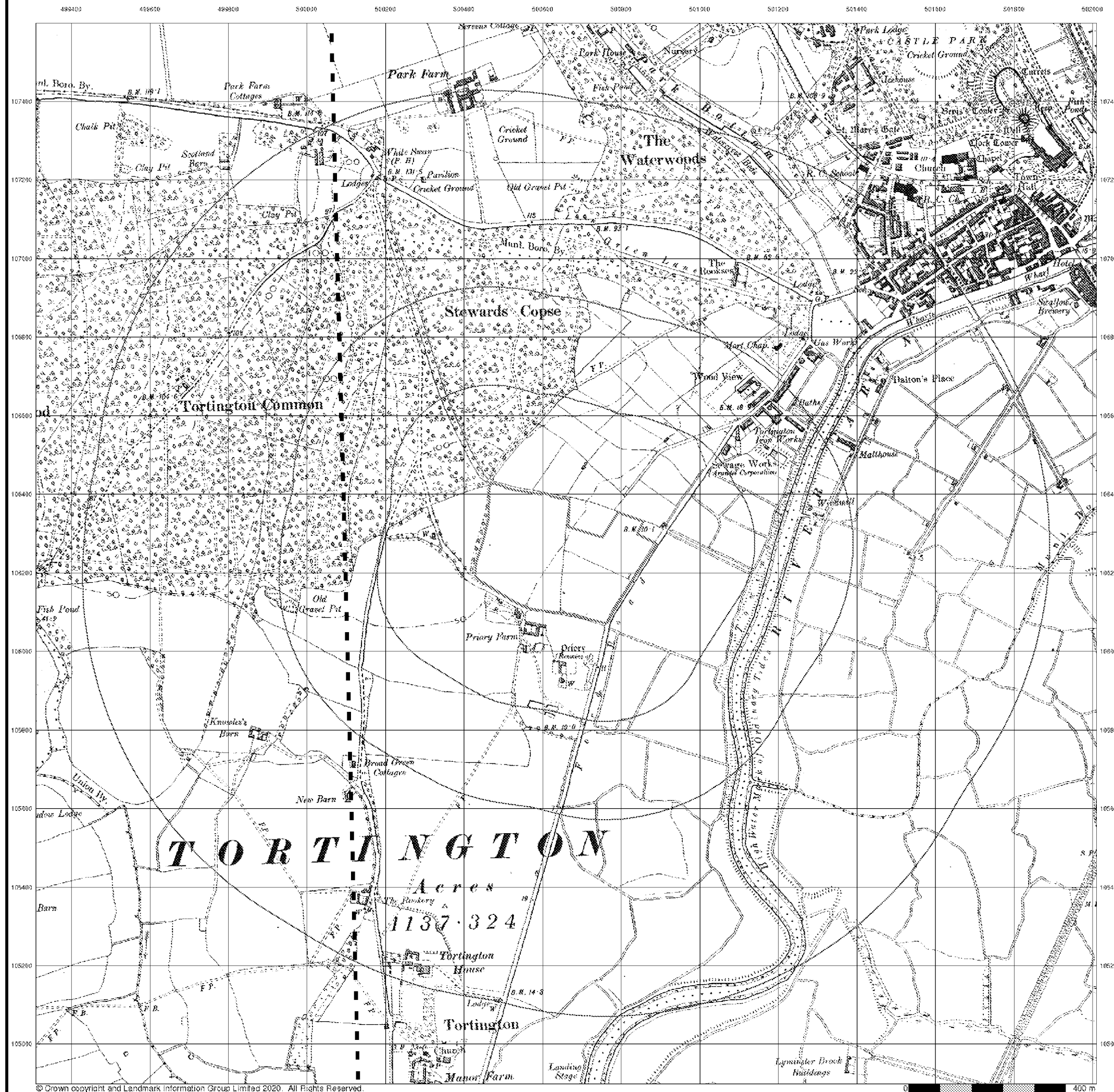


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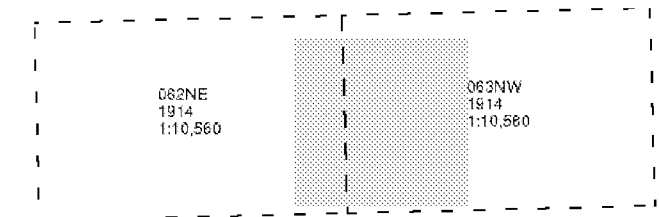
Sussex

Published 1914

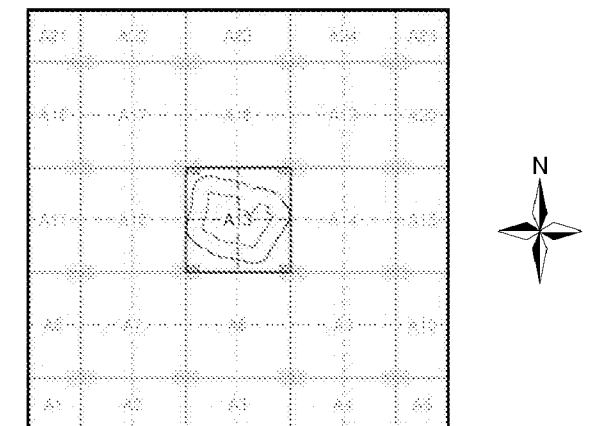
Source map scale - 1:10,560

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; these maps were used to update the 1:10,560 maps. The published date given therefore 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. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

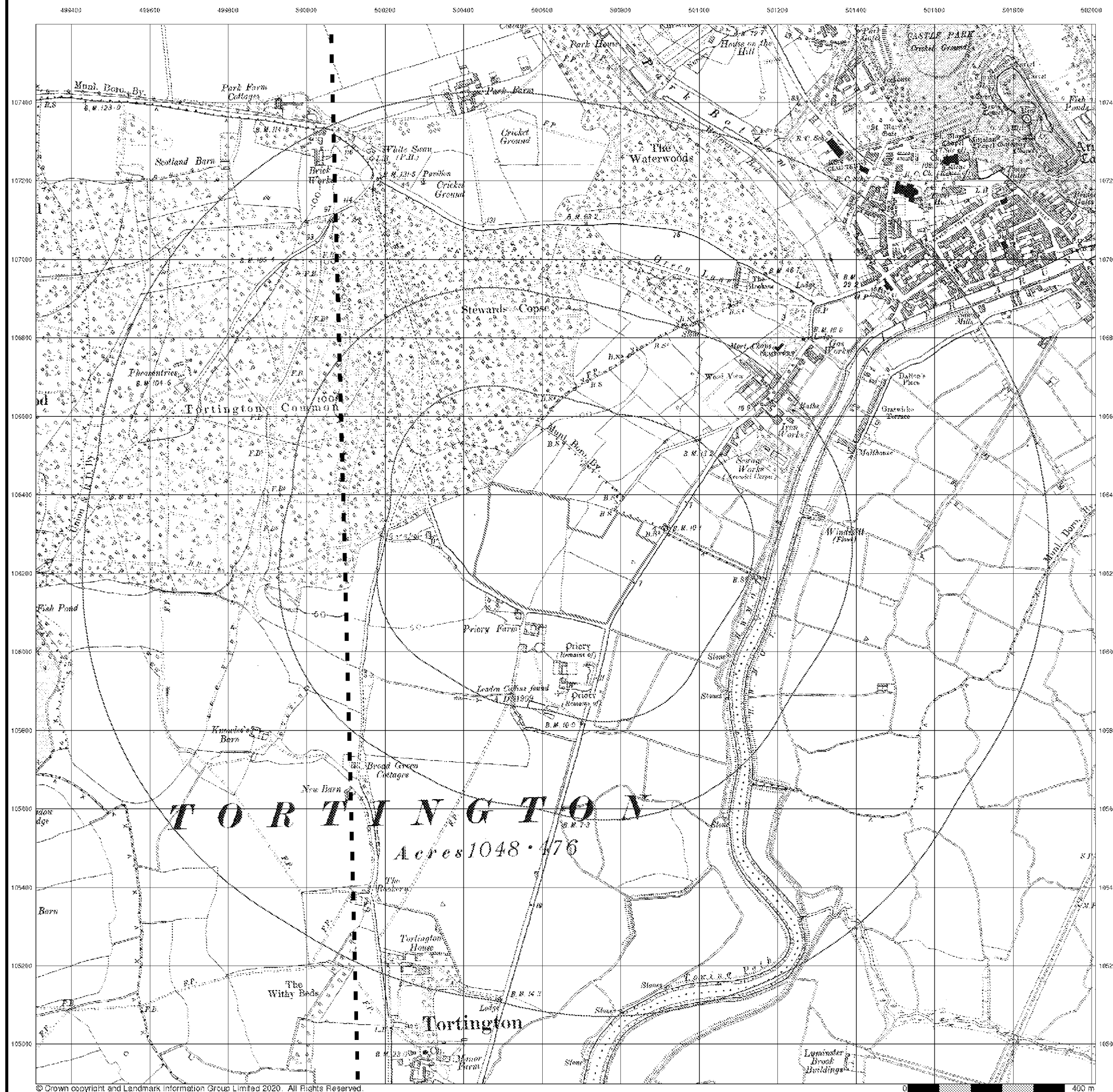


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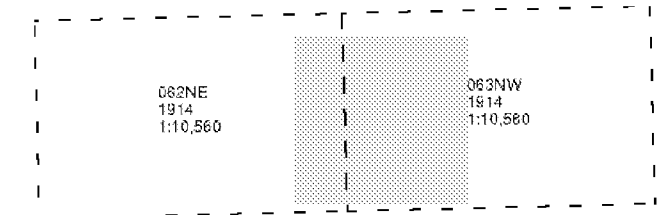
Sussex

Published 1914

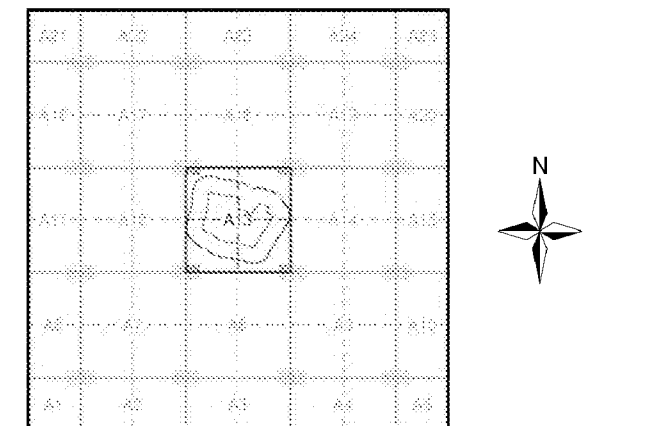
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Historical Map - Slice A

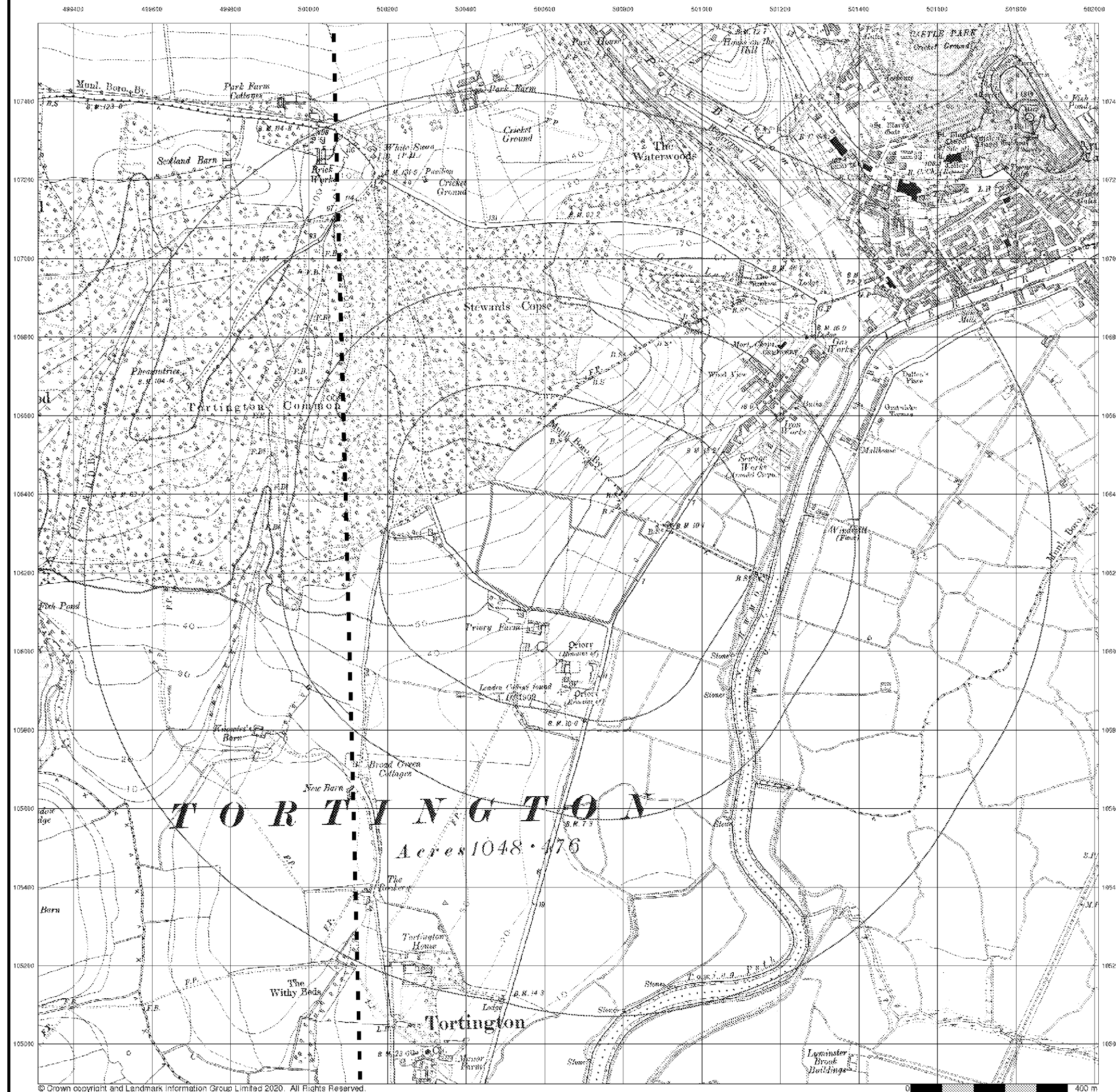


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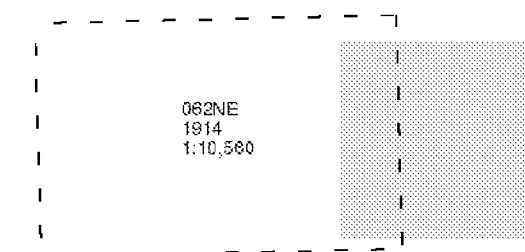
Sussex

Published 1914

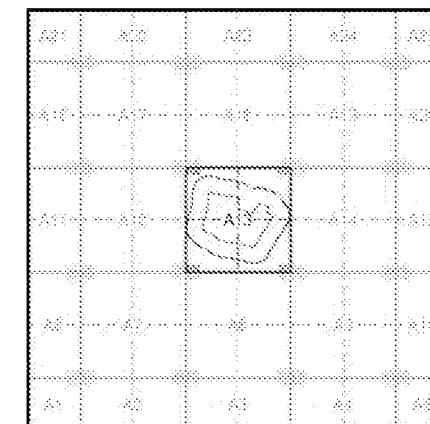
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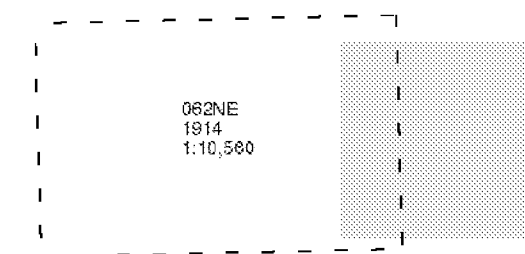
Sussex

Published 1914

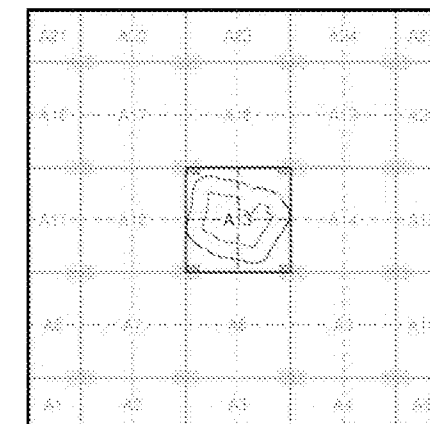
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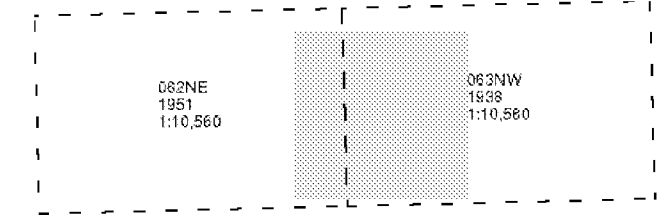
Sussex

Published 1938 - 1951

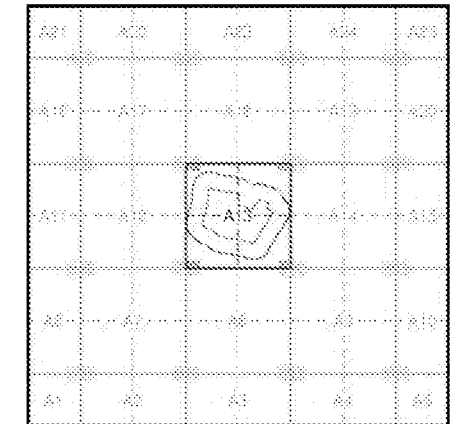
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Map Name(s) and Date(s)



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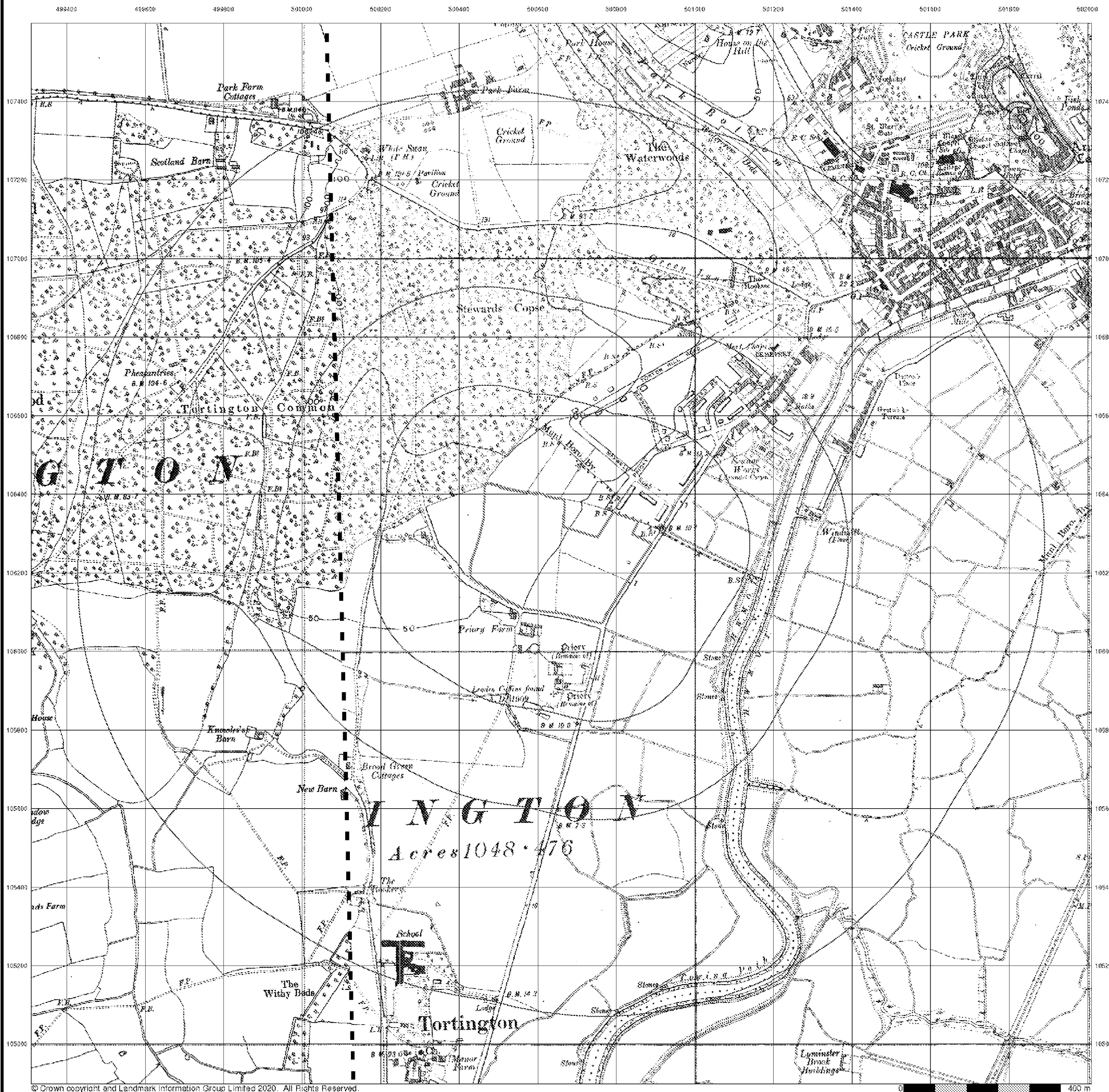


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Site Details

Land at Ford Road, Arundel, West Sussex, BN18 9ER



Historical Aerial Photography

Published 1947

Source map scale - 1:10,560

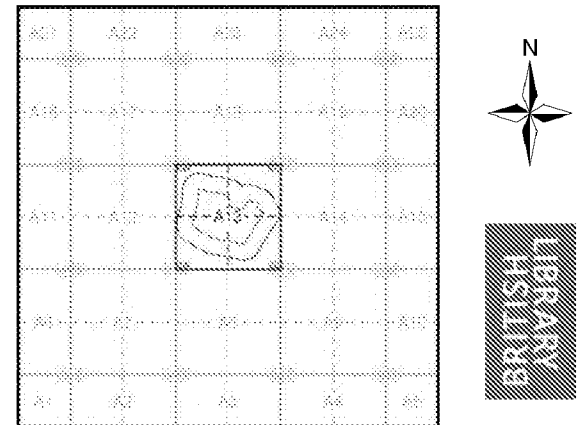
The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

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Map Name(s) and Date(s)

SU90NE	TQ00NW
1947	1947
1:10,560	1:10,560
SU90SE	TQ00SW
1947	1947
1:10,560	1:10,560

Historical Aerial Photography - Slice A



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